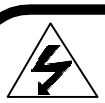
# Master Clock System (M212)

# User Manual

# P/N: 900000178
# Revision B

## For Brandywine Communications products with the following Part Numbers:
## 0366003##

# Safety Warnings

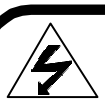


**WARNING:**

This unit contains lethal AC voltages. Disconnect the unit from the AC supply before removing the cover.

**WARNING:**

This unit contains dual power supplies. Isolate BOTH power supplied from AC Power before removing the top cover.



**WARNING:**

**The lightning flash with an arrowhead inside of an equilateral triangle is intended to alert the user to the presence of un-insulated "dangerous voltage" within the product's enclosure. The "dangerous voltage" may be of sufficient magnitude to constitute a risk of electrical shock to people. Do not attempt to repair the unit without first unplugging it.**

**CAUTION:**

**The exclamation point inside of an equilateral triangle is intended to alert the user to the presence of important operation and maintenance instructions in the user guide. Only qualified personnel should repair this unit. Several board assemblies contain static sensitive devices. Appropriate procedures must be used when handling these board assemblies.**

**Revision History**

| Rev | Date | Comments | ECO Number |
|---|---|---|---|
| A | 12/7/2020 | Initial release | 11560 |
| B | 04/8/2021 | Added Section 7 – Rear Panel Pinouts (pg 46) | 11683 |
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# 1 Introduction

**Figure 1. Master Clock System Front View**

Brandywine's M212 Master Clock System represents the next generation of modular timing systems. Built as a commercial derivative of the highly successful ruggedized Modular Master Clock, the M212 provides assured timing capabilities using Brandywine's Timewall™ technology.

At the center of the M212 system is Brandywine's powerful Master Clock Module (MCM). The MCM may be synchronized by a variety of reference sources and uses the selected reference to steer an embedded oscillator to provide stable and accurate time and frequency for the M212. Multiple references can be prioritized with automatic failover. Uniquely, the MCM's Timewall™ algorithms validate the GPS reference based upon the inherent stability of the MCM oscillator, providing hardening against possible GPS spoofing.

Available input reference selections include GPS (both C/A code and SAASM receivers are supported), IRIG-B, and Have Quick/1PPS. In additional an MCM may be synchronized to up to 2 other M212 chassis using a fiber optic crosslink, this provides additional resiliency for the M212 time and frequency references.

The standard oscillator in the M212 is a high quality Temperature Compensated Crystal oscillator, but the M212 optionally can be ordered with other reference oscillator choices, including Rubidium, Chip Scale Atomic Clock (CSAC) and Ovenized Oscillator (OCXO)

The output signals for the M212 are generated by up to 6 Output Signal Modules (OSM), and are ideal for custom solutions or future expansion. Available modules include NTP, low-phase-noise frequency, time code modules such as IRIG A, B, G, H, and NASA 36, BCD, PPS, PPM, Have Quick, serial data (RS232/422) as well as optical crosslink.

The M212 status and control is via front panel display for basic configuration and status, a secure web browser, and via SNMPv3. Network protocols also fully support privacy and authentication.

## 1.1 Master Clock System Basic Concept

The Master Clock System is a master clock that can have its capabilities defined by the use of standardized modules, allowing custom solutions to be created from standard hardware.

Through the use of these standardized modules, distributed timing networks for high accuracy applications may be readily created.

## 1.2 Specifications (Basic Unit)

### 1.2.1 Signal Reference Inputs

#### 1.2.1.1 C/A code GPS Receiver (standard)

| | |
|---|---|
| Receiver Type | GNSS multi constellation (GPS, GLONASS, Galileo[1], Beidou) |
| Sensitivity | Tracking: -159 dBm<br>Acquisition: -147 dBm |
| Accuracy | 15ns (1σ) (@ -130 dBm) |
| Connector Type | BNC J8 |

#### 1.2.1.2 SAASM GPS Receiver (optional)

| | |
|---|---|
| Receiver Type | GB-GRAM Type II |
| Keyfill cable | 5 pin Audio |
| Keyfill port | DS102 |
| COM Port | DB9–F connector |

#### 1.2.1.3 External 1PPS Input

| | |
|---|---|
| Signal Format | Per ICD-GPS-060B |
| Rate | 1 pulse per second |
| Impedance | 50 ohm |
| Connector Type | BNC J6B |

#### 1.2.1.4 External GPS Have Quick T/C Input

| | |
|---|---|
| Signal Format | Per ICD-GPS-060A, STANAG 4246 HQ2A |
| Rate | 1 frame per second |
| Impedance | 10k Ω |
| Connector Type | DB9M J5A |

#### 1.2.1.5 External IRIG B Input

| | |
|---|---|
| Signal Format | IRIG B Per IRIG 200-04 |
| Control Functions | Per IEEE1344 |
| Modulation ratio | 2.5:1 to 3.3:1 |
| Amplitude | 1 Vp-p to 5Vp-p |
| Impedance | >600 ohm |
| Connector Type | DB9M J5A |

### 1.2.2 Environmental

| | |
|---|---|
| AC Supply | |
| Voltage | 90-265 VAC 50/60 Hz. 100W Maximum |
| DC Supply | |
| Voltage | 18-36VDC or 36-72 VDC |
| Connector | Barrier Terminal Block |

### 1.2.3 Physical

| | |
|---|---|
| Length (depth) | 20.00” |
| Width | 17.00” Chassis Width<br>19.00” Front Panel Width |
| Height | 1.72” 1U chassis |
| Weight | 10 lbs |

### 1.2.4 Temperature

| | |
|---|---|
| Air Temperature | -15 to 55degC |
| Altitude Conditions | -1500 ft to +11,000 ft |

### 1.2.5 Shock and Vibration

| | |
|---|---|
| Operating Shock | MIL-STD 810F 20g/11ms |
| Bench Handling Shock | MIL-STD 810F |
| Vibration | MIL-STD-167-1 |
| Structure-borne Noise | MIL-STD-740-2 |

### 1.2.6 EMC

FCC Part 15, Class A
IEC CISPR 22
CE

### 1.2.7 Outputs

**Pulse-per-second (1PPS) Output 1**

| | |
|---|---|
| Signal Format | Per ICD-GPS-060B |
| Rate | 1 pulse per second |
| Rising Edge | On Time |
| Rise Time | <50ns |
| Fall time | <100ns |
| Pulse Width | 20 µs ±5% default. |
| Amplitude | 10V ±10% |
| Output condition | when TFOM<7 only |
| Connector Type | BNC |
| Number of Outputs | 2 |

**Have Quick Time of Day Output**

| | |
|---|---|
| Signal Format | Per ICD-GPS-060A, STANAG 4430 |
| Rate | 1 pulse per second |
| Rising Edge | On Time |
| Rise Time | <100ns |
| Fall time | <100ns |
| 1PPS coherence | < 100ns of rising edge of 1PPS |
| Amplitude | 5V ±5% |
| Accuracy to 1PPS | <100ns |
| Output condition | when TFOM<7 only |
| Connector Type | 3 Pin |

**BCD Time Code Output**

| | |
|---|---|
| Signal Format | Per ICD-GPS-060A |
| Rate | 50 bits/sec |
| 1PPS coherence | < 100ns of rising edge of 1PPS |
| Mark (logical 1) | +2.5V ±1V |
| Space | (logical 0) -2.5V ±1V |
| Output condition | when TFOM<7 only |

**IRIG B Time code Output**

| | |
|---|---|
| Signal Format | B122, B124, |
| Control Functions | B124 CF definition per IEEE1344 |
| Rate | 1kHz modulated sinewave |
| Modulation ratio | 10:3 ±10% |
| Amplitude | $3V_{p-p}$ ±20% into 50Ω load |
| Output condition | when TFOM<7 only |

**Alarm Output**

| | |
|---|---|
| No of outputs | 1 ( wire-OR’d from 2 MCMs) |
| Signal Format | Dry contact closure Normally closed |
| Normal Operation | Relay Active |
| Connector Type | 15 Pin D-Sub Male |

**Reference Frequency Outputs**

1 Requires firmware upgrade

| | |
|---|---|
| Signal Format | Sinusoid |
| Frequency | 5 MHz, and 10 MHz |
| Amplitude | 13dBm/1$V_{rms}$ |
| Harmonic Distortion-30dBc | |
| Non-Harmonic | -70dBc 1-500MHz |

**NTP Output**

| | |
|---|---|
| Signal Format | Ethernet 100BaseT |
| Protocols supported | NTPv3 (RFC-1305)<br>NTPv4 (RFC-5905) |
| No of Outputs | 1 (J7-B only) |
| Authentication | SHA-1, MD5, AutoKey |

**Management**

| | |
|---|---|
| Front Panel | Full color touch screen |
| Remote | SNMP V3 |
| Management Viewer | MMCView |
| Firmware upgrade | Using GPNTSModule<br>Update secure tool |

**Power and Environmental Specifications**

***Power***

| | |
|---|---|
| No of Inputs | 1 standard, 2 redundant optional |
| Voltage | 90-250VAC ±10% 50/60 Hz |
| Connector | IEC 320 standard, optional<br>MS3102A-10SL-3P |

***Physical Dimensions***

| | |
|---|---|
| Length (depth) | 20.00" (Chassis Depth) |
| Width | 17.00" (Chassis) – 19.00" (Front Panel) |
| Height | 1.75" (Chassis Height) |
| Weight | 25 lbs nominal (slides not included) |

***Cooling Requirements***

| | |
|---|---|
| Air Temperature | -15ºC to +53ºC |
| Altitude Conditions | 1500 ft to +11,000 ft. |
| Airflow | 30 cfm<br>Redundant Fans |

***Shock and Vibration Requirements or Sensitivities***

| | |
|---|---|
| Functional (operating) Shock | MIL-STD 810F Method 516.5<br>Procedure I |
| Bench Handling Shock | MIL-STD 810F Method 516.5<br>Procedure VI |
| Vibration, Functional (operating) | MIL-STD-167-1 |
| ***EMI*** | EN55022, EN55024, FCC Part 15 |
| ***Safety*** | CE Certified |

## 1.2.8 OSM Specifications

### 1.2.8.1 Universal Output Signal Module

The Universal OSM provides the ultimate in flexibility. The Universal OSM has 4 outputs, each of which is user-programmable to a wide variety of time code or pulse outputs. This flexibility ensures that an M212 can be reconfigured as requirements change, and fewer modules are needed in comparison to designs where modules are single function. Each output is individually adjustable for propagation delay, ensuring that for high accuracy synchronization different cable lengths can be accommodated.

Available output formats per connector

- 1 PPS and 1PPM
- HaveQuick
- IRIG A, B, E, G, H
- XR3, 2137

**Specifications**:

***Pulse-per-second/minute***

| | |
|---|---|
| Signal Format | Per ICD-GPS-060B |
| 1PPS Rate | 1 pulse per second |
| 1PPM Rate | 1 pulse per minute |
| Rising Edge | On Time |
| Rise Time | <20ns |
| Fall time | <100ns |
| Pulse Width | 20 µs ±5% default. |
| Amplitude | 10V ±10% into 50Ω |
| Output condition | when TFOM<7 only |

***Have Quick Time of Day Output***

| | |
|---|---|
| Signal Format | Per ICD-GPS-060A |
| Rising Edge | On Time |
| Rise Time | <100ns |
| 1PPS coherence | < 100ns of rising edge |
| Amplitude | 5V ±5% |
| Output condition | when TFOM<7 only |

***BCD Time Code Output***

| | |
|---|---|
| Signal Format | Per ICD-GPS-060B |
| Rate | 50 bits/sec |
| 1PPS coherence | < 100ns of rising edge |
| Mark (logical 1) | +2.5V ±1V |
| Space | (logical 0) -2.5V ±1V |
| Output condition | when TFOM<7 only |
| Connector Type | 3 Pin (Consult factory) |

***IRIG Time Code Output***

| | |
|---|---|
| Signal Format | B002, B122, B004, B124 (Consult factory for other formats) |
| Control Functions | B124 per IEEE1344 |
| Rate | 1kHz modulated |
| Modulation ratio | 10:3 ±10% |
| Amplitude | $5V_{p-p}$ ±20% |
| Output condition | when TFOM<7 only |

***2137 Time code Output***

| | |
|---|---|
| Signal Format | 2137 |
| Carrier | 1kHz modulated |
| Modulation ratio | 10:3 ±10% |
| Amplitude | $5V_{p-p}$ ±20% |
| Output condition | when TFOM<7 only |

***XR3 Time code Output***

| | |
|---|---|
| Signal Format | XR3 |
| Rising Edge | On Time |
| Rise Time | <100ns |
| 1PPS coherence | < 100ns of rising edge |
| Amplitude | 5V ±5% |
| Output condition | when TFOM<7 only |

***Propagation delay compensation***

| | |
|---|---|
| Applicability | All 4 outputs individually |
| Range | ± 0 – 1ms in 5ns steps |

**Low Phase Noise Analog OSM**

The Analog Low Phase Noise Module provides 4 low phase noise reference frequency outputs at 5, or 10MHz. The OSM incorporates a clean-up OCXO that is phase-locked to the MCM oscillator which must be OCXO, CSAC, or a Rubidium oscillator

**Specifications**:

| | |
|---|---|
| Waveform | Sinusoid |
| Amplitude | 13 ±2 dBm/$1V_{rms}$ |
| Harmonics | -40dBc |
| Non Harmonic | <-80dBc 10k - 500MHz |
| Connector Type | Coaxial, BNC |
| Accuracy | Locked to MCM oscillator |

| Phase Noise dBc/√Hz | 10MHz | 5MHz |
|---|---|---|
| 1Hz | -90dBc | -95dBc |
| 10Hz | -120dBc | -125dBc |
| 100Hz | -145dBc | -148dBc |
| 1KHz | -155dBc | -155dBc |
| 10KHz | -158dBc | -158dBc |

### 1.2.8.2 5MHz Output OSM

The 5MHz output OSM provides 4 reference frequency outputs at 5 MHz. The OSM buffers and distributes a 5MHz signal that is generated directly on the MCM. The stability and accuracy will reflect those of the selected MCM oscillator.

**Specifications**:

| | |
|---|---|
| Waveform | Sinusoid |
| Amplitude | 13 ±2 dBm/$1V_{rms}$ |
| Harmonic | -35dBc |
| Non Harmonic | <-65dBc 10k - 500MHz |
| Connector Type | Coaxial, BNC |
| Accuracy | Locked to MCM oscillator |
| Stability | Same as MCM oscillator |

### 1.2.8.3 10 MHz Output OSM

The 10MHz output OSM provides 4 reference frequency outputs at 10MHz. The OSM buffers and distributes a 10MHz signal that is generated directly on the MCM. The stability and accuracy will reflect those of the selected MCM oscillator.

**Specifications**:

| | |
|---|---|
| Waveform | Sinusoid |
| Amplitude | 13 ±2 dBm/$1V_{rms}$ |
| Harmonic | -35dBc |
| Non Harmonic | <-65dBc 10k - 500MHz |
| Connector Type | Coaxial, BNC |
| Accuracy | Locked to MCM oscillator |
| Stability | Same as MCM oscillator |

### 1.2.8.4 NTP Server OSM

The NTP Server module enables the Master Clock System to act as an NTP server over an Ethernet network. Designed with security in mind, the NTP server module uses a custom network stack that enables it to ONLY act as an NTP server, and prevent it from being used as a gateway to compromise the entire system.

**Specifications**:

| | |
|---|---|
| Signal Format | Ethernet 10/100BaseT |
| Protocols | NTPv3 RFC1305<br>NTPv4 RFC 5905 |
| Authentication | MD5, SHA-1 |
| Connector Type | RJ45 |
| No of Outputs | 2 |

### 1.2.8.5 PTP Grandmaster OSM

The PTP Server module enables the Master Clock System to act as a Precise Time Protocol (PTP) Grandmaster over an Ethernet network. The PTP OSM is fully compliant with the PTP protocol, and is capable of providing time synchronization for up to 256 clients. Designed with security in mind, the PTP server module uses a custom network stack that enables it to ONLY act as a PTP server, and prevent it from being used as a gateway to compromise the entire system.

**Specifications**:

| | |
|---|---|
| Signal Format | 10/100/1000BaseT |
| Protocols | PTPv2 (IEEE1588-2008) |
| Resolution | 8ns packet timestamp resolution |
| Accuracy | 20ns 3σ (crossover cable) |
| PTP Profiles | Default, Telecom, Enterprise, Power |
| Modes | Unicast, Multicast |
| Connector Type | SFP |
| Management | Web GUI |
| No of Outputs | 2 |
| Max no of cards | 3 |

### 1.2.8.6 Extended Performance PTP Grandmaster OSM

The Extended Performance PTP Server module enables the Master Clock System to act as a Precise Time Protocol (PTP) Grandmaster over an Ethernet network. The PTP OSM is fully compliant with the PTP protocol, and is capable of providing time synchronization to up to 1024 clients. Designed with security in mind, the PTP server module uses a custom network stack that enables it to ONLY act as an NTP server, and prevent it from being used as a gateway to compromise the entire system.

**Specifications**:

| | |
|---|---|
| Signal Format | 10GbE |
| Protocols | PTPv2 (IEEE1588-2008) |
| Resolution | 8ns timestamp resolution |
| Accuracy | 20ns 3σ (crossover cable) |
| PTP Profiles | Default, Telecom, Enterprise, Power |
| Transmission | Unicast, Multicast |
| Connector Type | SFP |
| Management | Web GUI |
| No of Outputs | 2 |
| Max no of cards | 2 |

### 1.2.8.7 BCD Time Code Output OSM

The BCD time code OSM provides 4 BCD time code outputs. The OSM buffers and distributes a BCD signal that is generated directly on the MCM. The stability and accuracy will be those of the selected MCM. The propagation delay compensation feature is not available on this OSM.

**Specifications**:

| | |
|---|---|
| Format | ICD-GPS-060B |
| Signal Format | Per ICD-GPS-060B<br>40 bits |
| Rising Edge | On Time |
| Rise Time | <100ns |
| 1PPS coherence | < 100ns of rising edge |
| Electrical | Per RS422/485 |

### 1.2.8.8 T1/E1 OSM

The T1/E1 OSM provides 16 Framed T1/E1 outputs. Each output may be selected independently. The stability and accuracy will be those of the selected MCM oscillator.

**Specifications**:

| | |
|---|---|
| Waveform (T1) | DS1 framed all ones, SF, D4, ESF, SSM support |
| Waveform (E1) | E1 framed all ones, CRC4 and CAS multiframe SSM support |
| No of outputs | 16 |
| Impedance | software selectable |
| Standards | ANSI T1.102, T1.403<br>ITU-T G.703 |
| Short/Long Haul | User programmable |
| Connector Type | 62pin D receptacle |
| Breakout Panel / Cable | 1U Panel / 36” Cable |
| Breakout connector | RJ45 |
| Accuracy | Locked to MCM oscillator |
| Stability | Same as MCM oscillator |

### 1.2.8.9 Optical Crosslink OSM

The Optical Crosslink Module is a unique feature of the M212. When installed, it allows a second M212 to be synchronized as a slave chassis. If both chassis have a primary reference installed (e.g. GPS) then the two MCM's operate as peers. Peering provides additional redundancy, as well as providing additional references to detect failures.

When a duplex cable is provided, the optical link provides seamless and automatic propagation delay compensation. A security mode allows the optical link to be operated in a single direction form Master to Slave over a single fiber.

**Specifications**:

| | |
|---|---|
| Connector Type | LC |
| No of Outputs | 2 bi-directional per OSM |
| **Synchronization Accuracy** | |
| Phase Measure Accuracy | 1ns |
| End to End Accuracy | <5ns synchronization |
| Optical | |
| Wavelength | Single Mode 1300nm |
| Safety | Class 1 CDRH/IEC 825 |
| Range[2] | 2000m 9/125um cable |

### 1.2.8.10 1 PPS Distribution Module

The 1PPS Distribution Module provides 4 1PPS outputs. The OSM buffers and distributes a 1PPS signal that is generated directly on the MCM. The stability and accuracy will be those of the selected MCM. The propagation delay compensation feature is not available on this OSM.

**Specifications**:

| | |
|---|---|
| Rising Edge | On Time |
| Rise Time | <15ns |
| Fall time | <60ns |
| Pulse Width | 20 µs ±5% default. |
| Amplitude | 10V ±10% into 50Ω |
| Source impedance | link selectable 50Ω/lowZ |

### 1.2.8.11 Octal Distribution Module

The Octal Distribution Module provides up to 8 RS232 or RS422 output ports that can be used to broadcast a time of day message. All output formats are identical, and selected at the MCM. One channel can be dedicated as an input channel to provide the MCM with a NMEA $GGA message as an input timing reference. Selection of RS232/422 is available on a per channel using user-installed push on links

**Specifications**

| | |
|---|---|
| No of channels | 8 |
| Connector Type | 62pin D receptacle |
| Electrical | |
| | RS232 |
| | RS422/485 |
| Channel selection | push on link |
| Input channel format | NMEA $GGA |

### 1.2.8.12 Have Quick Distribution Module

The Have Quick Distribution Module provides 4 Have Quick time code outputs. The OSM buffers and distributes a Have Quick signal that is generated directly on the MCM. The stability and accuracy will be those of the selected MCM. The propagation delay compensation feature is not available on this OSM.

**Specifications**:

| | |
|---|---|
| Format | ICD-GPS-060A |
| Signal Format | Per ICD-GPS-060A (Consult factory) STANAG 4430 HQ2A |
| Rising Edge | On Time |
| Rise Time | <100ns |
| 1PPS coherence | < 100ns of rising edge |
| Amplitude | Logic 1 2.4Vmin<br>Logic 0 0.25V max |

### 1.2.8.13 Modulated Time Code Distribution Module

The Modulated Time Code Distribution Module provides 4 AC modulated time code outputs. The OSM buffers and distributes the same time code signal that is generated directly on the MCM. The stability and accuracy will be those of the selected MCM. The propagation delay compensation feature is not available on this OSM.

**Specifications**:

***Time Code Output***

| | |
|---|---|
| Signal Format | B122, B124 2137 (Consult factory for other formats) |
| Control Functions | B124 per IEEE1344 |
| Rate | 1kHz modulated |
| Modulation ratio | 10:3 ±10% |
| Amplitude | $5V_{p-p}$ ±20%<br>Load impedance >50ohm |

[2] Consult Factory for longer range or multimode

# 2 Setup

Remove the Master Clock System from the shipping carton. The following items should be included in the shipment:
1x Master Clock System
2x Power supply cables
1x CD-ROM containing User Manual and Utility Software

## 2.1 Installation

### 2.1.1 Mounting

The Master Clock System can be installed into a 19” rack mount cabinet using rack slides. Slides are installed using 10-32 UNF-2B hardware.
Optional Rack Mount Slides:

P/N 002000123, SLIDE, RACK, 24", 21" TRAVEL, 85 LB
P/N 002000150, SLIDE, RACK, 28", 27" TRAVEL, 80 LB

Original Manufacturer: General Devices Chassis Trak Type C300.

### 2.1.2 Power

Insert the power cord of the Master Clock System into an electrical socket to power up the unit.

If dual redundant power is required, connect both power sources to independent power sources

Note that the Master Clock System uses a custom power cable designed to lock in place. Be sure to only use power cables made by Brandywine Communications

Power Cable Part Number:

### 2.1.3 Ethernet

Connect one end of an Ethernet patch cable to the Master Clock System Ethernet located on the Master Clock Module. Connect the other end of the Ethernet cable to the network with an Ethernet hub or switch.

# 3 Configuration

## 3.1 Status Page

Upon connecting to the M212's web interface, the first screen that will be displayed is the M212 Status page (Figure 2).

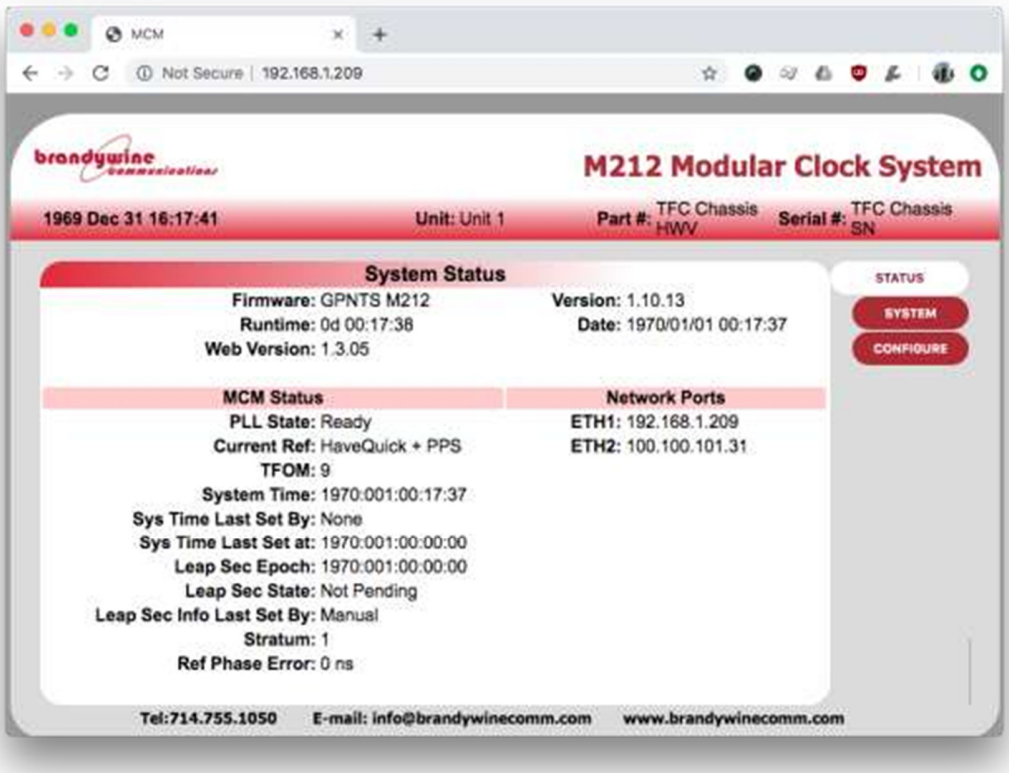


**Figure 2. M212 Status Page.**

The fields listed in this window and their explanation are listed in Table 1 below.

**Table 1. M212 Status Page Descriptors**

| FIELD | DESCRIPTION |
|---|---|
| Firmware | The name of the firmware installed on this system. |
| Version | The current firmware version |
| Runtime | The amount of time that the system has been powered on |
| Date | The current system date and time |
| Web Version | The current version of the web interface |
| PLL Status | The current status of the Phase Locked Loop (PLL) |
| Current Ref | The current input reference |

Table 1. M212 Status Page Descriptors

| FIELD | DESCRIPTION |
|---|---|
| TFOM | Time Figure of Merit (TFOM), a numerical rating of the reliability of the current time output, with 1 being the highest, and 9 being the lowest |
| System Time | The current year, day of year, and time that the system is using. |
| Sys Time Last Set By | The timing source that last set the system time. |
| Sys Time Last Let at | The time that the system time was last set by an external source |
| Leap Second Epoch | The date and time of an impending leap second if one is pending. |
| Leap Second State | Will say whether or not a leap second is pending. Leap second state can be:<br>**Not Pending** - No Future Leap Second has been announced by International Earth Rotation and Reference Systems Service (IERS).<br>**Pending** - A leap second has been announced by IERS but it has not happened yet.<br>**Past Pending** - A leap second was announced and has already occurred. |
| Leap Sec Info Last Set By | Displays the reference source that a leap second was last set up. |
| Stratum | The current reference stratum that the M212 is operating in. |
| Ref Phase Error | The reported phase error of the reference source. |

## 3.2 System Page

The System page on the M212 is broken down into two tabs, the Inventory tab and the settings tab.

### 3.2.1 System Inventory

The System Inventory tab (Figure 3) shows system inventory information.

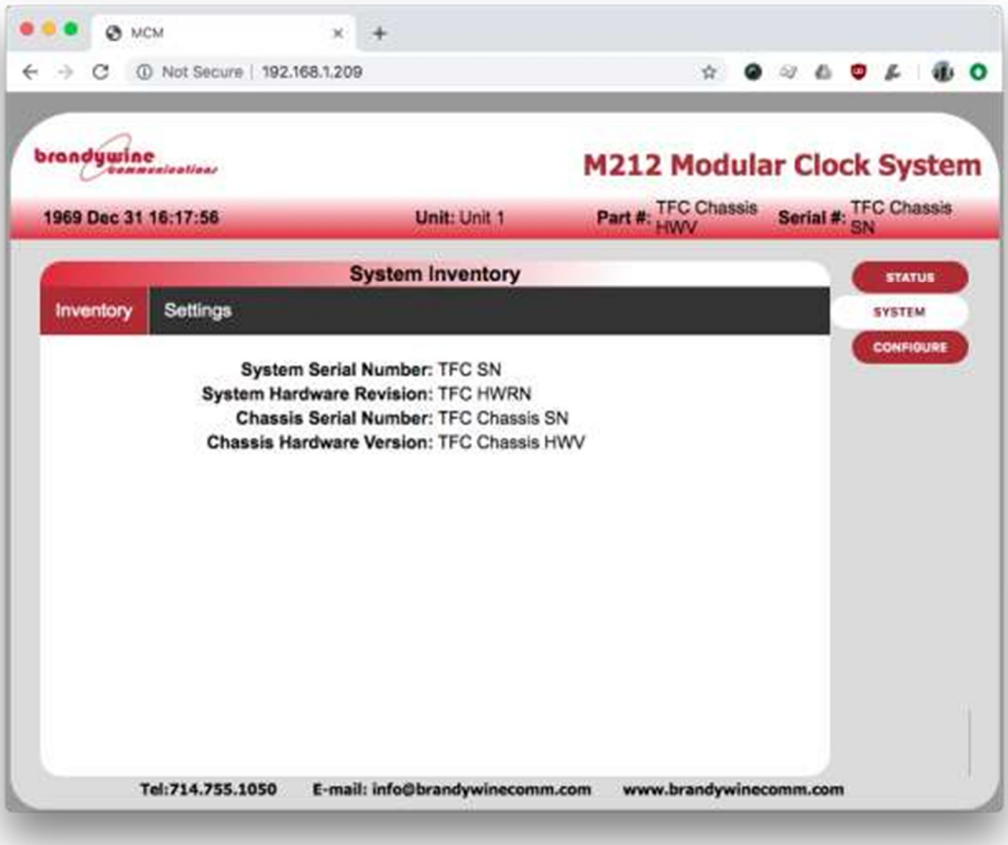


**Figure 3. System Inventory Tab**

The fields on the system inventory tab are listed in Table 2 below.

**Table 2. M212 System Inventory Tab Descriptors.**

| FIELD | DESCRIPTION |
|---|---|
| System Serial Number | The serial number of the M212 system. |
| System Hardware Revision | The hardware revision of the M212 system. |
| Chassis Serial Number | The serial number of the M212 chassis. |
| Chassis Hardware Version | The hardware version of the M212 chassis. |

### 3.2.2 System Settings

The system settings tab is used to change global settings with the M212, such as the system password, time zone and daylight saving time offset.

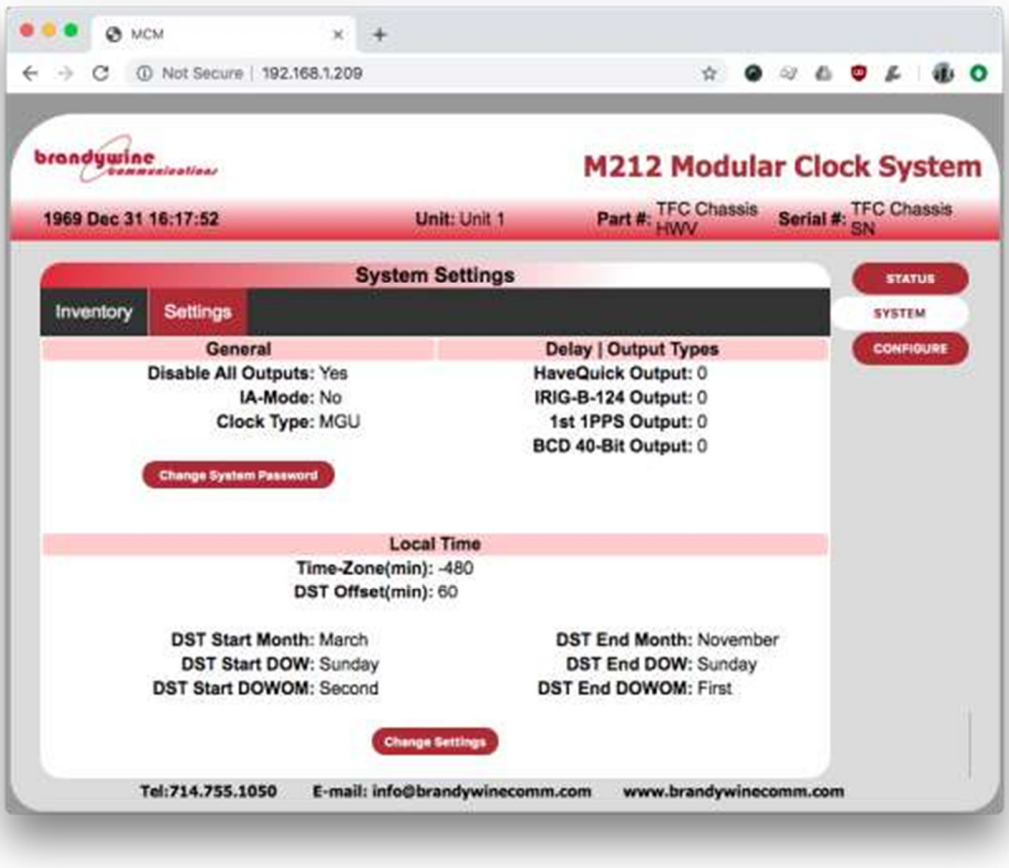


**Figure 4. M212 System Setting Tab in View Mode**

The fields of the system settings tab are listed below in Table 3.

**Table 3. M212 System Settings Tab Descriptors.**

| FIELD | DESCRIPTION |
|---|---|
| **General** | |
| Disable All Outputs | Indicates if all outputs from the M212 have been disabled for diagnostic purposes. |
| IA-Mode | Indicates if the M212 is currently running in Information Assurance (IA) mode or not. |
| Clock Type | Indicates if the M212 is currently operating as a Master Generation Unit (MGU), or as a Secondary Distribution Unit (SDU). |

Table 3. M212 System Settings Tab Descriptors.

| | |
|---|---|
| Change System Password | Change the login password to access the web interface |
| **Delay \| Output Types** | |
| HaveQuick Output | Indicates the delay compensation adjustment on the M212's HaveQuick output |
| IRIG-B Output Type | Use this dropdown menu to select the type of IRIG-B signal format the M212 should output |
| IRIG-B-Output | Indicates the delay compensation adjustment on the M212's IRIG-B output |
| 1st 1PPS Output | Indicates the delay compensation adjustment on the M212's 1PPS output |
| BCD 40-Bit Output | Indicates the delay compensation adjustment on the M212's 40-bit Binary Coded Decimal (BCD) output |
| **Local Time** | |
| Time Zone (min) | Indicates the time zone offset from UTC in minutes |
| DST Offset (min) | Indicates the Daylight Savings Time (DST) offset from standard time in minutes |
| DST Start Month | Indicates the month that DST starts on. |
| DST Start DOW | Indicates the Day of Week (DOW) that DST starts on. |
| DST Start DOWOM | Indicates the Day of Week of Month (DOWOM) that DST starts on |
| DST End Month | Indicates the month that DST ends on. |
| DST End DOW | Indicates the Day of Week (DOW) that DST ends on. |
| DST End DOWOM | Indicates the Day of Week of Month (DOWOM) that DST ends on |

Click the Change Settings button to switch the system settings tab into edit mode (Figure 5).

To save any settings adjustments, click on the "Submit" button.

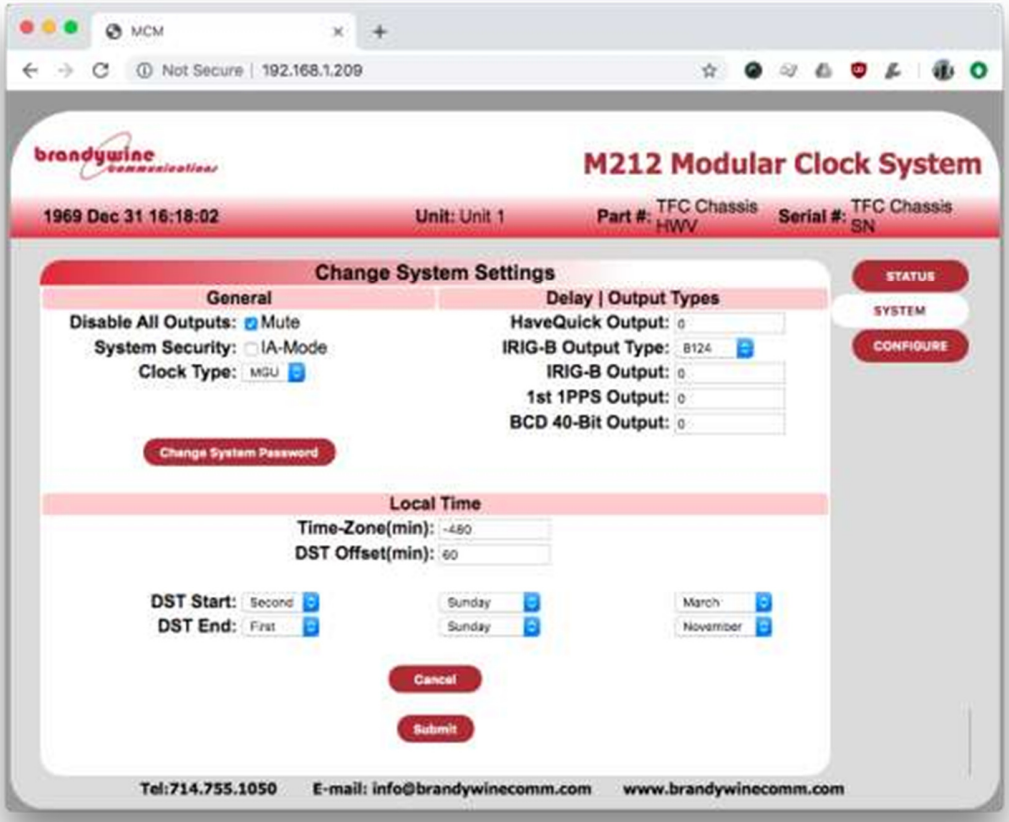


**Figure 5. M212 Settings Tab in Edit Mode**

## 3.3 Module Status and Configuration Pages

Clicking on the option for “Configure” from the right hand menu will open the module configuration windows, and underneath the configure menu will be the configuration webpages for each module installed.


**Figure 6. M212 Configuration Menu**

## 3.4 Master Clock Module (MCM) Configuration Page

Clicking the button labeled “MCM” will open the MCM status and configuration pages, from here the inventory, status and settings for the MCM are available for viewing and editing.

### 3.4.1 MCM Inventory Page

The MCM Inventory page shows the MCM’s serial number, hardware revision, software version and FPGA version.

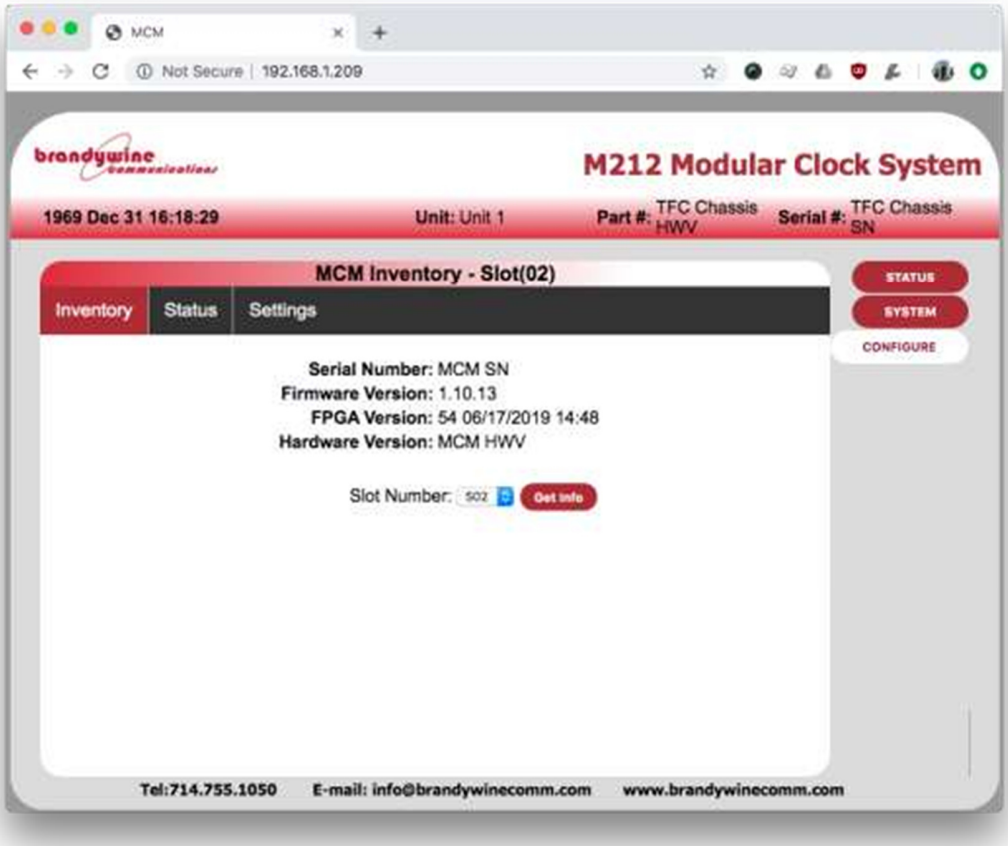


**Figure 7. MCM Inventory Page**

## 3.5 MCM Status Page

### 3.5.1 MCM Faults

The MCM Faults page (Figure 8) displays the current fault status with the MCM, as well as the fault status of any connected input references.

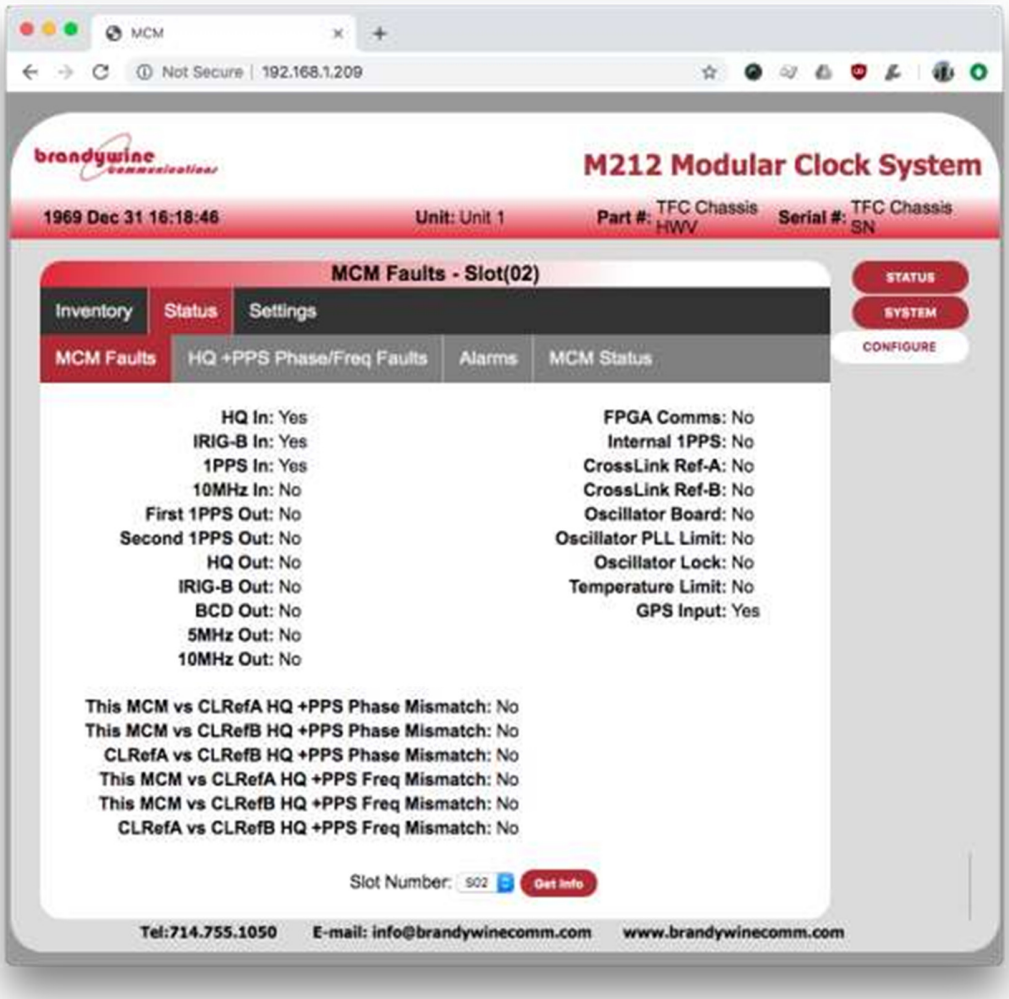


**Figure 8. MCM Faults Status Page**

### 3.5.2 HQ+PPS Phase/Freq Faults

The MCM HQ+PPS Phase and Frequency Faults page (Figure 9) displays the current fault status of any connected HaveQuick and 1PPS input references.

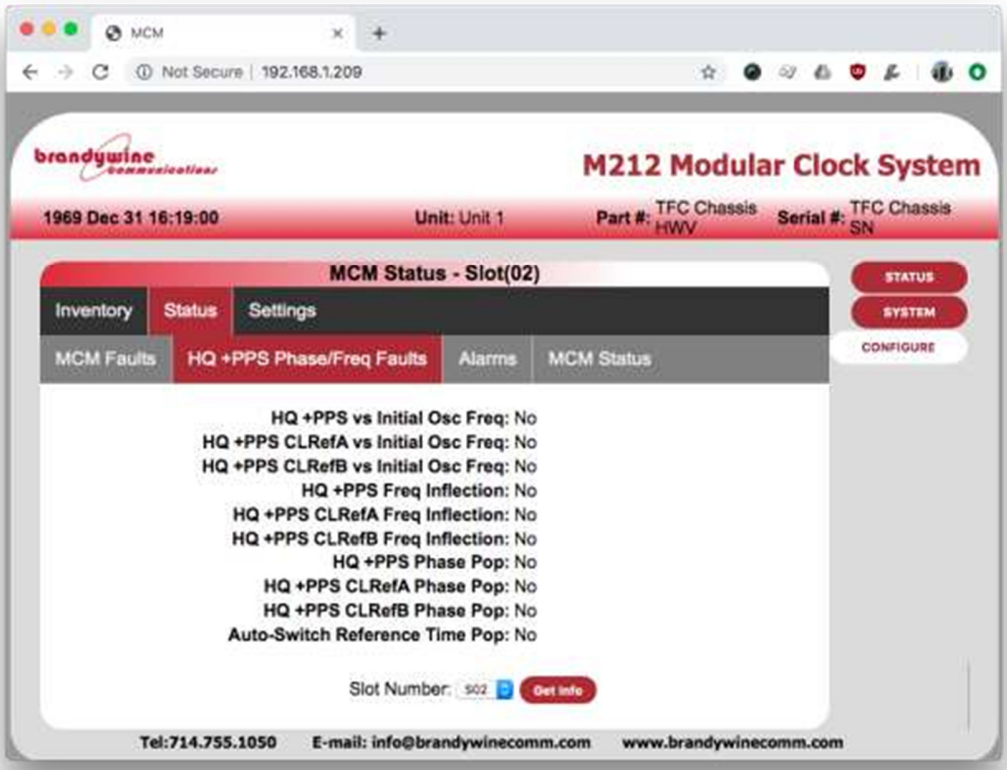


**Figure 9. MCM HQ+PPS Phase/Freq Faults Status Page**

### 3.5.3 Alarms

The MCM Alarms page (Figure 10) displays the current active alarms that the MCM is reporting. If the M212 is currently producing a buzzer alarm, the "Turn Off Buzzer" button can be used to temporarily disable the alarm buzzer.

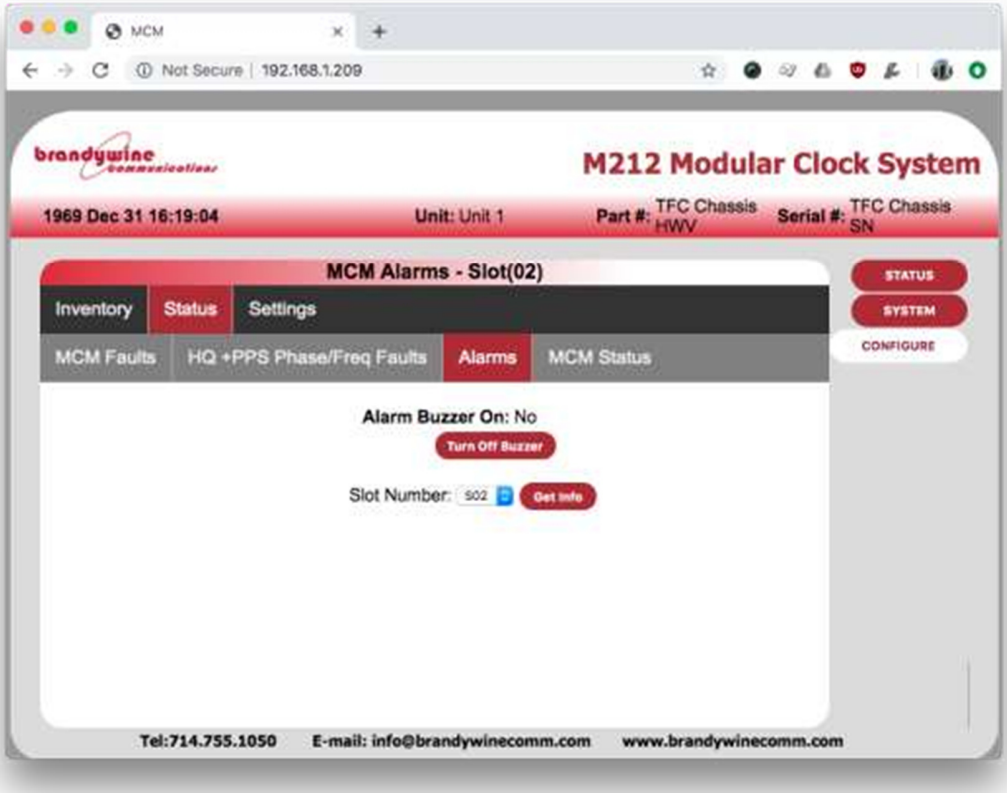


**Figure 10. MCM Alarms Status Page**

### 3.5.4 MCM Status

The MCM Status page (Figure 8) displays the current status of the MCM. Displayed fields include the current input reference, Time Figure of merit, and the leap second state, for a more complete listing of these status fields and what they mean, see Table 4 below.

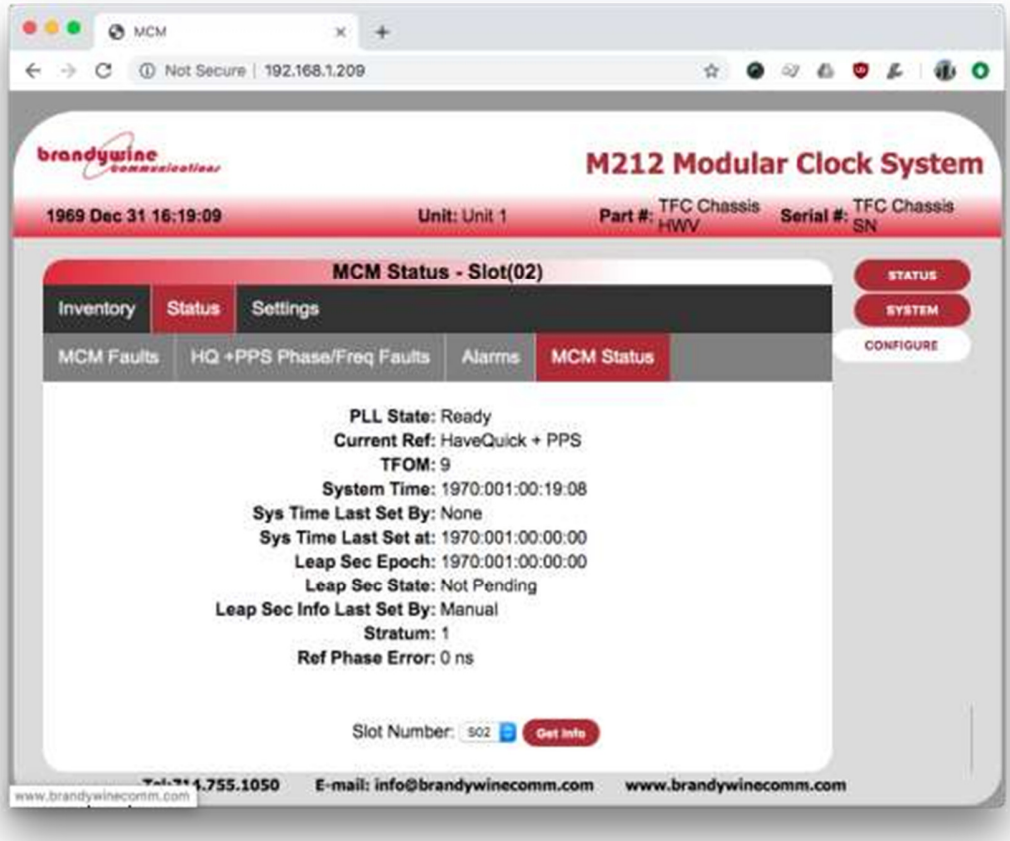


**Figure 11. MCM Status Page**

**Table 4. M212 MCM Status Page Descriptors**

| FIELD | DESCRIPTION |
|---|---|
| PLL Status | The current status of the Phase Locked Loop (PLL) |
| Current Ref | The current input reference |
| TFOM | Time Figure of Merit (TFOM), a numerical rating of the reliability of the current time output, with 1 being the highest, and 9 being the lowest |
| System Time | The current year, day of year, and time that the system is using. |
| Sys Time Last Set By | The timing source that last set the system time. |
| Sys Time Last Let at | The time that the system time was last set by an external source |

Table 4. M212 MCM Status Page Descriptors

| FIELD | DESCRIPTION |
|---|---|
| Leap Second Epoch | The date and time of an impending leap second if one is pending. |
| Leap Second State | Will say whether or not a leap second is pending. Leap second state can be:<br>**Not Pending** - No Future Leap Second has been announced by International Earth Rotation and Reference Systems Service (IERS).<br>**Pending** - A leap second has been announced by IERS but it has not happened yet.<br>**Past Pending** - A leap second was announced and has already occurred. |
| Leap Sec Info Last Set By | Displays the reference source that a leap second was last set up. |
| Stratum | The current reference stratum that the M212 is operating in. |
| Ref Phase Error | The reported phase error of the reference source. |

## 3.6 MCM Settings Page

Click the Settings tab to open the MCM Settings pages. The first settings subtab that will be opened is the MCM IP settings

### 3.6.1 IP Settings

The MCM IP settings subtab (Figure 12) enables the user to enable or disable the Ethernet ports on the MCM. In addition, this page is used to change the IP Address, Gateway address, and subnet mask of each port. Please note that DHCP is not supported, and the IP must be set manually.

**NOTE**

If the IP Address of the M212 is changed, the existing connection to the previous IP address will no longer work, to reconnect to the M212 web page, connect to it at the new IP address.

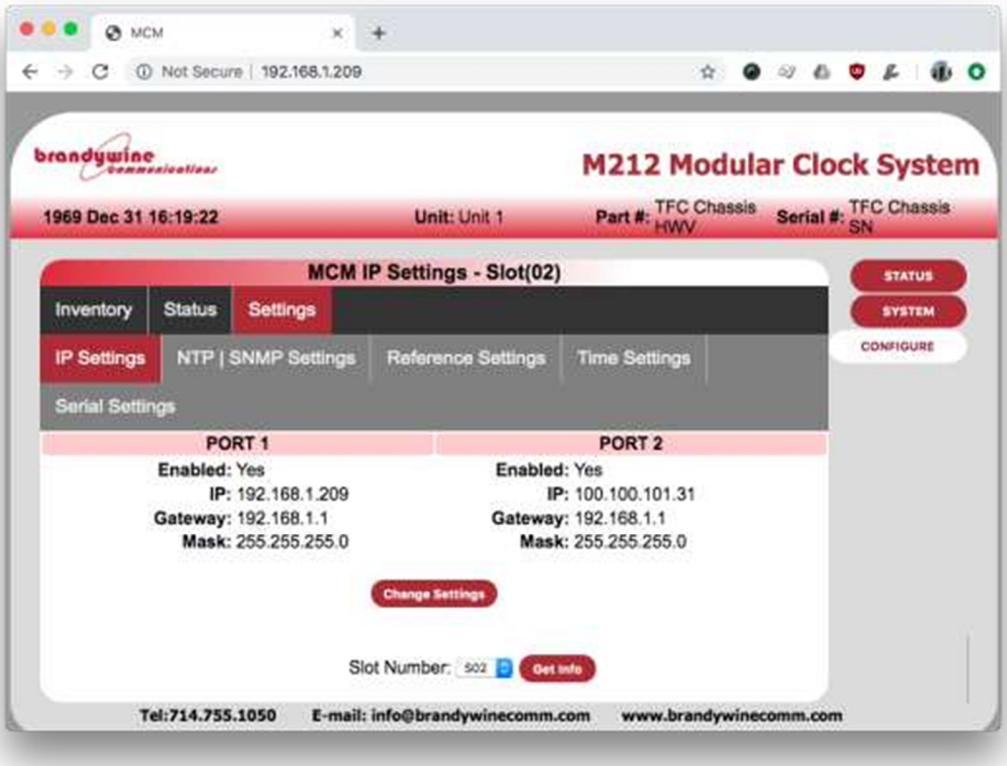


**Figure 12. MCM IP Settings Subtab**

### 3.6.2 NTP | SNMP Settings

The NTP and SNMP Settings subtab (Figure 13) enables the user to set the NTP Authentication method, key ID and hex key for use with secure NTP. The SNMP settings are used to adjust the authentication settings for SNMP and the SNMP trap IP address.

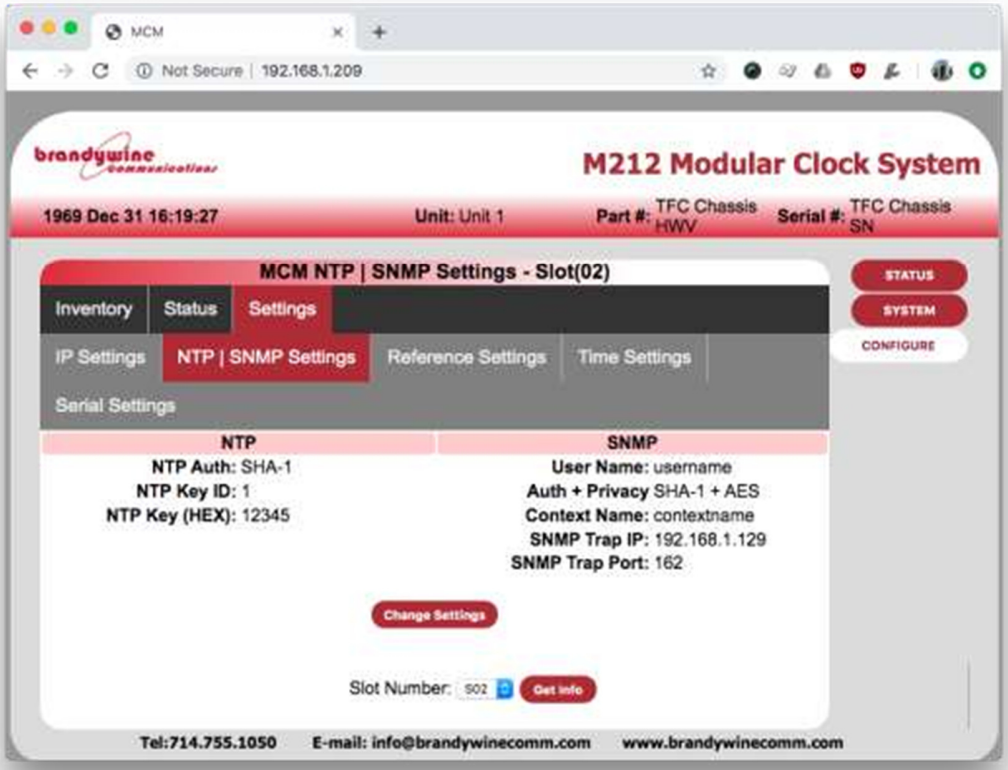


**Figure 13. MCM NTP and SNMP Settings**

### 3.6.3 Reference Settings

The Reference Settings subtab is plit into two pages (Figure 14) and it allows the user to select and prioritize input references for the M212.

#### 3.6.3.1 Reference Settings Page 1

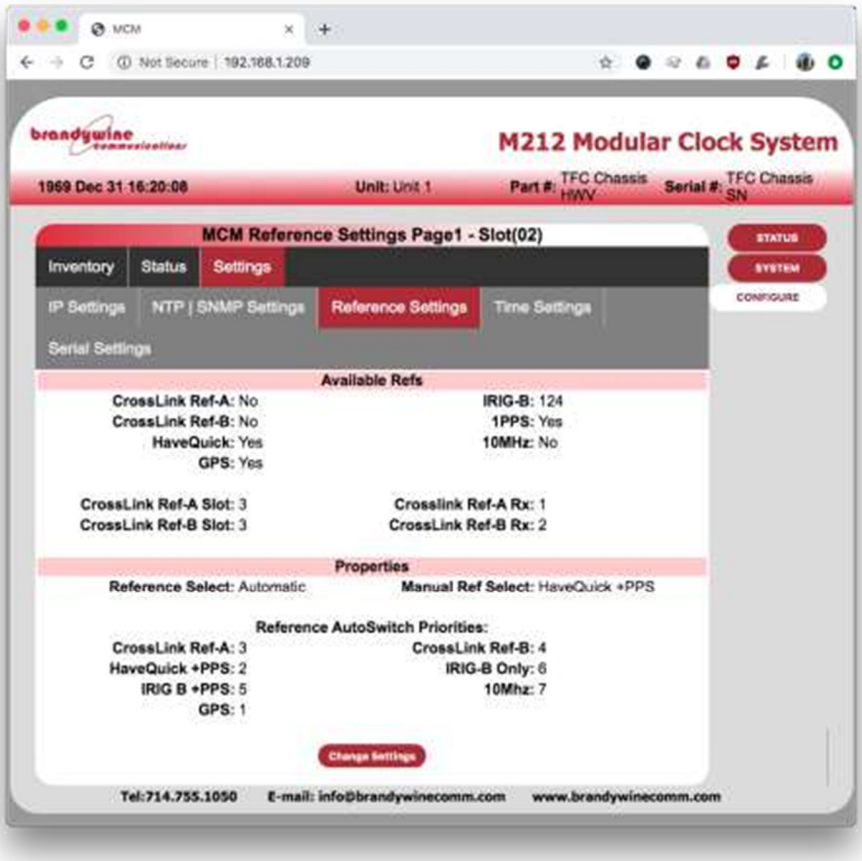


**Figure 14. MCM Reference Settings Page 1**

**Table 5. MCM Input Reference Settings Page 1 Setting Descriptors**

| SETTING | DESCRIPTION |
|---|---|
| **Available Refs** | |
| CrossLink Ref-A | Displays Yes when the M212's MCM is receiving time via the optical crosslink over port A. |
| CrossLink Ref-B | Displays Yes when the M212's MCM is receiving time via the optical crosslink over port B. |
| HaveQuick | Displays Yes when the M212's MCM is receiving time via HaveQuick. |
| GPS | Displays Yes when the M212's MCM is receiving time via GPS. |
| IRIG-B | Displays the IRIG-B Signal format the M212 is receiving if it is receiving time of day via IRIG-B |

Table 5. MCM Input Reference Settings Page 1 Setting Descriptors

| SETTING | DESCRIPTION |
|---|---|
| 1PPS | Displays Yes when the M212's MCM is receiving pulses via the 1PPS port. |
| 10MHz | Displays Yes when the M212's MCM is receiving frequency via the 10MHz input connection. |
| CrossLink Ref-A Slot | Displays the slot that optical CrossLink input reference A is installed in. |
| CrossLink Ref-B Slot | Displays the slot that optical CrossLink input reference B is installed in. |
| CrossLink Ref-A Rx | Displays the port that optical CrossLink input reference A is connected to. |
| CrossLink Ref-B Rx | Displays the port that optical CrossLink input reference B is connected to. |
| **Properties** | |
| Reference Select | Switch the MCM between automatic and manual reference selection. |
| Manual Ref Select | If the MCM is set to manual reference selection, this selects which source is used. |
| Reference AutoSwitch Priorities | For each of the input references listed, select a numerical value to assign each input source's priority, with 1 being the most important.<br>Once set, the MCM will try to use the input reference source listed as 1, but if that fails, it will automatically switch to input reference 2 if it is valid. If the lower-priority input reference is not valid, the M212 will iterate down to a lower priority input reference until a higher priority input reference is restored. |

### 3.6.3.2 Reference Settings Page 2

Page 2 of the MCM Reference settings subtab contains the settings for input reference delays, enabling the system to account for cable propagation delay, and AutoSwitch prevention.

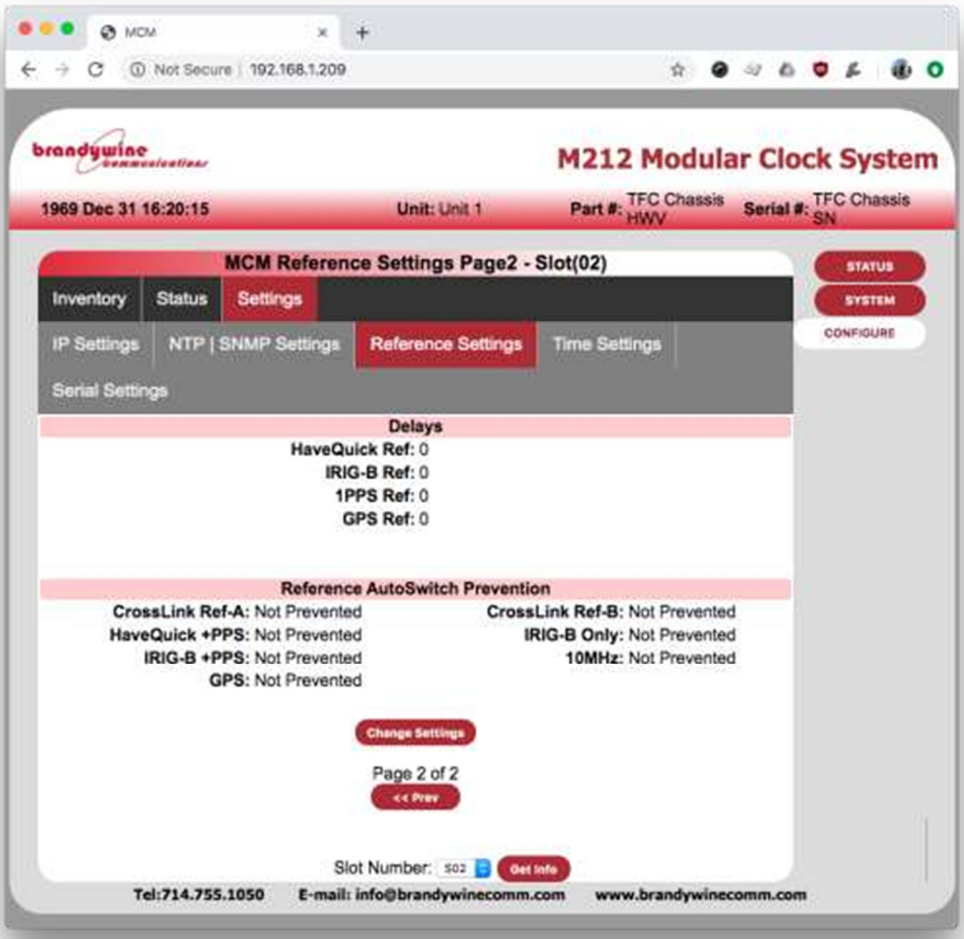


**Figure 15. MCM Reference Settings Page 2**

**Table 6. MCM Reference Settings Page 2 Setting Descriptors**

| SETTING | DESCRIPTION |
|---|---|
| **Delays** | |
| HaveQuick Ref | Adjust the delay compensation for the HaveQuick input reference in nanoseconds |
| IRIG-B Ref | Adjust the delay compensation for the IRIG-B input reference in nanoseconds |
| 1PPS Ref | Adjust the delay compensation for the 1PPS input reference in nanoseconds |
| GPS Ref | Adjust the delay compensation for the GPS input reference in nanoseconds |

Table 6. MCM Reference Settings Page 2 Setting Descriptors

| SETTING | DESCRIPTION |
|---|---|
| **Reference AutoSwitch Prevention** | |
| CrossLink Ref-A | Prevent the MCM's autoswitching system from selecting this reference automatically in the event of a reference failure |
| CrossLink Ref-B | Prevent the MCM's autoswitching system from selecting this reference automatically in the event of a reference failure |
| IRIG-B + 1PPS | Prevent the MCM's autoswitching system from selecting these references automatically in the event of a reference failure |
| GPS | Prevent the MCM's autoswitching system from selecting this reference automatically in the event of a reference failure |
| IRIG-B Only | Prevent the MCM's autoswitching system from selecting this reference automatically in the event of a reference failure |
| 10 MHz | Prevent the MCM's autoswitching system from selecting this reference automatically in the event of a reference failure |

### 3.6.4 Time Settings

The Time Settings subtab (Figure 16) allows the user to manually enter UTC time when the M212's MCM is operating in holdover mode or if it is only receiving frequency or pulse input references. The Manual Leap Second option is used when the input reference to the M212 does not support a leap second and the leap second must be entered manually.

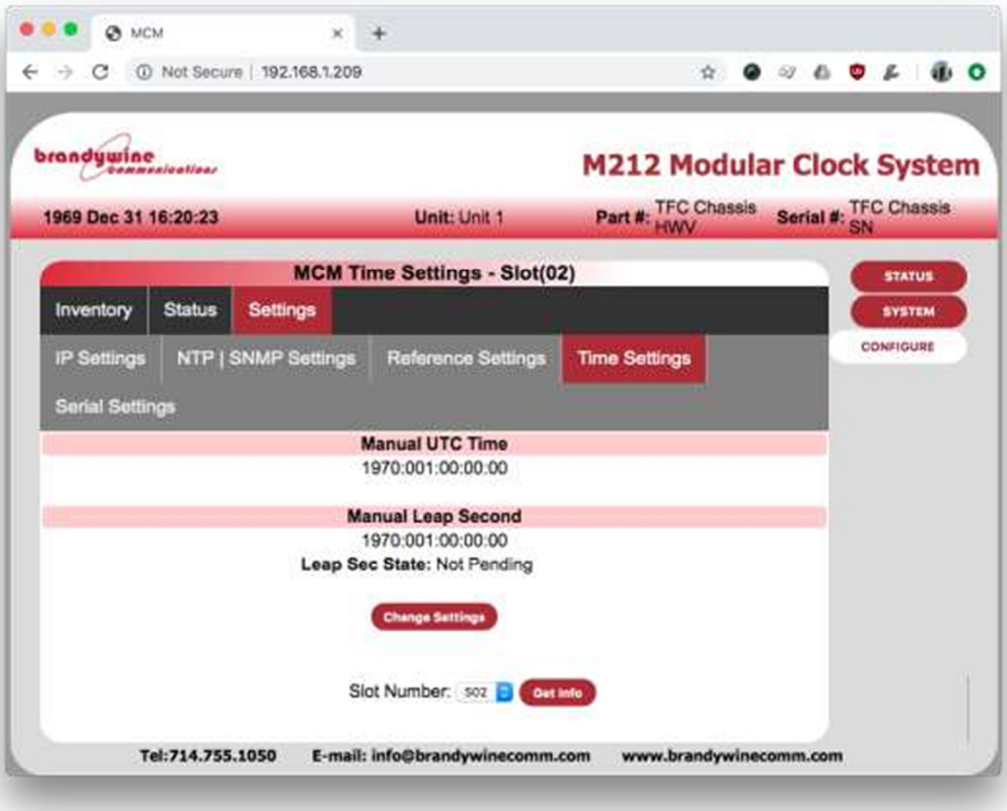


**Figure 16. MCM Time Settings**

### 3.6.5 Serial Settings

The Serial Settings subtab (Figure 17) allows the user to select the baud rate and output message format for the serial timecode output.

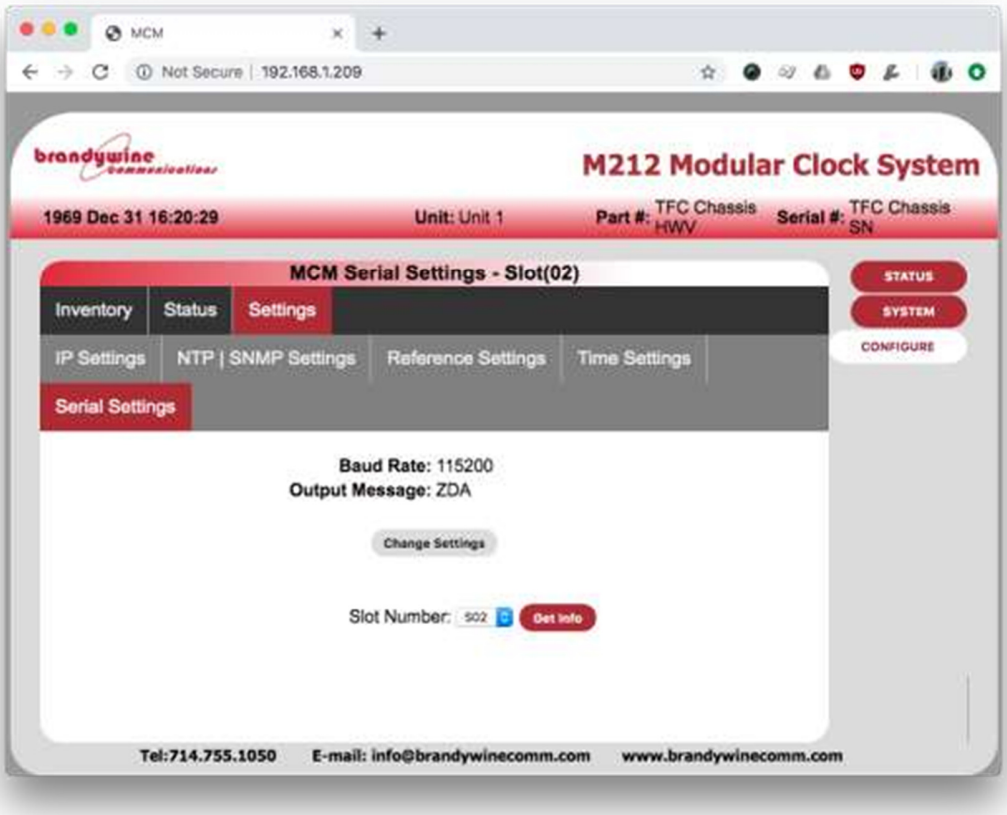


**Figure 17. MCM Serial Settings**

## 3.7 Universal Output Signal Module (OSM) Configuration Page

Clicking the button labeled “Universal” will open the Universal OSM status and configuration pages, from here the inventory, status and settings for the Universal OSM are available for viewing and editing.

### 3.7.1 Universal OSM Inventory Page

The Inventory page (Figure 18) shows the Universal OSM’s serial number, hardware revision, software version and FPGA version.

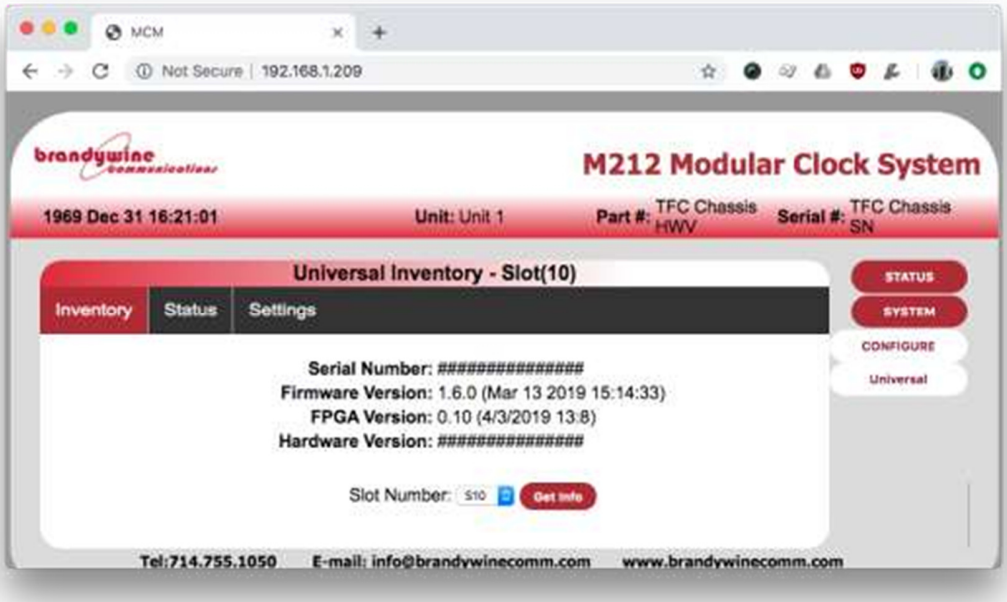


**Figure 18. Universal OSM Inventory Page**

### 3.7.2 Universal OSM Status Page

The Status page (Figure 19) shows the fault status for all four outputs for the Universal OSM.

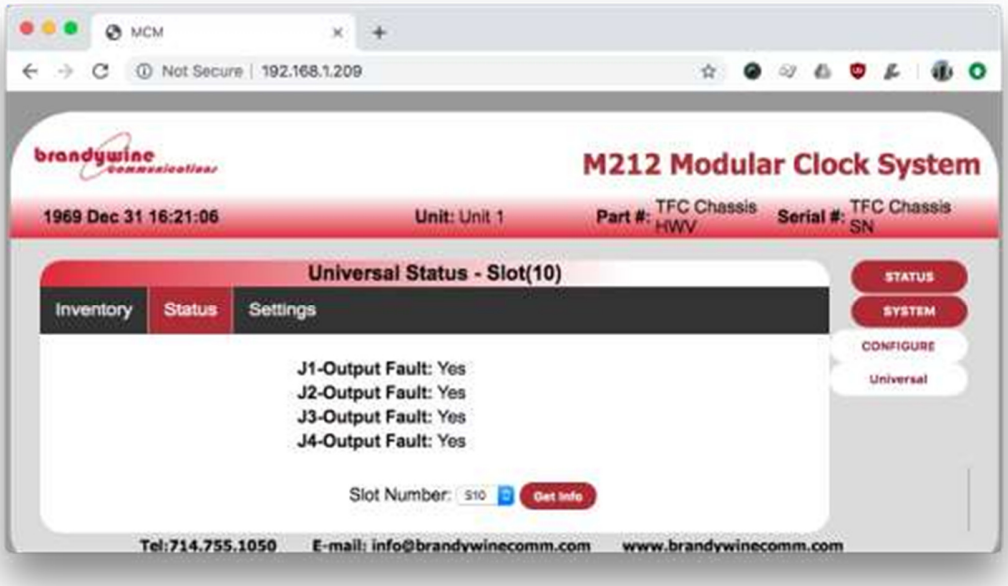


**Figure 19. Universal OSM Status Page**

### 3.7.3 Universal OSM Settings

Each output jack on the Universal OSM can be independently configured to output different formats of time or frequency, depending on the requested application. The Universal OSM Settings tab (Figure 20) is used to configure each jack.

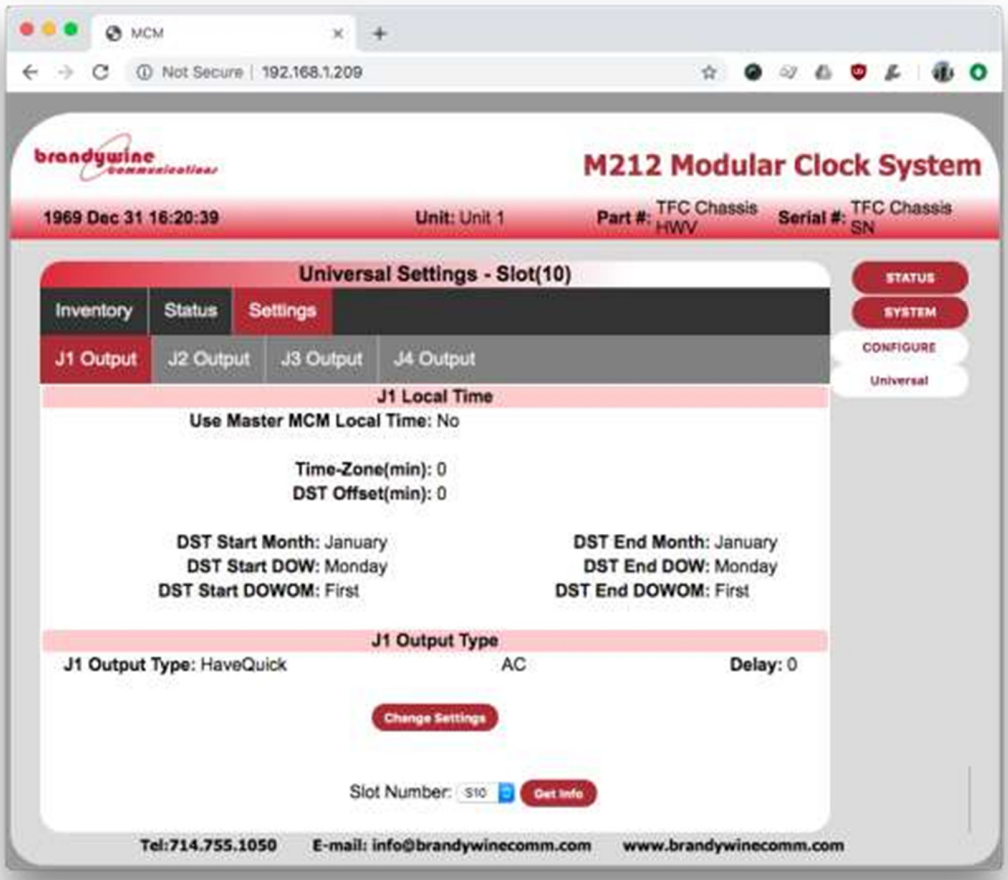


**Figure 20. Universal OSM Settings**

**Table 7. Universal OSM Setting Descriptors**

| SETTING | DESCRIPTION |
|---|---|
| **JX Local Time** | |
| Use Master MCM Local Time | Instruct the OSM to use the same local time settings as the MCM |
| Time Zone (min) | Indicates the time zone offset from UTC in minutes |
| DST Offset (min) | Indicates the Daylight Savings Time (DST) offset from standard time in minutes |
| DST Start Month | Indicates the month that DST starts on. |
| DST Start DOW | Indicates the Day of Week (DOW) that DST starts on. |
| DST Start DOWOM | Indicates the Day of Week of Month (DOWOM) that DST starts on |

Table 7. Universal OSM Setting Descriptors

| SETTING | DESCRIPTION |
|---|---|
| DST End Month | Indicates the month that DST ends on. |
| DST End DOW | Indicates the Day of Week (DOW) that DST ends on. |
| DST End DOWOM | Indicates the Day of Week of Month (DOWOM) that DST ends on |
| **JX Output Type** | |
| JX Output Type | Sets the output format for the selected output jack. |
| Delay | Adjust the cable delay in nanoseconds (µs) to compensate for cable propagation delay |

## 3.8 Network Time Protocol (NTP) OSM Configuration Page

Clicking the button labeled “Ntp” will open the NTP OSM status and configuration pages, from here the inventory, status and settings for the NTP OSM are available for viewing and editing.

### 3.8.1 NTP OSM Inventory Page

The Inventory page (Figure 21) shows the NTP OSM’s serial number, hardware revision, software version and FPGA version.

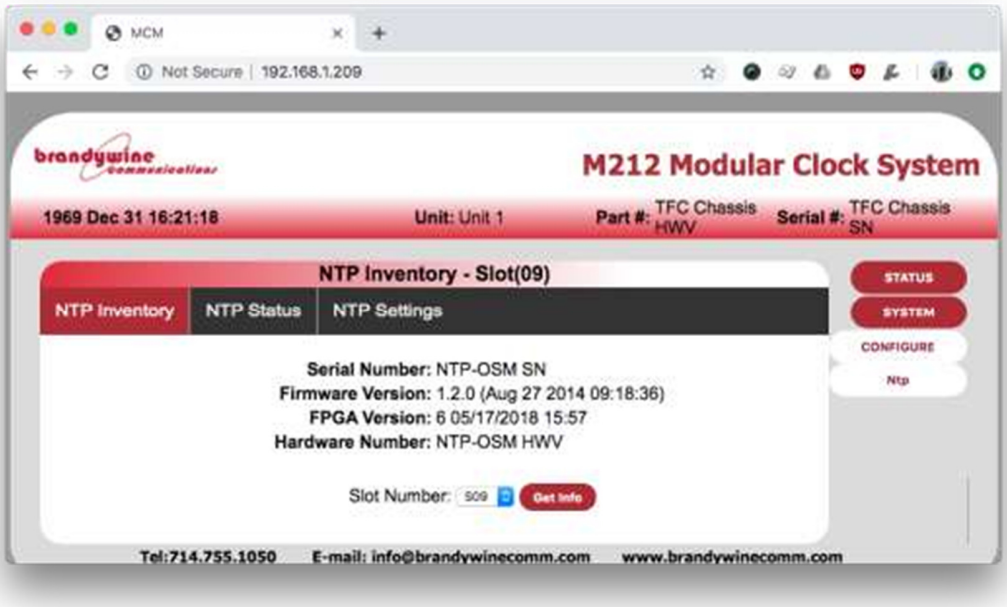


**Figure 21. NTP OSM Inventory Page**

### 3.8.2 NTP OSM Status Page

The Status page (Figure 22) shows the fault status for both ports on the NTP OSM, as well as showing the IPv6 Addresses of each port.

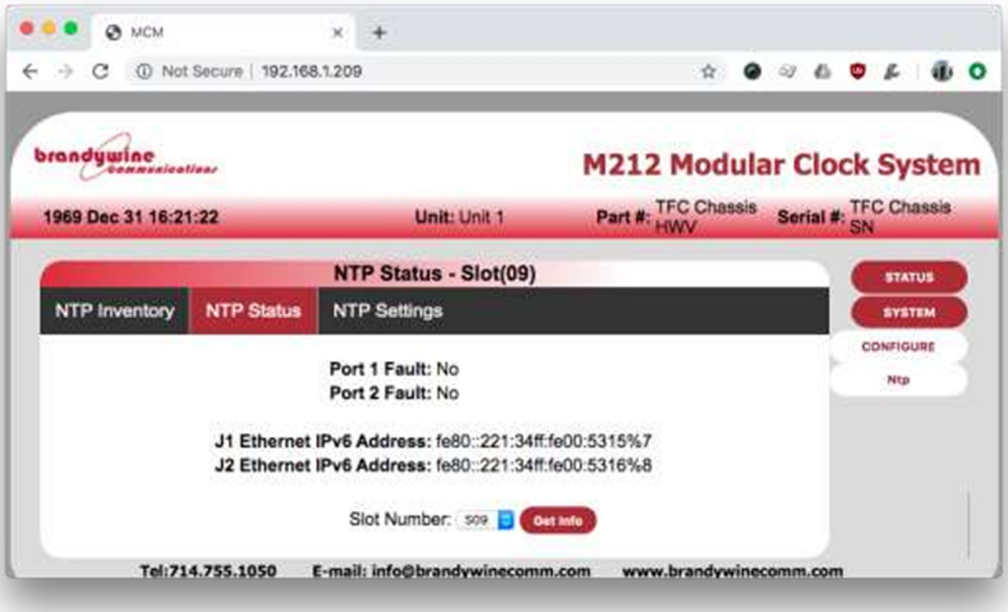


**Figure 22. NTP OSM Status Page**

### 3.8.3 NTP OSM Settings

The NTP OSM Settings Page enables the user to configure the IP address, gateway address, subnet mask, and authentication method, key ID and hex key for each port of the NTP OSM independently.

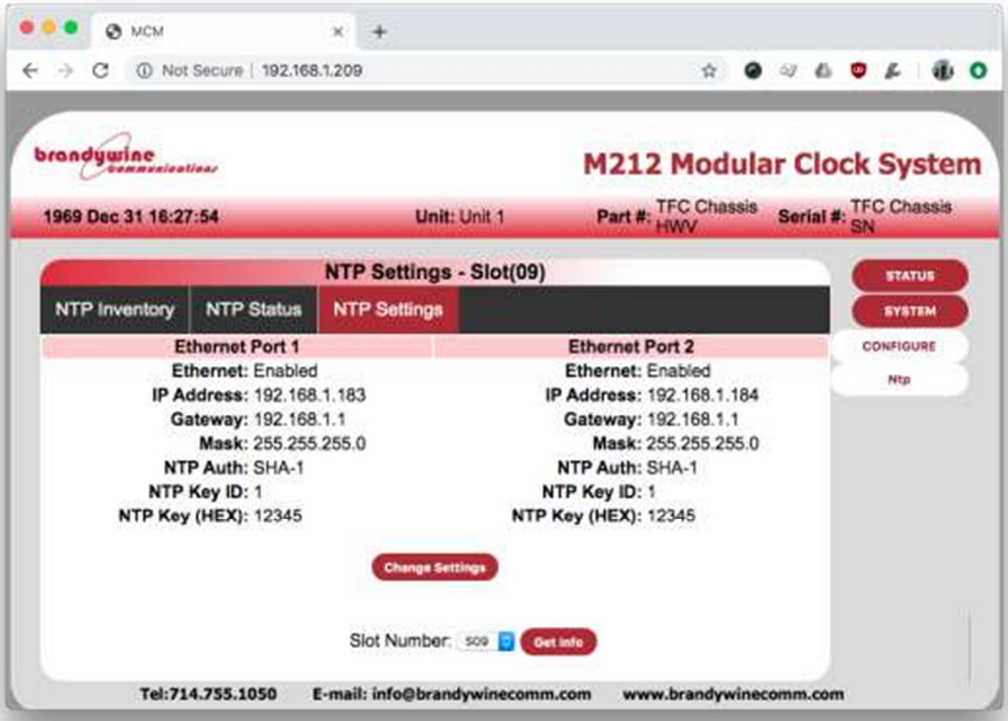


**Figure 23. NTP OSM Settings Page**

# 4 Support Information

All Brandywine Communications products come with a one-year warranty.

If the unit is still exhibiting problems not covered by the above troubleshooting guide, contact us for technical support at support@brandywinecomm.com or call us at 714-755-1050.

If it becomes necessary to return the unit to the factory for repairs, call us at 714-755-1050 extension 113 to arrange an RMA.

## 5 Front Panel Drawing

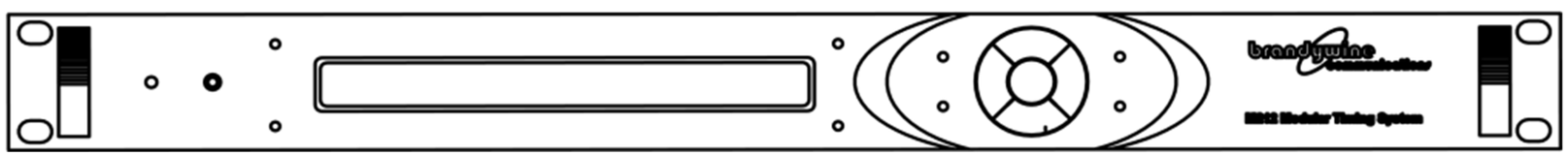


**Figure 24. M212 Front Panel Drawing**

# 6 Rear Panel Drawings

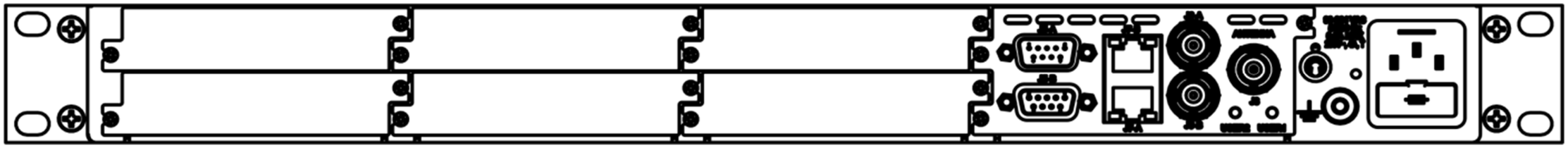

Figure 25. M212 Rear Panel Drawing

## 7 Rear Panel Pinouts

| M212 MCM Module Rear Panel Pinouts | |
|---|---|
| **Connector Ident** | **Function** |
| J6-A | 10Mhz Output |
| J6-B | 1PPS Input |
| J7-A | Ethernet Port 1 |
| J7-B | Ethernet Port 2 |
| J8 | GPS Antenna Input |
| | |
| **J5-A** | |
| **9 way 'D' Type Male** | |
| **Pin** | **Function** |
| 1 | Relay Alarm NC |
| 2 | Relay Alarm COM |
| 3 | 1PPS DC Output |
| 4 | IRIG B DCLS Output |
| 5 | Ground |
| 6 | Relay Alarm NO |
| 7 | Ground |
| 8 | Havequick Input |
| 9 | IRIG Input |
| | |
| **J5-B** | |
| **9 way 'D' Type Female** | |
| **Pin** | **Function** |
| 1 | Ground |
| 2 | RS232 TX |
| 3 | RS232 TR |
| 4 | Ground |
| 5 | Ground |
| 6 | RS422 TX+ |
| 7 | RS422 TX- |
| 8 | |
| 9 | |