Masterclock®



GMR6000

Resilient, High-Precision, Multi-Function NTP & PTP Master Clock

Configuration Guide

Engineered and Manufactured
in St. Charles, MO, USA

Disclaimer

Disclaimer
The information in this quick start guide is provided to assist users in the installation, first-time setup, and operation of the Masterclock GMR6000. While every effort has been made to ensure accuracy, Masterclock, Inc. assumes no responsibility for any errors or omissions that may appear.

Specifications, features, and firmware functionality are subject to change as part of Masterclock's policy of continuous product improvement. Some functions or options described may not be available in all versions or configurations of the GMR6000.
If discrepancies are found between this document and the operation of your unit, or if further clarification is needed, please contact Masterclock Technical Support for assistance.

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Contact and Technical Support
If you have questions or require information not found in this manual, or need assistance with setup, configuration, or troubleshooting, please contact Masterclock Technical Support.

Our team is available to provide detailed guidance for your specific application and ensure your equipment operates at its full capability.

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For additional documentation, firmware updates, or technical resources, visit www.masterclock.com.

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Package Contents

Each GMR6000 shipment includes the following items:

- GMR6000
- Power cable - supplied according to configuration
  - IEC cable for AC models
  - DC terminal block connector for DC models
- Rack-mount hardware
- Ethernet Cable (10ft)

Optional accessories may also be included if ordered, such as GNSS antenna, or SFP modules. Verify all contents before installation and retain packaging for warranty service.

For a complete list of items included with your purchase, please refer to your sales order invoice.





GMR6000

Multi-Functional Master Clock

The **GMR6000** master clock is a modern and versatile time server and frequency generator. The device can reference and synchronize to a variety of input sources and provides a local physical realization of time for systems to utilize. With built in power redundancy and intelligent switching and monitoring, the GMR6000 meets or exceeds contemporary system requirements for ensuring availability, accuracy, and traceability of time and frequency signals for mission-critical applications.



STANDARD INPUTS

- NTP - Network Time Protocol Client
- RS232 (DB-9) / RS422 (5 Pos TB) and/or IP packet serial messages - NMEA 0183, NENA Format 0,1, or 8, Truetime-Kinemetrics
- 2-Independently addressable RJ45 Ports
- 1-Independently addressable SFP, supporting fiber or copper modules
- Configuration via USB or Ethernet (Port 1 only)

STANDARD OUTPUTS

- NTP - Network Time Protocol Server
- 10 MHz Sinewave (BNC, 50 Ω, low phase noise and phase locked to PPS out)
- 1 PPS (BNC, 50 Ω)
- RS232 (DB-9) /RS422 (5 Pos TB) and/or IP packet serial messages - NMEA 0183, NENA Format 0,1, or 8, Truetime-Kinemetrics
- Programmable relay closure - NO/NC dry contact relay
- Relay/ACO (Automatic Change Over) output

INPUT OPTIONS

CONFIGURABLE REFERENCE PRIORITY INPUTS:

The following input reference sources can be used to synchronize the system and/or discipline the internal high stability oscillator.

- GNSS Receiver, Single or Multiconstellation selectable Single L1 or Multiband L1, L2/L5 supporting:
  GPS/GALILEO/BeiDou
  (or M-Code GPS Receiver)
- PTP/IEEE1588 - Precision Time Protocol
- Timecodes - IRIG (DCLS/AM) /SMPTE
- PPS - Pulse Per Second (Sync In)
- 10 MHz - 10MHz reference frequency

The priority of all input signals can be freely configured.

Notes: The unit is shipped with the NTP client disabled.

NMEA serial input may be used in conjunction with the Sync-In feature.

OUTPUT OPTIONS

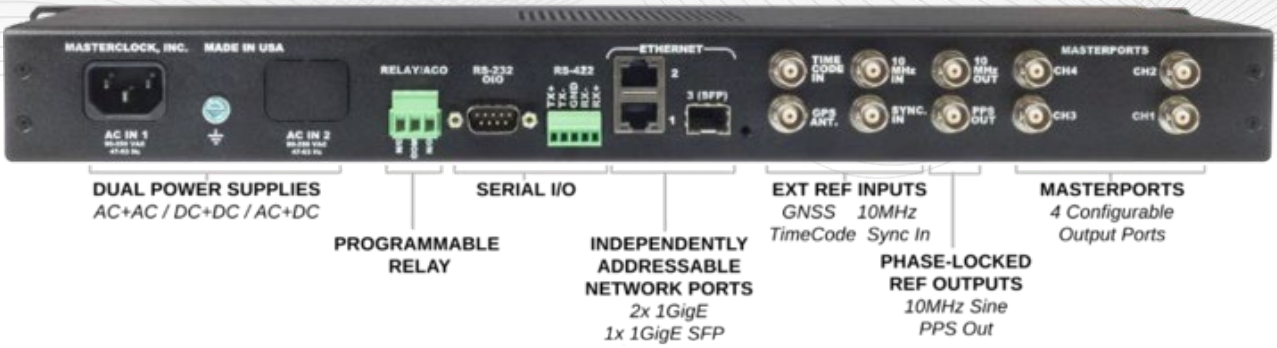
CONFIGURABLE (MASTERPORT) OUTPUTS:

Four configurable Masterport BNC outputs supporting:

- Time codes: IRIG (DCLS and AM) / SMPTE
- Audio/Video Sync: Genlock Black-Burst, Tri-Level Sync, Wordclock
- 1, 5, or 10 MHz Square Wave (Phase locked with PPS)
- Additional PPS
- User-defined Square Wave (Hz or kHz)
- Custom Period Square Wave (User-defined period/frequency)
- Programmable Pulse Output
- Programmable Reference Frequency
- HaveQuick II (Non-NATO) (Feature currently in development)
- Masterport outputs software switchable between 50 Ω and 75 Ω
- PTP/IEEE1588v2 - Precision Time Protocol (Network ports only)

GMR6000

Multi-Functional Master Clock



Network Features

STANDARD

- Three Independently Addressable isolated 1GigE Ethernet ports (Two RJ45 , one SFP)
- NTP Server: Synchronization of NTP and SNTP compatible clients
- NTP authentication: MD5, SHA-1, SHA-2

OPTIONAL

- PTP/IEEE 1588 **Boundary Clock, Ordinary Clock, Transparent Clock** or **Grandmaster** Synchronization of IEEE1588-2008 (PTPv2) compatible clients
  - Default E2E IEEE 1588-2008
  - Default P2P IEEE 1588-2008
  - SMPTE ST 2059-2 Professional Broadcast Environment
  - AES67 Profile for Audio/Video Bridging and Time Sensitive Networks
  - SMPTE 2110 for Audio/Video combined ST 2059-2 and AES67 Interoperability
  - Power IEC 61850-9-3
  - Power IEEE C37.238-2011
  - Power IEEE C37.238-2017
  - Telecom G.8275.1
  - Other PTP profiles by adjusting PTP settings manually

Security Features

Advanced Anti-Jamming, Anti-Spoofing Detection and Mitigation, Authenication on Dedicated Management Port(s), Authenticated NTP

Holdover Features

Features FAST Disciplining, and Low Phase Noise options for OCXO and Rubidium (RB) oscillators for extended holdover with low drift.

OCXO Oscillator:	**± 1.5 usec/24 hours**
Rubidium Oscillator:	**± 500 nSec/24 hours**

Management Features

- Dedicated isolated management network port
- Additional USB management port (Feature currently in development)
- Local or network firmware updates and licensing of new features
- WinDiscovery UI network device discovery launches HTTPS webpage configuration and status monitoring.(Feature currently in development)
- SSH CLI (Command Line Interface)
  Additonal SNMP v1, v2, and v2c,v3 AES-256 configuration (Sets), monitoring (Traps), and logging with provided MIBs. Syslog client
- Easy to read 13-digit 7 segment LED display (Date/Time or Day of year/Time)
- Eight multicolor LEDs on the front panel showing status/alarm of:
  - Power supplies
  - Holdover status
  - Lock indication
  - Stability - System Ready Indication
  - Current Reference (GNSS, PTP, TimeCode, Internal Oscillator)
  - GNSS Satellite Status

Power Features

STANDARD SINGLE OR OPTIONAL REDUNDANT POWER:

Select between single or dual power supplies

- AC: 90-264VAC, 50/60Hz, IEC (Universal IEC C14 AC input connector)
- DC: 24VDC, 48VDC, or 125 VDC
- < 20W Power Dissipation

SUPPORTED NETWORK PROTOCOLS

Protocol	Description
Transmission Control Protocol (TCP) and User Datagram Protocol (UDP)	Layer 4 - Transport Layer Network Protocol
Internet Protocol (IP)	IPv4, IPv6
Network Autoconfiguration	IPv4: Dynamic Host Configuration Protocol, DHCP (RFC 2131) IPv6: DHCPv6 (RFC 3315)
Network Time Protocol (NTP) Simple Network Time Protocol (SNTP)	NTP v2 (RFC 1119), NTP v3 (RFC 1305), NTP v4 (RFC 5905) SNTP v3 (RFC 1769), SNTP v4 (RFC 4330)
NTP Authentication	MD5, SHA-1 , SHA-2
Secure Shell (SSH)	SSH v1.3, SSH v1.5, SSH v2 (OpenSSH) - CLI (Command Line Interface)
Hypertext Transfer Protocol (HTTP)	HTTP/HTTPS (RC 2616) (Feature currently in development)
Simple Network Management Protocol (SNMP)	SNMPv1 (RFC 1157), SNMPv2c (RFC 1901-1908), SNMPv3 (RFC 3411-3418)
Precision Time Protocol (PTP)	IEEE1588-2008 v2, IEEE1588-2019 v2.1
Internet Group Management Protocol (IGMP)	IGMPv2 (RFC 2236), IGMPv3 (RFC 3376)
Syslog Protocol (SYSLOG)	SYSLOG (RFC 5424)

PTP PROFILES (PRE-CONFIGURED)

Default	Default E2E IEEE 1588-2008 Default P2P IEEE 1588-2008
Media, Audio/Video	SMPTE ST 2059-2 Professional Broadcast Environment AES67 Profile for Audio/Video Bridging and Time Sensitive Networks SMPTE 2110 for Audio/Video combined ST 2059-2 and AES67 Interoperability Power IEC 61850-9-3 Power IEEE C37.238-2011 Power IEEE C37.238-2017 Telecom G.8275.1
Compliance	Safety: IEC 62368-1:2018 Audio/video, information and communication technology equipment - Part 1: Safety requirements EMC: EN IEC 55035 Electromagnetic compatibility of multimedia equipment FCC, CE Marked, ANSI , ROHS TAA Compiant Traceability to <1 microsecond (ref: tf.nist.gov/general/pdf/3167.pdf)
Temperature & Humidity	Operating: 0 to 60°C (32 to 140°F), Up to 90% (non-condensing) Storage: -20 to 70°C (-4 to 158°F), Up to 90% (non-condensing)
MTBF	>500,000 hours (Calculated using Fixed/Ground Mil HDBK 217F assumptions)
Size & Weight	Size: 16.90w x 1.750h x 9.75d in (42.92w x 4.445h x 24.76d cm) Weight: 2.6 lbs. (1.2 kg)

SUPPORTED TIME CODES

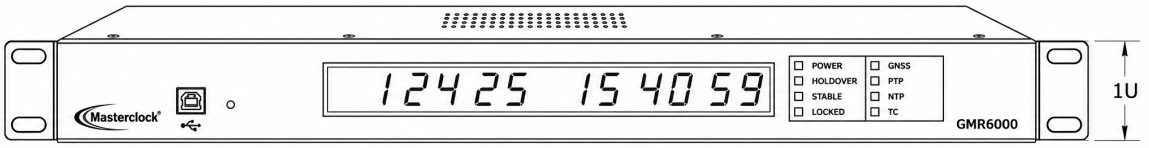
Time Code (LTC, Serial Formats)	Description
IRIG (DCLS, Amplitude Modulated)	Inter-Range Instrumentation Group - IRIG STANDARD 200-16 IRIG-A, IRIG-B
SMPTE	Society of Motion Picture and Television Engineers SMPTE 12M, 309M, 24/25/30 ND fps - 29.97 Drop Frame
HaveQuick II	HaveQuick Non-NATO version (Feature currently in development)
Serial ASCII Codes	
NMEA-0183	National Marine Electronics Association
NENA	National Emergency Number Association , Format 0,1,8 per NENA PSAP Master Clock Standard, NENA-STA-026.5-2022, February 28, 2022
Truetime/Kinemetrics	Legacy Truetime Kinemetrics DDD:HH:MM:SS format
IRIG	Inter-Range Instrumentation Group - IRIG STANDARD 212-00 IRIG-J

OPTIONAL CONFIGURATION ITEMS

Part #	Description	
GMR-AVSync	Blackburst (BB), Tri-Level Sync (TLS), Word Clock & SMPTE, BNC Cntr	Licensable
GMR-TCADV	IRIG-A, IRIG-E, IRIG-G, IRIG-H, BNC Cntr (IRIG-J Serial Cntr)	Licensable
GMR-PTP	PTP IEEE 1588 Server / Client, 1 GigE, all network ports	Licensable
GMR-PPO	Custom Waveform Output	Licensable
GMR-GNSS	GNSS Receiver, BNC Connector	Specify at order
GMR-M-Code	Encrypted GPS M-Code receiver - Contact sales for information	Contact Sales
GMR-HSO-3	Internal Rubidium Ultra High Stability Oscillator	Specify at order
GMR-SYNC-IN	PPS, PPM, PPH, Input, BNC Cntr	Licensable
GMR-TCG	Time Code Generator (IRIG-A, IRIG-B, SMPTE 12M, 309M, 24/25/30 ND fps - 29.97 Drop Frame)	Licensable
GMR-TCR	Time Code Reader (IRIG-A, IRIG-B, SMPTE 12M, 309M, 24/25/30 ND fps - 29.97 Drop Frame).	Specify at order
AC Power Cords Available:	IEC C13 to North American (NEMA 5-15, Type B), Euro Plug (CEE 7/7, Type F), U.K. Style (Type D), or Australia/New Zealand (Type I)	Specify at order

Unpack and Inspect

- Before installation, verify that the GMR6000 and all accessories are present and undamaged.
- Handle the unit carefully during unpacking to prevent accidental impact or static discharge.
- Take note of the device's serial number, MAC address, and initial password printed on the label. This information will be required for technical support or service inquiries. The default password is randomly generated at the time of manufacturing. Product registration is not required for warranty coverage.



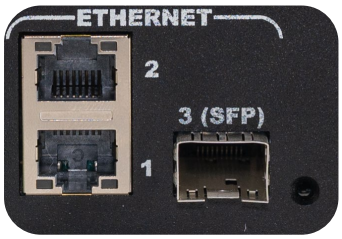
Mount the Unit

- Select a suitable location for operation. The GMR6000 requires 1U of a standard 19-inch equipment rack. Always utilize all four mounting bolts to ensure a secure mount.
- The GMR6000 uses passive heat dissipation - avoid obstructing the top, bottom, and side ventilation whenever possible.
    - Devices equipped with Rubidium (Rb) oscillators will generate additional heat compared to those outfitted with a standard OCXO. This is expected behavior and should not impact the functionality of the unit.
- For temporary testing, the GMR6000 can be placed on a stable workbench, table, or other flat surface. Be mindful of static discharge.
- Ensure that the unit is properly grounded according to local or site-specified electrical codes. Additional grounding is recommended by utilizing the dedicated grounding screw located between the two power inlets. Attach a suitable wire from this screw to a ground source.

Network Connections

The GMR6000 provides multiple network interfaces for time synchronization, network communication, and administrative access. Connect the appropriate ports based on your network design requirements.

- The GMR6000 is outfitted with three interfaces; ports 1 and 2 are ethernet, and port 3 is a standard SFP module (copper or fiber).
- Port 1 is the dedicated network management interface; other network ports will not allow configuration changes through the WinDiscovery software or SSH.
- Each port supports 10/100/1000 Mbps operation and automatically negotiates link speed and duplex.
- By default, each port has DHCP enabled. Static IP addresses can be configured through the WinDiscovery software or SSH through port 1.



Network Interfaces

Input References

In addition to NTP and PTP, the GMR6000 can synchronize to several external timing references and utilizes them one at a time in the order of a user-specified priorities list. All connections use a standard BNC port; adapters may be required.

- GNSS Connection – Connect a suitable GPS/GNSS antenna to the GPS ANT. port on the rear I/O panel. The GMR6000 outputs 5V from its antenna port to accommodate powered antennas. Avoid using passive antennas.
- Time Code Input – For synchronizing to an external Time Code source (IRIG-B or SMPTE LTC), connect the source via standard BNC cable to the TIME CODE IN located on the rear I/O panel. The GMR6000 will automatically detect and decode incoming signals.
- PPS – Allows the input of a stable Pulse-Per-Second (PPS) signal from another source. It is recommended that both the GMR6000 and PPS source use a shared common ground to maintain signal integrity.
- 10MHz – Allows the input of an external 10MHz clock source. Using this reference will override the GMR6000's internal 10MHz clock. Useful for synchronizing two devices that may not have a shareable timing reference.

Output

- PPS – Allows other devices to synchronize to the Pulse-Per-Second (PPS) generated by the GMR6000's internal oscillator. The PPS and 10MHz signals are synchronized and always stay aligned with one another.

- 10MHz – Allows other devices to synchronize to the 10MHz signal generated by the GMR6000's internal oscillator. This does not alter the 10MHz output, though users are unlikely to see any large variance between them.

MasterPorts

MasterPorts are a new feature exclusive to the GMR6000. These consist of four fully independent, user-configurable BNC ports that can output various types of signals.

- **IRIG** – Generates an IRIG Time Code output. This can be configured as IRIG-B00x, IRIG-B12x, IRIG-A00x, or IRIG-A12x. These also include configurable coded expressions for most common IRIG signals. Can output UTC, Local Time, or Custom time.

- **SMPTE** – Generates a standard SMPTE Time Code, configurable to 24, 25, 29.97, or 30 FPS (frames per second). These also support date encoding with 309M, Leitch, or zero-filled.

- **Video/Audio Sync** – Generates synchronous output of NTSC or PAL Black Burst, Tri-Level Sync (TLS) from 720i/p, 1080i/p at 50, 59.94 and 60Hz, or Wordclock between 32KHz to 192KHz.

- **Waveform Output** – Generates Custom Frequency Square Waves (user-defined), Custom Period Square Waves (user-defined), High Frequency Square Waves of 1, 5 or 10MHz, or a secondary PPS (Pulse Per Second).

- **None** – Output of individual ports can be disabled.

Power

The GMR6000 is designed for redundancy, allowing customers to select between single or dual power configurations. Both AC and DC are acceptable power inputs (specify at order). Units equipped with two power connectors will automatically and seamlessly switch between them with no interruption of service.

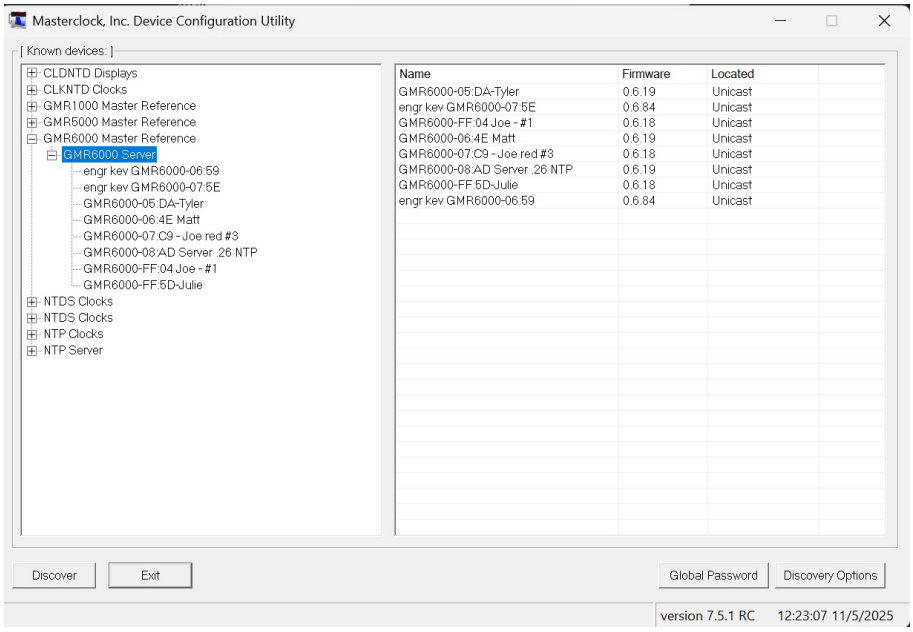
- Units with AC power should be connected to a properly grounded outlet rated at 100-240 VAC, 50/60 Hz.
- Units with DC power should be connected ensuring that the positive and negative terminals are correctly chosen, these will be labeled on the connector along with voltage and current ratings.
- To maximize the use of dual-power GMR6000's, connect each port to a separate source. If both inlets are powered by the same source, redundancy will not be effective.
- A blue-green colored grounding screw is present between the two power inlets on the rear I/O. This screw effectively grounds the main PCB inside to the metal chassis. It is recommended to attach a wire from this screw to a proper ground source in the facility such as a server rack or dedicated equipment ground.



Download WinDiscovery at Masterclock.com

WinDiscovery

WinDiscovery is Masterclock's dedicated device management software. This software runs on Windows computers and allows users to configure, monitor and manage any Masterclock device. It provides a graphical interface for network discovery, setup, and monitoring, making it the ideal tool for system administrators who want to configure, verify, or troubleshoot their device without a command-line. SSH is available for users who prefer command line interface configuration. See page 37 for SSH information.



When launched, the program scans all local subnets for connected Masterclock devices after pressing the "Discover" button. Detected units appear in the main window with their model, firmware version, and network "Location" (Unicast/Broadcast/Multicast).

As the GMR6000 is password-protected, WinDiscovery prompts for the administrator password before configuration can be made.
Tip: You can view basic device properties or status without a password by right-clicking the device entry and selecting the appropriate option.

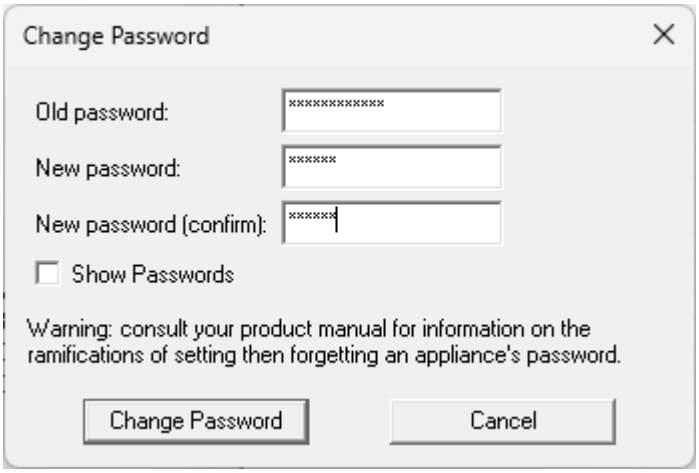
Initial Configuration
WinDiscovery

First Time Setup

- Connect applicable inputs and outputs required by your configuration.
- Connect an ethernet cable to network port 1, or a USB to the front panel port.
- Insert the power cable(s) to power on the device.
- Load WinDiscovery software on your computer - this can be downloaded from Masterclock.com under either Products > Software, or Resources > Firmware.
- Providing the GMR6000 and the computer being used are on the same network, click “Discover” in the lower corner of WinDiscovery to bring up a list of available devices to configure.
- Click on your device where it appears in the list to open the Device Settings.

The GMR6000 is shipped with a randomized alphanumeric password. This password is specific to its respective device, and no two units will share the same unique default password. The default password is printed on the device’s label, box label, or by giving the front reset button a short press to display it on the GMR6000’s LED display (this method will no longer work after initial setup).

Upon Discovering the device in WinDiscovery (or first-time connection through SSH) the user will be prompted to enter the default password, followed by a field to enter a new password.



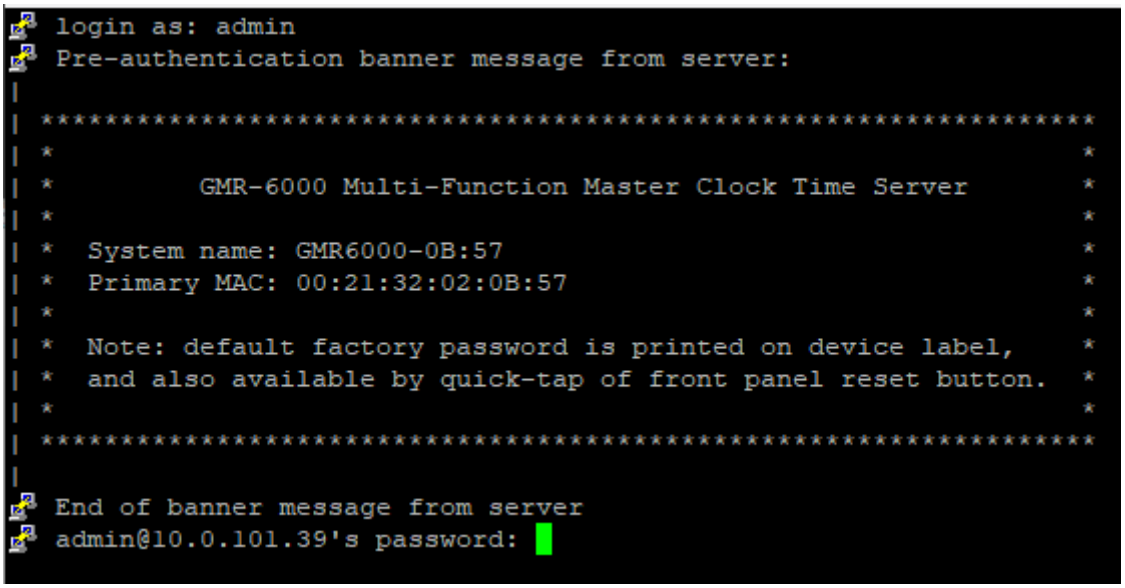
SSH

SSH (Secure Shell) is an alternate method of configuring and managing functions of the GMR6000 when WinDiscovery is not available or not allowed by your organization's security policy. SSH uses a CLI (Command Line Interface) as opposed to the GUI (Graphical User Interface) provided by WinDiscovery.

- Connect an ethernet to network port 1 (USB is not applicable for SSH configuration)
- Insert the power cable(s) to power on the device.
- Using a terminal program of your choosing, such as TeraTerm, PuTTY, OpenSSH etc. establish a connection to your GMR6000 using the IP address. The device's IP address can be shown on its LED display by giving a single short press of the reset button. This will also display the factory default password.
- The default username for SSH is **admin**

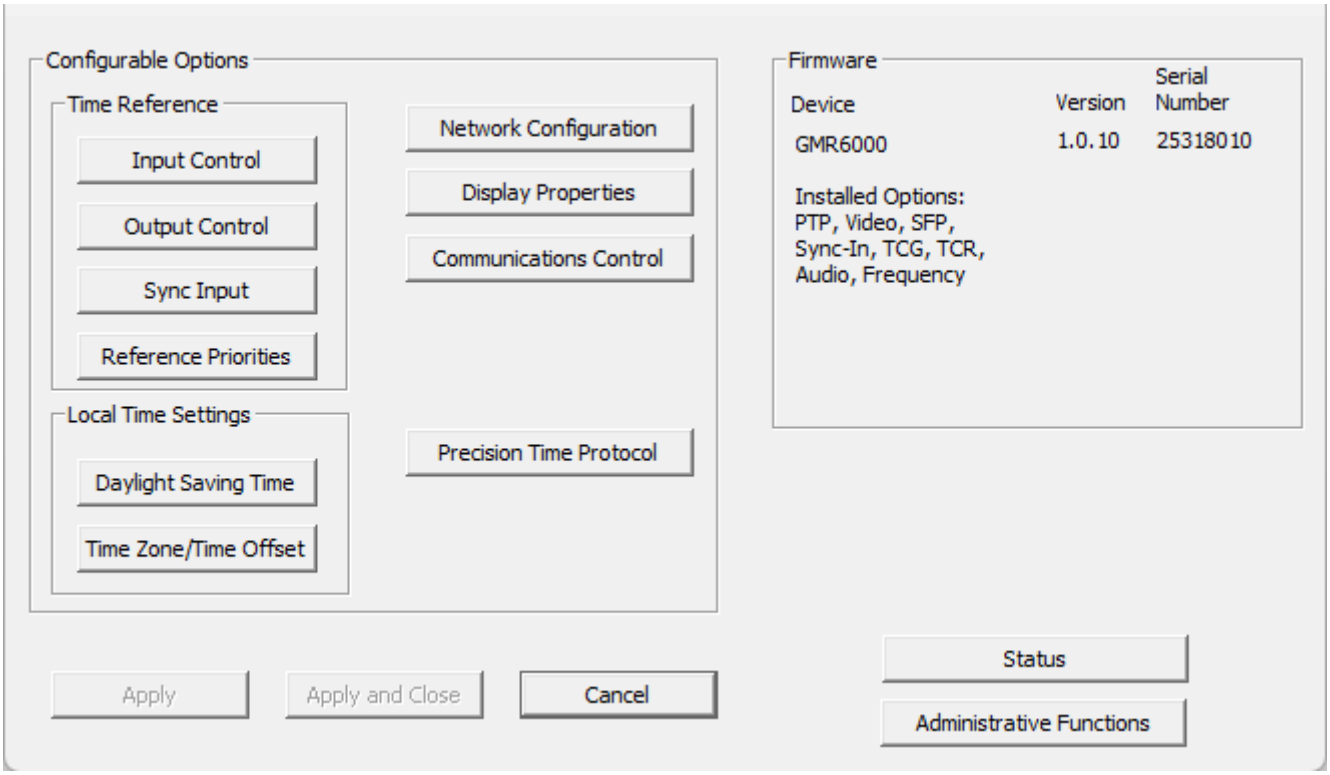
Upon first-time connection through SSH the user will be prompted to enter the default password, followed by a field to enter a new password.

For additional information regarding SSH, please refer to page 40 of this guide.



Device Settings

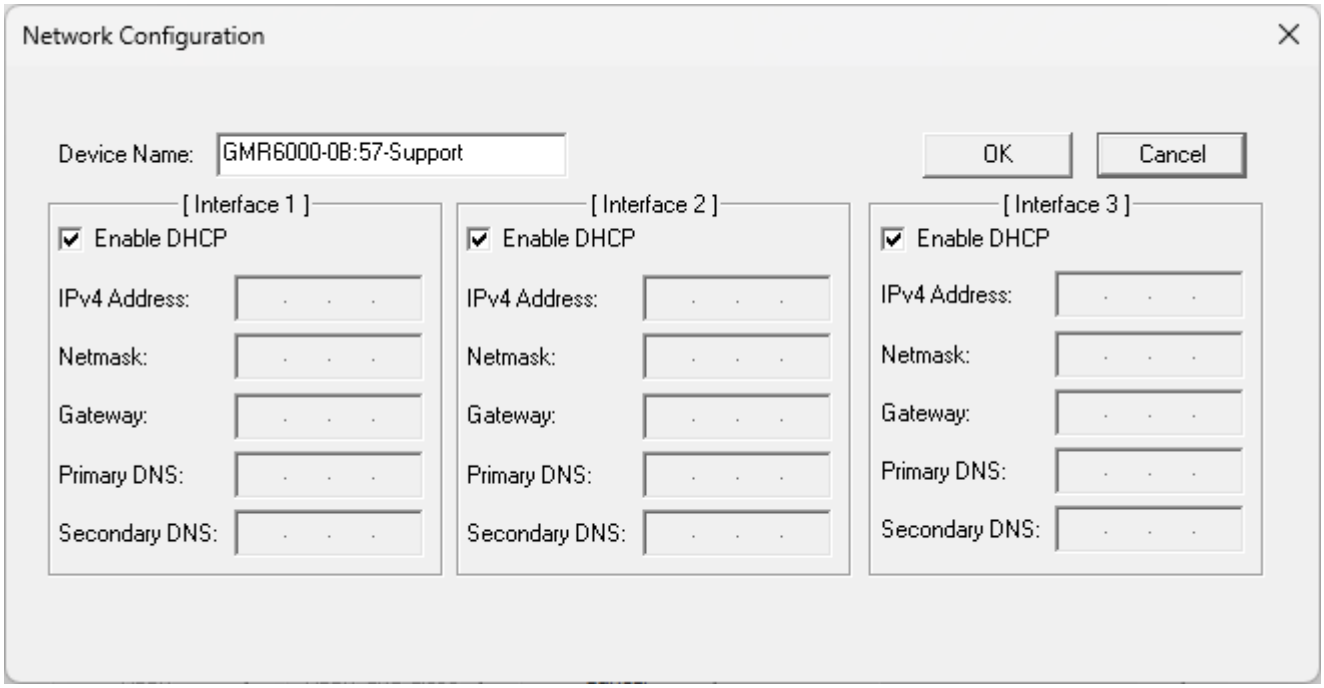
This is the primary screen shown when configuring the GMR6000 through WinDiscovery. It consists of several Configurable Options, Time References, Local Time Settings, Network and Display Configurations, and if applicable to your order specifications it will also have a Precision Time Protocol (PTP) options button.



The right side provides Firmware information status; showing you the Device, Firmware Version, Device Serial Number, as well as any Options that were installed by the factory (per device order). Additional options may be purchased and remotely unlocked through an option key, contact sales@masterclock.com to learn more about unlockable features.

Network Configuration (Device Settings)

The most important place to start is with the Network Configuration option in Device Settings. In this menu you will have the ability to set a device Name, as well as configure all three network interfaces with DHCP or a user-defined IP Address for static settings independently.



Changing the default Device Name can be incredibly useful for keeping track of multiple devices. By default, the Device Name is the model number and the last four digits of the primary MAC address. By appending the name with a location such as “BREAKROOM” or “FRONTDESK”, you can help others involved in IT and networking by making clocks easy to physically locate or manage on a network.

The screen capture above has a device named “GMR6000-0B:57-Support”, indicating this device is located in the Technical Support area of Masterclock.

If DHCP is enabled but no DHCP server is available, the GMR6000 will assign a fallback address to the affected interface. This usually begins with 169.254.xx.xx Where xx.xx is the decimal representation of the last two bytes of the MAC address.

Input Control (NTP Client)

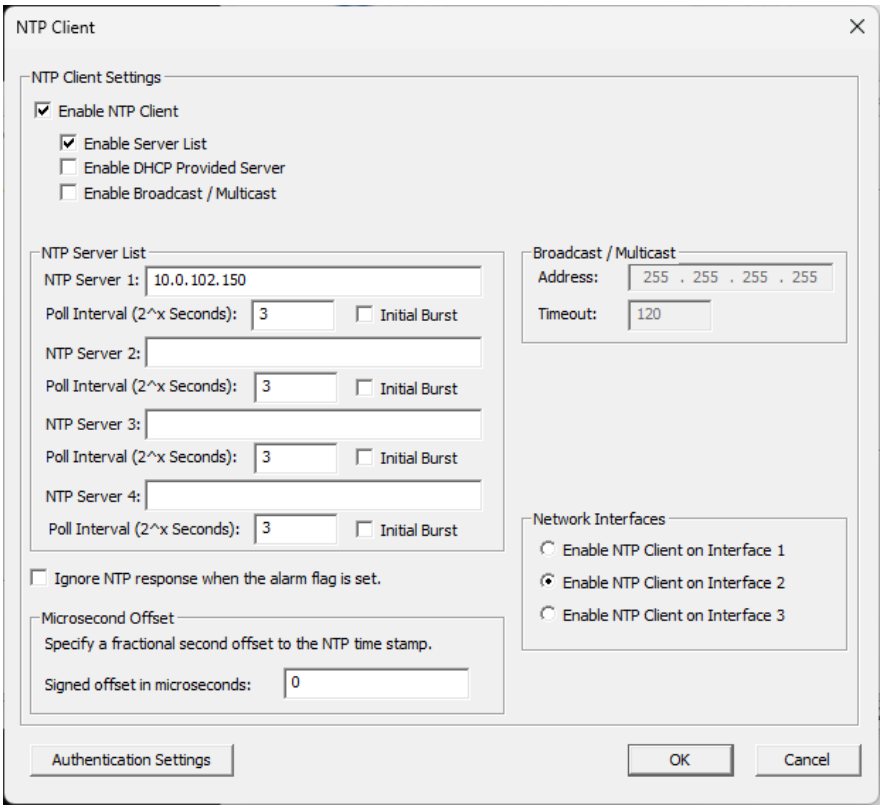
The GMR6000 can utilize other NTP servers as a timing reference. These NTP servers can be on your local network or located on the broader internet and can be configured through the Input Control > NTP Client menu.

In this menu you can enable or disable the GMR6000's NTP Client, you may also enable a list of specific servers to query, set it to query a DHCP provided server, and enable or disable Broadcast/Multicast listening.

In the NTP Server List users may also define a polling interval for individual servers, as well as selecting whether to send an initial burst of requests when first connecting in order to quickly calculate delay and offset.

Users may also select a specific Broadcast/Multicast address if enabled.

You can choose to accept or ignore NTP responses that contain alarm flags which indicate whether or not the queried server itself has a valid reference.



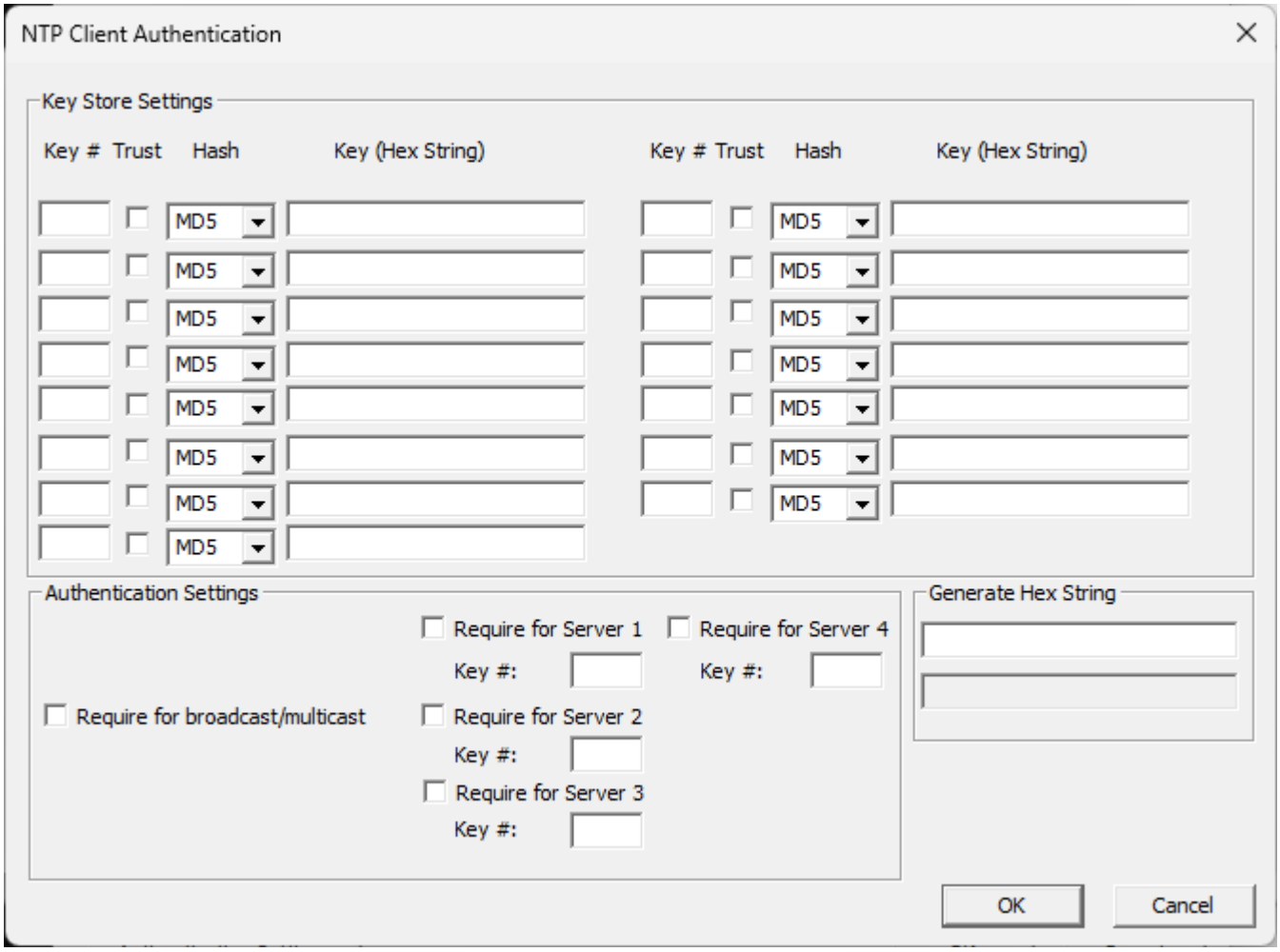
An offset for NTP time stamps can be set to a resolution of microseconds.

Users may select up to one Network Interface to act as an NTP client at a time.

Input Control (NTP Client Authentication)

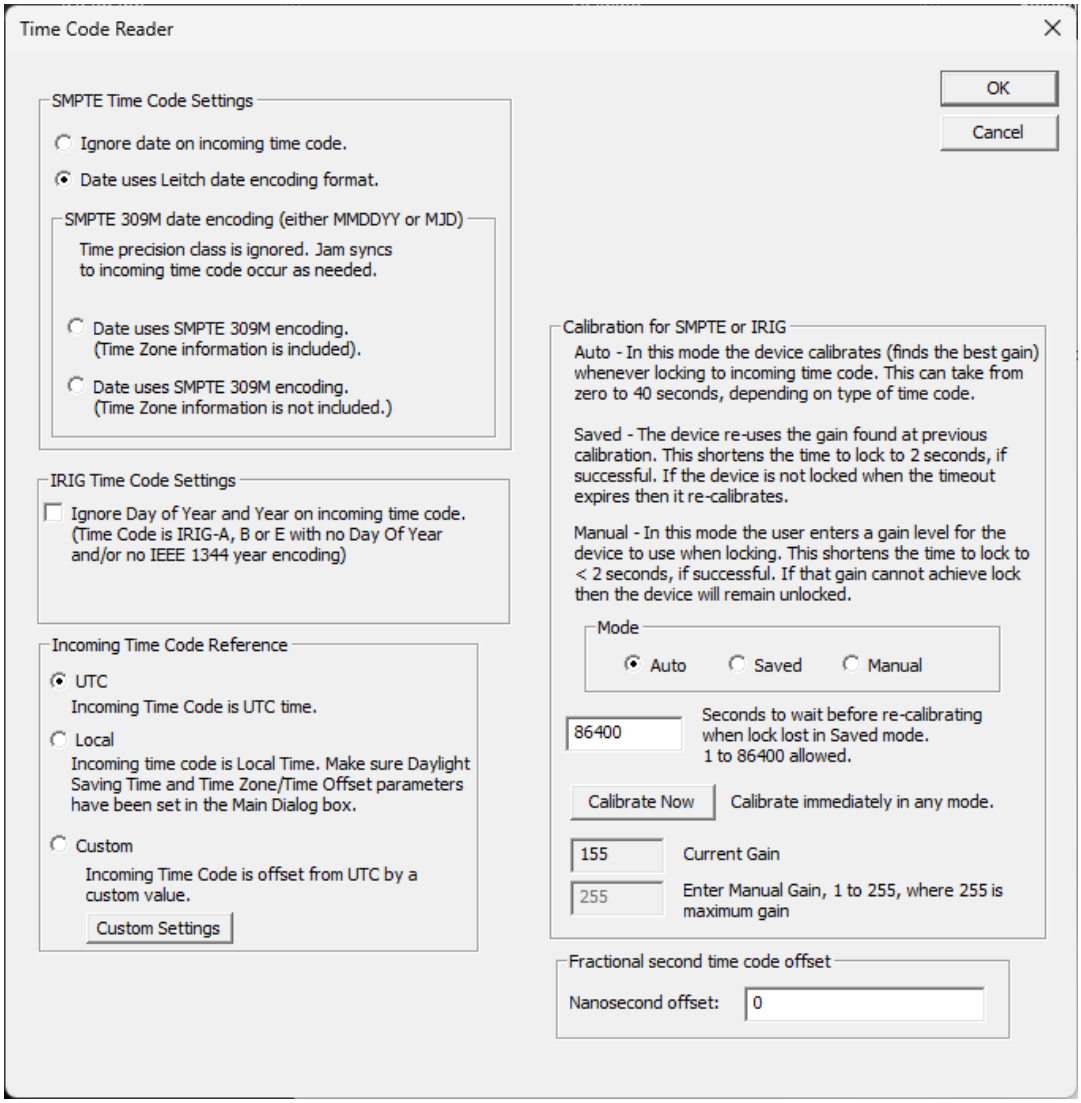
The GMR6000 is able to query and receive authenticated NTP responses from a server. Users can specify up to sixteen (16) key numbers. These can be enabled or disabled individually, can be required for specific communicating with specific servers that were configured in the previous menu, and hex strings can be generated in this window.

You may select between MD5, SHA-1 or SHA-2 authentication for each key. **Only hexadecimal keys are accepted.** For ASCII keys, utilize the generation tool in the lower right corner of the window to convert them to hexadecimal.



Input Control (Time Code Reader)

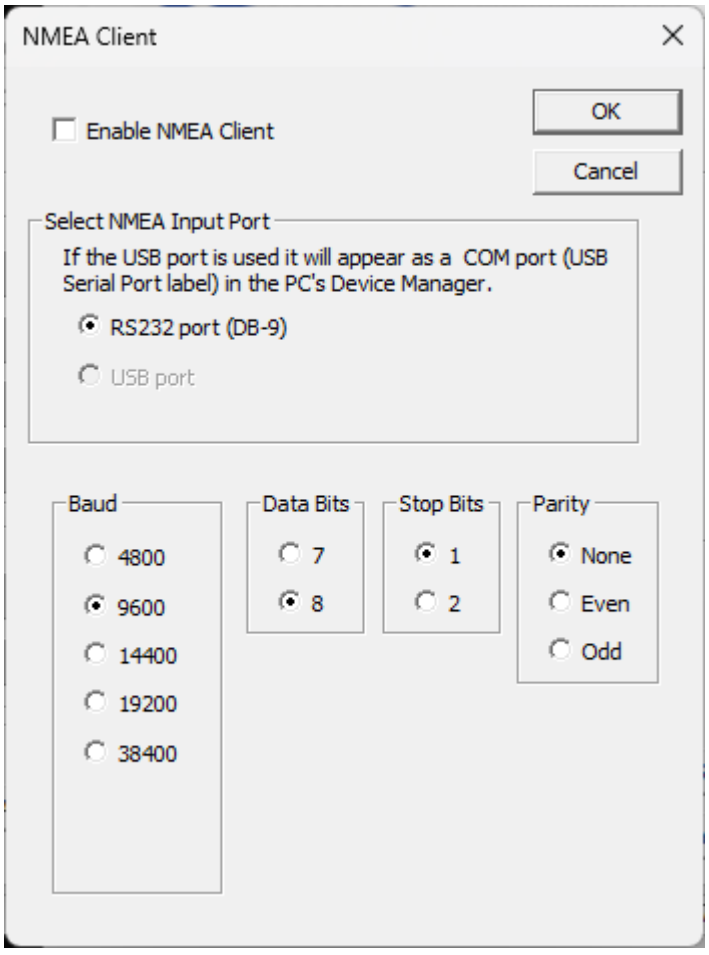
The GMR6000 is able decode multiple types of incoming Time Code from other devices. In the Input Control > Time Code Reader menu, users can modify various settings related to SMPTE and IRIG inputs. In most cases using the automatic calibration is sufficient for decoding, but you can also select specific gain levels for incoming signals.



Input Control (NMEA Client)

NMEA messages may be used as a reference in conjunction with the Sync-In feature.

The NMEA client can be manually enabled or disabled. Input is allowed through the RS232 port located on the rear IO, or through the front USB port. Users can specify a common Baud rate between 4800 to 38400, as well as specify Data Bits, Stop Bits, and Parity type.



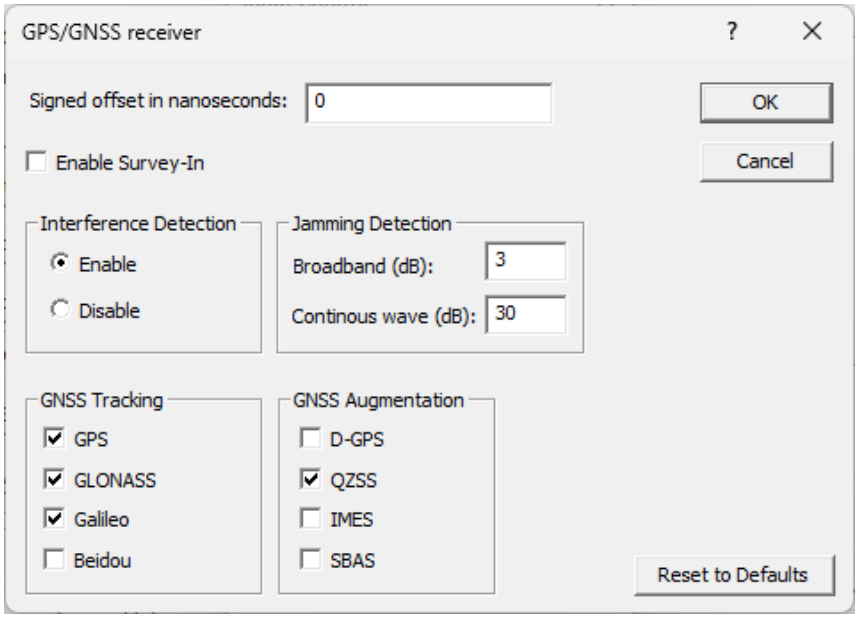
Input Control (GPS/GNSS)

GPS/GNSS is the preferred method of timing synchronization for the GMR6000. Through this menu users may set an offset to account for cable delay between the antenna and the receiver. Cable delay calculations can vary based on the length and type of cable used, refer to the manufacturer's specifications sheet to determine the correct offset.

Survey-In
A useful for stationary installations where the GMR6000 will consistently lock to certain satellites based on its location. This allows the device to lock with higher accuracy to fewer satellites than it would normally need.

Interference Detection
Allows the GMR6000's internal receiver to monitor for excessive or unexpected signal noise and report interference when necessary.

Jamming Detection
Similarly monitors the signal for broadband interference or continuous wave signals attempting to overwhelm the receiver.

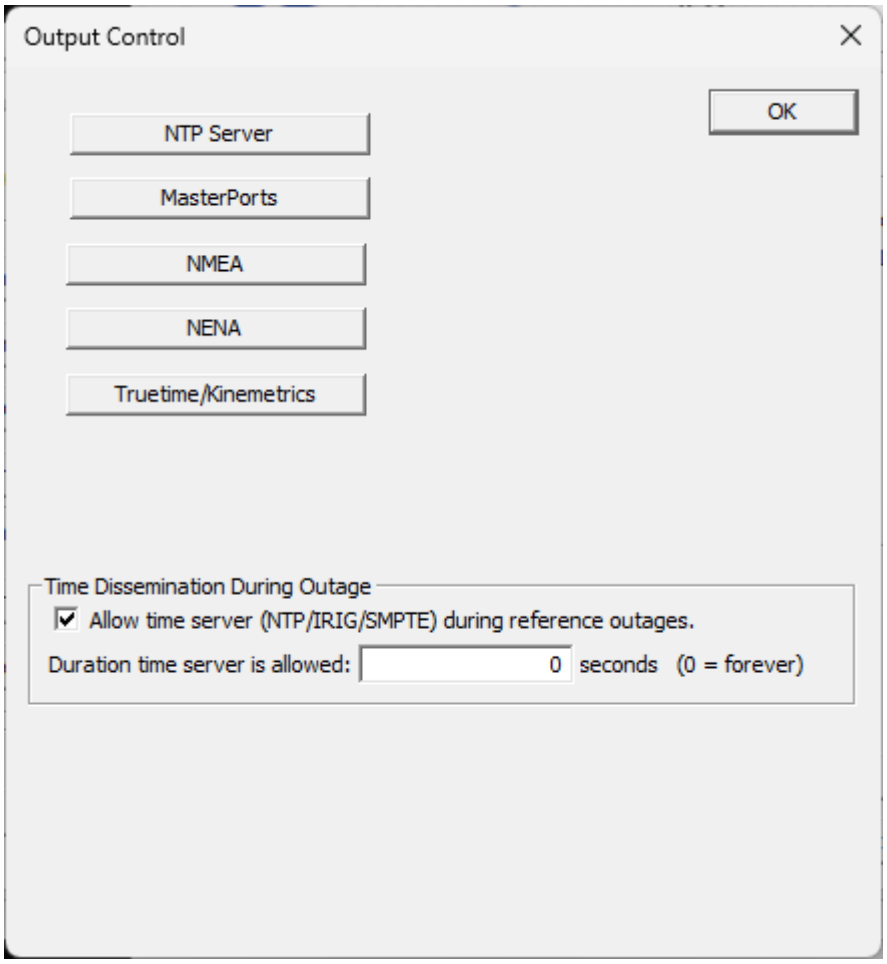


GNSS Tracking
Allows users to select which constellations should be used for reference. Up to three may be selected. Note that Beidou and GLONASS may not be enabled at the same time.

GNSS Augmentation
When GPS is enabled, this allows for various systems of augmentation to be used. By default, the QZSS system primarily used in Japanese and Asian markets is enabled.

Output Control

The GMR6000's Output Control menu serves as the primary configuration window for signal and reference output from the device.



At the bottom of this window you'll find an important option; **Time Dissemination During Outage**. This setting allows the GMR6000 to continue to output reference signals such as NTP, Time Code, and more, without a valid external input reference. By default, the device is configured to cease most signal output after 24-hours (86400 seconds), unless this value is changed to 0 where it will output signal regardless of having a valid external input reference.

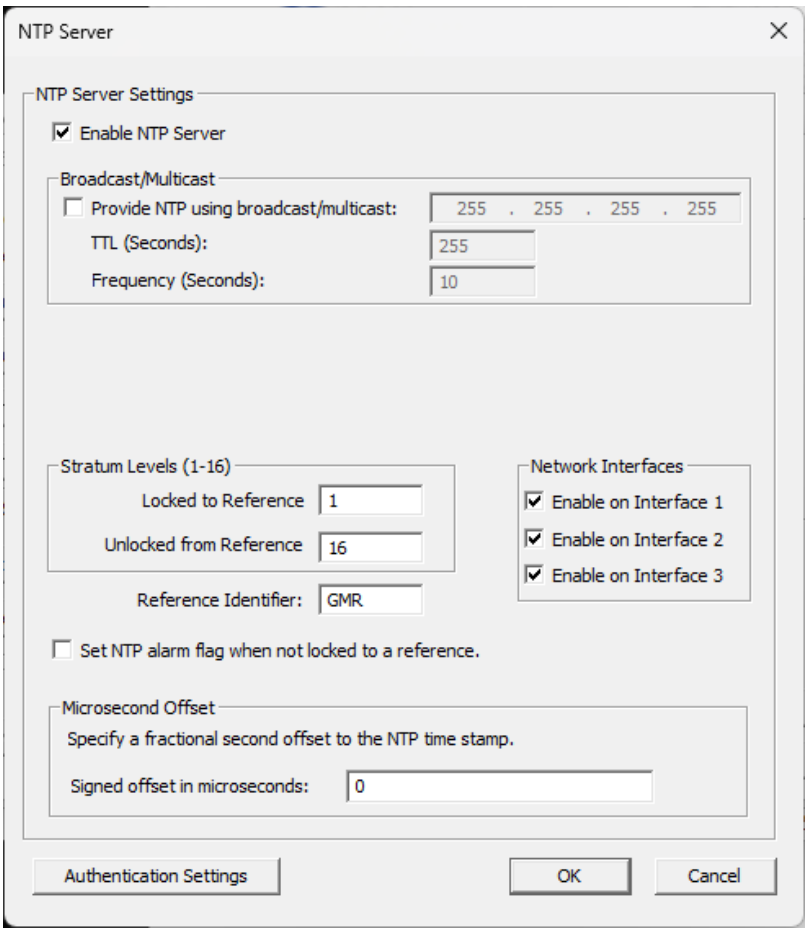
Output Control (NTP Server)

The GMR6000's NTP Server can be enabled or disabled with no effect on other outputs such as PTP or Time Code. If enabled, NTP clients will be able to query the IP address of the GMR6000 and receive replies over UDP port 123.

Broadcast/Multicast - allows the GMR6000 to provide NTP to clients over a broadcast address, with user-defined frequency.

Stratum Levels – When locked to a reference such as GPS/GNSS, the GMR6000 is considered to be a Stratum 1 time server. By default, without a reference the GMR6000 will report itself as Stratum16, or unsynchronized. This setting allows the user to choose how the time server reports itself, allowing you to bypass standard Stratum levels as needed.

Network Interfaces – Specifies which network ports on the back will act as NTP servers.



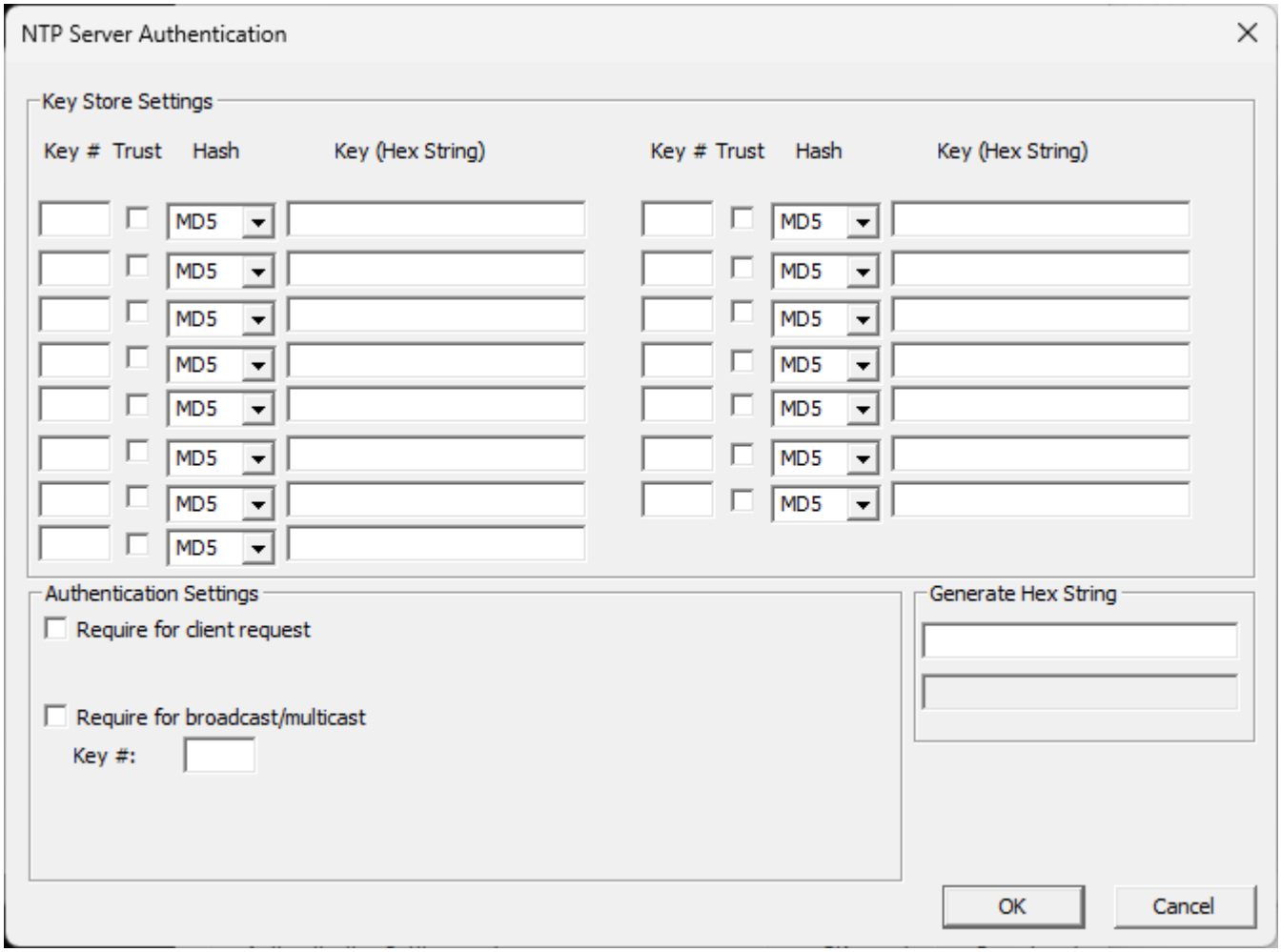
NTP Alarm Flag – If checked, this applies extra data bits to each NTP packet that informs compatible devices that the GMR6000 is currently responding with no valid external reference. Masterclock displays such as the NTDS series will then begin to flash their colons at a rate of once per second to alert viewers that the time it is displaying may be without a valid reference.

Microsecond Offset – Allows the user to input a fractional offset to the timestamp to account for delays.

Output Control (NTP Server Authentication Settings)

The GMR6000 is able to respond to authenticated NTP queries from a client. Users can specify up to sixteen (16) key numbers. These can be enabled or disabled individually, can be required for specific communicating with specific servers that were configured in the previous menu, and hex strings can be generated in this window.

You may select between MD5, SHA1 or SHA2 authentication for each key. **Only hexadecimal keys are accepted.** For ASCII keys, utilize the generation tool in the lower right corner of the window to convert them to hexadecimal.

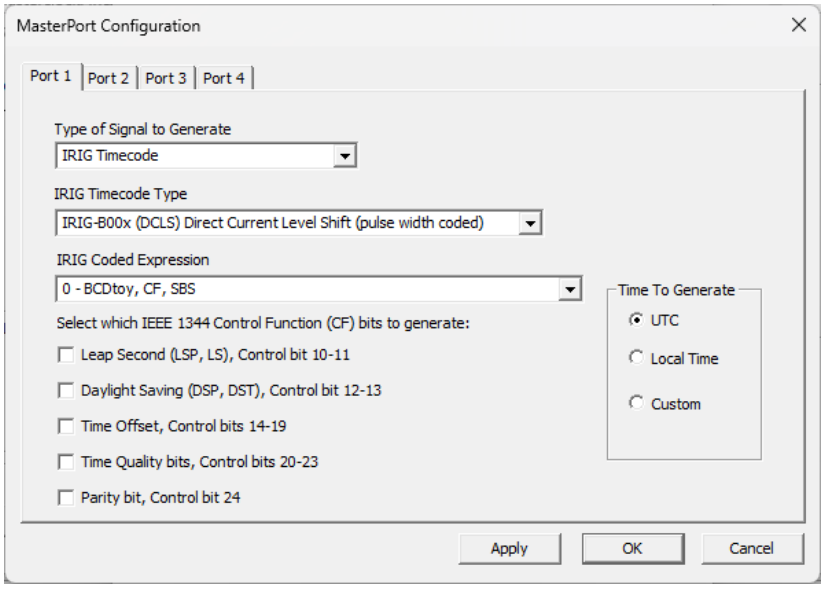


Output Control (MasterPorts)

MasterPorts are a new feature available exclusively on the GMR6000. These are four independently controllable outputs using standard BNC connections. Depending on the options installed with your GMR6000, these can be configured to output:

- IRIG (A/B, AM/DCLS)
- SMPTE
- Video/Audio Sync
- Waveform Output.

Each port can output any one of the aforementioned signals. All ports can be set to the same output, or each a different type. Ports can also be individually disabled.



IRIG Time Code

IRIG time code can be configured to output with A00x (DCLS), B00x (DCLS), A12x(AM), or B12x (AM) with coded expressions and control functions. It can then generate these as UTC, Local, or a Custom time.

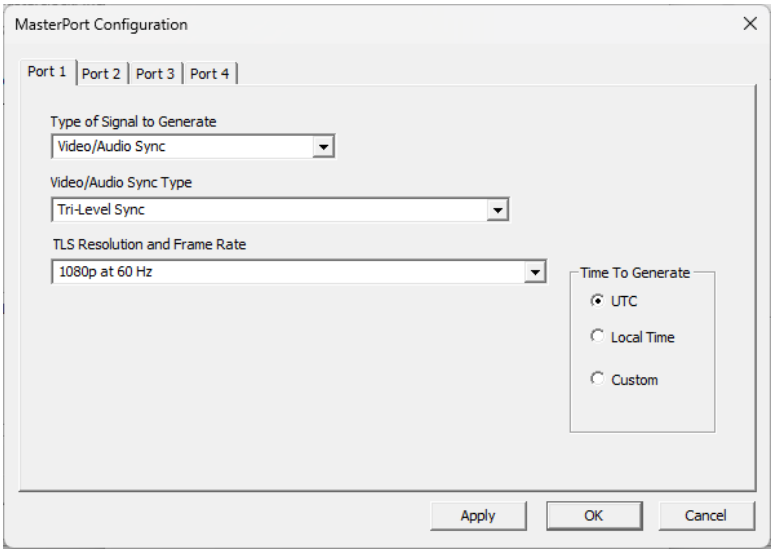
SMPTE

Available to output SMPTE Time Code in 24, 25, 29.97 (drop frame), or 30 FPS (frames per second). Extra encoding options are available such as 309M, Leitch, or zero filled.

Video/Audio Sync

With Video/Audio Sync, each MasterPort can be configured to generate common broadcast signal types like NTSC/PAL Black Burst, Tri-Level Sync and Wordclock.

- NTSC/PAL Black Burst is primarily used in standard-definition broadcast. It is an analog signal containing horizontal and vertical timing information, along with a color burst reference. Sometimes called Bi-Level Sync.



- Tri-Level Sync is also an analog video reference signal, though it is mainly used with high-definition and UHD systems. It is more precise than Black Burst and reduces timing errors in HD production environments.
    - TLS is supported at 720i/p, 1080i/p, using refresh rates of 50Hz, 59.94Hz, or 60Hz.

- Wordclock is a digital audio timing reference used to synchronize the sample clocks of digital audio equipment. It does not contain any actual audio data, but instead maintains the sample rate of recording devices to prevent clicks, pops and drift.
    - Wordclock supports common sample rates from 32kHz up to 192kHz.

Waveform Output

Waveform is a highly customizable MasterPort output. In the simplest terms, this can be used a frequency generator. Its default behavior is similar to that of the dedicated PPS (Pulse-Per-Second) output, and it can act as another PPS output if desired.

High Frequency Square Wave

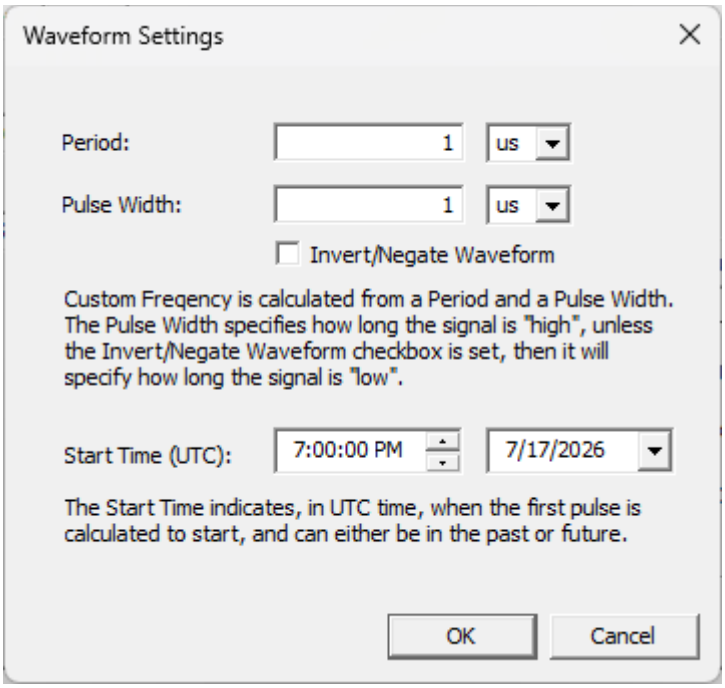
This setting allows the user to output a preset square wave signal, choosing between 1MHz, 5MHz and 10MHz.

Custom Frequency Square Wave

This option allows users to specify a set frequency to generate. Hz or kHz are selectable, and a maximum value of 937500Hz or 750kHz can be entered.

Custom Period Square Wave

This option allows users to set a custom period of time, pulse width, and starting time to generate a waveform. The resolution of period and pulse width are in microseconds, milliseconds, seconds, minutes or hours. The waveform can also be inverted if desired. A time to start generating can also be set in UTC.



Output Control (NMEA)

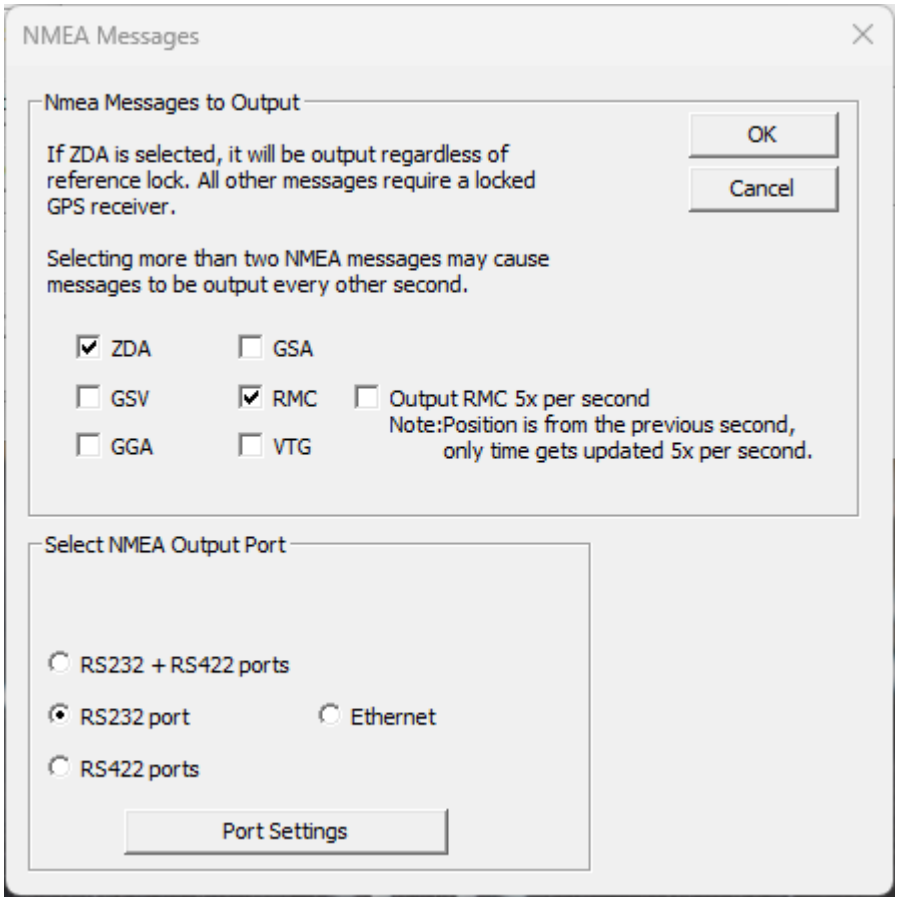
NMEA output is a standardized text-based data format that transmits navigation, position and timing information between the GNSS receiver and other equipment. Masterclock uses the NMEA 0183 standard. This feature is most commonly used in maritime, aviation, and defense and aerospace industries but may be useful for other applications.

NMEA Messages

Users may choose what type of messages to output including:

- ZDA
- GSV
- GGA
- GSA
- RMC
- VTG

RMC messages also contain an option to output at 5x per second, this only updates the timing information at an increased rate while positioning is updated normally at 1x per second.



NMEA Output Port

The GMR6000 is capable of transmitting NMEA messages over both its RS232 and RS422 ports, as well as ethernet. Users may select either the RS232, RS422, or both simultaneously. If Ethernet is selected, NMEA will only be output over Ethernet.

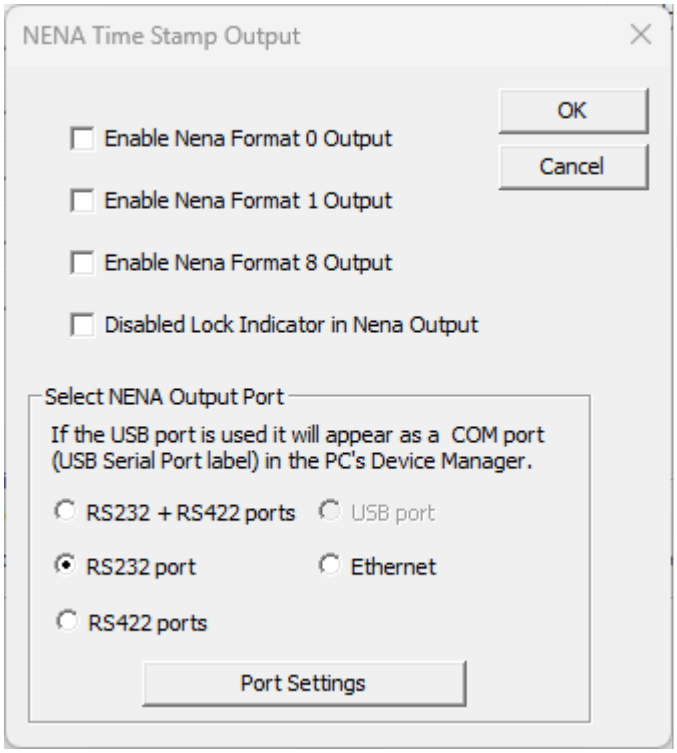
Output Control (NENA)

NENA is a standardized serial time-message format made for PSAPs (Public Safety Answering Points). This is most commonly used in facilities that process emergency calls such as police, fire or medical. These messages help maintain consistent timestamps across equipment.

NENA Formats

Users may choose what format of messages to output including:

- Format 0 which provides
  - Day of Year
  - Time in H:M:S
  - Sync status
  - Daylight Saving status
  - Time Zone
- Format 1 which provides
  - Day of Week
  - Calendar date
  - Two-digit year
  - Time in H:M:S
  - Sync status
- Format 8 which provides
  - Four-digit year
  - Day of Year
  - Time in H:M:S
  - Sync status
  - Daylight Saving status
  - Offset from UTC.



NENA Output Port

The GMR6000 is capable of transmitting NENA messages over both its RS232 and RS422 ports, as well as ethernet. Users may select the RS232, RS422, or both simultaneously. If Ethernet is selected, NENA will only be output over Ethernet.

Output Control (TrueTime/Kinemetrics)

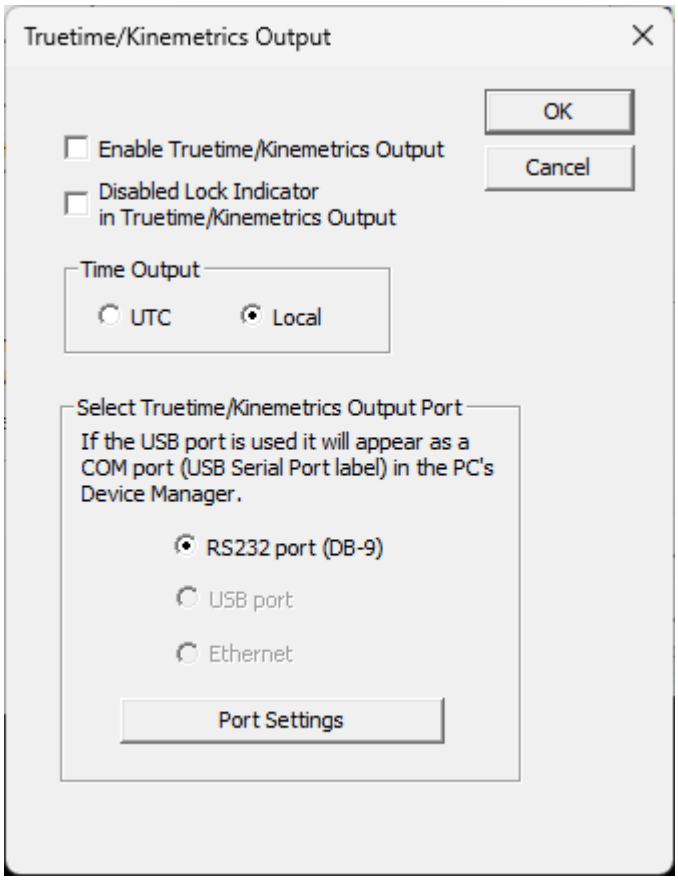
An older system of synchronization used primarily for seismic-monitoring instruments.

Users may select whether to enable or disable TrueTime/Kinemetrics Output.

The Lock indicator can be disabled when using T/K output.

Users may select whether to output UTC or Local time.

Currently TrueTime/Kinemetrics can only be output over the RS232 port which uses a standard DB9 (DE-9) connector.

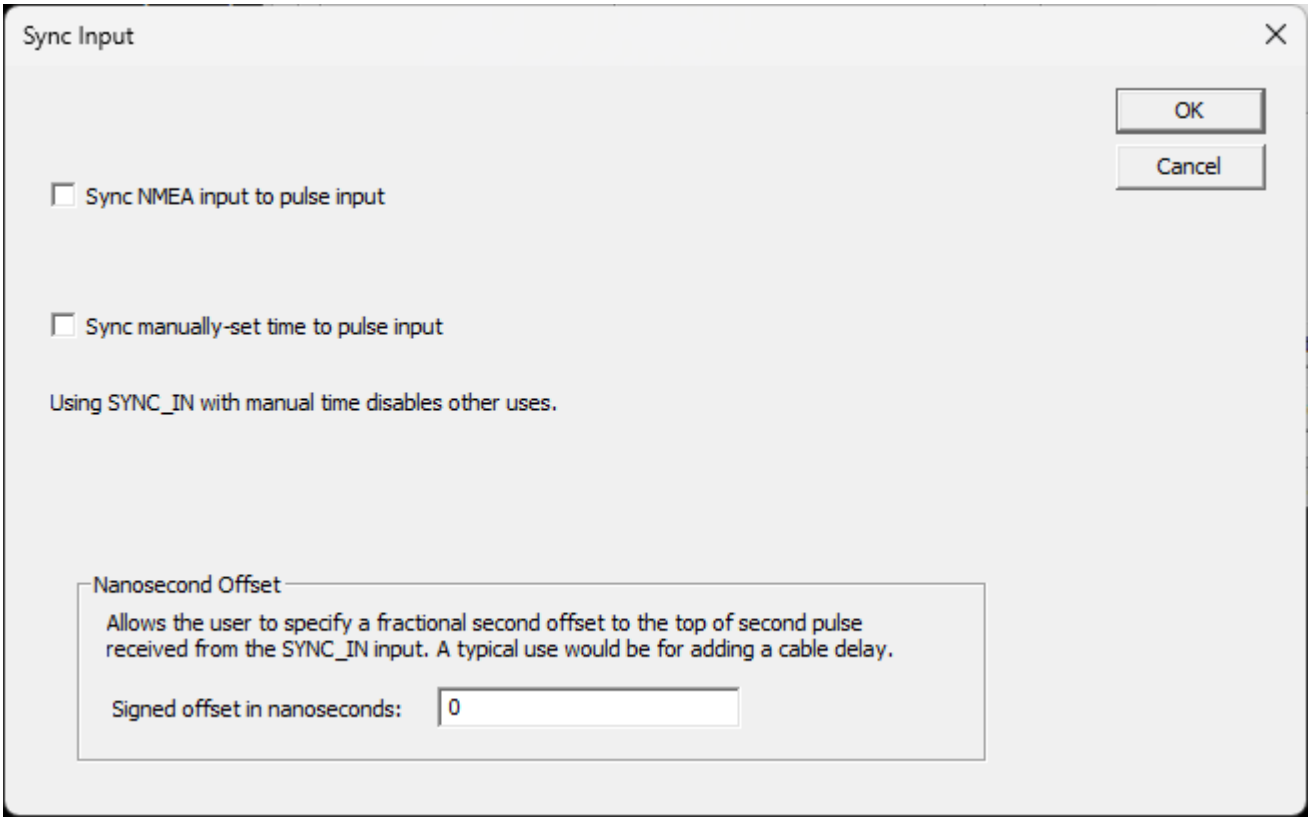


Sync Input

This feature allows the GMR6000 to use a pulse signal as a synchronization reference. If NMEA is enabled, users can synchronize the NMEA input with the addition of a pulse signal to keep messages aligned.

Only one option (Sync NMEA / Sync Manually) may be used at a time.

Users can also specify an offset with nanosecond resolution to compensate for cable delays.

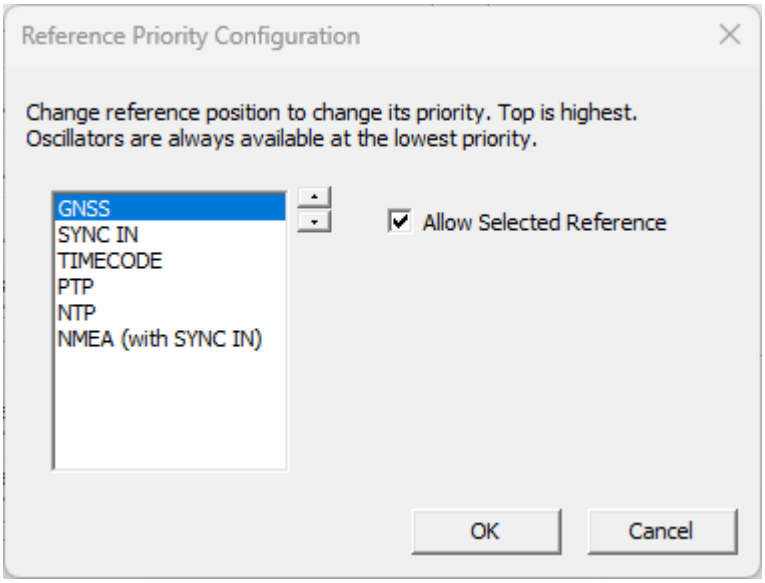


Reference Priorities

This menu allows users to manually define which references should be used and in which order. Internal oscillators are always considered to be the lowest priority and will not be used if other references are available. Users can force the oscillator to be used by issuing an HSO Holdover command in SSH.

GNSS is usually the highest priority as it provides the most accurate timing reference possible, but the order can be changed if users prefer to use other references such as Time Code, PTP, or NTP.

In the screenshot (right) the reference sources are listed top to bottom in order of highest to lowest. If GNSS were unavailable, the GMR6000 would attempt to use Sync In, if this were unavailable it would proceed to using Time Code, and so forth.



References can also be disabled entirely, individually, to prevent unwanted references from being selected.

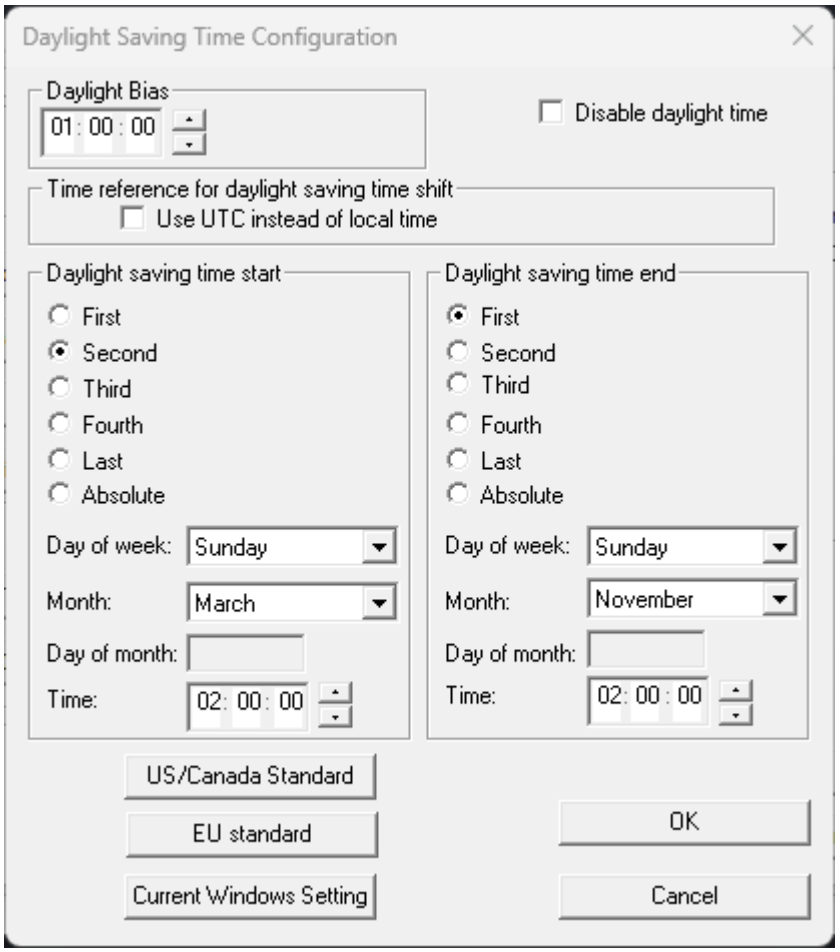
Daylight Saving Time (DST)

Daylight Saving Time settings commonly used in North America. This allows the GMR6000 to compensate local time output automatically based on the time changes used in North America throughout the year.

Users can specify a time and date to begin and end DST. Clicking either the US/Canada Standard or EU Standard buttons will automatically configure the time, day and month to begin and end the time change.

US DST begins on the second Sunday of March, and ends on the first Sunday of November. EU Standard changes this to begin on the last Sunday in March, ending on the last Sunday in October.

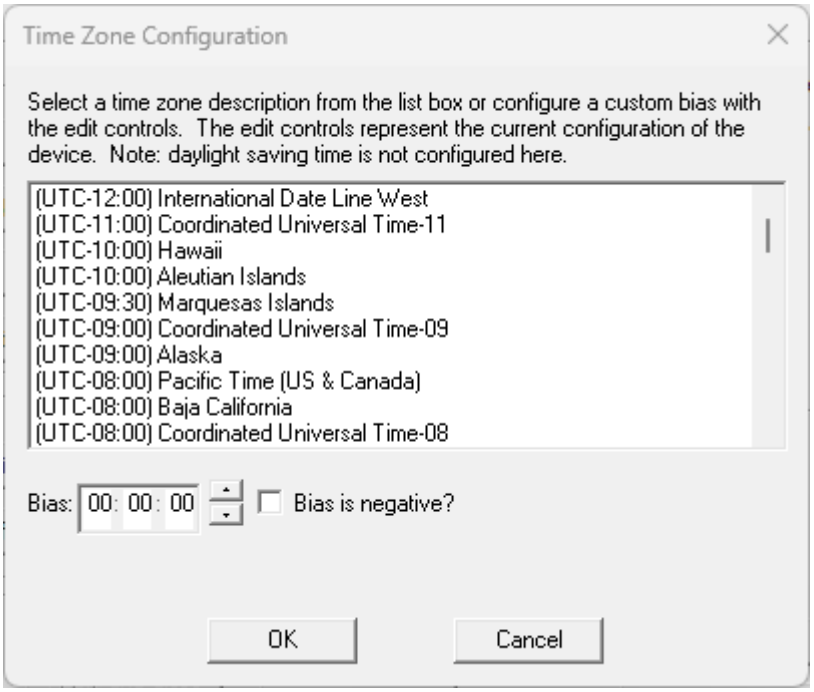
Daylight Saving Time can also be disabled for countries that do not observe yearly time adjustments.



Time Zone/Time Offset

The Time Zone settings allow you to specify the time zone in which the GMR6000 is located. This has no impact on UTC time, but will change the local time display and output.

The offset can be set to the resolution of seconds, minutes and/or hours. You may also choose from a preset list of available time zones. The offset can be either positive or negative compared to UTC.



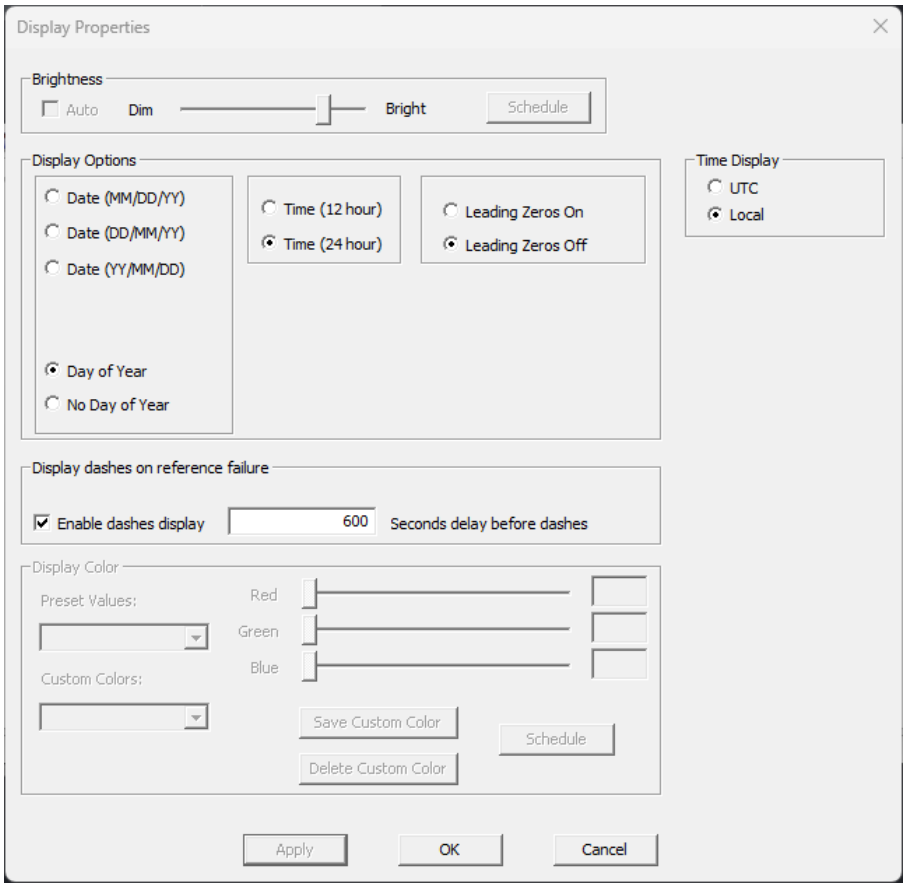
Display Properties

These settings allow you to change the behavior of the GMR6000's front panel display. The brightness of the display can be manually adjusted.

Choose whether to display the Date as MM/DD/YY, DD/MM/YY, or YY/MM/DD. You may also choose to display Day of Year, which will display the current day as a number out of 365.

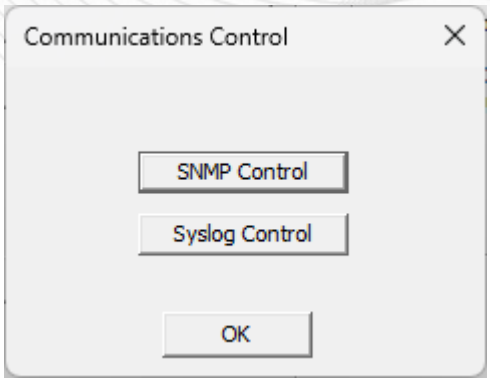
Users can also configure the display to show time in 12-hour or 24-hour format, with or without a leading 0. They may also choose between displaying UTC or Local time.

Upon reference loss, the GMR6000 can alert users by changing its display entirely to dashes (---------), indicating a loss of timing reference.



Communications Control

SNMP and Syslog are available for monitoring the GMR6000. These can provide important status information on the operation of the device to remote operators. These can be enabled or disabled.

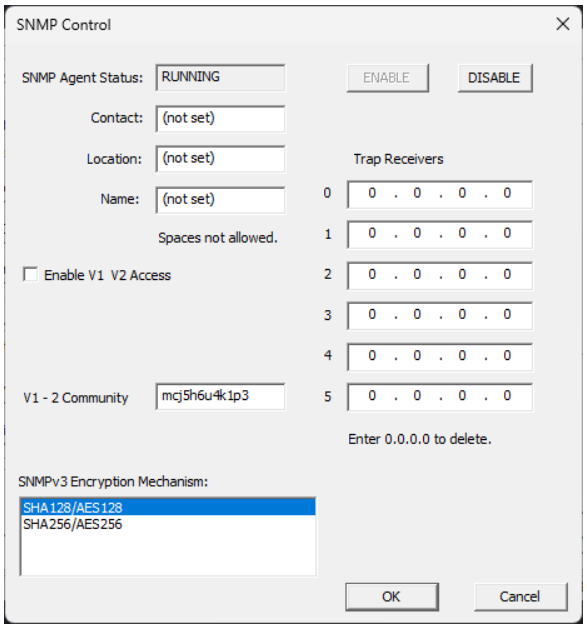


SNMP

The GMR6000 uses SNMP V3 by default, and V1 and V2 can be enabled. Users may specify Trap Receivers, as well as the type of encryption to use (SHA128 or SHA256).

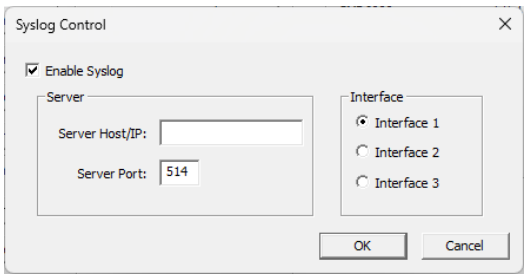
Masterclock provides a set of custom MIBs to be used with an MIB browser. These are included with the downloads for the latest firmware, or separately on our website under Products > Software.

Please note that Masterclock does not provide or support any specific MIB browser. This is designed to work with most available browsers.



Syslog

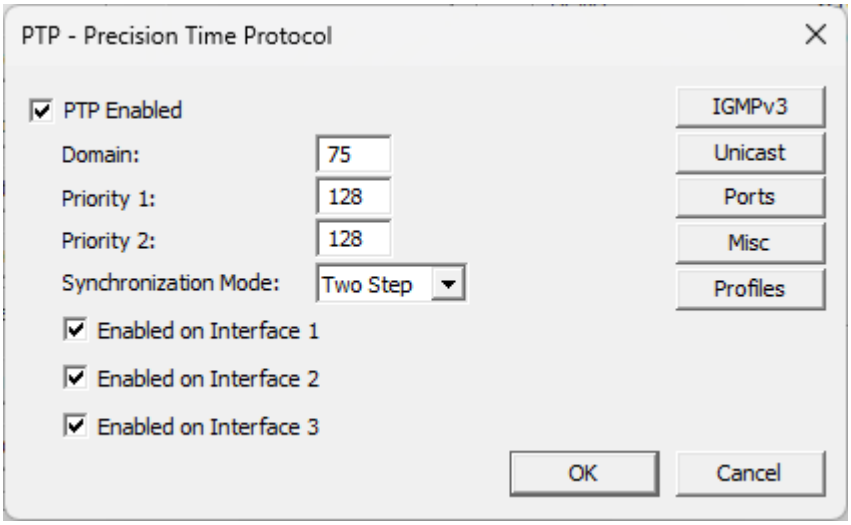
Disabled by default, but can be enabled by the user. Allows specifying of a Server Host/IP, port, and which network interface of the GMR6000 should be used for Syslog communication.



Precision Time Protocol (PTP)

The GMR6000 can distribute precise time using Precision Time Protocol, or PTP. PTP is configured through WinDiscovery and may be enabled independently on Ethernet Interface 1, Interface 2, and Interface 3.

The main PTP - Precision Time Protocol window controls whether PTP is active and provides access to the detailed configuration menus.



Select **PTP Enabled** to enable PTP operation on the GMR6000.
Clearing this option disables PTP on all interfaces, regardless of the individual interface selections below it.

The **Domain** identifies the PTP timing system in which the GMR6000 participates. PTP devices must normally use the same domain to exchange timing information.
The available domain range depends on the selected profile. For the IEEE 1588 Defaults profile, the available range is 0 through 127, with a default value of 0. Some industry profiles may automatically apply a different default domain or restrict the available range.

Priority 1 and **Priority 2** influence Grandmaster selection through the Best Master Clock Algorithm, or BMCA. Lower values are preferred. Priority 1 is normally used to establish the intended Grandmaster hierarchy. Priority 2 provides an additional comparison between clocks that otherwise advertise similar clock quality. Lower values are higher priorities.

Changing these values does not guarantee that the GMR6000 will become Grandmaster. BMCA also evaluates clock class, clock accuracy, clock variance, and clock identity.

Precision Time Protocol (PTP) Cont.

The Synchronization Mode determines how precise Sync-message timestamps are transmitted.

- One Step inserts the precise transmit timestamp directly into the Sync message.
- Two Step sends a Sync message followed by a Follow Up message containing the precise transmit timestamp.

The available mode may depend on the selected profile. The IEEE 1588 Defaults profile supports both 1 Step and 2 Step, with 2 Step selected by default.

The GMR6000 supports a variety of common PTP profiles, including:

Profile	Application
IEEE 1588 Defaults	General-purpose PTP operation
Default E2E	General-purpose PTP using End-to-End delay measurement
Default P2P	General-purpose PTP using Peer-to-Peer delay measurement
SMPTE ST 2059-2	Broadcast and professional media synchronization
AES67	Professional audio-over-IP synchronization
SMPTE ST 2110	Professional media-over-IP systems
AES67/ST 2059-2 Interoperability	Mixed AES67 and SMPTE timing environments
Telecom G.8275.1	Telecom networks with full PTP timing support
Power IEC 61850-9-3	Power utility and substation timing
Power IEEE C37.238-2011	IEEE power profile, 2011 edition
Power IEEE C37.238-2017	IEEE power profile, 2017 edition

Using the command line

Connect to the GMR6000 using an SSH terminal client and the IP address of network port 1. Sign in as admin using the password for your device. The factory password is printed on the device label.

Finding commands and viewing settings

Enter ? to view the command menu. Enter a command without setting arguments to view its status where a show form is listed. For example, network intf1 displays the settings for interface 1.

```
network intf1
refstatus
ptp status
```

Reading the command reference

Each row shows the full command on the left and its purpose on the right. Replace names, addresses, numbers, and other placeholders with the values for your installation. Do not type placeholder brackets. In choice lists, on/off means choose one option. The port value rs232/rs422 is a combined value that selects both ports.

Example: brightness x means type brightness followed by a number from 0 through 14. Enter brightness 8 to choose level 8.

Menus and actions

Enter ptp config to open the PTP configuration menu. Appending ? to ptp config also opens that menu. Enter S to save and exit, or Q to leave without saving.

Use reboot only when you intend to restart the device. Do not append ? to reboot to request help. Use the reference entry to review a restart or reset command before running it.

Topics in this reference

See the command reference contents on page 41 for topic names and page numbers. You can also use the PDF bookmarks to jump directly to a topic.

SSH Commands

Use this index to find commands, configuration menus, and setting explanations.

Topic	Page
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PTP port settings: unicast and VLAN	60
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Device information and administration

Use these commands to identify the device, name it for your installation, manage access, and restart or reset it.

Command	Purpose and entry guidance
`devicename`	Show the current device name.
`devicename xxx`	Set the device name to xxx, at most 31 characters.
`properties`	Display the model, serial number, MAC address, Family ID, Device ID, Primary app, and Bootloader app.
`options`	Display licensable features.
`admin lockout`	Enable or disable the network administrative management lockout.
`password xxx yyy zzz`	Change the password, where xxx is the current password, yyy is the new password, and zzz confirms the new password.
`status`	Show system time-dissemination status and current references.
`reboot`	Restart the GMR6000. Enter this command only when you are ready for the device to restart.
`settodefault y`	Reset configuration to defaults without changing network settings.
`settodefault all y`	Reset configuration and network settings to defaults.

Restarting and restoring defaults

A restart interrupts device operation. Restore defaults only when you intend to replace the current configuration. settodefault y keeps the network settings; settodefault all y also resets the network settings.

Display settings

Choose the display time base separately from the date and time format. Use UTC for an unoffset display, or local time to apply your time-zone and daylight-saving settings.

Command	Purpose and entry guidance
`brightness`	Show the display brightness level.
`brightness x`	Set brightness to x, from 0 through 14. A value of 0 turns the display off.
`display`	Show the current display format.
`display utc`	Select UTC as the clock display time base.
`display local`	Select local time as the clock display time base.
`display 12eu`	Use 12-hour time and European date format (dd/mm/yy).
`display 12us`	Use 12-hour time and U.S. date format (mm/dd/yy).
`display 12asian`	Use 12-hour time and Asian date format (yy/mm/dd).
`display 24eu`	Use 24-hour time and European date format (dd/mm/yy).
`display 24us`	Use 24-hour time and U.S. date format (mm/dd/yy).
`display 24asian`	Use 24-hour time and Asian date format (yy/mm/dd).
`display eu12`	Use European date format (dd/mm/yy) and 12-hour time.
`display us12`	Use U.S. date format (mm/dd/yy) and 12-hour time.
`display asian12`	Use Asian date format (yy/mm/dd) and 12-hour time.
`display eu24`	Use European date format (dd/mm/yy) and 24-hour time.
`display us24`	Use U.S. date format (mm/dd/yy) and 24-hour time.
`display asian24`	Use Asian date format (yy/mm/dd) and 24-hour time.
`dayofyear on`	Turn on day-of-year display.
`dayofyear off`	Turn off day-of-year display.
`zeros`	Show the leading-zero setting.
`zeros on`	Turn on leading zeros in 24-hour mode.
`zeros off`	Turn off leading zeros in 24-hour mode.
`dropframe jam`	Command drop-frame time to jam-sync at the top of the second.
`dropframe jamtime hh:mm`	Set the local daily jam time. Use minutes 00, 10, 20, 30, 40, or 50. Enter 00:00 to turn the daily jam off.

Time, time zone, and daylight saving

The time command sets UTC. Time-zone and daylight-saving settings determine local time without changing UTC.

Command	Purpose and entry guidance
`time`	Show the current time and date.
`time hh:mm:ss mm/dd/yyyy`	Set UTC time and date using 24-hour time and a year of 2000 or later.
`timezone`	Show the current time zone.
`timezone xx:yy:zz`	Set a positive UTC offset. Use hours from -12 through 13, with minutes and seconds for finer resolution.
`timezone -xx:yy:zz`	Set a negative UTC offset. Use hours from -12 through 13. Enter timezone 0:0:0 for UTC.
`dst`	Show Daylight Saving Time settings.
`dst eu`	Set Daylight Saving Time to the EU standard.
`dst us`	Set Daylight Saving Time to the U.S./Canada standard.
`dst off`	Turn off Daylight Saving Time and clear the begin/end dates.
`dst ex`	Show examples for entering relative and absolute dates.
`dst utc`	Toggle 'Use UTC instead of local time.'
`dst begin Occurrence Day_of_Week Month hh:mm:ss bias_in_minutes`	Set a recurring DST start rule and its bias in minutes.
`dst end Occurrence Day_of_Week Month hh:mm:ss`	Set a recurring DST end rule.
`dst begin Month Day hh:mm:ss bias_in_minutes`	Set an absolute DST start date/time and bias. Use dst ex for date-entry examples.

Custom daylight-saving rules

Use dst begin and dst end to define when daylight saving starts and ends. A recurring rule specifies an occurrence, day of the week, month, and time. An absolute start rule specifies a month, day, and time. The bias is the number of minutes added during daylight saving. Use dst ex to view date-entry examples.

GNSS receiver

Select the constellations and bands used for timing, then choose the operating mode that matches the installation. Stationary mode runs a survey for a fixed installation. Portable and airborne dynamics are available when stationary mode is off.

Command	Purpose and entry guidance
`gnss`	Show information about the GNSS receiver.
`gnss offset #`	Set the GNSS time offset in signed nanoseconds.
`gnss sat x y z`	Select one to three constellations: gps, gal, bei, or navic. List only the constellations you want to receive.
`gnss aug x y z`	Select SBAS, QZSS, or none for GNSS augmentation.
`gnss defaults`	Restore the GNSS receiver default settings.
`gnss dynamic x`	Select portable or airborne dynamics. Turn stationary mode off before setting dynamics manually.
`gnss acquisition x`	Set normal, high, or highest acquisition. high requires 4 satellites at 12 dBHZ or more; highest requires 5 satellites at 15 dBHZ or more.
`gnss stationary on/off`	Enable or disable stationary mode. Stationary mode runs survey-in, with a default survey duration of 24 hours and expected accuracy better than 1 m.
`gnss band gps L1 L5`	Select GPS receive bands using the shown setter tokens. Keep at least one band selected; use gnss sat to turn off a constellation.
`gnss band gal E1 E5`	Select Galileo receive bands using the shown setter tokens. Keep at least one band selected; use gnss sat to turn off a constellation.
`gnss band bei B1 B2`	Select BeiDou receive bands using the shown setter tokens. Keep at least one band selected; use gnss sat to turn off a constellation.
`gnss band navic L5`	Select NavIC receive bands using the shown setter tokens. Keep at least one band selected; use gnss sat to turn off a constellation.
`gnss cwwavethreshold <0-255>`	Set the continuous-wave threshold trigger level. Default: 60.
`gnss syslog <jam|spoof|cw> <enable|disable>`	Enable or disable syslog reporting for the selected GNSS event.
`gnss trap <jam|spoof|cw> <enable|disable>`	Enable or disable trap reporting for the selected GNSS event.
`gnss lockoverride <jam|spoof|cw> on <0-255 minutes>`	Enable a lock override for the selected event and duration in minutes.
`gnss lockoverride <jam|spoof|cw> off`	Disable the selected lock override.

Selecting receive bands

Constellation	Command tokens	Signal family
GPS	L1, L5	L1 and L5
Galileo	E1, E5	E1 is in the L1 family; E5A is in the L5 family.
BeiDou	B1, B2	B1C is in the L1 family; B2A is in the L5 family.
NavIC	L5	L5

Keep at least one receive band selected. To stop receiving a constellation, leave it out of the gnss sat selection.

Event reporting examples

The following commands enable syslog and SNMP trap reporting for jamming, spoofing, and continuous-wave events:

```
gnss syslog jam enable
gnss syslog spoof enable
gnss syslog cw enable
gnss trap jam enable
gnss trap spoof enable
gnss trap cw enable
```

Oscillator, holdover, and leap seconds

Holdover uses the internal oscillator while external references are not being used. You can switch holdover immediately or arm a schedule with UTC start and stop times.

Command	Purpose and entry guidance
`hso`	Show HSO status information.
`hso savecal`	Save the current HSO calibration.
`hso reset`	Reset the oscillator calibration.
`hso jam`	Jam the PPS output to the current reference.
`hso jam_threshold`	Show the jam threshold in microseconds.
`hso jam_threshold x`	Set the jam threshold. A value of 0 disables jamming.
`hso eval_osc`	Recalibrate the oscillator frequency range.
`hsoholdover`	Show HSO holdover settings.
`hsoholdover on/off`	Turn holdover on or off immediately. Both forms clear the scheduled start and stop times.
`hsoholdover start hh:mm:ss`	Set the scheduled UTC start time for holdover.
`hsoholdover stop hh:mm:ss`	Set the scheduled UTC stop time for holdover.
`hsoholdover enable`	Arm the schedule already stored in start and stop.
`hsoholdover disable`	Disable the schedule and set holdover off.
`leapsecond`	Show leap-second parameters.
`leapsecond tai [num]`	Set the UTC/TAI offset; also adjust the historical leap-second count.
`leapsecond number [num]`	Set the historical leap-second count; also adjust the UTC/TAI offset.
`leapsecond on <positive|negative> mm/dd/yyyy`	Enable a positive or negative leap second at 23:59:59 UTC on the entered date. Use the literal sign word positive or negative.
`leapsecond off`	Disable leap-second processing.

Both immediate holdover commands clear the scheduled start and stop times. Enter the schedule again before enabling scheduled holdover. For leap-second entry, use the literal word positive or negative for the sign.

Automatic changeover

ACO controls participation in automatic changeover switching. Use the status command to check the selection state before changing participation or running an indication test.

Command	Purpose and entry guidance
`aco`	Show ACO selection status.
`aco [enable/disable]`	Enable or disable participation in ACO switching.
`aco test on`	Force an ACO failover indication without otherwise affecting system operation.
`aco test off`	End a previously enabled ACO failover test.

ACO integration must be available on the device before participation in automatic changeover can be enabled.

MasterPort Output Configuration

The four MasterPorts are configured independently. In the commands below, [i] is the output port number, 1 through 4. Select a signal family to view its format choices, then enter a complete format command to configure output.

Command	Purpose and entry guidance
`mport`	Show MasterPort settings for all outputs.
`mport [i]`	Display the settings for output port i. Port numbers are 1 through 4.
`mport [i] local`	Offset time code using the local DST and time-zone settings.
`mport [i] utc`	Apply no time-code offset; use UTC.
`mport [i] custom`	Offset time code using custom DST and time-zone settings.
`mport [i] dst`	Show custom DST help. Select custom first, then supply eu, us, or off to apply a rule.
`mport [i] tz`	Show custom time-zone help. Select custom first, then supply an offset to apply it.
`mport [i] smpte`	Open the smpte format menu; this bare form does not enable output. Use mport smpte ? for the required setter arguments.
`mport [i] irig`	Open the irig format menu; this bare form does not enable output. Use mport irig ? for the required setter arguments.
`mport [i] wave`	Open the wave format menu; this bare form does not enable output. Use mport wave ? for the required setter arguments.
`mport [i] video`	Open the video format menu; this bare form does not enable output. Use mport video ? for the required setter arguments.
`mport [i] off`	Disable a MasterPort.
`mport [i] freq`	View available formats and settings for generating a specific frequency. mport freq ? displays the format list.
`mport [i] dst <eu|us|off>`	Apply a custom DST rule after mport [i] custom.
`mport [i] tz <offset>`	Set the custom time-zone offset after selecting mport i custom.
`mport [i] irig b00x`	Set IRIG B, DCLS. Replace x with the coded expression, 0 through 7.
`mport [i] irig b12x`	Set IRIG B, 1 kHz sine carrier. Replace x with the coded expression, 0 through 7.
`mport [i] irig a00x`	Set IRIG A, DCLS, 10 frames per second. Replace x with the coded expression, 0 through 7.
`mport [i] irig a12x`	Set IRIG A, 10 kHz sine carrier. Replace x with the coded expression, 0 through 7.

Command	Purpose and entry guidance
`mport [i] irig cf <all|ls|ds|offset|quality|parity> <on|off>`	Enable or disable all IRIG control functions or the selected function.
`mport [i] wave pps [width]`	Set PPS output with the width argument.
`mport [i] wave 1mhz`	Set a 1 MHz square wave.
`mport [i] wave 5mhz`	Set a 5 MHz square wave.
`mport [i] wave 10mhz`	Set a 10 MHz square wave.

IRIG coded expressions

In b00x, b12x, a00x, and a12x, replace x with a coded-expression digit from 0 through 7. Expression 4 selects IEEE 1344. Use expression 6 with Masterclock IRIG devices.

IRIG control functions

Setting	What it controls
all	Select all control functions.
ls	Leap-second information.
ds	Daylight-saving information.
offset	Time-offset information.
quality	Time-quality information.
parity	Parity checking information.

Choose on or off for the selected control function. For example, mport 1 irig cf ls on enables leap-second control information on port 1.

Custom local time

Select mport i custom before entering the port-specific dst or tz setting. Use local to follow the device local-time settings, or utc to output UTC without a local offset.

Show format choices and required arguments

```
mport freq ?
mport smpte ?
mport video ?
mport wave ?
```

Network interfaces and multicast

Use intf1, intf2, or intf3 to identify a network interface. A static IPv4 address can be entered with a separate netmask or in CIDR notation. DNS servers are configured separately as DNS 1 and DNS 2.

Command	Purpose and entry guidance
`network`	Show the network-interface summary.
`network [I]`	Display an interface. Use intf1, intf2, or intf3 as the interface name.
`network [I] dhcp on/off`	Enable or disable DHCP on the interface.
`network [I] a4 [address] [netmask]`	Set the static IPv4 address and netmask. The settings take effect immediately.
`network [I] a4 [CIDR]`	Set and immediately apply a static IPv4 address using CIDR notation.
`network [I] g4 [address]`	Set a static IPv4 default gateway for the interface.
`network [I] dns 1 [address]`	Set the primary static IPv4 DNS server for the interface.
`network [I] dns 2 [address]`	Set the secondary static IPv4 DNS server for the interface.
`network [I] arp`	Show the ARP table for the interface.
`network [I] mcast report`	Trigger a multicast report for the interface.
`network [I] mcast show`	Show multicast subscriptions on the interface.
`network [I] dhcp release`	Immediately release the DHCP lease and revert to a fallback IP address.
`network [I] dhcp renew`	Immediately renew the DHCP lease on the interface.
`igmpmode`	Display the current IGMP reporting mode.
`igmpmode x`	Set the IGMP reporting mode, where x is 0 to 3.
`igmpv3`	Display the PTP INCLUDE and EXCLUDE source lists. Each list holds up to eight source addresses.

Viewing an interface

```
network intf1
```

The interface detail shows DHCP state, IPv4 address, netmask, gateway, and the two DNS servers.

NMEA and NENA input and output

Select the message format and the output connection required by the receiving equipment. Match the serial baud rate and parity at both ends of the connection.

Command	Purpose and entry guidance
`nmeainput`	Display basic information about NMEA input.
`nmeainput on`	Enable NMEA input.
`nmeainput port baud parity`	Enable NMEA input. port is rs232 or rs422; baud is 4800, 9600, 19200, or 38400; parity is none, odd, or even.
`nmeainput timeout n`	Set the number of seconds to wait for an NMEA message.
`nmeainput max n`	Set the maximum permitted time change, in seconds.
`nmeainput off`	Disable NMEA input.
`nmeaoutput`	Display basic information about NMEA output.
`nmeaoutput off`	Disable NMEA output.
`nmeaoutput on`	Enable all NMEA output messages.
`nmeaoutput on xxx`	Enable message xxx: gga, gll, gsa, gsv, rmc, rmc5x, vtg, or zda. rmc5x sends five RMC sentences per second, with position from the previous second.
`nmeaoutput port baud parity`	Enable NMEA output. port is rs232, rs422, or rs232/rs422; baud is 4800, 9600, 19200, or 38400; parity is none, odd, or even.
`nmeaoutput off xxx`	Disable NMEA output message xxx.
`nmeaoutput ethernet <ipaddr> <ipport> <yes|no>`	Configure NMEA Ethernet output with the destination IP address, port, and yes/no option.
`nmeaoutput decimals <0-3>`	Set the output decimal precision from 0 through 3.
`nmeaoutput force <$GP\|$GN|off>`	Force the sentence prefix to $GP or $GN, or turn prefix forcing off.
`nmeaoutput rmc_delay <0-255>`	Set the RMC output delay value from 0 through 255.
`nmeaoutput echo_gga_vtg`	Configure GGA and VTG message echo.
`nenaoutput`	Display basic information about NENA output.
`nenaoutput xxx yyy port baud parity`	Enable NENA output. xxx is format0, format1, or format8; yyy is lock or nolock; port is rs232, rs422, rs232/rs422, or USB; baud is 4800, 9600, 19200, or 38400; parity is none, odd, or even.
`nenaoutput off`	Disable NENA output.

NTP client

Enable the NTP client to use network time servers as references. Add each server with its network interface, then configure its polling and authentication settings.

Command	Purpose and entry guidance
`ntpclient`	Display current NTP client settings.
`ntpclient stats`	Show detailed statistics for the current servers.
`ntpclient on/off`	Start or stop the NTP client.
`ntpclient dhcp on/off`	Enable or disable use of DHCP-provided NTP servers.
`ntpclient alarm on/off`	Enable or disable rejection of packets with the alarm flag set.
`ntpclient set interface [i]`	Set the interface used by the NTP client.
`ntpclient broadcast on/off`	Enable or disable NTP client broadcast mode.
`ntpclient broadcast addr [ip]`	Set the IP address used for broadcast messages.
`ntpclient broadcast timeout [number]`	Set the timeout for broadcast servers.
`ntpclient broadcast auth on/off`	Enable or disable broadcast authentication.
`ntpclient list`	View the current NTP server list.
`ntpclient list on/off`	Enable or disable the NTP server list.
`ntpclient list add [server name] interface [i]`	Add an NTP server by address or name and specify its network interface in the same command.
`ntpclient list remove [server num]`	Remove a server from the list.
`ntpclient list [server num] name [server name]`	Change a server name.
`ntpclient list [server num] interface [i]`	Change the interface assigned to a server.
`ntpclient list [server num] interval [number]`	Set the polling interval as a power-of-two exponent. For example, enter 3 for an eight-second interval.
`ntpclient list [server num] burst on/off`	Enable or disable an initial burst of requests after connecting.
`ntpclient list [server num] auth enable/disable`	Enable or disable authentication for a server.
`ntpclient list [server num] key [number]`	Set the authentication key ID for a server.
`ntpclientauth`	Show current NTP client authentication settings and keys.
`ntpclientauth key x y z -a "str"`	Add an ASCII key. x is the key entry (up to 15), y is the key number (1-65535), z is MD5, SHA1, or SHA2, and str is the ASCII key string.
`ntpclientauth key x y z -h "hex"`	Add a hexadecimal key. x is the key entry (up to 15), y is the key number (1-65535), z is MD5, SHA1, or SHA2, and hex is the hexadecimal key string.

Command	Purpose and entry guidance
`ntpclientauth trusted x y ... z`	Mark the listed key numbers as trusted.
`ntpclientauth nottrusted x y ... z`	Mark the listed key numbers as untrusted.

Adding a server

```
ntpclient list add 192.0.2.10 interface 1
```

This example adds the server at 192.0.2.10 using interface 1. Replace the example address and interface with the values for your installation.

Polling intervals

The server-list interval is entered as a power-of-two exponent. Enter 3 for an eight-second polling interval, because 2 to the power of 3 is 8. Use ntpclientauth to manage the keys used by authenticated servers.

NTP server

Enable the NTP server on each network interface that will answer client requests. Configure the reference ID, stratum reporting, broadcast service, and authentication as required.

Command	Purpose and entry guidance
`ntpserver`	Display current NTP server settings.
`ntpserver on/off`	Start or stop the NTP server.
`ntpserver interface [i] on/off`	Enable or disable the NTP server on an interface.
`ntpserver alarm on/off`	Enable or disable the alarm flag in outgoing NTP packets after reference loss.
`ntpserver set id [name]`	Set the NTP reference ID to a name of four or fewer characters.
`ntpserver set stratum_locked [number]`	Set the stratum reported while locked to a non-NTP reference.
`ntpserver set stratum_unlocked [number]`	Set the stratum reported when unlocked or in holdover.
`ntpserver broadcast on/off`	Enable or disable the broadcast server.
`ntpserver broadcast frequency [number]`	Set the broadcast-message interval in seconds.
`ntpserver broadcast addr [ip]`	Set the IP address used for broadcast messages.
`ntpserver broadcast ttl [number]`	Set the TTL for broadcast packets.
`ntpserver broadcast auth enable/disable`	Enable or disable broadcast authentication.
`ntpserver broadcast auth keyid [number]`	Set the key ID used by the broadcast server.
`ntpserverauth`	Show current NTP server authentication settings and keys.
`ntpserverauth key x y z -a "str"`	Add an ASCII key. x is the key entry (up to 15), y is the key number (1-65535), z is MD5, SHA1, or SHA2, and str is the ASCII key string.
`ntpserverauth key x y z -h "hex"`	Add a hexadecimal key. x is the key entry (up to 15), y is the key number (1-65535), z is MD5, SHA1, or SHA2, and hex is the hexadecimal key string.
`ntpserverauth trusted x y ... z`	Mark the listed key numbers as trusted.
`ntpserverauth nottrusted x y ... z`	Mark the listed key numbers as untrusted.

The locked stratum applies while using a non-NTP reference. The unlocked stratum applies during reference loss or holdover. The reference ID can contain up to four characters.

PTP service and menu navigation

PTP settings are grouped into a device-wide configuration and settings for each network interface. Use the PTP profile required by the timing network, then review the interface and message settings.

Command	Purpose and entry guidance
`ptp status`	Show a summary of PTP service status.
`ptp config`	Open the interactive PTP configuration menu.
`ptp start/stop`	Start or stop the PTP service.
`ptp enable/disable`	Enable or disable the PTP service at system start.
`ptp syslog enable/disable`	Enable or disable PTP diagnostic output to syslog.
`ptp verbosity 0-7`	Set the PTP diagnostic verbosity level.
`ptp status dataset <all|default|current|time|parent|port>`	Display a PTP dataset. Run this command at the ssh> prompt after leaving the PTP configuration menu.

Opening and leaving the configuration menu

Action	What to enter
Open configuration	Enter ptp config at the ssh> command prompt.
Choose an item	Enter the number beside the menu item.
Save and exit	Enter S.
Exit without saving	Enter Q from any menu level.
Return to the previous menu	Enter R from a submenu.
Cancel one field	At New value for ptp...>, press Enter without typing a value.

Run status and dataset commands at the ssh> prompt. Use ptp config to enter configuration directly.

PTP main menu

Menu item	Use it to
1. Domain	Set the PTP timing domain.
2. Priority1	Set the first user-defined priority used in grandmaster selection.
3. Priority2	Set the second user-defined priority used in grandmaster selection.
4. One/two-step clock mode	Choose One-Step or Two-Step timestamp delivery.
5. Network interface options	Enable or disable PTP on an interface. Selecting an interface toggles its state.
6. Unicast master tables	Configure the remote clocks used for unicast discovery. There are eight table slots.
7. Port options	Configure message transport and timing for each interface.
8. Miscellaneous options	Configure clock behavior and additional protocol settings.
9. PTP profile	Select the profile used by the timing network.

One-Step and Two-Step

One-Step includes the precise transmit timestamp in the Sync message. Two-Step sends that timestamp in a separate Follow Up message. Select the mode required by the profile and the other clocks on the network.

Device-wide and per-interface settings

Domain, priorities, clock mode, and profile apply to the PTP configuration as a whole. Port options apply to the interface you select. Review each enabled interface separately.

PTP message intervals

An interval is the time between messages. The Announce, Sync, and delay-request interval fields use an integer code instead of a time in seconds. Each increase of 1 doubles the interval; each decrease of 1 halves it.

If you want an interval of	Enter this value	Approximate message rate
0.125 seconds	-3	8 per second
0.25 seconds	-2	4 per second
0.5 seconds	-1	2 per second
1 second	0	1 per second
2 seconds	1	1 every 2 seconds
4 seconds	2	1 every 4 seconds
8 seconds	3	1 every 8 seconds

Example: set a half-second Sync interval

1. In Port options, select the interface you want to configure.
2. Select the Sync interval field.
3. At the new-value prompt, type -1 and press Enter.
4. Save the configuration with S when you have finished your changes.

```
Value to type: -1
Resulting interval: 0.5 seconds
Resulting rate: 2 Sync messages per second
```

The menu may display the calculation as 2 ^ -1 = 0.500000 seconds. The ^ symbol means "to the power of." Type only -1 in the field, not the calculation or 0.5.

Use the conversion only for interval fields

Receipt timeouts are counts of missed messages, not interval codes. Unicast request duration is a service duration. Use the field description to determine what to enter.

PTP port settings: transport and timing

Open Port options from the PTP main menu, then select an interface. Match its transport, delay mechanism, and message rates to the connected timing network.

Setting	What it controls
Network transport	How PTP packets are carried: IPv4, IPv6, or Ethernet Layer 2.
Delay mechanism	E2E measures the end-to-end path; P2P measures the link to the neighboring clock.
Announce receipt timeout	Missed Announce messages allowed before the current timing source times out.
Delay response timeout	Missing delay responses allowed before a synchronization fault is declared.
Delay-request interval	Spacing of delay-measurement requests. Use the interval conversion table.
Announce interval	Spacing of clock-advertisement messages. Use the interval conversion table.
Sync interval	Spacing of synchronization messages. Use the interval conversion table.
Delay asymmetry	Compensation for unequal travel times in the two directions.

Choosing message rates

Use the intervals required by the selected profile and the other clocks on the network. A smaller interval value sends messages more frequently. For example, -1 is twice per second, while 1 is once every two seconds.

PTP port settings: unicast and VLAN

Setting	What it controls
Hybrid end-to-end	Use unicast delay requests and replies with E2E timing.
Inhibit multicast	Suppress multicast PTP transmission.
Unicast listen	Allow this port to accept requests for unicast PTP service.
Unicast request duration	Requested length of a unicast service contract, in seconds.
Unicast master table	Select the table of remote clocks used for unicast discovery.
VLAN tag on TX	Add a VLAN tag to transmitted packets. TX means transmit.
VLAN tag filter on RX	Apply VLAN filtering to received packets. RX means receive.
VLAN tag ID	Identify the VLAN used for PTP traffic.
VLAN tag priority	Set the priority carried in the VLAN tag.

Network terms

Unicast sends packets to one destination. Multicast sends packets to a group of receivers. A VLAN is a logical network carried over shared Ethernet equipment. Match the VLAN settings to the switch configuration.

PTP Clock and Protocol Settings

Open Miscellaneous options from the PTP main menu. These settings control clock correction, lock qualification, and device-wide PTP behavior.

Setting	What it controls
Hardware clock step threshold	Offset threshold for direct hardware-clock corrections instead of gradual adjustment.
Stable-lock offset threshold	Offset limit used to qualify stable lock.
Stable-lock sample count	Number of offset samples used to qualify stable lock.
Domain timescale	Time scale used by the PTP domain.
User description	Text that identifies or describes this clock.
Maximum steps removed	Limit on the timing-path distance from the grandmaster.
PTP version	Protocol version used for PTP communication.
Client-only clock	Restrict operation to receiving timing rather than becoming a timing server.

An offset is the measured difference between two clocks. A clock step changes time directly; gradual adjustment changes the clock rate to reduce the difference over time. Keep threshold values consistent with the timing requirements of the application.

PTP network addressing and traffic priority

These fields are also in Miscellaneous options. Address values and traffic markings must match the PTP network design.

Setting	What it controls
DSCP for general messages	IP traffic-class marking for PTP general messages.
DSCP for event messages	IP traffic-class marking for PTP event messages.
IPv4 PTP multicast address	IPv4 group address for PTP multicast traffic.
IPv4 peer multicast address	IPv4 group address for peer-delay traffic.
IPv6 PTP multicast address	IPv6 group address for PTP multicast traffic.
IPv6 peer multicast address	IPv6 group address for peer-delay traffic.
PTP L2 MAC address	Ethernet destination address for PTP Layer 2 traffic.
PTP peer L2 MAC address	Ethernet destination address for Layer 2 peer-delay traffic.

DSCP and message types

DSCP is an IP packet marking that network equipment can use to assign traffic priority. Event messages carry information used for precise timing. General messages support the protocol, including clock announcements and related information.

PTP profiles

A profile defines a compatible set of PTP operating rules for an application. Select the profile used by the rest of the timing network, then review the domain, clock mode, and interface settings.

Profile	Application
No Profile	Use individually configured PTP settings.
IEEE 1588 Defaults	General-purpose PTP.
Delay Request-Response Default	General-purpose PTP using E2E delay measurement.
Peer-to-Peer Default	General-purpose PTP using P2P delay measurement.
SMPTE 2059-2	Broadcast and professional media timing.
AES67 Media	Audio-over-IP timing.
SMPTE 2059-2/AES67 Interoperability	Mixed SMPTE and AES67 timing environments.
Telecom G.8275.1	Telecommunications timing networks.
IEC/IEEE 61850-9-3	Power utility and substation timing.
IEEE C37.238-2011	Power-system timing profile, 2011 edition.
IEEE C37.238-2017	Power-system timing profile, 2017 edition.

Reference priorities and reference loss

A reference must be allowed and suitable before it can be selected. Priority 1 is the highest position. Moving a reference to a position changes its place in the reference order.

Command	Purpose and entry guidance
`refpri`	Show current reference-priority status and settings.
`refpri <reference> <allow|disallow>`	Allow or disallow a reference: gnss, ext, tcr, ptp, ntp, or nmea.
`refpri <reference> <priority>`	Move gnss, ext, tcr, ptp, ntp, or nmea to the new priority position, numbered from 1 upward. The moved reference takes that slot.
`refpri default`	Reset references to their default priorities.
`refpri 10mhz <auto|internal|external>`	Choose the 10 MHz clock routed to the processor. The device 10 MHz output remains the internal oscillator.
`refstatus`	Display reference priority, condition, and eligibility.
`reflossallowserver`	Show the allow-time-server setting.
`reflossallowserver x`	Set seconds before disabling time-server output after reference loss. A value of 0 allows the time server forever during reference loss.
`reflossallowserver allow`	Allow the time server to continue operating during reference loss.
`reflossallowserver disallow`	Disallow time-server operation during reference loss.
`reflossdashes`	Show the clock-mode reference-loss display setting.
`reflossdashes x`	Set the colon-flash duration before the display is blanked.
`reflossdashes colonflash`	Flash the colons during reference loss.
`reflossdashes nodashes`	Do not display dashes during reference loss.

Reading reference status

The reference-priority display lists priority, source, condition, and eligibility. A disallowed reference is excluded from selection. A reference can be allowed but temporarily unsatisfactory because its signal is not suitable.

10 MHz selection

refpri 10mhz chooses the clock routed to the processor. The dedicated 10 MHz output is generated by the internal oscillator.

SNMP configuration and users

Configure a trap receiver before sending test traps. Use names and text without spaces for the SNMP contact, name, location, and sendtrap commands.

Command	Purpose and entry guidance
`snmp`	Show basic SNMP settings.
`snmp start`	Start the SNMP agent.
`snmp stop`	Stop the SNMP agent.
`snmp contact abc`	Set system.sysContact to abc. Spaces are not allowed in abc.
`snmp name abc`	Set system.sysName to abc. Spaces are not allowed in abc.
`snmp location abc`	Set system.sysLocation to abc. Spaces are not allowed in abc.
`snmp add xxx.xxx.xxx.xxx`	Add an IP address as a trap destination.
`snmp del x`	Delete trap-destination address number x.
`snmp coldstart`	Send a test cold-start trap.
`snmp warmstart`	Send a test warm-start trap.
`snmp linkup`	Send a test link-up trap.
`snmp linkdown`	Send a test link-down trap.
`snmp sendtrap abc`	Send a test trap containing text abc. Use text without spaces and configure a trap receiver first.
`snmp community add abc`	Set the custom community name to abc.
`snmp community del`	Delete the custom community name.
`snmp v12 on/off`	Enable or disable SNMP v1/v2 read-only access. Default: off.
`snmplogin trapuser X`	Set the Xth trap user.
`snmplogin authpriv 1`	Use SHA128/AES128 authentication and privacy.
`snmplogin authpriv 2`	Use SHA256/AES256 authentication and privacy.
`snmplogin names`	Show SNMP names.
`snmplogin add name pw`	Add a user: at most 3 users; name at most 12 characters; password at most 16 characters. Change a password by deleting and re-adding the user.
`snmplogin del name`	Delete a user. The last remaining user cannot be deleted.

Synchronization input and syslog

Command	Purpose and entry guidance
`syncinput disable`	Disable SYNC IN.
`syncinput nmea on/off`	Enable or disable use of NMEA for date/time with SYNC IN supplying the top of second.
`syncinput manual on/off`	Enable or disable synchronization of the current or manually set system time to SYNC IN.
`syncinput edge rising/falling`	Capture the rising or falling edge.
`syncinput offset #`	Set the SYNC IN offset in nanoseconds.
`syslog enable/disable`	Enable or disable syslog output.
`syslog interface [interface name]`	Set the network interface used for syslog.
`syslog server [hostname/IP]`	Set the remote syslog server.
`syslog port [port-number]`	Set the remote syslog port.
`syslog test`	Send a test message.

Choose either NMEA-assisted synchronization or manual-time synchronization for SYNC IN. Syslog sends device messages to the server and port you specify, using the selected network interface.

Time-code reader and calibration

Command	Purpose and entry guidance
`tcr`	Show Time Code Reader settings.
`tcr nanoseconds #`	Set the nanosecond offset for the TCR top of second.
`tcr smpte_nodate`	Set SMPTE date encoding to none.
`tcr smpte_leitch`	Set SMPTE date encoding to Leitch.
`tcr smpte_309m`	Set SMPTE date encoding to 309M.
`tcr smpte_309m_no_time_zone`	Set SMPTE date encoding to 309M without a time-zone field.
`tcr irig_nodate`	Set IRIG date encoding to none.
`tcr irig_1344year`	Set IRIG date encoding to IEEE 1344.
`tcr local`	Offset time code using local time settings.
`tcr utc`	Apply no offset; use UTC.
`tcr custom`	Offset time code using custom time settings.
`tcr dst eu/us/off/ex`	Set the custom time-code Daylight Saving Time mode. ex shows manual-entry examples.
`tcr tz xx:yy:zz`	Set the custom time-zone offset to x hours, y minutes, and z seconds.
`tcr_cal`	Show the calibration setting.
`tcr_cal auto`	Use automatic calibration mode.
`tcr_cal manual x`	Use manual calibration gain x, from 1 to 255.
`tcr_cal saved`	Use saved calibration mode.
`tcr_cal timeout x`	Set the saved-mode timeout before recalibration after lock loss, in seconds.
`tcr_cal now`	Break lock and calibrate immediately.

Reading calibration status

The mode line identifies the active calibration mode. The manual-gain value is stored separately, so a displayed manual-gain value does not mean that manual mode is active.

TrueTime and diagnostics

Command	Purpose and entry guidance
`truetime`	Show TrueTime/Kinemetrics output parameters.
`truetime on`	Enable TrueTime output.
`truetime on xxx port baud parity`	Enable TrueTime output. xxx is lock or nolock; port is rs232 or rs422; baud is 4800, 9600, 19200, or 38400; parity is none, odd, or even.
`truetime off`	Disable TrueTime output.
`truetime time utc`	Output UTC time.
`truetime time local`	Output local time.
`debug`	Show debug settings; not available on all devices.
`debug ssh`	Display live debug output in the current SSH session. Use debug off to stop output. This command selects a live view rather than a stored setting.
`debug off`	Turn debug output off.
`debug skew`	Output current skewing values.
`debug port baud databits parity stopbits`	Configure the debug output port and its baud rate, data bits, parity, and stop bits.
`ping -I intf`	Select the network interface used to transmit requests.
`ping -c count`	Stop after sending count packets.
`ping -h hoplimit`	Set the IPv6 hop limit or IPv4 TTL.
`ping -i interval`	Wait interval seconds between packets.
`ping -p pattern`	Set the byte pattern used for packet data.
`ping -s size`	Set the number of data bytes.
`ledtest`	Show the current LED test mode.
`ledtest 1`	Turn on all display segments.
`ledtest 2`	Rotate through the segments of each digit at full brightness.
`ledtest off`	Turn off the LED test.
`memfree`	Display current system and extended-memory usage and status.
`memtest`	Test system and extended memory and report the results.

Health and Safety

Safety Information

These devices generate, use and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to radio or television reception, which can be determined by removing power from the device, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Connect the device's AC or DC power cord into an outlet on a different circuit than other devices.
2. Increase the physical distance between the GMR6000 and other devices.
3. Contact technical support.

This GMR6000 has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.



Never insert any metallic object into the devices case. Doing so increases the risk of electrical shock, short circuiting, fire or personal injury.
Never expose this device to rain, or use it near water or in damp or wet conditions.
Never place objects containing liquids on or near this device, as they may spill into its openings increasing the risk of electrical shock, short circuiting, fire or personal injury

Only qualified persons are authorized to carry out maintenance on this device. Read this User's Manual carefully, and follow the correct procedure when setting up the device. Do not open your Masterclock product or attempt to disassemble or modify it.

Electrical Safety:

Operate only within rated AC/DC ranges.
Ensure proper grounding.
Do not operate with damaged cables or connectors.

Environmental Safety:

Operate between 0-60 °C, <90% RH non-condensing.
Avoid exposure to static, liquids or corrosive environments.

Mechanical Safety:

Use rack-mount hardware for installation.
Do not place on desktops or block vents located on the top and bottom of the unit. Always secure your device using proper mounting hardware. Do not put unnecessary stress on connected cables.

Health and Safety

Warnings:
No user-serviceable parts inside.
Opening the unit risks electric shock or shorting sensitive components. Contact the Masterclock Support Team for assistance if your device is not working as expected.

Compliance:
Meets IEC 62368-1 and EN IEC 55035 standards.