



# MCR5000

Master Clock Reference

## User Manual

The **MCR5000** is a high-precision Ethernet master clock reference utilizing a built-in NTP client to accurately set system time from up to two NTP servers

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**The MCR5000** is a high-precision time and frequency reference system based on NTP (Network Time Protocol) over the Ethernet. Designed for the rack mount, this multiple input and output generator serves commercial establishments, industry, military and laboratory environments. GPS, NMEA and Time Code options are available.

**Thank you** for your purchase of a MCR5000 precision time and frequency reference system from Masterclock.

**Here you'll find instructions** for unpacking and installing your MCR5000, proper care and configuration.

**We are here to help.** You can reach us using various contact methods (phone, email, etc.) found at our website: [www.masterclock.com](http://www.masterclock.com)

Before calling, please attempt to find the answer to your situation here. You'll find this user manual will handle virtually all of your questions.

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## OPERATING ENVIRONMENT

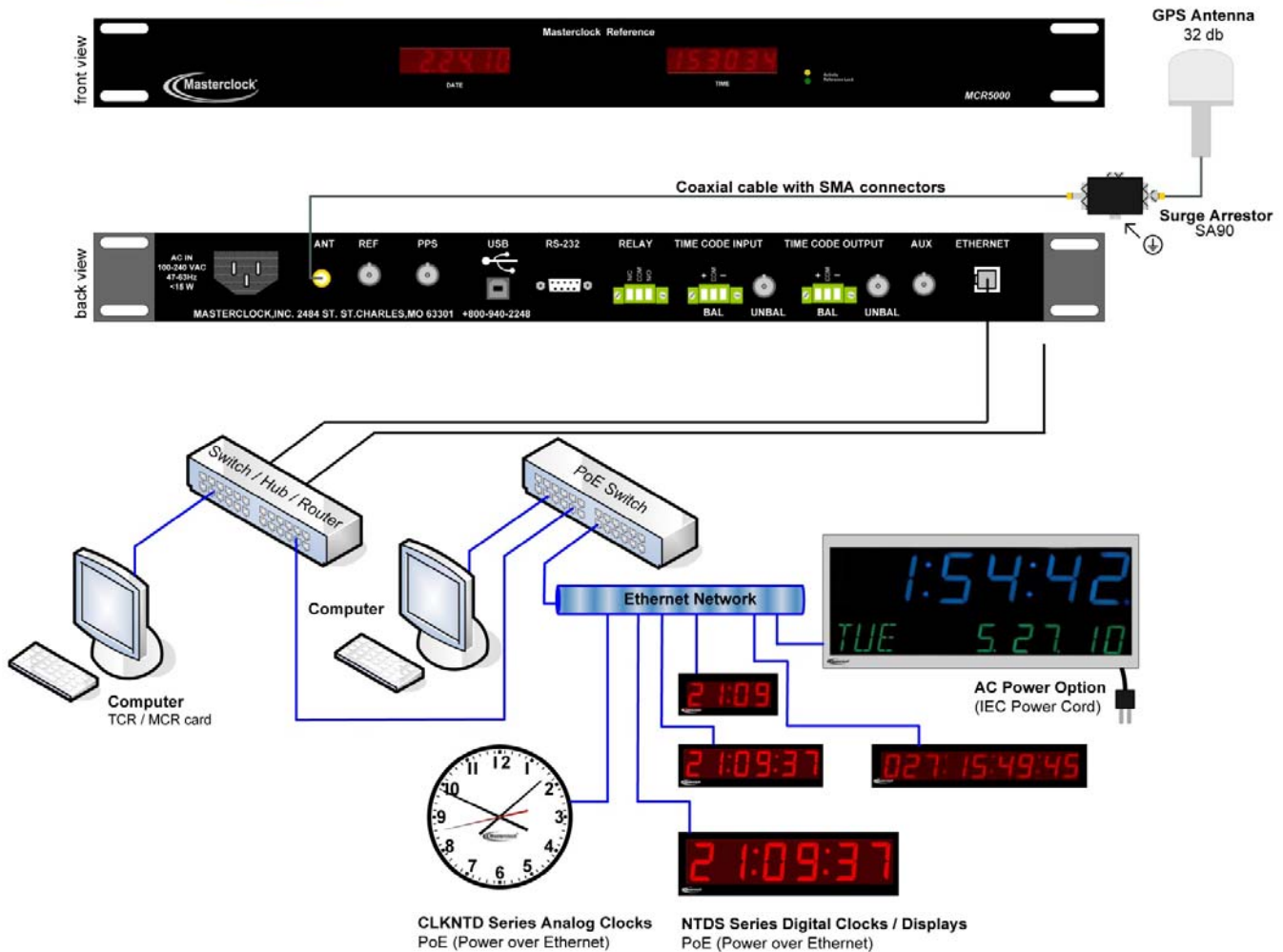


**Moisture:** The MCR5000 is not moisture-proof. It is designed for indoor use only. Treat it as you would any other delicate electronic device and do not expose it to water, high humidity excessive heat or physical abuse. Please see the “Specifications” section (p. 48) for details.

**Static:** Do not subject the unit, particularly the antenna input connector, to electrostatic discharge (ESD) during handling. Discharge yourself to a ground before handling the unit. Preferably, use a static discharge wrist strap connected to earth ground when installing or configuring the device.

**Caution: No user-serviceable parts are inside the MCR5000.**  
Please contact the factory if you require service or repair

# Masterclock® Master Clock Solution - MCR 5000



# Introduction

**SEE THE PRE-INSTALLATION CHECKLIST AND QUICK START INSTRUCTIONS: PAGE 18**

## QUICK DRIVER INSTALLATION

- 1. Insert** the USB cables and configuration software CD that shipped with your MCR5000.
- 2. Onscreen select** the MCR5000 directory.
- 3. Run** the 'setup.exe' application from the CD.

By default, the setup utility will suggest installing files to **C:\Program Files\ Masterclock\MCR5000**.

- 4. Click** [Okay].

**Open the software** by clicking the shortcut in your start menu.

**Note:** Other methods should not be used to manage the device while using this software.

**When locked to GPS satellites, the MCR5000** can read NTP, NMEA, NENA or time can be set manually. The MCR5000 can generate NMEA, NENA, PPS or PC time via USB.

**Optional outputs** include NTP, Time Code basic (IRIG B and SMPTE), Time Code Advanced (IRIG A and E), PPO and a 10 MHz sine wave.

**Holdover accuracy and stability** is maintained with a High Stability Oven-controlled Oscillator (HSO). Each MCR5000 can operate on a 10/100 MBit local area network.

## DRIVER INSTALLATION

**The MCR 5000 is available in multiple configurations** to fit almost any need with configurable plug-in modules.

A **USB type B port** has been included on the rear of the MCR5000 to provide a means of configuring the operation of the MCR5000 via software or as a serial data port.

To utilize the USB port with a host computer, connect a USB type A/B cable from the host computer to the MCR5000.

**Before the unit can be configured, the device drivers must first be loaded.** A software configuration program (WinDiscovery) and USB drivers have been provided on a CD with the MCR5000.

**Installing USB drivers:** Once the MCR5000 is powered up, the Windows **Plug and Play Manager** will detect the new Masterclock USB device and request drivers. Insert the driver software CD into the CD reader of your computer.

When requested by the Windows **Plug and Play Manager**, select the option to **“Install from a list or specific location [Advanced]”** in order to manually browse for the drivers. Browse to the drivers located under the **Drivers\MCR\** directory on the CD and select **[OK]**, then select **[Next]**.

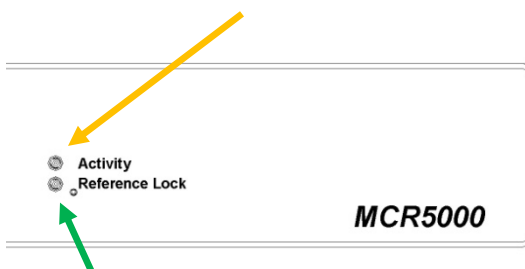
The driver will automatically load into your computer. If not, see the box at left for other instructions.

## FRONT PANEL 'LED' STATUS

The MCR5000 provides two LEDs on the front panel.

The upper amber LED (labeled: **Activity**) pulses briefly and only occasionally with every NTP request.

The lower green LED (labeled: **Reference Lock**) blinks twice per second during power up, then once per second after synching to the external reference.





## WINDISCOVERY

Included with your MCR5000 is the WinDiscovery GUI application. WinDiscovery is a detection, configuration, & management software application which works with all Masterclock brand network devices. It operates under the Windows XP/7, Server 2003 2008 operating systems.

## FRONT PANEL LED DISPLAY OPTIONS

- Six-digit time or date or alternating time/date display
- Two-window, twelve-digit date and time display
- 12- or 24-hour time
- Display in either US [MMDDYY] or European [DDMMYY] formats
- Adjustable brightness control
- Display UTC time or local time with fully configurable time zone and DST offsets



## BATTERY BACKED RTC AND TCXO

The MCR5000 maintains its internal time settings in battery-backed memory located on a RTC chip. A Temperature Compensated Crystal Oscillator (TCXO) provides a freewheeling accuracy (maximum drift) of +/- 1 minute per year (165 mS/day).

The battery supplies power to the TCXO 32kHz oscillator and RTC when the unit is powered off. This allows the internal time to be maintained and the time and date to increment, when power is off. Under normal operating condition, the memory devices maintaining the RTC data is powered by the external DC power supply and does not rely on the battery for data retention.

The battery is a maintenance-free rechargeable manganese lithium type. A built-in battery charging circuit is used when the unit is powered on, eliminating the need for maintenance.

## NON-VOLATILE MEMORY CONFIGURATION

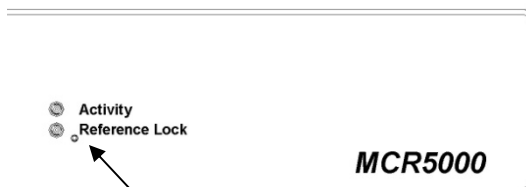
The MCR5000 maintains its configuration parameters internally in non-volatile memory, even when the power is off. These configuration settings include the assigned (DHCP or Static) IP address and network settings, assigned device name, NTP operational mode, brightness level, assigned stratum levels, Telnet access, RTC usage validity during primary reference outages and password. All configuration parameters (except for the time/date stored in the RTC) may be reset to the factory default state (see below).

## SET TO FACTORY-DEFAULT CONFIGURATION

The MCR5000 is fully tested with factory defaults prior to shipping. This factory default configuration is defined as:

- UTC reference time (no local time zone offset, daylight saving auto adjustment disabled)
- DHCP configuration mode enabled for Network Address and NTP Server addresses
- Query (unicast) NTP client mode enabled (broadcast/multicast modes disabled)
- Time dissemination via Real-Time Clock (RTC) during reference outages enabled for 24 hours
- Password – set to “**public**”
- Device name – set to MCR1000-XX:XX (where XX:XX are the last two octets of the MAC address of the unit)
- Relay Schedule – disabled (relay actuates upon loss of external time reference)
- Telnet enabled

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**SET TO FACTORY DEFAULT BUTTON ACCESS HOLE** To reset the configuration back to the factory default insert the end of a paperclip into the pinhole marked here. Push in to depress the “**Set to factory default**” button inside the unit. Maintain pressure for 5 seconds or until the front panel display goes to all dashes “-----”.

## RESET TO FACTORY DEFAULTS

In some situations (such as a lost password or removal of confidential information, perhaps prior to sending the unit in for repair service), it may be necessary to return the MCR1000 to its factory default configuration. The factory defaults may be restored by using the software interface method (WinDiscovery or Telnet) or by accessing a recessed button located on the front panel (see illustration at left) in recessed pinhole. Insert a paperclip-type wire into the hole and maintain pressure for at least 5 seconds.



# Standard Features

## TIME CODE INPUT NOTICE

Depending on many factors beyond the control of MC, the signals that are received from the Time Code Input Source are subject to interference, noise, loading effects and other influences such as time code format *that could cause* the MCR5000 with an installed TCR (Time Code Reader) option to provide erroneous time and/or date information and, under some conditions, *could prevent* it from providing time/date information.

## TIME CODE OUTPUT NOTICE

Depending on many factors beyond the control of MC, the time code signals that are generated from the MCR5000 with an installed TCG (time code generator) option are subject to interference, noise, loading effects and other influences, such as a time code format that could affect a device decoding the time code signal to provide erroneous time and/or date information. The time code output of this device should not be relied upon for critical timing applications.

## GPS RECEIVER NOTICE

Depending on many factors beyond the control of Masterclock, the signals that are received from the GPS satellites are subject to interference, fading, satellite failure and other influences *that could cause* the MCR5000 with an installed GPS receiver option to provide erroneous time and/or date information and, under some conditions, *could prevent* it from providing time/date information.

**It is the responsibility of the user to determine the adequacy and suitability of this device for the intended use.**

- Internal battery-backed **Real Time Clock (RTC)** retains time during loss of power or loss of active reference(s).
- **Maintenance-free rechargeable battery**
- Additional **Telnet interface** for alternate configuration and maintenance on non-Windows OS networks
- **Temperature Compensated Oscillator (TCXO)** with holdover stability <165mS/day
- Supports NTP **broadcast, multicast** and/or **unicast** (query) modes
- Fully configurable network settings, automatic via **DHCP/BOOTP**, or **Static IP** addressing support
- Security features include **password protection** of configuration, authenticated communications and the ability to disable Telnet management access
- UTC time internal reference
- Fully configurable local time offset support with Time Zone and Daylight Saving Time (DST) offset, along with the ability to create custom time offsets
- Remotely monitor status and behavior via easy-to-use *WinDiscovery* software
- **Programmable Dry Contact Relay** (24VDC or 24VAC, 250mA) for scheduled events
- Single event (daily) programmable **relay schedule** (upgradeable to multi-event with **Event Time** software)
- **PPS (Pulse Per Second)** output TTL level signal which is locked to the most accurate active time reference
- Front panel power and NTP activity LED status indicators
- USB serial port interface
- RS232 serial port Interface
- NMEA 0183 ASCII serial output
- Kinematics/Truetime
- NENA 911 PSAP master clock standard
- Firmware and function upgradeability

# Optional Features

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While the MCR5000 can handle up to seven modules, five are currently offered by Masterclock.

1. **GPS Receiver**
2. **TCR**
3. **TCG**
4. **HS**
5. **PPO**

Depending upon the configuration of the MCR5000 you purchased, your unit can also support additional (up to six) hardware module accessories and multiple advanced function options. The ability to add these optional features to the MCR5000 makes it an extremely versatile network device and suitable for a large variety of applications.

## ❖ **NTP SERVER FUNCTION**

- Selectable Stratum identification levels (1-15)
- Query, broadcast, multicast modes
- May be operated independent from or in conjunction with the built-in NTP client

## ❖ **GPS**

- GPS Receiver module with 12 channel parallel/simultaneous receiver

## ❖ **TCR: TIME CODE READER MODULE**

- Reads SMPTE 24, 25, 30-fps, non-drop frame , IRIG-B, 1 kHz Amplitude Modulated and pulse width coded(un-modulated)
- Automatic time code detection circuit with automatic gain adjust
- Single-ended unbalanced or differential balanced inputs
- Supplied with BNC9-TCI time code input adapter for SE unbalanced input
- Optional DB9 breakout adapter available for differential balanced input
- Fully configurable offset for Time Zone and DST
- Programmable delay offset with 1 mS resolution



❖ **TCR+**  
**ADVANCED TIME CODE READER**

- Reads advanced IRIG formats A and E, in addition to basic IRIG-B and SMPTE

❖ **TCG**  
**TIME CODE GENERATOR MODULE**

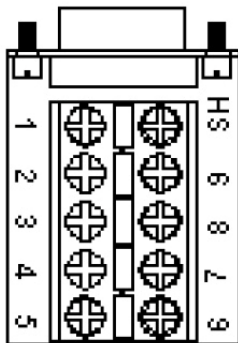
- Generates SMPTE 24, 25, 30-fps, non-drop frame , IRIG-B, 1 kHz, Amplitude Modulated and pulse width coded (unmodulated)
- Single ended unbalanced output
- Fully configurable offset for time zone & DST
- Programmable delay offset with 1 mS resolution

❖ **TCG+**  
**ADVANCED TIME CODE GENERATOR**

- Generates advanced IRIG formats A and E in addition to basic IRIG-B and SMPTE

❖ **HS: HIGH STABILITY MODULE**

- Internal Oven Controlled Crystal Oscillator (OCXO) provides high stability time reference of <250 mS /year drift while freewheeling after disciplining from a GPS or other accurate reference.
- Calibrates or locks to best “active” time source – use GPS option for maximum holdover stability.
- 10 MHz sine wave frequency reference output (requires HS option)



**DB9 Breakout Adapter**  
(item sold separately)

❖ **PPO: PROGRAMMABLE PULSE OUTPUT**

- Pulse interval and duration can be selected via software from 100 μseconds to 3 days
- Default is 1PPM (pulse per minute)
- Pulse output is 5Vpp from a low impedance source.
- Pulse width selectable from 10 μS to 100mS.
- Accuracy is same as the current reference source, whether it is GPS, Time Code, NTP, etc.

❖ **DB9 BREAKOUT ADAPTER**

- For full I/O (input /output) signal access



**WinDiscovery** permits remote network device detection, configuration and management of Masterclock brand network devices from Windows-based PCs. It is your primary detection, configuration and maintenance software. Details on page 22.

## TELNET INTERFACE – FOR UNIX AND LINUX

A Telnet terminal style command line interface is used on networks that are not Windows-based (i.e. Linux and Unix). The Telnet interface may be disabled. See page 34.

## PASSWORD PROTECTION

The **MCR5000** is provided with a password as a security access feature. Each Masterclock network device requires a password that must be entered before the device will accept configuration changes. Each device or set of devices can have a unique password or they can all share the same one. The password can be changed and retained to permit access only to authorized users.

A password can be a maximum of 11 characters and may contain any sequence of letters, numbers, and common punctuation. Passwords are case-sensitive.

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## DEFAULT PASSWORD

The factory default password is **public**.

## UTC/GREENWICH MEAN TIME REFERENCE

The MCR5000 reference time is based on UTC (Coordinated Universal Time). UTC is the local time at the prime reference meridian at Greenwich, England. At a given location on the planet, local time can be displaced (referenced to UTC) by -11 to +12 hours. The NTP time distribution standard operates with UTC-reference time only. All offsets for time displacements are input at the final stage (e.g. for computers and clocks). Otherwise a double offset might occur.

UTC is sometimes colloquially referred to as "Greenwich Mean Time" (abbreviated GMT).

## TIME ZONE OFFSETS

A time zone offset (or bias) can be provided to adjust the time for display or time output purposes. A bias can be set as a positive (+) or negative (-) value with a resolution of one second. **Factory default: No offset = UTC time.**

## DAYLIGHT SAVINGS TIME

Daylight savings time (aka "Summer Time" in Europe) adjustments can be configured separately and in addition to a time zone offset.

Daylight time standards vary widely throughout the world. Traditional daylight/summer time is configured as a one (1) hour positive bias. The new US/Canada DST standard is: one (1) hour positive bias, starting at 2:00 am on the second Sunday in March, and ending at 2:00 am on the first Sunday in November.

In the European Union, daylight change times are defined relative to the UTC time of day instead of local time of day (as in U.S.). European customers, please carefully consult the section entitled **Daylight Savings Settings** (p. 26) for details on setting daylight time.

To ensure proper hands-free year-around operation, the automatic daylight time adjustments must be configured using the daylight time option and not with the time zone offset option.

**Factory default: Daylight savings time is not set.**

## LEAP SECONDS

UTC runs at the rate of atomic clocks, but when the difference between this official time and one based on the rotation of the Earth approaches one second, a "leap second" is added to UTC.

This has virtually nothing to do with the ongoing gradual slowing of the earth's rotation over millions of years, which occurs at a much slower rate.

# DHCP/BOOTP AUTO-CONFIGURATION

**Important Note:**

Long DHCP names are not supported. Only the first 14 characters of the device name will be registered by the DHCP server.

The IP address of the unit is required to configure the MCR5000 with Telnet. The DHCP server can be utilized to provide the IP address of the associated device name that is registered.

**Important Note:**

An MCR5000 network device will not function properly if configured to use DHCP services when no DHCP server is present on the network. An MCR5000 network device will default to a fallback IP address of 169.254.X.Y when no DHCP server is available on the network, where X and Y are random.

The MCR5000 can obtain its network configuration automatically from DHCP or BOOTP, when one or the other is available on the network. Utilizing DHCP/BOOTP, the MCR5000 will automatically be assigned its network configuration including an IP address, and additional functions such as DNS server and Router/Gateway settings. This feature is enabled by default.

**DHCP (Dynamic Host Configuration Protocol)** is a mechanism for automating the configuration of networked devices that use TCP/IP. When DHCP is enabled, DHCP configuration acquisition will overwrite any manual configuration items.

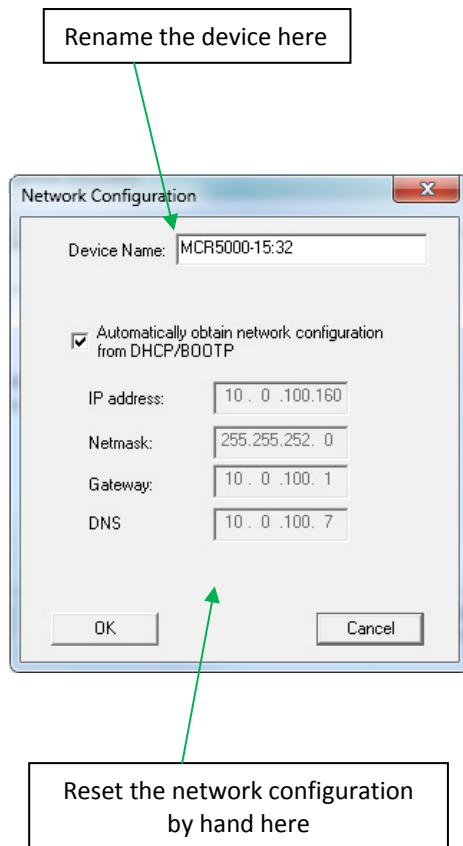
**BOOTP** is a precursor to DHCP. The MCR5000 can obtain configuration from a BOOTP server when DHCP is absent.

The MCR5000 can automatically obtain **Time Zone Offset** configuration and the NTP server addresses (primary and secondary). To utilize these features the DHCP server of the network must be pre-configured with the appropriate checklist items (see below). **Factory default: DHCP enabled.**

The following RFC2132-defined optional configuration items are, when available, used by the MCR5000 for configuration:

Option	No.	Comments
Time Offset	2	The value provided will be used for the time zone offset configuration, unless it is defined as zero in which case it will be ignored and the MCR will rely on internal configuration. Note: this option does <u>not</u> provide information appropriate for dynamic daylight savings time use.
Router	3	The first IP address provided will be used for router/gateway configuration.
Domain Name Server	6	Up to two server IP addresses may be specified. MCR clock will treat addresses as primary and secondary DNS servers.
Network Time Protocol Server	42	Up to two server IP addresses may be specified. MCR clock will treat addresses as primary and secondary NTP servers.

## DEVICE NAME/DHCP NAME REGISTRATION



All Masterclock network appliances should be provided with custom device names relating to your own organizational requirements. It is recommended that a robust naming scheme (perhaps based on location) be developed before devices are installed on a campus or throughout a building.

**By default, device names are the product name abbreviation followed by the last octet of the device's Ethernet address (MAC address).**

The device name may be changed from the factory default name by entering a unique name of up to 32 characters.

If a DHCP server is available on the network when the MCR5000 is installed, the unit will be auto-registered with the DHCP server. The network system administrator can then view this DHCP name registration and the currently assigned IP address, at the DHCP server.

### STATIC IP CONFIGURATION

The MCR5000 allows for Static IP address, gateway and DNS, network configuration entries to be made manually if no DHCP/BOOTP server is available. In addition, the NTP server addresses can be adjusted manually. Manual configuration requires disabling the DHCP defaults via *WinDiscovery* (or other configuration method).

### NTP (NETWORK TIME PROTOCOL)

NTP is an open-standard time synchronization protocol designed for precision synchronization and maintenance of time/date on computers and other devices attached to TCP/IP networks. NTP itself is transported with the **UDP/IP (User Datagram Protocol)**, and is usually served on **port 123**. NTP time/date is UTC-referenced, as the protocol has no provisions for representing time zones or daylight savings ("Summer Time" in Europe).

A wealth of useful NTP information and resources can be found at

<http://www.ntp.org>

**Warning:** If NTP Server is enabled and an offset is created for it, the NTP Client must be disabled, else the NTP time served will be erroneous.

**Note:** Use of the multicast addressing method requires the use of routers & switches and other network devices that support the **Internet Group Management Protocol (IGMP)**. In addition, the IGMP mode must be enabled and configured for multicasting addressing to be implemented properly. The implementation of multicasting addressing is beyond the scope of support available from Masterclock. Please ensure that your network system components are capable of, and configured properly for, IGMP before utilizing the multicast addressing feature.

**Note:** You will need to check with your firewall vendor to determine how to enable multicast traffic through a firewall. In addition you may want to read RFC 2588: IP Multicast and Firewalls.

The MCR5000 acquires its internal UTC time reference from an NTP timeserver by using a built-in NTP client. The NTP client is fully configurable and can operate in several NTP modes to reference both a primary and a secondary NTP server. The client can be disabled in order to allow operation of the unit as a stand-alone unit without network connection.

## NTP SERVER OPTION

The MCR5000 can also act as a NTP server with the installation of the **NTP Server Option**. This option is fully configurable and can operate in several NTP modes. See the optional features section (page 11) for more information.

## NTP ADDRESSING MODES

**UNICAST** - The MCR5000 supports the unicast method of NTP packets transfer. Unicast method involves direct transfer of requested information from the NTP server to the NTP client based on a query or NTP time request. The unicast method is supported simultaneously when either the broadcast or multicast modes are selected.

**BROADCAST** - The MCR5000 supports the broadcasting of NTP packets. This feature is useful in situations where network administration may wish to avoid the network traffic created by a large number of clients making periodic NTP requests, or in situations where such periodic requests end up synchronized in such a manner as to exceed the MCR5000's ability to reply. The broadcast mode is a widespread or open-ended broadcast, not intended for any specific IP address.

The MCR5000 provides NTP [UDP] broadcasts using the broadcast address [255.255.255.255].

**Note:** Some firewalls and routers will not forward UDP broadcasts by default. Security configurations may need to be adjusted to allow the UDP broadcast packets to pass on the configured port.

**MULTICAST** - The MCR5000 also supports multicast addressing of NTP packets as a recently added feature. As opposed to broadcast mode (see above), data is sent to every possible receiver (client). Multicasting is useful because it conserves bandwidth. It does this by replicating packets, only as needed within the network, to send them only to receivers (clients) that want them, thereby not transmitting unnecessary packets.

**The concept of a group is crucial to multicasting.** Every multicast requires a multicast group; the sender (or source) transmits to the group address, and only members of the group can receive the multicast data. A group is defined by a Class D address.

The MCR5000 does not restrict the use of the multicast address assignment and supports the full range of class D multicast addresses or groups from 224.0.0.0 to 239.255.255.255. These groups or class D address ranges for multicasting are defined and governed by **RFC3171, IANA IPv4 Multicast Guidelines.**

Typically, the multicast address range is from 224.0.1.0 to 224.0.1.255.

224.0.1/24 is considered the **INTERNET WORK CONTROL BLOCK.** The address range is utilized for NTP traffic. Please refer to the RFC3171 for your specific application and implementation.

The Internet Group Management Protocol (IGMP) is a protocol that controls group membership for individual hosts. This protocol only operates in a LAN setting, but is required if you wish to be able to join a multicast group on a host. IGMP is defined in RFC 2236.

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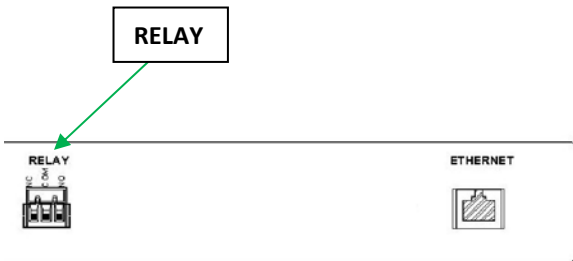
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**ANYCAST** - The MCR5000 does not currently provide anycast capability.

For more information on **How to Listen for NTP** please see page 32.



# Back Panel Interfaces



**CAUTION:** Connecting input voltages or switching currents beyond the maximum ratings for the relay could damage the MCR5000. Such damage is not covered under your warranty.

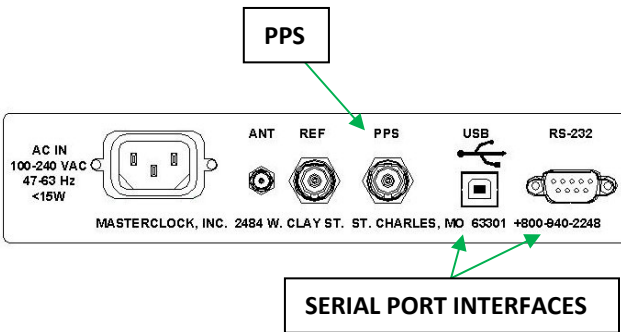
## RELAY AND PROGRAMMABLE RELAY EVENT

The MCR5000 includes a low voltage dry contact 24V AC or DC relay that can be configured to be either NO (normally open) or NC (normally closed) using the terminal block connector on the rear of the unit.

The relay can provide two mutually exclusive functions.

1. By default, the relay will actuate to indicate when the unit has lost synchronization (lock) with the external time reference.
2. The relay can be programmed to actuate at a single time (defined as HH:MM:SS start time) for a specified duration (in seconds) once per day. This single daily event schedule feature is included with the MCR5000.

Please refer to the specifications section (p. 47) for the maximum relay ratings.



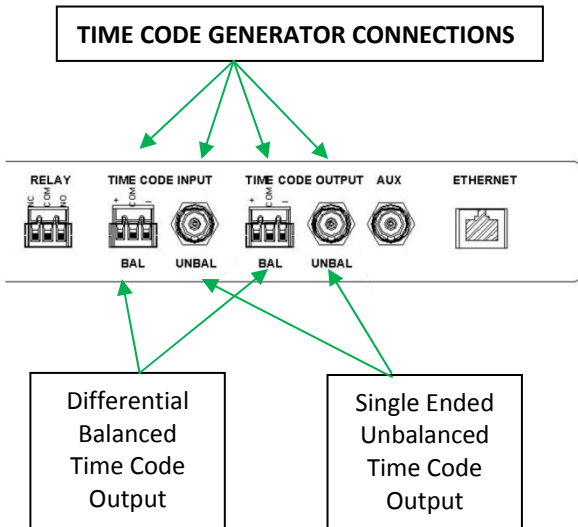
## PPS (PULSE PER SECOND) OUTPUT

The MCR5000 provides a PPS output. PPS is commonly used as an on-time mark for timing and synchronizing systems.

The PPS is a 5V TTL level signal that is locked to the currently selected and most accurate time reference (external or internal). The rising edge of PPS signal provides the “On Time” mark. The PPS output of the MCR5000 is available on the BNC connector on the rear of the unit labeled “PPS.” For additional information, see the specifications section of this manual (p. 48).

## SERIAL PORT INTERFACES

The MCR5000 provides both an RS-232 null modem and USB-type B serial interface for serial communications and configuration.

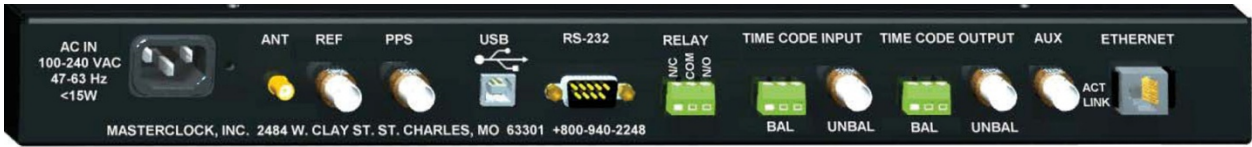


## TIME CODE GENERATOR (TCG) OPTION

### Time Code Output Connections

Connect the time code signal cable to either the terminal block connector (for differential balanced output) or the BNC connector (for single-ended unbalanced time code output), and then to your load device (Time Code Reader (TCR) device).

# Installation



## CHECKLIST

### Dynamic Networking Configuration (default for all MCR5000 devices)

- Confirm that a DHCP/BOOTP service is accessible on the local network
- Determine if DHCP server will provide NTP server configuration
- Determine if DHCP server will provide time zone configuration

-- OR --

### Static Networking Configuration

- IP address and netmask designation for device
- Primary and secondary DNS (domain name) servers
- Gateway/router
- Primary and secondary NTP time sources

## PRE-INSTALLATION CHECKLIST

The MCR5000 is a network device with an NTP client enabled and configured for DHCP provided network settings and NTP server addresses (by default).

Before installing an MCR5000 on a network one should be prepared with the following basic configuration information (see box at left) the MCR5000 requires. You may need to obtain some of this information from your network administrator.

## QUICK START INSTRUCTIONS

- Make all connections at the rear of unit, but keep the power disconnected until the last step.
- Connect the MCR5000 device to your LAN (Local Area Network) hub/router/switch using Cat5 cable making the connection to the RJ45 connector labeled "Ethernet."
- Attach any additional cables for accessing desired features or installed options. See the appropriate section of the user manual for making connections for standard I/O or installed options.
- Insert the WinDiscovery CD into a computer running Windows 2000, XP, 7, Server 2003 or Server 2008 SP-1. The **Installshield** application will begin automatically if AutoRun is enabled on your system. Otherwise, browse to the CD root directly and click the **setup.exe** file to begin the installer.
- Finally, connect the supplied AC power cord.

## RS-232 Communications

Pin TCD	Signal 2 RxD	MCR5000 signal name
2	RxD	Receive Data
3	TxD	3 Transmit Data
5	SG	Signal/System Ground

The **RS-232 interface** [DB-9 male connector] may be used to connect your PC with the MCR5000 in order to receive NMEA 0183 messages.

The **MCR5000 serial port pinout is defined at right**. RS-232 communications from a standard IBM PC or compatible host computer use a standard straight thru cable (3 wires only: pin 2, 3 and 5).

D-Sub Connector 1		D-Sub Connector 2	
Dsub1	Signal	Signal	Dsub2
2	Transmit Data	Transmit Data	2
3	Receive Data	Receive Data	3
5	Signal/System Ground	Signal/System Ground	5

The default communication settings for the RS-232 port are:  
**4800 baud, 8 data bits, 1 stop bit, no parity.**

The RS-232 port can be configured for baud rates of 4800, 9600, 19200, 38400, and 57600; along with 7 or 8 data bits, 1 or 2 stop bits, and the parity bits can be selected as None, Odd, and Even.

**For communication with other types of RS-232 receiving devices it may be necessary to observe the following requirements:**

- Connect the transmit (TX) line of the MCR (pin 3 of the DB-9 connector) to the receive (RX) line of the host system.
- Connect the receive (RX) line of the clock (pin 2 of the DB-9 connector) to the transmit (TX) line of the host system.
- Connect the ground line of the clock (pin 5 of the DB-9 connector) to the ground of the host system.
- Ensure the host system can communicate via standard RS-232 at 4800 baud, 8 data bits, 1 stop bit, no parity.

Pins 2 and 3 must use RS-232 voltage levels. The MCR5000 cannot decode TTL-level serial communications at pin 2 and 3 of the DB-9 connector.

- Ensure that any cable you are using for communication with the MCR5000 is within the RS-232 standard length and is a working cable.
- The interface may require a null modem cable.
- A “null modem” 3-wire serial cable or simple RS-232 cable utilizing pins 2,3 and 5 only should be used

D-Sub Connector 1		D-Sub Connector 2	
Dsub1	Signal	Signal	Dsub2
2	Receive Data	Transmit Data	3
3	Transmit Data	Receive Data	2
5	Signal/System Ground	Signal/System Ground	5

## NTP CLIENT INFORMATION

If you want to synchronize a computer system or network to the MCR5000 with NTP server option installed you must incorporate a NTP/SNTP client. This client is responsible for asking the NTP server for time/date information. In some cases it simply listens on the network for NTP time broadcasts, then sets the internal time of the computer or device. NTP client applications come in a variety of offerings, supporting different features, with different levels of accuracy, fault tolerance and reporting. Many are inexpensive to license, or are free (like the client app from Masterclock, see below).

## FREE SNTP CLIENT SOFTWARE

Masterclock provides a FREE **Simple Network Time Protocol (SNTP)** client for use to synchronize PCs, workstations and servers. This client app is called **MasterSyncPC Freeware** and it can be downloaded at the Masterclock website.

<https://www.masterclock.com/MasterSyncPC2.php>

The software is provided as-is, as a courtesy to our customers, with no technical support provided. This application is developed to run under Windows 2000, Windows XP, 7, Server 2003 and 2008 SP-1.

# WinDiscovery Installation and Operation



Included on CD with your **MCR5000** is the **WinDiscovery** software application for detection, configuration and management of all your NTP devices from Masterclock. The application operates in the Microsoft Windows operating system.

## INSTALLING WINDISCOVERY

As instructed on page 3: **Insert the CD** that shipped with your MCR5000 to automatically install WinDiscovery. If **AutoRun** is not enabled on your computer:

1. Run the “**setup.exe**” application from the CD.
2. By default, the setup utility will suggest installing files to **C:\Program Files\Masterclock\WinDiscovery**. Click [**OKAY**].

## USING WINDISCOVERY

**Open WinDiscovery** from the “Start Menu” or by double-clicking the shortcut icon on the desktop.

Click the [**Discover**] button to reveal all the devices accessible on the network. The status bar will display the count of devices found. When complete (please wait until ‘100%’ appears then disappears), a list of **device families and groups** will be displayed in the **left pane** of the **WinDiscovery** window. Click the [+] buttons to reveal the individual devices. Click the [-] buttons to hide the individual devices.

Each device is configured with a **device name** from the factory. Each device name includes the model name and a MAC address extension. You should change the device name to one that can identify the location of the device.

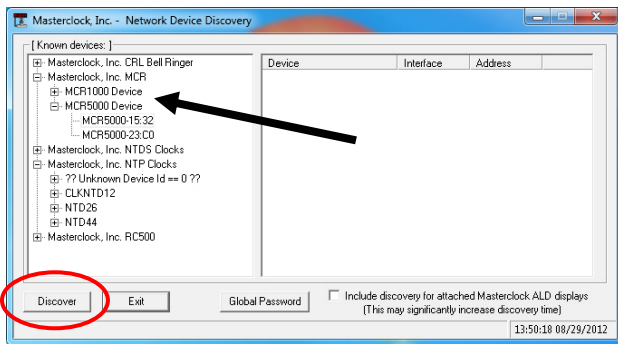
It is highly recommended that only one user opens **WinDiscovery** at a time. Other methods should not be used to manage the network devices while using this software application.

## MENU

To open a **menu of options**, including **Properties and Device Settings**, right click the device name.

**Or**

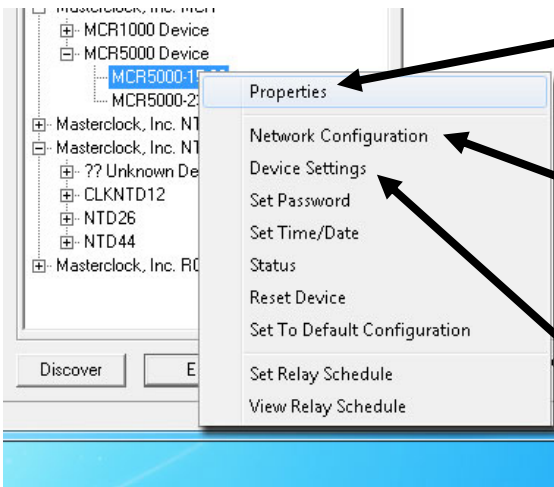
To open the **Device Settings** window, left click the device name.



## INSIDE THE MENU OF OPTIONS WINDOW:

Click your choice to open the window for that function.

Below: The menu that appears following a right click to the device name.



### PROPERTIES

The device properties may be viewed in summary by clicking the [Properties] button.

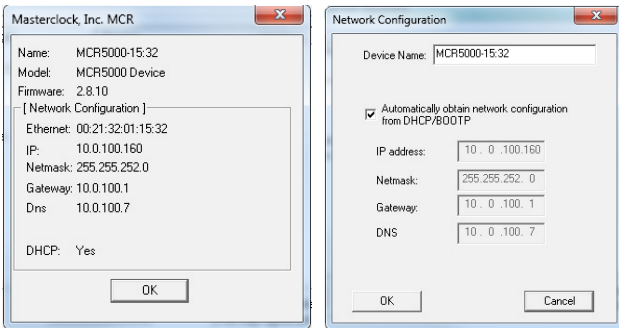
### NETWORK CONFIGURATION

The network configuration may be viewed in summary by clicking the [Network Configuration] selection.

### DEVICE SETTINGS

Here your MCR 5000 can be configured to receive and display time in the format that you prefer, using time zone offsets and DST settings to completely customize it relative to UTC time.

The top right section of the Device Settings shows a list of the Firmware associated with the MCR5000, which may include several options, including HSO, TCG and GPS. The rest of the Device Settings are buttons leading to new windows described below.



Properties

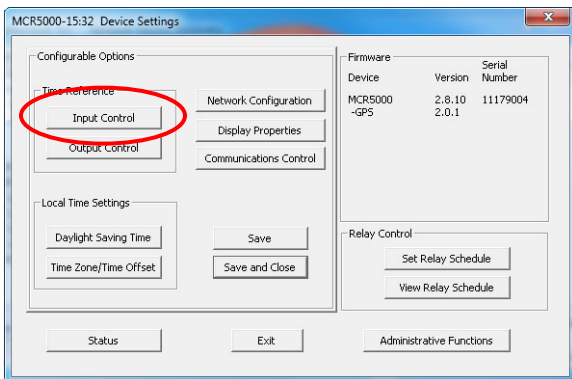
Network Configuration

### DEVICE SETTINGS (DS) – INPUT CONTROL (IC)

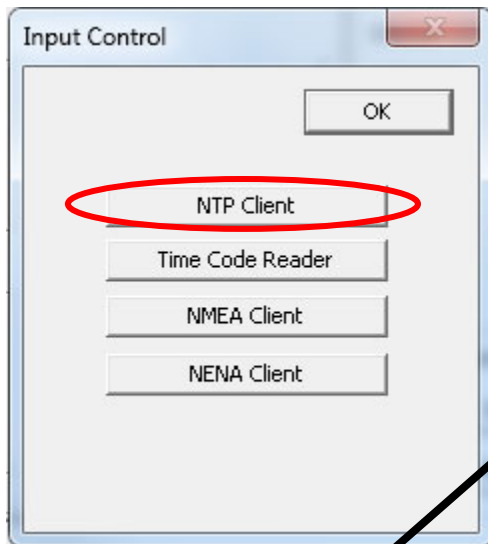
Each MCR5000 network device can be fully configured to display local time (or date) in the format that you prefer, using time zone offsets and DST settings to completely customize it relative to UTC time.

In addition, the **Device Settings** window includes access to all configuration options for network, time references for input and output, display properties, relay control, administrative functions such as password, as well as a status display.

Any changes made in this window will not be applied until you click the [Save] button, or the [Save and Close] button, prior to clicking the [Exit] button.



Device Settings – Input Control



## DS > IC > NTP CLIENT

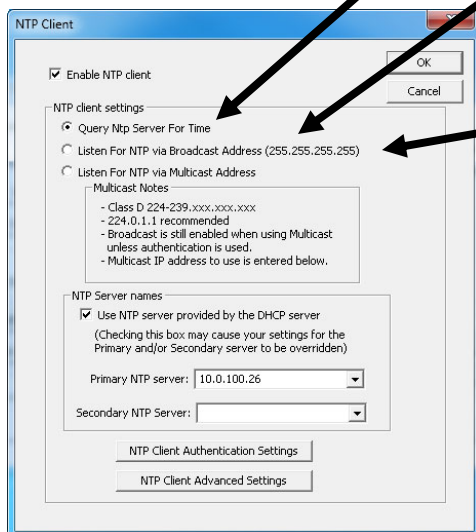
The [NTP Client] button allows for setting the NTP mode and parameters of the NTP client in the network device.

**The NTP client is enabled by default.** It may be desirable to disable the NTP client for certain applications such as those in which the MCR5000 will not reside on a network during typical operation. Deselecting “Enable NTP client” option will disable the NTP client.

**QUERY NTP server for Time is enabled by default.** If you want instead to listen form NTP broadcasts or multicasts see below.

**LISTEN FOR NTP BROADCASTS** - The network clock can configured to listen to NTP broadcasts by selecting the “Listen for NTP via broadcast address [255,255,255,255]” checkbox. The Broadcast/Multicast timeout period (in seconds) is adjustable when this mode is selected.

**LISTEN FOR NTP VIA MULTICAST ADDRESS** - The network clock can be set up to listen to NTP using multicast addressing by selecting the “Listen for NTP via multicast address(es)” checkbox.



When enabled, the multicast class D/Group address may be specified as well as the frequency that multicast broadcasts will be issued. This can be changed as desired. The NTP client can listen for NTP multicast broadcasts using the full class D/ group address range. The NTP client does not restrict the use of the multicast address assignment and supports the full range of class D multicast addresses or groups from 224.0.0.0 to 239.255.255.255.

**Note:** While listening to NTP broadcasts, the unit can also query the time server.

**Note:** Some NTP/SNTP clients will expect NTP servers to operate on port 123 and cannot be configured to utilize alternate ports.

**Note:** While listening to NTP broadcasts/multicasts, the ntp client cannot be configured to query the time server. Some NTP/SNTP clients will expect NTP servers to operate on port 123 and cannot be configured to utilize alternate ports.

These groups or class D address ranges for multicasting are defined and governed by RFC3171, *IANA IPv4Multicast Guidelines*.

Typically, the multicast address range 224.0.1.0 - 224.0.1.255 (224.0.1/24) [Internetwork Control Block] is utilized for NTP traffic, however, please refer to the RFC3171 for your specific application and implementation.

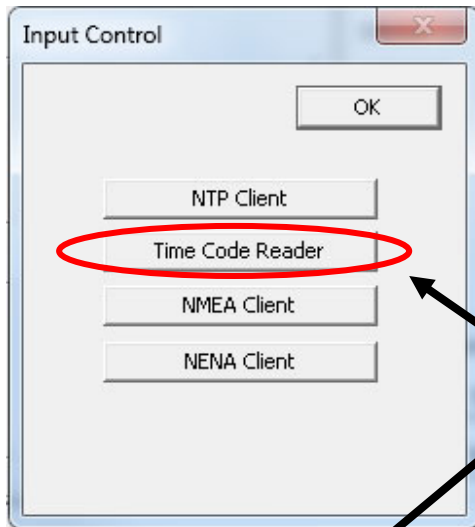
The network client can be configured to either query the NTP time server at a selected interval, to listen to NTP broadcasts only, or to listen to multicast broadcasts. When multicast mode is selected, the client will also listen to broadcast messages. The default configuration is to query the NTP server at 10-second intervals. To configure the device to only listen to NTP broadcasts, click the checkbox for “Listen for NTP broadcasts only”, and enter a “Broadcast/Multicast Timeout” in seconds. The default timeout is 3600 seconds.



**NTP SERVER NAMES** (see page 21) – By default the box is checked for “Use NTP server provided by the DHCP server” and a primary NTP server address is displayed. If you wish to uncheck the box and provide your own server addresses for both primary and secondary servers, do so here.

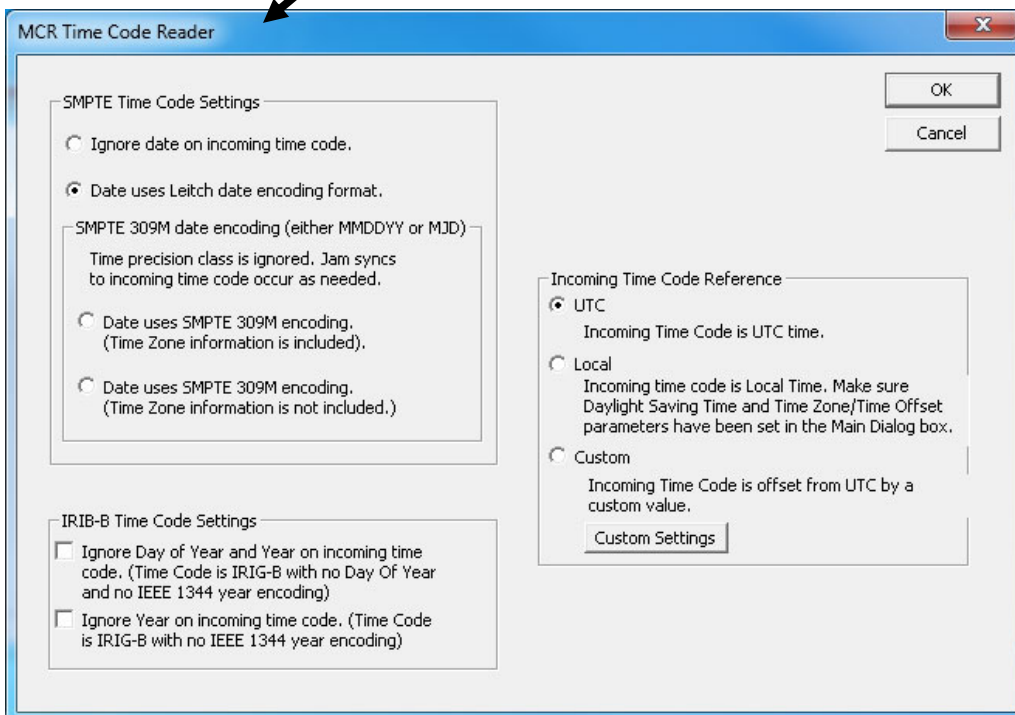
**NTP CLIENT AUTHENTICATION SETTINGS** – This window permits the entering of up to 15 MD5 key values to be trusted/allowed. Primary client settings permit the entry of a primary server key number, a secondary server key number and a broadcast key number.

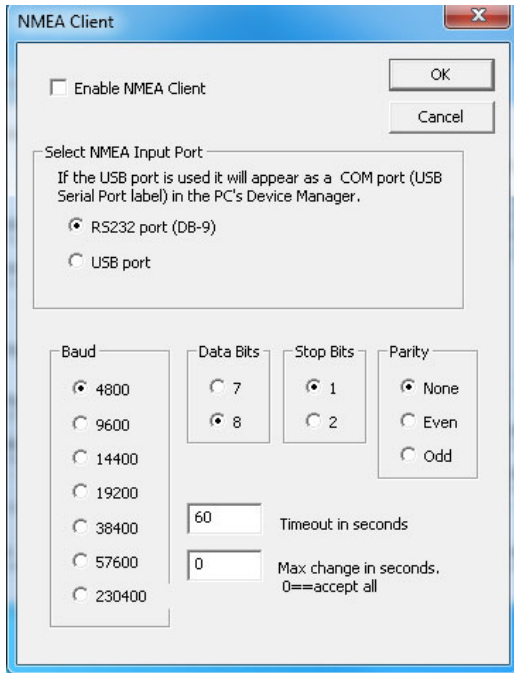
**NTP ADVANCED SETTINGS** - Advanced settings allow for the adjustment of additional network communication settings. Under most typical operating circumstances it is not necessary, nor is it suggested to change the advanced settings options.



**DS > IC > TIME CODE READER**

This button will only operate when a Time Code Reader is networked. Choose from the selections offered and click the [OK] button when complete.





### DS > IC > NMEA CLIENT

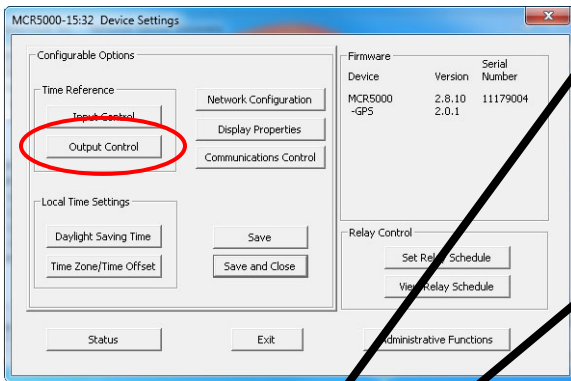
Click the [Enable NMEA Client] button (see page 22) to adjust the port, Baud rate, Data bits, Stop bits, Parity, Time out and Maximum change for NMEA input data.

### DS > IC > NENA CLIENT

Click the [Enable NENA Client] button (see page 22) to adjust the port, Baud rate, Data bits, Stop bits, Parity, Time out and Maximum change for NENA input data. The NENA window is virtually identical to the NMEA window.

### DEVICE SETTINGS (DS) – OUTPUT CONTROL (OC)

Click the [Output Control] button to access the following MCR5000 options (see below). Any changes made in this window will not be applied until you click the [Save] button, or the [Save and Close] button.



### DS > OC > NTP SERVER -

By default the [Enable NTP Server] button is checked with all appropriate settings filled in. If you want to change these settings, uncheck the box. Stratum levels can be modified. By clicking the NTP Server Authentication Settings button you can set MD5 key settings for both Client and Server, plus enable authentication for client request, broadcast and multicast packets.

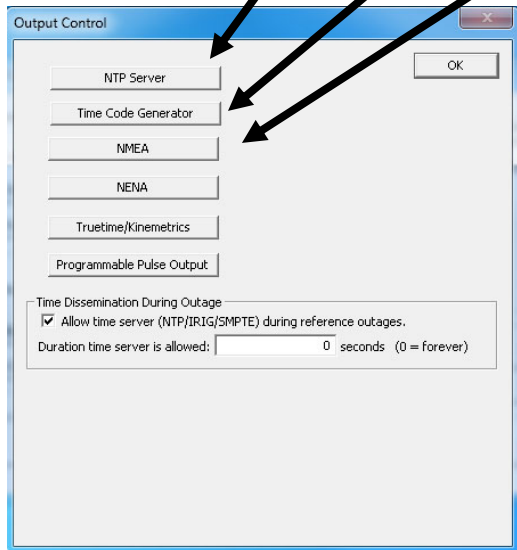
**DS > OC > TIME CODE GENERATOR** – This button operates only when a Time Code device is on the network. See page 22 for a sample of this window.

**DS > OC > NMEA** - The MCR5000 provides an NMEA (National Marine Electronics Association) 0183 message output on the RS232 serial port. All MCR5000 units can transmit the current ZDA format NMEA message, based upon the current UTC time of the MCR5000, using the RS232 port.

NMEA message output is disabled by default.

Select the RS232 settings button to adjust the baud rate and communications settings for the MCR5000 window. The RS232 port can be configured for baud rates of 4800, 9600, 19200, 38400, and 57600; along with 7 or 8 data bits, 1 or 2 stop bits, and the parity bits can be selected as None, Odd, and Even. The default settings will be 4800 baud, 8 data bits, no parity, 1 stop bit.

The NMEA messages may be monitored on a computer using HyperTerminal or the output may be connected to other devices or applications which accept NMEA 0183 messages.



Additional NMEA 0183 messages are available for output on the RS-232 serial port, if the GPS receiver option is installed. See the section for **GPS option** (page 11).

## NMEA and WinDiscovery

The MCR5000 may be configured with the NMEA 0183 option for communication between marine electronic devices such as an echo sounder, sonar, gyrocompass, autopilot and GPS, among other instruments.

The MCR5000 will use any one of the following NEMA messages for time synchronization.

### \$GP ZDA

### \$GP RMC

### \$GP GGA

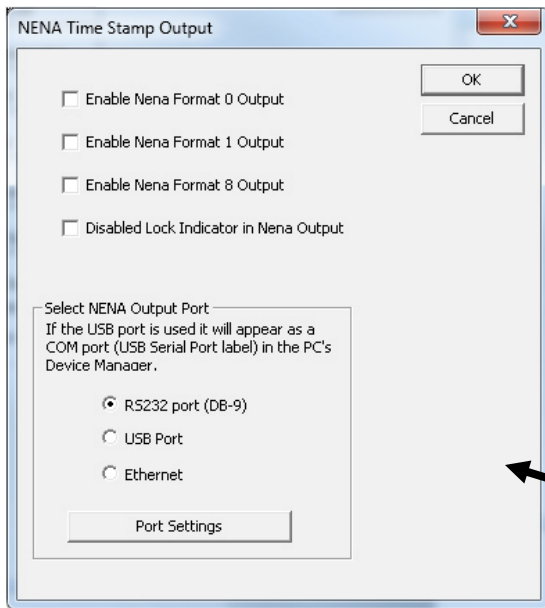
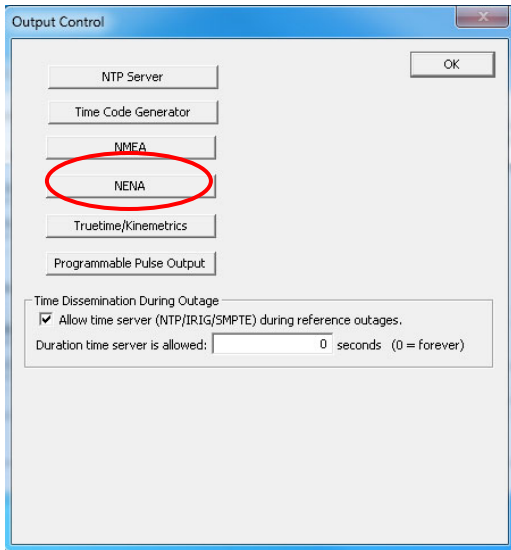
### \$GP GLL

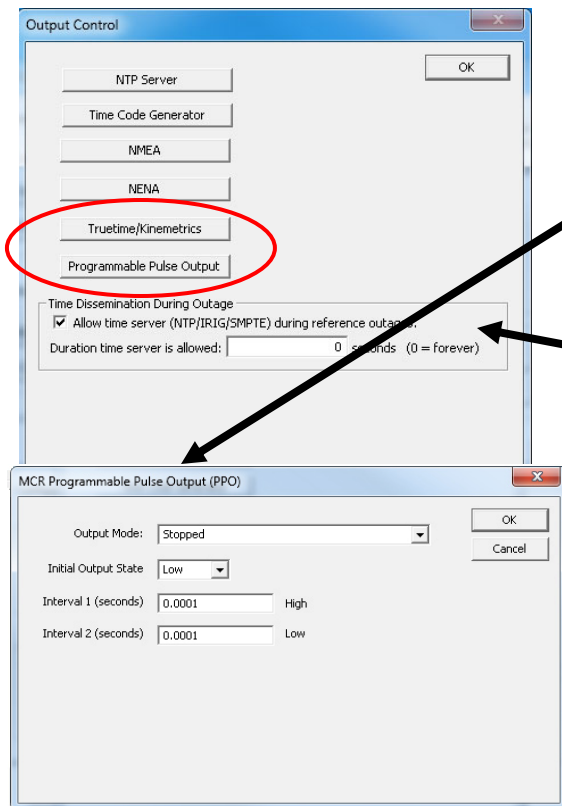
In order to activate and configure your MCR5000 for the NMEA option, please do the following:

1. Open WinDiscovery and click "Discover." If the MCR menu does not appear, click "Discover" again.
2. Click on the MCR list [+] button
3. Click on the MCR1000 Device list [+] button
4. Click on your MCR 5000 to reveal the "Device Settings"
5. Click on "Input Control" to reveal that window
6. Click on "NMEA Client" to reveal that window
7. Click on "Enable NMEA Client." The other options should be preselected. Click "OK"
8. Close the last two windows, but keep open the MCR5000 "Device Settings"
9. Click on "Output Control"
10. Click on "NMEA" to reveal the "NMEA Messages" panel
11. Here you may select which one of the four GPS message codes (listed above) is appropriate for your GPS device

You may also select which NEMA Output Port to use. Click "OK" when done and close all windows.

**DS > OC > NENA** – Click the [NENA] button (page 23) to access the **NENA Time Stamp Output** window. This permits you to enable one of three NENA formats or disable one. It also permits selection of a port setting.





**DS > OC > TRUETIME/KINEMATICS** – This button enables selection of this output and adjustment of the port settings.

**DS > OC > PROGRAMMABLE PULSE OUTPUT** – This button operates only in the presence of a PPO device. When a PPO device is present the window at left appears enabling choices to be made in the Output Mode, Input Output State, the first interval and the second interval.

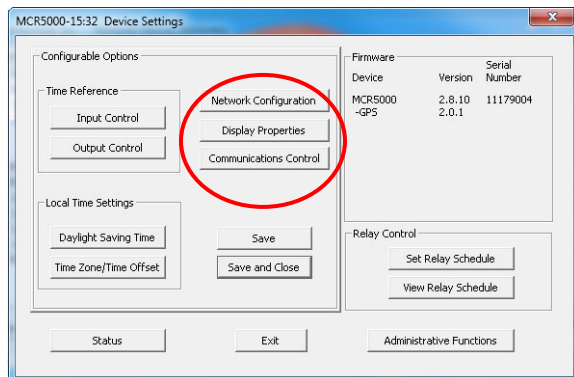
**DS > OC > TIME DISSEMINATION DURING OUTAGE** – This button is enabled and set by default. Customize this setting only if required to do so.

## DS > NETWORK CONFIGURATION

As on the earlier described window (p. 20), the network configuration may be viewed in summary by clicking the **[Network Configuration]** selection.

## DS > DISPLAY PROPERTIES

Here you can change the brightness of the display or modify the presentation of the date and time. You can change the display from UTC to local time and you can alternate times with dates and set the rate at which they change.



## DS > COMMUNICATIONS CONTROL

Certain advanced features may be configured using the “Communications Control” button. These features include, access to the Telnet configuration interface, which you may allow and set a new port for, or retain the default port: **23**.

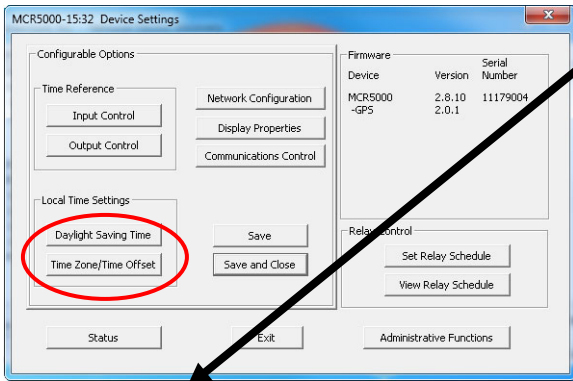
### Potential Network Topology Communication Problems

Networks separated by physical routers will often block UDP broadcasts preventing WinDiscovery from locating devices on a remote network.

Under such circumstances, WinDiscovery must be operated from a computer within the remote network. Or the routers separating the networks must be configured to pass bidirectional UDP traffic (including broadcasts) on port **6163**.

Consult your network administrator for additional information.

Personal or network computer firewall applications, such as ZoneAlarm®, BlackIce, Symantec Client Firewall, or the Windows OS firewall may also prevent WinDiscovery from operating correctly. Configure the firewall to allow bidirectional UDP traffic on port 6163 or temporarily disable the firewall while using WinDiscovery.



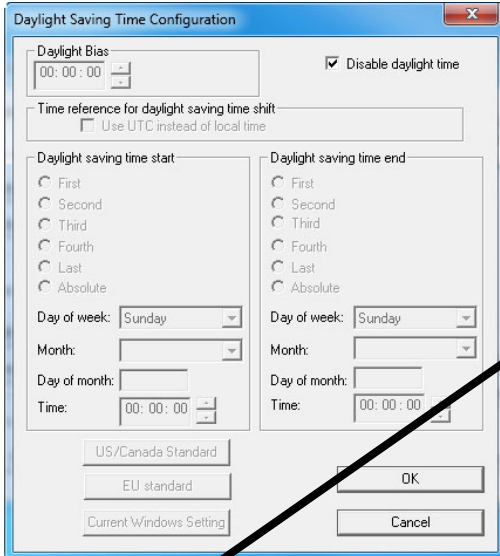
## DAYLIGHT SAVINGS TIME SETTINGS

Click [**Daylight Saving Time**] to open this window. The clock has complete flexibility to display any time zone and DST combination.

For setting the DST rules, use one of the following options.

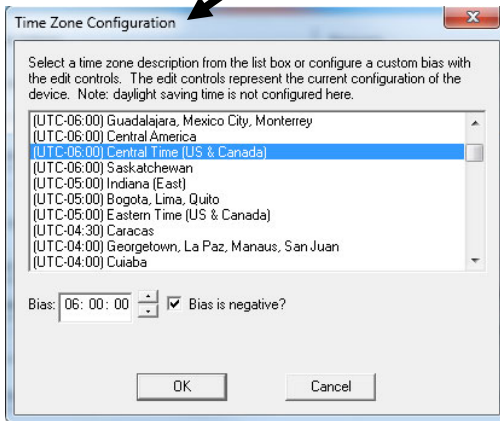
1. Manually enter the daylight saving time rules; or
2. Click the [**US/Canada Standard**] button; or
3. Click the [**EU Standard**] (European Union) button.
4. Then Click [**Current Windows Setting**] to apply the current configuration for your Windows OS.
5. Click [**OK**] to close the Window.

The DST rules will be saved when you click either the [**Apply**] button or the [**Apply and Close**] button.



## TIME ZONE/TIME OFFSET

Click here to open the “**Time Zone Configuration**” window. Here you’ll find a list of time zones, including city and area descriptions to help with the selection. Select the offset that fits your location and click [**OK**] to close the window.

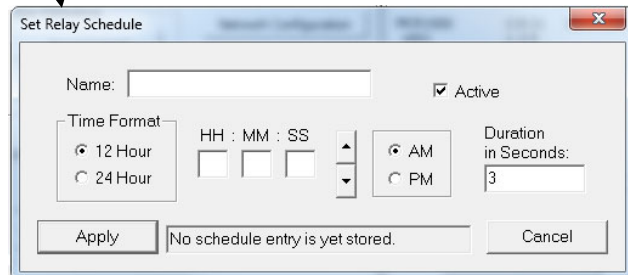
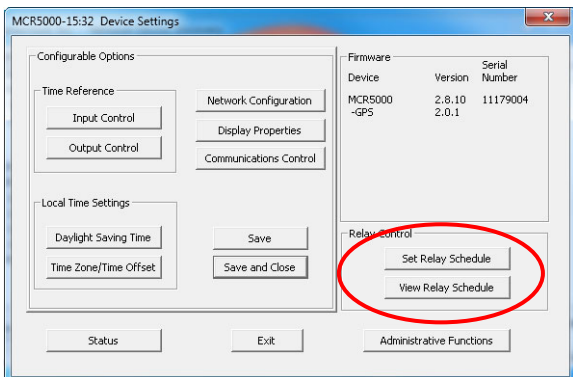


## DS > RELAY CONTROL :

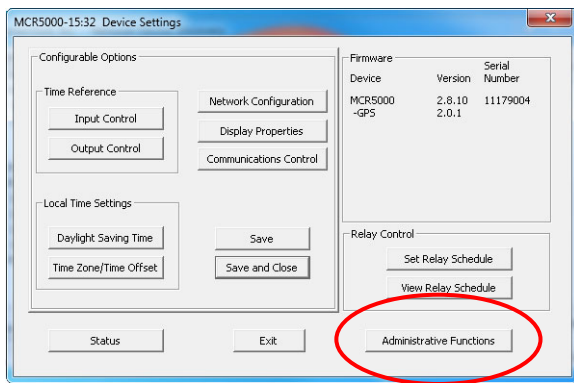
### SET RELAY SCHEDULE

### VIEW RELAY SCHEDULE

Set a schedule of relay switch events with the [**Set Relay Schedule**] button. Once a schedule has been applied to the MCR5000, the current relay schedule information can be retrieved to validate the entry was made correctly and the schedule is active by using the [**View Relay Schedule**] button.

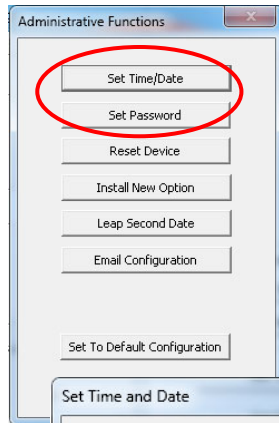






## DS > ADMINISTRATIVE FUNCTIONS (AF)

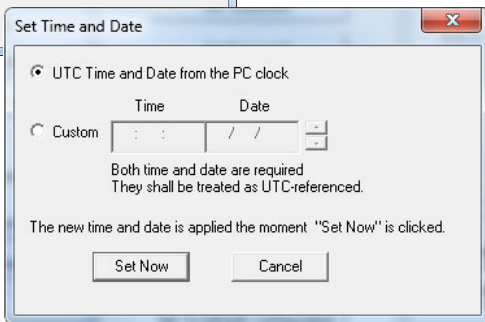
Click the **[Administrative Functions]** button to access a menu of functions that are otherwise rarely accessed. These include: 1. Set Time/Date (not UTC or local time); 2) Set Password; 3) Reset Device; 4) Install New Option; 5) Leap Second Date (input this when it is announced); 6) Email Configuration (to automatically alert you via email of any situations within the system when they happen). Below we'll look at this new windows one at a time.



### DS > AF > SET TIME/DATE WINDOW

There may be situations where you do not want to display local time. This feature may be most useful for demonstrations, in lab situations, environments where an external reference time signal is not available, when the built-in NTP client is disabled or when a network connection to an NTP server is not available.

Click the **[Set Time/Date]** button to reset the time to your preference. You will be prompted with some additional instructions then offered the choice to continue. Click **[Yes]**.



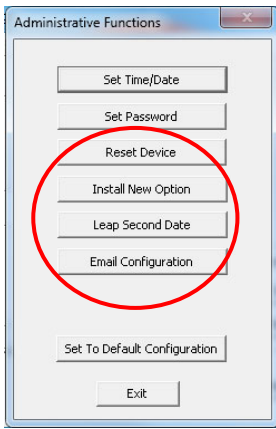
In the Set Time and Date window click the **[Custom]** button to enter your new time and date. Click the **[Set Now]** button to activate your custom time. To return to UTC time click the **[UTC Time and Date button from the PC clock]** button. Then click **[Set Now]**



### DS > AF > SET PASSWORD

Click **[Set Password]** to create a new password. You will need to enter the old password. A warning is printed on this window concerning the ramifications of forgetting an appliance password. In a worst-case scenario you would reset the MCR5000 to its factory default settings, including the factory default password: **"public"**.

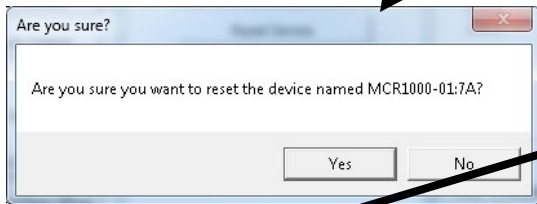
There is a second way to set a password on page 30 and describes more fully the rules surrounding password usage.



### DS > AF > RESET DEVICE

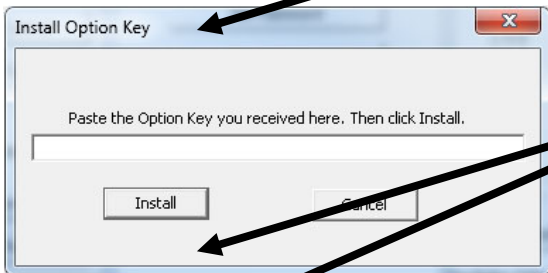
Click [**Rest Device**] to induce a **soft reset**. This procedure allows the MCR5000 to clear its current communications buffer and re-initialize its processing, which includes another software request for a DHCP address. This feature is intended to allow the user to remotely reset the unit and does not restore the factory default state.

Alternatively, if you are not in the Administrative Functions window but are viewing the list of devices after pressing the [**Discover**] button, simply right click on the device you are interested in and select the [**Reset Device**] button.



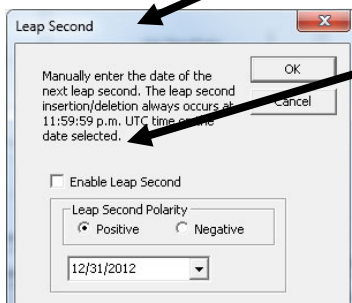
### DS > AF > INSTALL NEW OPTION

Click [**Install New Option**] to install a new option key you requested and received here. This will install the new option into the software.



### DS > AF > LEAP SECOND DATE

Click [**Leap Second Date**] to enable a future leap second to occur on a date that you manually enter.

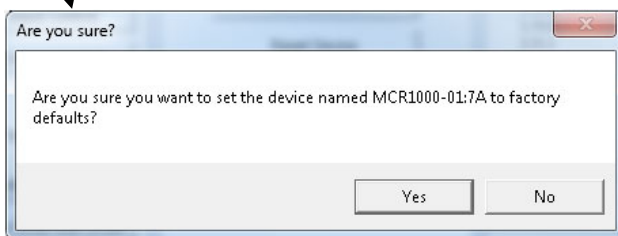
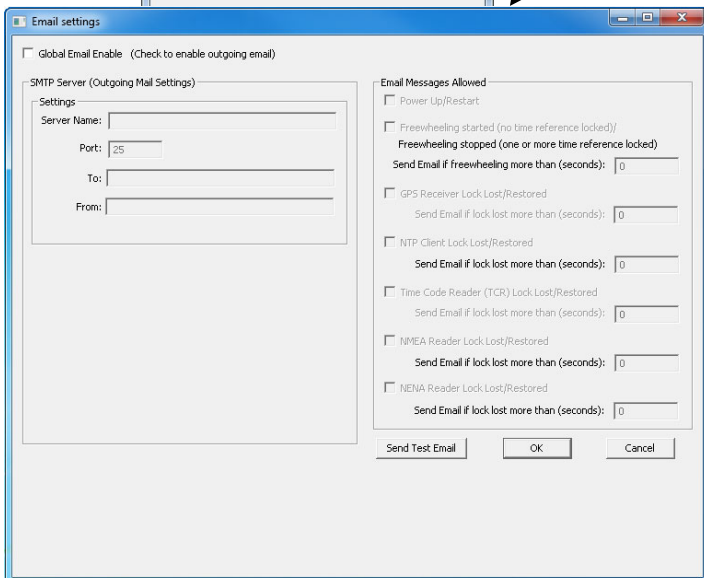


### DS > AF > EMAIL CONFIGURATION

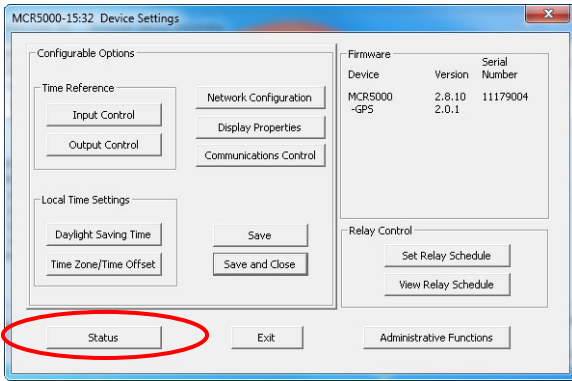
Click the [**Email Configuration**] button to generate email alerts when certain conditions are met.

### DS > AF > SET TO DEFAULT CONFIGURATION

Click the [**Set to Default Configuration**] button to reset all of your previously entered options and customs settings back to the original factory settings.

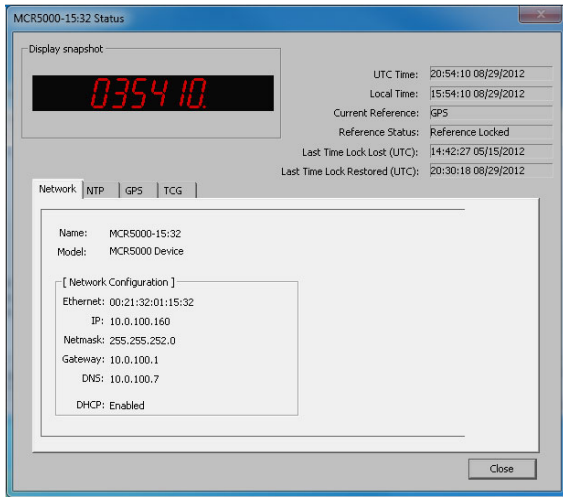






## DS > STATUS

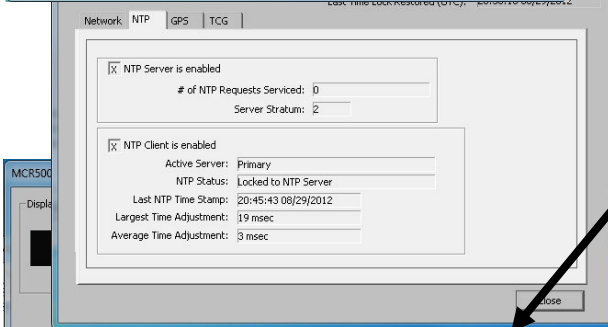
At the bottom left of the MCR5000 Device Settings window is the **[Status]** button. The Status window includes a Display Snapshot of the digital clock on the face of the MCR5000 in real time (see below for a dual display sample). On the right appear the UTC time and date, local time and date, the current reference signal (in this case GPS), the reference status (in this case Locked) and two windows listing **Last Time Lock Lost** and **Restored**.



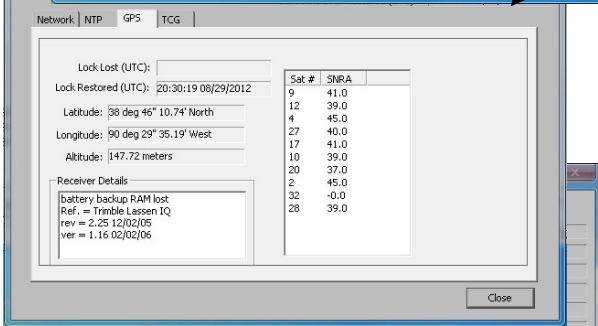
Below these listings are tabbed windows for **Network**, **NTP**, **GPS** and **TCG**.

**Network Tab** - includes the name of the device, the model of the device and a summary of the network configuration, much of this data is repeated from the network configuration window described earlier (p. 20).

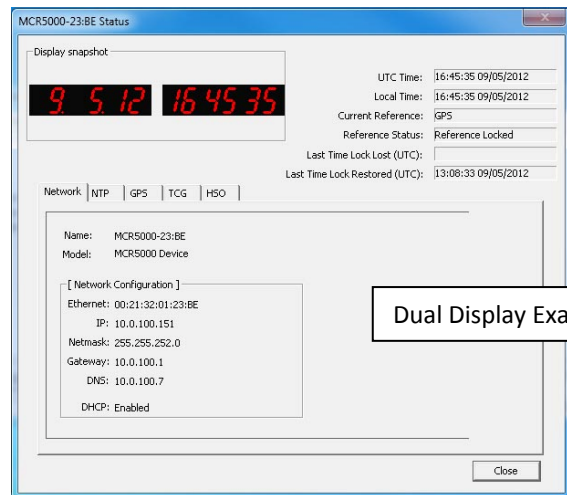
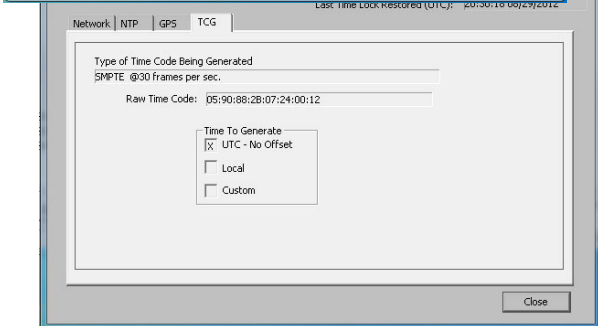
**NTP Tab** - includes a checkbox for an enabled NTP server, plus the number of NTP requests service and the server stratum. Also includes a checkbox for an enabled NTP client including indications for the active server, the NTP status, the last NTP time stamp, the largest time adjustment, and the average time adjustment.



**GPS Tab** - includes time and date for Lock Lost (UTC), Lock Restored (UTC), your geographical position, receiver details and a list of the satellites the GPS antenna is listening to (in this case nine) and their individual SNR (signal-to-noise ratio, with 41.0 as the highest quality).



**TCG Tab** - includes the **Type of Code Being Generate** (in this case SMPTE@30fps), the **Raw Time Code** and the **Time to Generate** whether you choose **UTC**, **Local** or **Custom**.



Dual Display Example

## SET PASSWORD

Each Masterclock device in your network may have its own password (see the Properties window to **Set Password**), or you may create a **Global Password** on the **Discover** window (see below). The default password that comes with each MCR5000 from the factory is “**public**”.

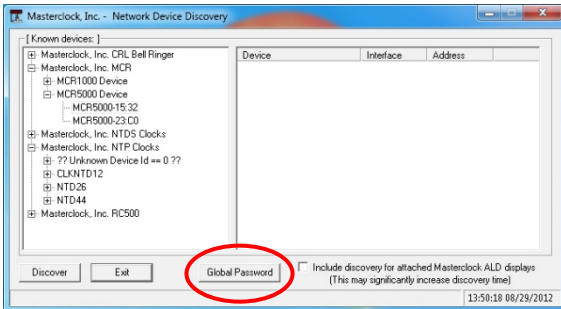
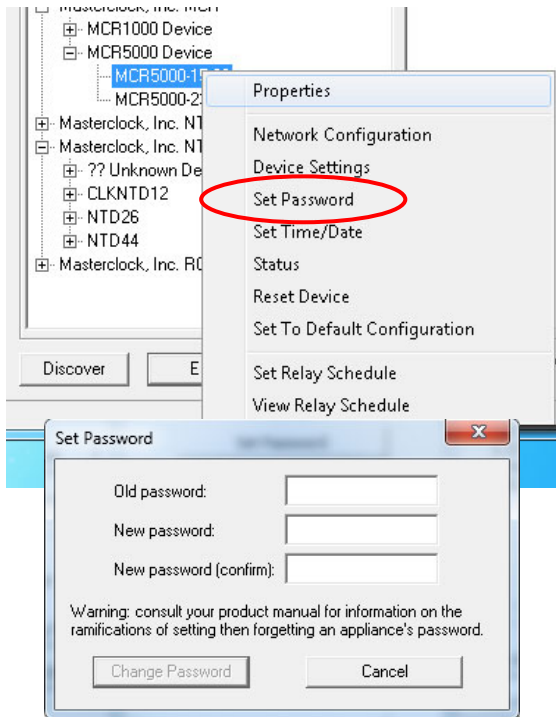
Your custom password should be one to eleven characters and is case-sensitive. For added password strength, you should use both alphanumeric and special ASCII characters.

**The password must be entered twice to confirm the entry.** Click [**Change Password**] to save or [**Cancel**] to discard the change.

When a password is set for a device, each time you click [**OK**], [**Apply**] or [**Apply and Close**] for that device you will be asked for the password. You can select the “**Remember this password for the session**” box and you will not be prompted for the password, until you restart **WinDiscovery**. Or you can use the **Global Password** feature, described below.

If you enter the wrong password and selected the “Remember this password for the session” checkbox, you will receive an error upon clicking [**OK**], [**Apply**] or [**Apply and Close**] to any configuration changes. You can close the **WinDiscovery** session to forget the wrong password(s). However, this will require entering the passwords again for each device.

Alternately, you can remove the incorrect password entry during a **WinDiscovery** session by going to the drop-down menu for the device and selecting the [**Forget memorized password**] button.



The **Global Password** being used must match the password on all the devices being administered. On any new system being installed, the factory default global password is “**public**”.

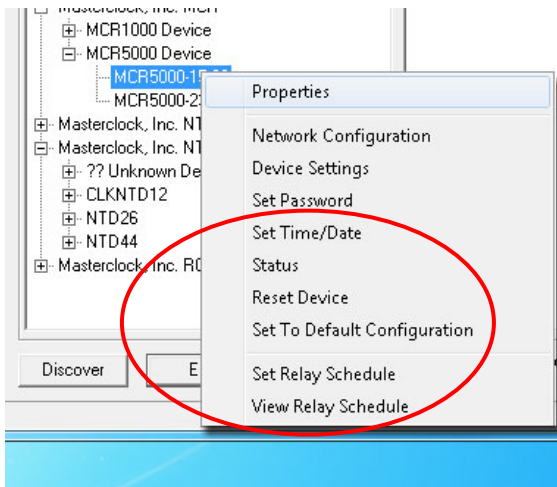
## GLOBAL PASSWORD

The **Global Password** feature allows the user to enter a single password for all NTP devices using the same password. During this session and subsequent sessions of **WinDiscovery**, you will not have to enter the password.

### ENABLING / DISABLING GLOBAL PASSWORD

1. Check “**Enable Global Password.**”
2. Type your password.
3. Click [**OK**]

To disable the Global Password, de-select the “**Enable Global Password**” checkbox and click [**OK**].



## FROM THE PROPERTIES MENU: SET TIME/DATE

Click the Set Time/Date button and a window appears reminding the user “This feature is only to be used to set the UTC time and date if the device is not locked to a reference and is free-wheeling. “ Other cautionary remarks follow. At the bottom of the window you may choose to continue or not. If you choose the [Yes] button, the **Set Time/Date** window appears, previously seen on page 27.

## STATUS

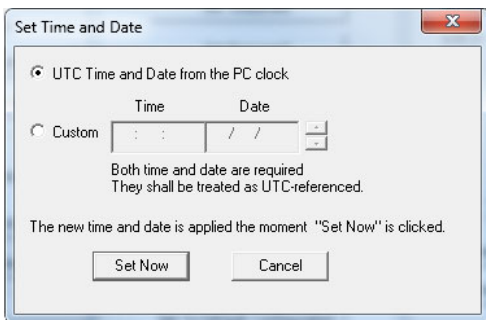
See **Status** window, page 29.

## RESET DEVICE

See **Reset Device** window, page 28.

## SET TO DEFAULT CONFIGURATION

See **Set to Default Configuration** window, page 28.



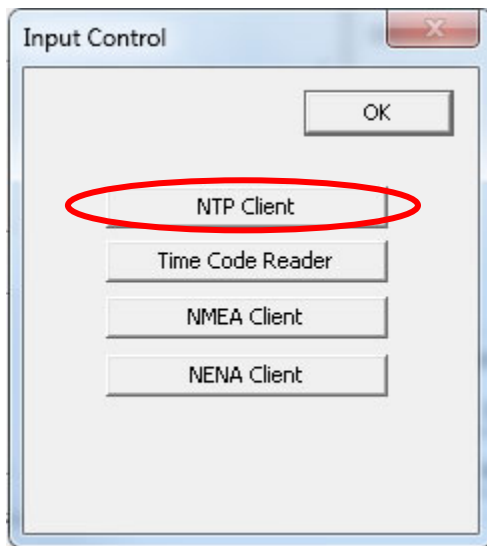
## SET RELAY SCHEDULE

See **Set Relay Schedule** window, page 26.

## VIEW RELAY SCHEDULE

See **View Relay Schedule** window, page 26.

# How to Listen for NTP



## NTP ADDRESSING MODES

**UNICAST** - The MCR5000 supports the unicast method of NTP packets transfer. Unicast method involves direct transfer of requested information from the NTP server to the NTP client based on a query or NTP time request. The unicast method is supported simultaneously when either the broadcast or multicast modes are selected.

**MULTICAST** - The network clock can be set up to listen to NTP using multicast addressing by selecting the **[Listen for NTP via multicast address(s)]** checkbox.

When enabled, the **“Multicast class D/Group address”** may be specified as well as the frequency that multicast broadcasts will be issued. This can be changed as desired.

The network clock can listen for NTP multicast broadcasts using the full class D/Group address range. The network clock does not restrict the use of the multicast address assignment and supports the full range of class D multicast addresses or groups from **224.0.0.0** to **239.255.255.255**. These groups (or class D address ranges for multicasting) are defined and governed by RFC3171, IANA IPv4 Multicast Guidelines.

Typically, the multicast address range, **224.0.1.0 – 224.0.1.255** (Internetwork Control Block), is used for NTP traffic. However, please refer to the RFC3171 (link below) for your specific application and implementation.

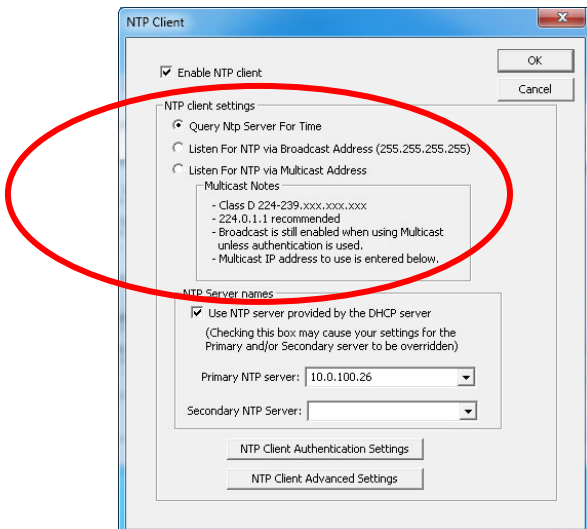
<http://www.elook.org/computing/rfc/rfc3171.html>

**BROADCAST** - The network clock can be configured to listen to NTP broadcasts by selecting the **[Listen for NTP via broadcast address 255.255.255.255]** checkbox.

The broadcast timeout is adjustable when this mode is selected.

**The default configuration** is to query the NTP server at 10-minute intervals. The clock drift is  $\pm 1$  minute per year, so you can adjust as needed. To configure the network clock device to only listen to NTP broadcasts, click the checkbox for **“Listen for NTP broadcasts only”** and enter a **“Broadcast Timeout”** in minutes. The default timeout is 60 minutes.

As mentioned earlier, the **ANYCAST** mode is not used.



## DHCP – DEFAULT AND FALLBACK

The default factory setting for network configuration is to use DHCP/BOOTP.

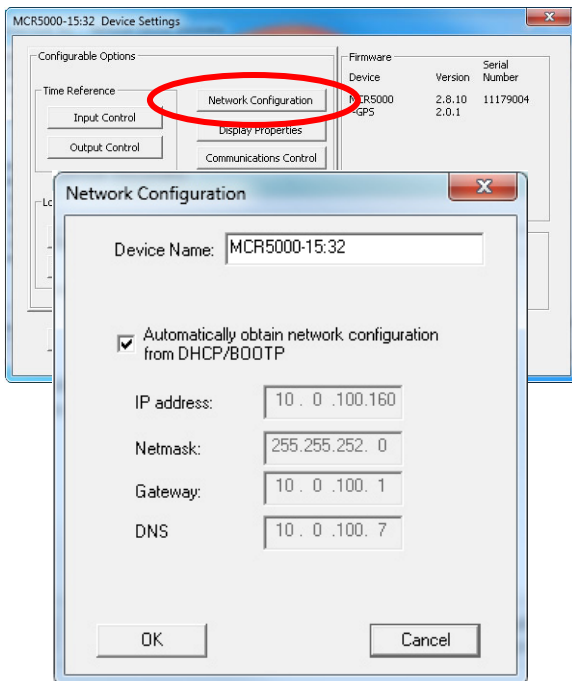
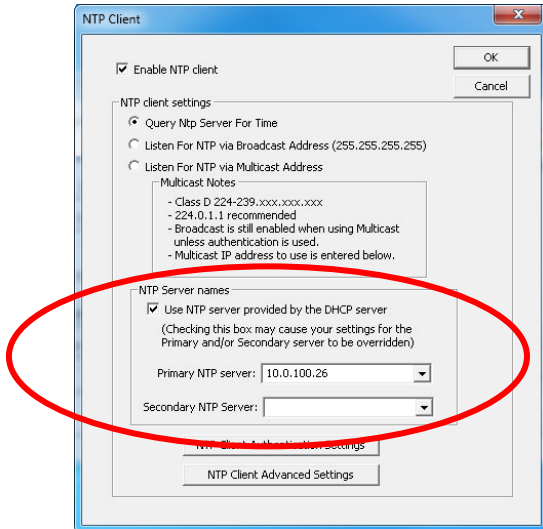
**Fallback Address** - If a DHCP server cannot be found on the network by the NTP clock, the IP address will be assigned a fallback IP address of **169.254.xxx.xxx**.

## STATIC IP

To use a static IP address, de-select the checkbox in the **NTP Client** window, **NTP Server names** section (at left) for **[Use NTP server provided by the DHCP server]**.

Back under the **Device Settings Window** (at left), open the **Network Configuration Window** (at lower left) and uncheck the box **[Automatically obtain network configuration from DHCP/BOOTP]**. You must then enter the IP address, netmask, gateway, primary DNS appropriately.

Devices which have been assigned a **fallback IP address of 169.254.xxx.xxx** will be displayed in the main **WinDiscovery** window with **RED** text, indicating a problem with the configuration.



**The static IP address** you enter must not be in use by another device on the network. This includes IP address ranges reserved for use by the DHCP server. If a static IP address creates a duplicate IP address condition, the network clock will be assigned a fallback IP address of **“169.254.xxx.xxx.”**

The **“169.254.xxx.xxx”** address is a link local address range (not allowed on the Internet) that is used by Microsoft whenever their DHCP clients cannot find a DHCP server.

## NTP CLIENT AUTHENTICATION SETTINGS

The NTDS series uses the **MD5 Message Digest Algorithm**, which is a widely used cryptographic hash function that produces a 128-bit hash value.

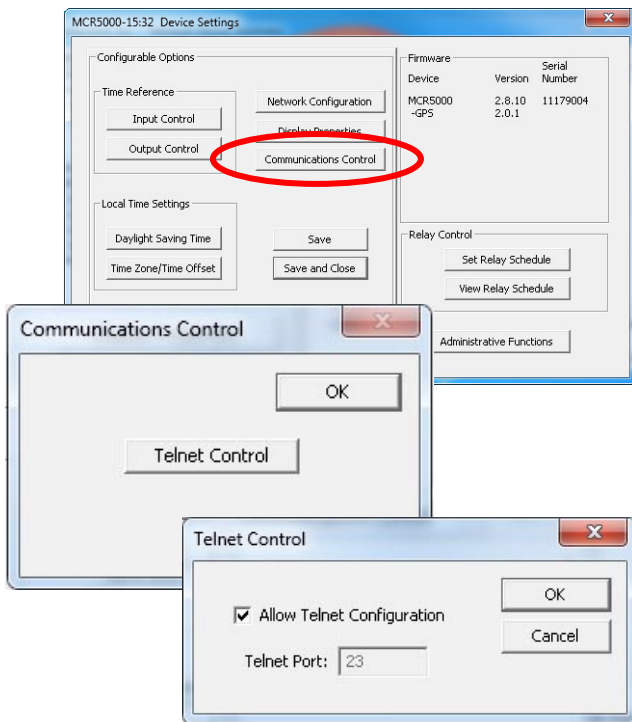
<http://en.wikipedia.org/wiki/MD5>

## NTP CLIENT ADVANCED SETTINGS

From the NTP Client window, the **[NTP Client Advanced Settings]** button allows for the adjustment of additional network communication settings. Under most operating circumstances it is not necessary to change these settings.

The factory-default TCP/UDP port for NTP service is: **“123”**

# Using Telnet



## TELNET OPTION

Typically you'll use the free WinDiscovery app to establish first-time networking configuration. However, you may use **Telnet** on systems with a DHCP server.

To access the Telnet button, go back to Device Setting and click the [Communications Control] button. In the Communications Control window, click the [**Telnet Control**] button and select [OK]. By default the Telnet Port is set at **23**. If you wish to change it, deselect the "Allow Telnet Configuration" checkbox and click [OK].

**PORT DEFINITION** – If Telnet is allowed, the port must be defined. **The default Telnet port is 23.** See your network administrator if you need additional information.

**IP ADDRESS** – If Telnet is allowed, the IP address of the unit is required. By default, the MCR5000 is configured to obtain an IP address via DHCP. If a DHCP server is available on the network when the MCR5000 is installed, it can be utilized to provide the IP address of the associated device name that is registered with the server.

Configuration via Telnet may not be convenient for devices operating with a factory default network configuration since the IP address is not known.

Telnet username: **public**. Telnet password: **public**.

### Port 23

Some NTP/SNTP servers will expect NTP clients to operate on port 123.

If the advanced settings have been altered for your clock and you begin experiencing difficulty in getting your clock to synchronize to the NTP time server, or the clock begins acting erratically, try returning the advanced settings to the default values: "**23**."



# Time Code Generation Option

If you have the **Time Code Generation Option** (page 15), you will need to configure a **Time Code Generator** on WinDiscovery under “Device Settings.”

Select [**Output Control**].

Then select [**Time Code Generator**].

The resulting **Time Code Generation** window allows you to choose the **Type of Time Code to Generate** and the **Coded Expression**. Modify these inputs to fit your location. Then select **Time To Generate** for **Local Time** or **Custom Time** if different than the **UTC** default.

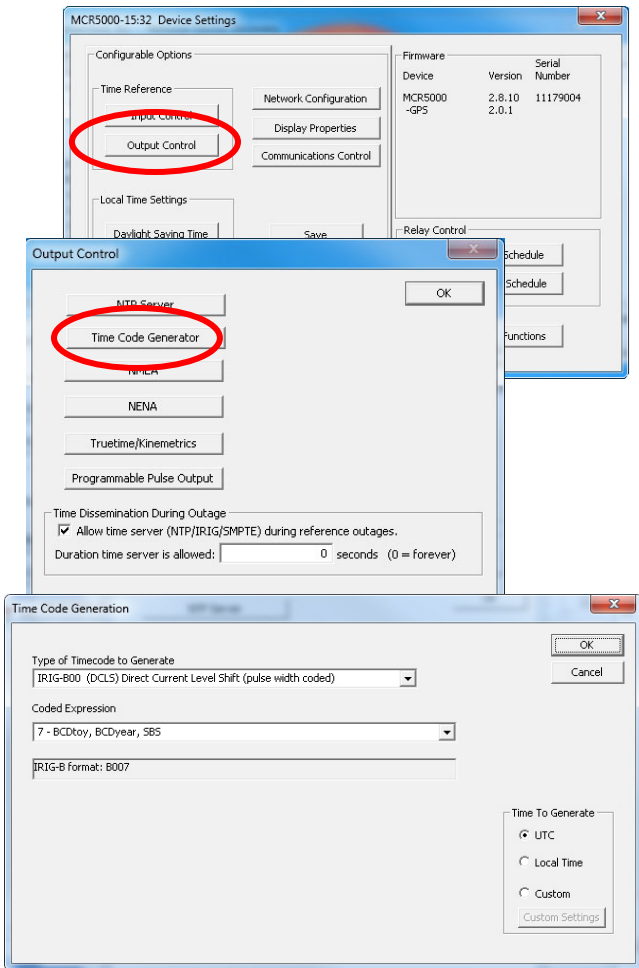
## TIME CODE GENERATION

Within this window are two or more drop down menus (depending on your option purchases).

The **Type of Timecode to Generate** window reveals several IRIG and SMPTE choices. All IRIG choices create two further dropdown windows, as shown at left. SMPTE choices create one distinctly different drop down menu and a checkbox.

If you do not change these selections the default selections will remain in effect.

The **Time to Generate** subwindow provides a default choice of **UTC**, along with choices for **Local Time** and **Custom** to fit your needs. Click the [**OK**] when all of your choices have been made.

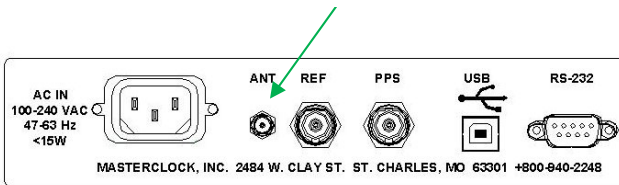




# GPS Option

With the **GPS option** the MCR5000 derives precision UTC time from satellites. It uses an internal receiver that requires a pre-amplified GPS antenna.

## GPS ANTENNA – SMA FEMALE



**Note:** All components of the GPS system [MCR5000 unit with GPS receiver, power supply, GPS antenna, antenna cable] are tested as a system at the factory before shipment.

### Be sure:

- 1) the GPS antenna, the MCR5000 and the supplied coaxial antenna cable have not been damaged;
- 2) the GPS antenna has an unobstructed view of the sky;
- 3) the power connector is properly installed;
- 4) and the front panel LED follows the startup sequence described earlier (on, off and then on).

Masterclock highly recommends using only the pre-made/pre-tested antenna cables provided by Masterclock, Inc. For best performance, it is best to order these cables (see available antenna packages, page 37) at the same time that you order your MCR5000 with GPS option installed since the unit has been factory tested as a system with the antenna cables and antenna before shipment.

## GPS ANTENNA CONNECTIONS

1. **Disconnect** power from the unit.
2. **Provide** the antenna with a clear view of the sky. Do not move it again until after the MCR5000 has achieved satellite lock (explained below). Route the antenna cable to the back of the MCR5000.
3. **Connect** the antenna cable coaxial connector to the gold SMA female connector on the rear of the unit (labeled ANT in image at left).
4. **Reapply** power to the MCR5000.

## START-UP AND GPS SATELLITE ACQUISITION

When the MCR5000-GPS is initially powered up the time to acquire satellites and extract correct time is typically 5 to 15 minutes. In less the optimal conditions this could extend to 25 minutes. Atmospheric conditions, type of antenna, antenna location and antenna cable length will affect acquisition time.

When restarting, if the location, time and number of satellites have not significantly changed since last power down, the unit should start up much faster.

## GPS LOCK RELATED ISSUES AND TROUBLESHOOTING TIPS

The following items are specific to the MCR5000 with GPS option installed and should be considered only after the 25 minute satellite acquisition time has elapsed without acquisition.

### PROBLEMS:

Unit is not locking to GPS.

The LED on the front panel is always steady ON.

Unit is not serving time.

*WinDiscovery* displays no GPS satellite information



**Above:** Basic Antenna  
Included with GPS option.

**Below:** Standard antenna and  
PVC pole.



## POSSIBLE REASONS/SOLUTIONS:

**STEADY ON:** The reference lock LED stays steady ON when the unit has not locked to GPS and is not serving NTP time.

**FLASH ONCE PER SECOND:** The reference lock LED (page 13) will flash once per second when locked to GPS.

**FLASH TWICE PER SECOND:** The reference lock LED will flash twice per second when freewheeling (running without external signal, running on an internal oscillator).

The MCR5000 must first acquire an initial lock to GPS before it will serve time. Once locked, the unit can continue to serve time (either while locked to GPS or while freewheeling) as long as the DC input power is not interrupted.

1. **Wait** at least 20-30 minutes if installing the GPS receiver device in a new location. The GPS receiver must find and acquire the signal from at least four GPS satellites simultaneously and will continue to acquire up to the eight satellites. When placed in a new location, time to first lock will vary, but can be quite lengthy since the GPS receiver must update its internal almanac and ephemeris data from the GPS satellites.
2. **Check** the GPS antenna, antenna cable, and connectors. Make sure the cables and connectors are not damaged and the threaded connectors are tightly coupled.
3. **Relocate and reinstall** the GPS antenna outdoors with a clear/unobstructed view of the sky. Find a rooftop or similar location such as a large open field or parking lot with an unobstructed view. While the unit may lock to GPS on some occasions with the antenna located indoors near a window, such use is not recommended. Your GPS antenna must not be near satellite dishes or sources of RF interference such as transmitters or other antennas.
4. **Replace your cable and connectors.** Your antenna cable or connectors may be shorted or open.
5. **Check your cable length.** You may be using too long of an antenna cable or using an improper impedance cable. If necessary, remove the long antenna cable and connect the MCR5000 directly to the short cable on the GPS antenna using the short SMA male to SMA male adapter provided with your antenna package. Preferred and tested GPS antenna cable is available from Masterclock in lengths up to 500 feet (152m).

**Note:** Damage to the GPS receiver is not covered under warranty.

If you need uninterrupted precise time, please purchase a spare MCR5000 with a GPS option. Order your first MCR5000 with additional TCR or HSO as a backup reference.

For repairs contact technical support at Masterclock (see page 56 for contact).

**Note:** Damage to the GPS cables is not covered under warranty.

If the GPS antenna or cables are damaged please contact Masterclock to order replacements.

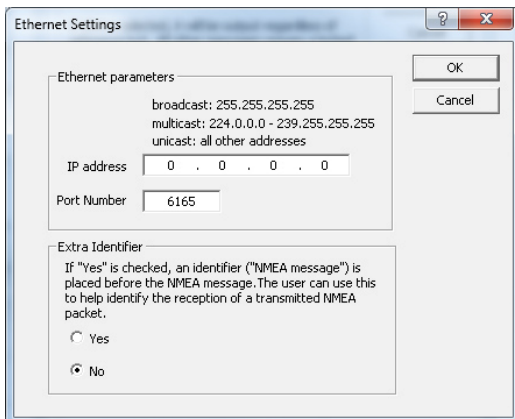
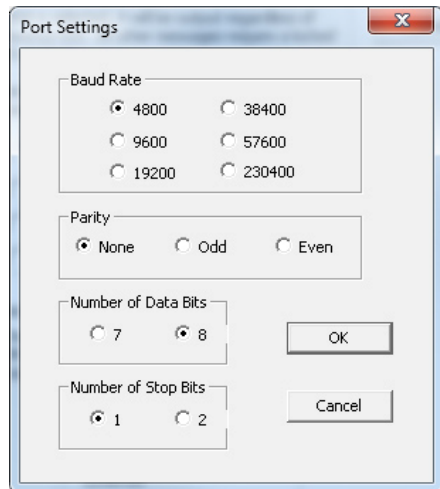
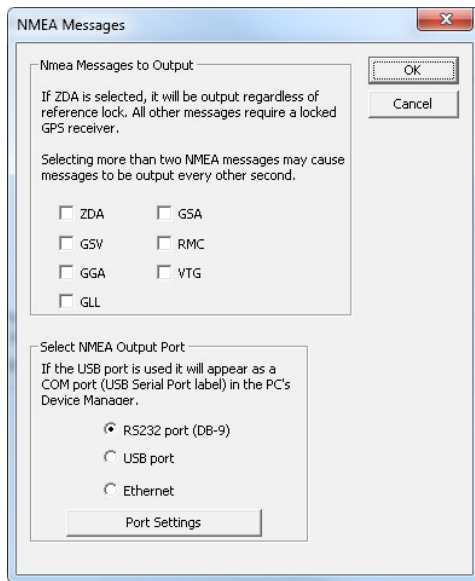
GPS antenna cannot be repaired.

The MCR5000 with a GPS module installed requires a pre-amplified antenna. The MCR5000 provides +3 VDC via the center pin of the SMA coaxial cable/connector for remote power to the antenna.

**WARNING:** Attaching a passive (non-pre-amplified) antenna to the MCR5000 could destroy the GPS receiver module. This is a major repair cost which is not covered by warranty.

6. **Internal damage:** The GPS receiver located within the unit may have been damaged during the installation or handling. Handle the MCR5000 with GPS receiver as you would any electronic device. Do not subject the unit (particularly the antenna input connector) to electrostatic discharge (ESD) during handling. When handling or installing the device, observe proper ESD protection methods; and as a minimum, discharge yourself to a convenient ground before handling the unit. Preferably, use a static discharge wrist strap connected to earth ground when handling, installing, and or configuring the device.
7. **Inappropriate power application:** An MCR5000 with the GPS receiver option provides power to the pre-amplified GPS antenna using low voltage supplied on the center pin of the antenna cable. To avoid damage to the GPS receiver (and/or GPS antenna) caused by a short circuit, make antenna connections only after all power is removed from the unit.
8. **Incompatible antenna:** Do not use antennas provided by others. They may not be compatible with the GPS antenna supplied with your system and may damage the GPS receiver unit.
9. **Damage during installation:** The GPS antenna cables may be damaged by pulling and twisting the connectors. You should also avoid pinching and over-bending the cables themselves. This may occur while using a cable puller. Ensure that you do not pull directly on the connectors during the installation. Ensure that you do not twist the connector at the location where the connector meets the cable, as this can damage the braid. The coaxial cable should not be crushed, crimped or bent at a sharp angle nor should it be strained by pulling. Any damage to the cable could result in improper functioning. If the cable is to be coiled for storage, the coil diameter should be at least 6". If your GPS antenna cables are damaged please contact Masterclock to order replacements.

# Additional NMEA 0183 Sentence Outputs



The MCR5000 can output additional NMEA 0183 sentences on the RS232 serial port. By default, all MCR5000 units transmit the basic ZDA format, based on the current UTC time. However, additional sentences are available (see list below) and these can be accessed with by simply checking the appropriate boxes (at left).

**ZDA**

**GSV**

**GGA**

**GLL**

**GSA**

**RMC**

**VTG**

**GSV**

NMEA sentence output is disabled by default. It can be enabled by selecting one or more sentences from the list.

**Note:** Selecting more than two NMEA sentences may cause the sentences to be output every other second as opposed to every second. This characteristic is an inherent function of the GPS receiver and is particularly true when selecting GSV sentence output. When GSV is selected, up to three GSV sentence will be output, with information regarding 4 satellites per message. Increase the baud rate (maximum = 57600) whenever adding additional sentences to help increase message delivery capability within the second.

## NMEA OUTPUT PORT

Select your preferred output port:

**RS232 port (DB-9)**

**USB port**

**Ethernet**

The first two selections produce a Port Settings window (at middle left) with preselected **[Baud rate]**, **[Parity]**, **[Number of Data Bits]** and **[Number of Stop Bits]** buttons.

The third selection produces the window at lower left, **Ethernet Settings**.



9. That reveals the Port Settings window. Select your BAUD rate (e.g 9600). Parity = None. Number of Data Bits = 8. Number of Stop Bits = 1. Click **[OK]**.
10. The **NMEA Message** window reappears. Click **[OK]**.
11. The **Output Control** window reappears. Click **[OK]**.
12. The MCR5000 Device Settings window reappears. Click: **[Save and Close]**.
13. The WinDiscovery window reappears. Click **[Exit]**.
14. Open **PuTTY.exe**. Select the **[Run]** button.
15. That reveals the PuTTY Configuration window. On the right you'll be inputting your Basic options for your PuTTY session.
16. For Connection Type, select the **[Serial]** button.
17. That reveals above it the Serial Line and Speed. These are automatically filled in. If they need to be changed to match the settings you earlier input to WinDiscovery (step 9), then do so. Click the **[OPEN]** button.
18. This reveals another PuTTY window opens displaying **streaming satellite data** delivered onscreen once per second. For instance: ZDA data delivers UTC time followed by the date and associated data.

## “Soft” Restarts

A soft restart may periodically be performed by the network device to automatically attempt to rectify a problem it may be experiencing. The network device will perform an automatic soft restart under the following conditions:

1. If the device is not receiving an NTP poll response or an NTP broadcast response depending on which mode the NTDS is in.
2. If the NTDS device is set to use DHCP and cannot find a DHCP server. You will recognize a soft restart when the MCR5000 Reference Lock LED blinks twice per second for a short time. You may even hear a relay click.

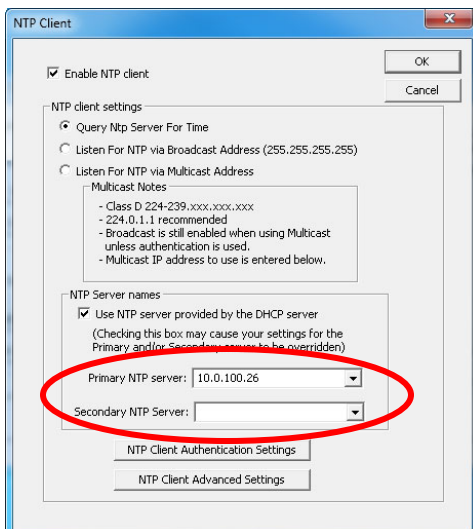
The timeout before doing a soft restart is not less than ten minutes. Several factors can increase the time between soft restarts.

1. The soft restart will be delayed by two hours if a connection is made by Telnet or WinDiscovery.
2. The soft restart could be delayed if the user changes the default parameters for NTP poll retries/timeouts or the NTP broadcast times out. For example, if the NTP broadcast timeout is increased to 60 minutes the soft restart timeout will also be increased to 60 minutes.

The primary and secondary server information (at left) can automatically be configured by the DHCP server when selecting the [Use NTP server(s) address provided by DHCP server] checkmark, provided your DHCP server is configured to do so. Consult an IT /Network Administrator to utilize this option [DHCP Server Option 042].

The default port for NTP service is **123**. This can be changed if desired. **[Note: some NTP/SNTP servers will expect NTP clients to operate on port 123 and cannot be configured to utilize alternate ports.]**

Some NTD clocks will only operate in Unicast/Query mode using server port 123. This mode is selected exclusively when neither the listen for NTP broadcast nor the listen for NTP multicast modes are selected.



If the advanced settings have been altered for your device and you begin experiencing difficulty in getting your clock to synchronize to the NTP time server, or the clock begins acting erratically, such as performing soft restarts; try returning the advanced settings to the **default values** shown above.

## Troubleshooting Tips

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**Software Tip:** WinDiscovery uses bi-directional UDP messaging on port 6163 for both the discovery process and to communicate configuration and status packets to and from the Masterclock network clock(s). Delivery of UDP messages/ packets is not guaranteed. If you experience intermittent problems with WinDiscovery, try closing the current session and restart the application. If this does not resolve the issue try the following trouble shooting tips, or switch to an alternate method of configuration such as Telnet.

All MCR5000 units are fully checked and system tested at the factory for proper operation before shipment and unless physical damage is found, the unit is probably functional. So the following problems can probably be solved by the customer/user.

### **PROBLEM:**

Unable to find (i.e. “discover”) the new MCR5000 on the network using WinDiscovery.

### **POSSIBLE REASONS/SOLUTIONS:**

1. Verify that you have supplied power to the network device.
2. The discovery process was not complete before selecting clock(s). After clicking the [**Discover**] button, wait until the discovery status indicates 100% completion.
3. Verify that the network device is a Masterclock brand device. WinDiscovery is not designed to work with network products from other vendors.
4. Verify that the network device is on the same physical network as the computer from which you are running WinDiscovery.
5. If the computer is separated from the device by a router (on a remote network) or a firewall it is likely that the router/firewall is blocking communication with the device. Run WinDiscovery from a computer within the remote network, or ask a network system administrator to configure the router/firewall in question to pass through (both directions) UDP broadcasts on port 6163

**Note:** If this does not resolve the detection problems you may additionally configure to pass through both directions UDP broadcasts on ports 6165, 6166, and 6264.



Some routers will not forward UDP broadcasts across networks currently. This capability is required to use WinDiscovery for enterprise-level management of Masterclock network appliances. If you are running a personal firewall product, such as **ZoneAlarm** or **BlackICE**, or the built-in Windows firewall you must adjust their configurations to pass through (both directions) UDP traffic on port 6163.

6. Verify that the hub/router/switch is capable of supporting the 10MB speed that the attached network device requires.
7. Verify that a DHCP/BOOTP server is present on the network. If the clock has been configured to use DHCP for network configuration, but no DHCP/BOOTP server is present, the clock may not respond to discovery requests for up to twenty seconds after power-on.

**Note:** DHCP configuration is enabled as a factory-default. In addition, the clock will reset its address (fallback) to one within the link-local address space (169.254.xxx.xxx) when no DHCP server is present or is not able to be reached.

8. Reset the clock to initiate a new DHCP IP address request, or use static IP address mode.
9. Consult your network system administrator to ensure that a DHCP server is present and accessible on your network and/or to obtain a list/range of available IP addresses.
10. Verify that all network cables, hubs, etc. are in proper working order. Be sure that Ethernet crossover cables are not being used where inappropriate.

## PROBLEMS:

MCR5000 was found using WinDiscovery, but the status display is intermittent or not updating. The MCR5000 clock does not appear to be responding to configuration changes using WinDiscovery. Other device(s) previously found with WinDiscovery do not show up now that the MCR5000 is hooked up. The MCR5000's status or settings show garbled characters in WinDiscovery.

## POSSIBLE REASONS/SOLUTIONS:

1. The WinDiscovery application may have been left open too long and the device's configuration may have changed during the session. This can occur if the DHCP server has issued new or refreshed addresses without alerting you. If so, close the *WinDiscovery* application and restart it.
2. The discovery process was not complete before selecting your device. After clicking the [**Discover**] button, please wait until the status indicates 100% completion.
3. Verify that the physical network cables and equipment and configuration for UDP have not changed.
4. Verify that you are currently the only user accessing the device via WinDiscovery or Telnet.
5. The network may currently be experiencing heavy traffic which is reducing bandwidth and/or causing collisions with the UDP messages/packets between several devices and WinDiscovery. Since the delivery of UDP messages is not guaranteed, heavy bandwidth traffic can cause WinDiscovery to not receive the latest configuration or status packets, and thus show outdated or garbled information. If this is the problem, press the [**Discover**] button again and wait until the discovery process completes. This will occasionally resolve issues with units not being discovered.
6. Close the current *WinDiscovery* session and restart the *WinDiscovery* application.
7. Take steps to increase the bandwidth and reduce network traffic.
8. If this is an ongoing problem, consider the Telnet configuration method or remove the clock system to an isolated LAN.

## PROBLEMS:

Device appears in RED text in the WinDiscovery “tree.” Device is being assigned an IP address of 169.254.xxx.xxx. Device is not maintaining its assigned IP address. Device function is erratic, appears to periodically reset itself.

## POSSIBLE REASONS/SOLUTIONS:

1. Incorrect network configuration may be causing the device to receive a fallback IP address and or perform soft restarts. Verify that the IP address configured for the clock is correct. If you manually enter (or DHCP assigns) an IP address that already exists on the network, this will create an IP address conflict. The device will reset its address (fallback) to one within the link-local address space. Determine the cause of the fallback IP address and resolve the issue.
2. View the error status field under the status window to help determine the cause of why the clock received a 169.254.xxx.xxx. Near the bottom of the Status window the error will be displayed. If there is no error, the text box will not be displayed.
3. When the Ethernet interface is initialized the network device will verify that the IP address (either static or assigned by DHCP) is not being used by another device on the network. If a conflict is found the NTD clock will default to a 169.254.xxx.xxx address. The IP address that caused the error is saved and returned as an error to WinDiscovery. This error status is available to the user via the Status window on WinDiscovery.
4. If static IP addressing is being used the original conflicting static IP address can be restored by doing a soft restart of the device using either WinDiscovery or Telnet prior to changing any other configuration parameters.
5. If DHCP was selected and the network device fell back to a 169.254.xxx.xxx address approximately every 10 minutes (depending upon the “Advanced Settings” values), the Ethernet interface will be reinitialized and the NTD clock will attempt to get an IP address from the DHCP server. If the NTD is successful, the error will be cleared and the new address from the DHCP server will be used. If a discovery was done using WinDiscovery or Telnet was used during this time, this initialization will be delayed by 2 hours.

**Note:** Devices which have been assigned a fallback IP address of 169.254.xxx.xxx will be displayed in the main WinDiscovery window with **RED** text, indicating a problem with the configuration.

**IMPORTANT NOTE:** if the configuration of the network device is changed while a 169.254.xxx.xxx is being use, then the current 169.254.xxx.xxx address will become the permanent static address and the original conflicting static address is lost. At this point, it is necessary to manually change the static IP address to a one that will not conflict, or you may have to do a “**Reset Configuration**” to restore the system to factory default settings.

**PROBLEM:**

Device appears to 'reset' periodically.

**POSSIBLE REASONS/SOLUTIONS:**

1. Check the network connection and setup. If DHCP is enabled [*Note: DHCP is enabled by default*] and a DHCP server is not active on the local network the clock will hesitate periodically while attempting to resolve DHCP configuration. To correct the problem, switch to manual networking configuration or determine why the local DHCP server is not operating.
2. If the device cannot resolve its DHCP address in DHCP mode, the unit will periodically perform a soft restart to reinitialize its communication port and DHCP configuration. See the trouble shooting section on fallback IP address.
3. If the device has not been configured with at least one valid DNS server (or that DNS server is down) hesitations similar to those described in #1 will occur. At least one valid DNS server is required for operation.

**Note:** For security purposes, the Telnet interface can be disabled. When disabled, you will no longer be able to access the unit with Telnet. To re-enable the Telnet feature, one of the other configuration methods must be used, or the unit must be reset to factory default configuration.]

**PROBLEM:**

Unable to communicate with the MCR5000 on the network with Telnet.

**POSSIBLE REASONS/SOLUTIONS:**

1. If the MCR5000 has been configured to use DHCP for network configuration but no DHCP/BOOTP server is present, the MCR5000 may not respond to discovery requests for up to twenty seconds after power-on. [*Note: DHCP is enabled as a factory-default.*]
2. Verify that you have the correct IP address for the unit and the IP address did not change. If using DHCP to provide the IP address, this address may change periodically, you must know the IP address of the unit to use the TELNET interface.
3. Verify that the device does not have the Telnet interface disabled.

**PROBLEM:**

NTP/SNTP client is unable to communicate with the MCR5000

**POSSIBLE REASONS/SOLUTIONS:**

1. Verify that the MCR5000 is attached to the network.
2. Verify that all network cables, hubs, etc. are in proper working order. Be sure that Ethernet crossover cables are not being used where inappropriate.
3. Verify that the MCR5000 is actually reachable from the client. Try “pinging” the IP address of the MCR5000. If this fails, it is possible that the MCR5000 has an invalid network configuration or that the network is down. Consult your network administrator for assistance.
4. Verify that the MCR5000 is set to output if operating in internal oscillator/real time clock mode and that the maximum time difference has not been exceeded.
5. Verify that the client is not using “Symmetric Active” mode. The MCR5000 does not use Authentication and will not work with NTP/SNTP clients in a “Symmetric Active” mode.

See the knowledgebase articles at the Microsoft website regarding using the Windows W32Time service (built in NTP/SNTP time client for the XP/2003 Servers).

**PROBLEM:**

The NTP client indicates that the MCR5000 is providing invalid time, or has flagged time as invalid.

**POSSIBLE REASONS/SOLUTIONS:**

1. The MCR5000 will always answer NTP requests (unless the client is set to use symmetric active mode). The MCR5000 will flag time as invalid if it does not have trusted time to distribute. This may occur temporarily during GPS navigation state changes or before the first GPS acquisition during an MCR5000 power up following a long period without power.
2. By default, the MCR5000 will begin flagging time invalid after 24 hours of consecutive GPS acquisition failure or non-operation (i.e. power off). This is a protective feature. It can be adjusted or disabled if desired.

**PROBLEM:**

The UTC date and time are incorrect and the unit does not retain time settings when powered down or up.

**POSSIBLE REASONS/SOLUTIONS:**

The MCR5000 maintains its internal time in battery-backed memory located using a Real Time Clock (RTC). The battery supplies power to the TCXO 32kHz oscillator and RTC when the unit is powered off. This allows the internal configuration to be maintained and the time and date to continue to increment. So, if there is a problem here, the internal battery likely needs replacement.

The battery type is a “maintenance free” 3V rechargeable magnesium lithium battery. It can be replaced by a qualified technician. Or the unit can be sent to technical support at Masterclock.

See the “Specifications” section for details on the recommended battery replacement, or contact technical support for assistance.

**PROBLEM:**

Lost password.

**POSSIBLE REASONS/SOLUTIONS:**

Your custom password cannot be recovered if it is lost. Reset the clock to the factory default configuration (see page 14). After the clock has been reset to factory defaults, the unit must be reconfigured to your custom settings.

The factory - default password is “**public**”.

## **PROBLEM:**

Multiple error windows titled, “**Bad Password**,” continue to pop-up each time a configuration setting is applied.

## **POSSIBLE REASONS/SOLUTIONS:**

1. You have entered and “remembered” an incorrect password in the password windows. You must clear the memorized password using one of the two options below.
2. WinDiscovery only remembers the password for the current session, so close the WinDiscovery session and reopen it. All passwords will be forgotten and you can start anew.
3. As an alternative to closing your WinDiscovery session, right click on the device in the left WinDiscovery window. The last entry in the pop-up menu lists “**Forget Memorized Password.**” Select this option.
4. You are using a global password that is different from the password of the unit you are trying to administer. Change the global password to match that of the unit, or change the unit password to the global password.

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## **IF THESE TROUBLESHOOTING TIPS DO NOT SOLVE YOUR PROBLEM**

Contact technical support at [support@masterclock.com](mailto:support@masterclock.com) or call (636) 724-3666. You may also seek help in the support area of the [www.masterclock.com](http://www.masterclock.com) website.



## SPECIFICATIONS

### Communications – Protocols

- DHCP/BOOTP (default)
- Static IP addressing
- Network Time Protocol (NTP)
- IPV4 (RFC3171)
- SNTP V4 (RFC 2030)
- NTP version 3 (RFC 1305)
- UDP, port 123 (default)
- Unicast (Query) mode [port 123, default]
- Broadcast mode [255,255,255,255 default]
- Multicast mode (RFC3171 IANA IPV4 multicast guidelines)

### Configuration

- WinDiscovery - network discovery and configuration utility
- Windows 2000, XP, 7, 2003 and 2008-SP1 Server operating systems
- Proprietary packet protocol – UDP, port 6163
- Device password or global password support
- Telnet – TCP, port 23 (default)

### Communications – I/O

Ethernet (10/100mbps) RJ45, 10/100 baseT  
 Length of communication cable (Cat5/5e) 100 meters max

RS-232  
 (Programming/Configuration Port: DB9 male,  
 TX, Pin 2  
 RX, Pin 3  
 Gnd/Return, Pin 5

The default communication settings for the RS-232 port are: 4800 baud, 8 data bits, 1 stop bit, no parity.

Length of communication cable: 3 meters max  
 (use standard straight thru cable)

USB: USB-Type B  
 Length of communication cable: 3 meters max

The communication settings for the USB port are:  
 57600 baud, 8 data bits, 1 stop bit, no parity

### Serial Port

RS-232 (ASCII):  
 9600 baud, 8 data bits, one stop bit, no parity USB



### Timing Characteristics (standard)

Type: Temperature Compensated  
Crystal Oscillator (TCXO)

Stability: +/- 1 min/year (0-40 C)  
+/- 3 min/year (41 to 50 C)

PPS output: Level : 5V TTL [BNC Female]

Pulse width: 40 uSec  
(varies with active ref – see options)

Rise time: 10 nS

On-time mark: Active rising edge locks  
to current active reference (see options)

Accuracy NTP Client: Network Client  
1-10mS typical  
10 sec query (default)

### Power Requirements

AC input voltage: 100-240 VAC +/-10%  
(90-264VAC), 47-63 Hz

AC input connector: Universal IEC  
input connector

AC power consumption: <15W

Protection: Built in fuse, output power limiting,  
over voltage, and short circuit protection.



**Caution: No user-serviceable parts are inside the MCR5000.** Please contact the factory if you require servicing or repair.

### Battery

Original: 3V, 17 mAh,  
Maintenance-free  
Rechargeable manganese lithium

Replacement: 3V,17 mAh, Coin Cell  
Maintenance-free  
Rechargeable manganese lithium  
Panasonic ML1220/V1A



### Physical

Size: 19 x 9 x 1.75 in.  
(48.3 x 22.9 x 4.5 cm)

Weight: 3 lbs. (1.4 kg)

### Operating Parameters

Operating temperatures: 0 to +50°C  
0 to 40C  
+/- 1 min/year for Battery

Operating relative humidity: Up to 90%  
(non condensing @ 25°C)

Storage temperatures: -40 to +70° C

Storage relative humidity: Up to 90%  
(non condensing @ 25°C)

## Time Code (TC option)

### Supported Time Code Formats:

SMPTE/EBU/Film:  
(30/25/24 fps), NDF non-drop frame  
LTC Linear/Longitudinal, Forward running  
User bits with date encoding to Leitch/Masterclock

BiPhase Correction Bit 2: Enabled  
Or No User bit date encoding: zero filled

IRIG-B: Format: IRIG-B(00) pulse width coded  
(a.k.a. dc level shift, un-modulated)

IRIG-B(12): 1 kHz Amplitude Modulated,  
3.3:1 mark to space ratio.

CF (Control Fields): CF =IEEE1344 year encoding  
(equivalent to IRIG 200-04)

Or

CF = zero filled (IRIG 200-98, and prior)  
SBS (Straight Binary Seconds): enabled

## Time Code Reader (TCR option)

### Time Code Input

Signal & Connector: Single Ended, Unbalanced  
BNC-female  
Differential, Balanced  
TC + , TB pin 1,  
TC - , TB pin 3,  
Optional shield - TB pin 2

Input Impedance: >50kOhm

Auto- Detection, Auto-Gain Adjust Range:  
SMPTE 24/25/30 fps, NDF: 0.2 to 12 Vpp

IRIG-B00 un-modulated: 0.5 to 12Vp

IRIG-B12, 1khz AM: 0.5 to 8 Vpp

## Time Code Generator (TCG option)

### Time Code Output Signal & Connector:

Single Ended,  
Unbalanced,  
BNC-female,  
Differential,  
Balanced

TC +: TB pin 1,  
TC -: TB pin 3,  
Optional shield: TB pin 2

Output Impedance: 50 Ohm  
Output Signal Level: SMPTE  
4 Vpp into 600 Ohm,

### High Stability (HS) option

Crystal oscillator type: OCXO  
(Oven Controlled Crystal Oscillator)  
Disciplined by the most accurate  
active reference available

Stability: <250mS/year  
1x10<sup>-11</sup> freewheeling with GPS option  
referenced & disciplined over several months

10 MHz Reference output (option): 10 MHz  
sine wave  
2.5 Vpp  
50 Ohm  
SMA female "REF"

Auxiliary reference output (option): 10 MHz  
100 kHz, 10 kHz, 1 kHz, 100 Hz, 10 Hz  
or 1 Hz squarewave  
(AUX) BNC female connector "AUX"

PPS Accuracy & pulse duration: 80 uSec  
pulse width on time edge  
locked to disciplined HSO

### GPS receiver (option)

Receiver: Internal,  
12 Channel Simultaneous/Parallel

Antenna: ConnectorExternal  
SMA Female "Antenna"

Frequency: L1, 1575 MHz ± 10 MHz

RF Bias to antenna: 3V DC, center pin

### Standard antenna

External pre-amplified  
antenna (required): L1 , 1575 MHz ± 10 MHz

Polarization: Right Hand Circular

Impedance: 50 Ohm

Weight: 4.9 oz (140 g)

Dimension: 3.7" diameter x 4.9" length  
(96mm x 126 mm)

Voltage: 3/5 VDC (center pin)

Mounting: pipe, M24 x 1.5 internal thread

Power Consumption: @ 22 ma (.24W)

Gain: 32 dB Standard

Temperature: -40 to +85 °C

### Antenna Cable

Standard antenna cable  
(low loss Belden 8219): 50'/15m

Max antenna cable  
(low loss Belden 8219): 75'/23m

Max antenna cable  
(low loss Belden 9913): 500'/152m

PPS Accuracy and pulse duration: 4uSec pulse,  
on-time leading edge  
same as GPS when locked

### Relay Rating

Input contact rating: up to 24 VDC/VAC  
250 mA max

Type: Normally Closed (NC)  
or Normally Open (NO)  
with Common

Connector: Terminal Block (TB), screw terminal

### Programmable Pulse Output (PPO Option)

Type: Rising Edge Triggered, +5V, TTL

Output Impedance: 50 Ohm

Pulse Interval: 100  $\mu$ Sec to 3 days  
(1PPM default)

Pulse Width: 10  $\mu$ Sec to 100 mSec  
(50 mSec default)

Accuracy: Same as currently selected  
reference source

### DB9 Connector RS-232 I/O (summary)

Type: DB-9 Male Pins

Pin 1: NC

Pin 2: RS232 Tx

Pin 3: RS232 Rx

Pin 4: NC

Pin 5: Ground/Return

Pin 6: NC

Pin 7: NC

Pin 8: NC

Pin 9: NC

## Limited Warranty

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This Masterclock product warranty extends to the original purchaser.

Masterclock warrants this MCR5000 against defects in materials and workmanship for a period of five years from the date of sale . If Masterclock receives notice of such defects during the warranty period, Masterclock will, at its option, either repair or replace products that prove to be defective.

Should Masterclock be unable to repair or replace the product within a reasonable amount of time, the customer's alternate remedy shall be a refund of the purchase price upon return of the product to Masterclock. This warranty gives the customer specific legal rights. Other rights, which vary from state to state or province to province, may be available.

### **EXCLUSIONS**

The above warranty shall not apply to defects resulting from improper or inadequate maintenance by the customer, customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product or improper site preparation and maintenance (if applicable).

### **WARRANTY LIMITATIONS**

MASTERCLOCK MAKES NO OTHER WARRANTY, EITHER EXPRESSED OR IMPLIED, WITH RESPECT TO THIS PRODUCT. MASTERCLOCK SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In any state or province which does not allow the foregoing disclaimer, any implied warranty of merchantability or fitness for a particular purpose imposed by law in those states or provinces is limited to the one-year duration of the written warranty.

### **EXCLUSIVE REMEDIES**

THE REMEDIES PROVIDED HEREIN ARE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL MASTERCLOCK BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

In any state or province that does not allow the foregoing exclusion or limitation of incidental or consequential damages, the customer may have other remedies.

### **HARDWARE SERVICE**

You may return your MCR5000 to Masterclock for repair service. Please contact the factory for **RETURN AUTHORIZATION** before returning the unit. When you return your MCR500 for service, you must prepay all shipping charges, duty, and taxes. For international returns, please contact the factory

**CELAB®**  
Via Maira snc  
04100 Latina  
Italy  
[celab@celab.com](mailto:celab@celab.com)



## CERTIFICATE OF CONFORMITY

Certificate Number UCN : 800304226312  
Job : J8276  
Date of Issue : 2010-07-30  
Certificate valid up to : 2013-07-29

Brand Name : *Masterclock, Inc.*  
Type : *PRECISION TIME & FREQUENCY REFERENCE SYSTEM*  
Model N : *MCR5000*

Manufacturer : Masterclock, Inc.  
Address : 2484 W. Clay St.  
63301 St. Charles, MO. U.S.A.

Standard Used  
EN 60950-1:2006 Safety Information technology equipment

EN 61000-6-1:2007 EMC Immunity Generic Commercial

EN 61000-6-3:2007 EMC Emission Generic Commercial

**Conclusion:**

*The product meets the technical requirement of the above standards and the technical requirements of the following directives.*

**Low Voltage Directive 2006/95/EC EMC 2004/108/EC 93/68/EEC 92/31/EC**

*This certificate is only valid for the equipment and configuration described, in conjunction with the test data detailed above and with compliance with all applicable legal requirement for the product .*

The CE mark as show below can be used, under the responsibility of the manufacturer or the importer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives prescriptions.



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Massimiliano Bertoldi  
General Manager – CELAB  
[www.celab.com](http://www.celab.com) DOC 121

[www.celab.com](http://www.celab.com)

## Contact Us

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