



MCR1000

Master Clock Reference

User Manual

The **MCR1000** 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 MCR1000 is a high-precision time and frequency reference system based on NTP (Network Time Protocol) over the Ethernet. Designed for the desk top or rack mount, this single input and output generator serves commercial establishments, industry, military and laboratory environments. GPS, NMEA, NENA and Time Code options are also available.

Thank you for your purchase of a MCR1000 precision time and frequency reference system from Masterclock.

Here you'll find instructions for unpacking and installing your MCR1000, 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

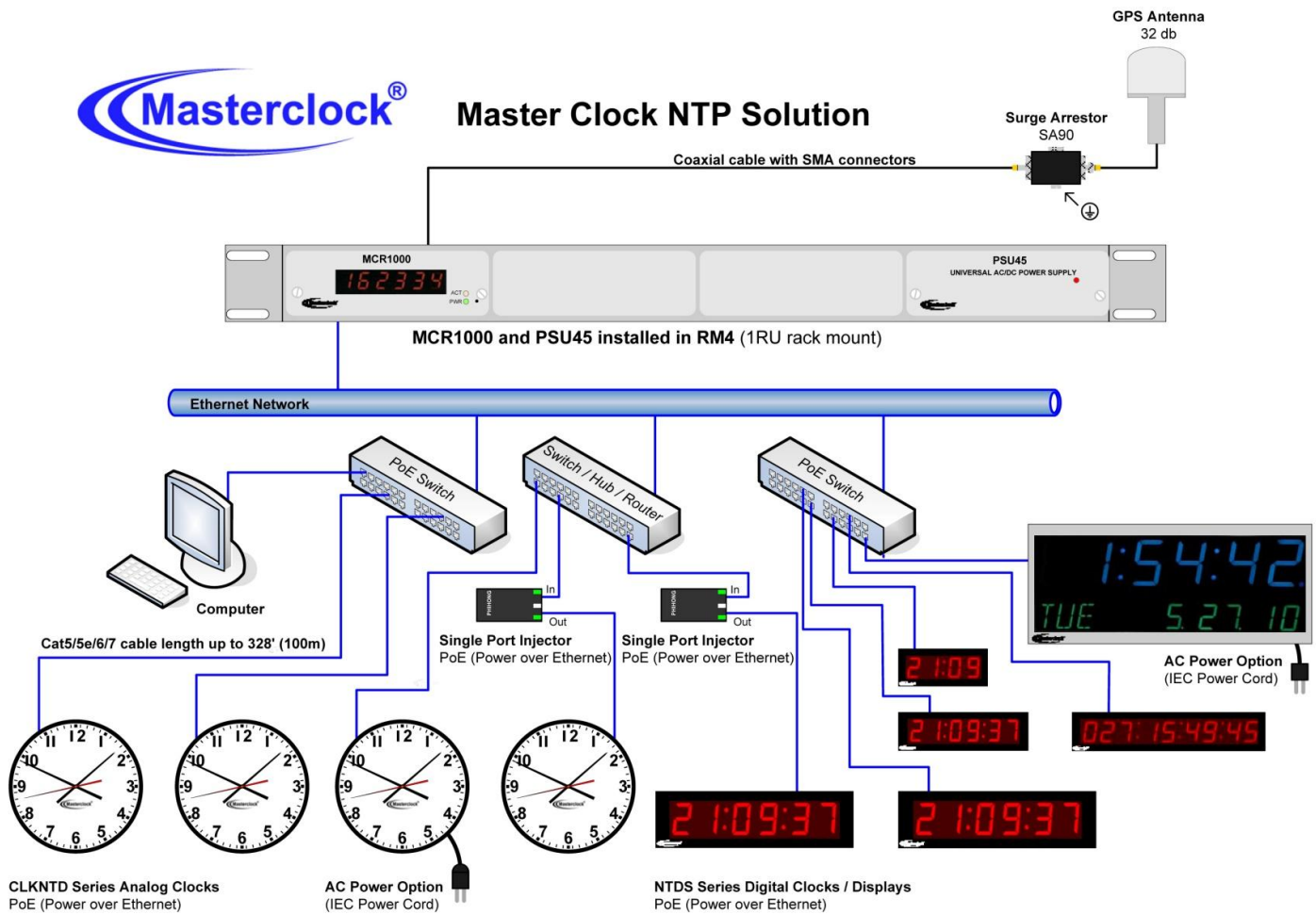
Before calling, please attempt to find the answer to your situation here. You'll find this user manual will handle virtually all of your questions.

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Master Clock NTP Solution



OPERATING ENVIRONMENT



Moisture: The MCR1000 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 MCR1000. Please contact the factory if you require service or repair

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 MCR1000.
- 2. Onscreen select** the MCR1000 directory.
- 3. Run** the 'setup.exe' application from the CD.

By default, the setup utility will suggest installing files to **C:\Program Files\ Masterclock\MCR1000**.

- 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.

MCR1000 is a high-precision, yet small profile, **Master Clock Reference (MCR)** device operating on an Ethernet network and utilizing a built-in **Network Time Protocol (NTP)** client to accurately set system time from one or two NTP servers.

When locked to GPS satellites, the MCR1000 can read NTP, NMEA, NENA or time can be set manually. The MCR1000 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 10 MHz sine wave.

Holdover accuracy and stability is maintained with a crystal oscillator that can be upgraded with a **High Stability Oven-controlled Oscillator (HSO)** option. Each MCR1000 can operate on a 10/100 MBit local area network.

DRIVER INSTALLATION

The MCR 1000 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 MCR1000 to provide a means of configuring the operation of the MCR1000 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 MCR1000.

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 MCR1000.

Installing USB drivers: Once the MCR1000 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.



WINDISCOVERY

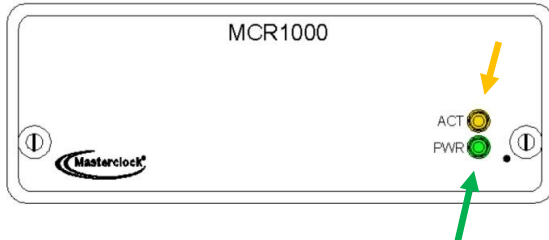
Included with your MCR1000 is the WinDiscovery GUI application. WinDiscovery is a detection, configuration and management software application which works with all Masterclock brand network devices. It operates under most Windows-based operating systems. See page 19 for details.

FRONT PANEL 'LED' STATUS

All MCR1000 models have two LEDs on the front panel.

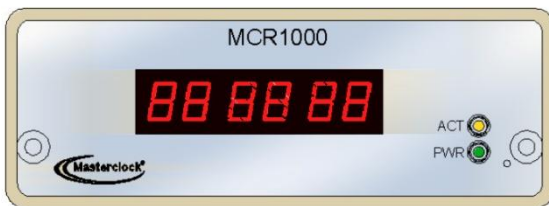
The upper amber LED (labeled: **ACT for Activity**) pulses briefly and only occasionally with every NTP request.

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



OPTIONAL FRONT PANEL DISPLAYS

Optional front panel displays may be ordered with your MCR1000 to provide a time or date display. A six-digit LED shows the current time or date. A nine-digit LED shows the day of year (doy) and current time or date. See page 8 for details.



BATTERY BACKED RTC AND TCXO

The MCR1000 maintains its internal time settings in battery-backed memory located on a RTC chip. A **Temperature Compensated Crystal Oscillator (TCXO)** provides freewheeling accuracy (maximum drift) down to ± 1 minute per year (= 165 mS/day).

A built-in battery supplies power, up to 24 hours, 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, whenever power is removed.

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

NON-VOLATILE MEMORY CONFIGURATION

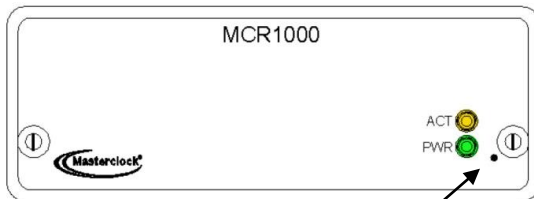
The MCR1000 maintains its configuration parameters internally in non-volatile memory, even when the power is off. These configuration settings include the assigned (DHCP or Static) IP address and network settings, assigned device name, NTP operational mode, brightness level, assigned stratum levels, 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.

SET TO FACTORY-DEFAULT CONFIGURATION

The MCR1000 is fully tested with factory defaults prior to shipping. This factory default configuration is defined as:

- UTC reference time (no local time zone offset and daylight saving auto adjustment is 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 “- - - - -” [if digits are installed].

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 in the pinhole on the front panel (see illustration at left). Insert a paperclip-type wire into the pinhole and maintain pressure for at least 5 seconds to reset the unit to factory defaults.

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 MCR1000 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 MCR1000 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 INPUT NOTICE

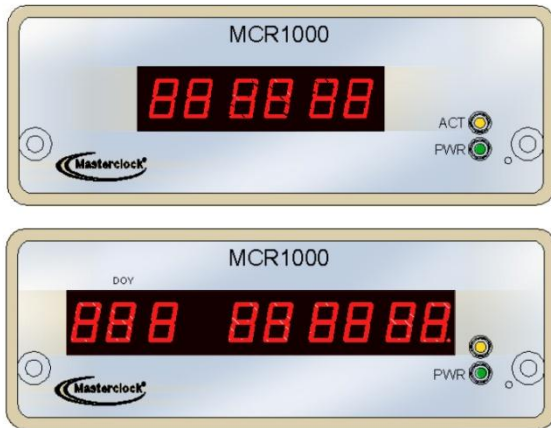
Depending on many factors beyond the control of Masterclock, the signals that are received from the GPS satellites are subject to interference, fading, satellite failure and other influences *that could cause* the MCR1000 with an installed GPS receiver option to provide erroneous time and/or date information 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)
- **Temperature-Compensated Crystal Oscillator (TCXO)** with holdover stability <165mS/day
- **Maintenance-free rechargeable battery**
- Supports NTP **broadcast, multicast, and/or unicast** (query) modes of operation
- Fully configurable network settings: automatic via **DHCP/BOOTP**, or **Static IP** addressing support
- Monitor status and behavior via **WinDiscovery** app
- **Telnet interface** for alternate configuration and maintenance on non-Windows OS networks
- Security features include **password protection** of configuration, authenticated communications and the ability to disable Telnet management access
- UTC time internal reference
- Fully configurable Time Zone, DST and custom time offsets
- **Programmable Dry Contact Relay** (24VDC, 250mA)
- Single event (daily) programmable **relay schedule**
- **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
- R232 serial port interface
- Kinematics/Truetime
- NENA 911 PSAP master clock standard
- NMEA 0183 ASCII serial output
- Firmware and function upgradeability

Optional Features

Your MCR1000 can support up to three hardware module accessories and multiple advanced function options. These make the MCR1000 an extremely versatile network device and suitable for a large variety of applications.



❖ FRONT PANEL LED DIGITAL TIME DISPLAY

- Six-digit time/date display
- Nine-digit time display, plus DOY (day of year)
- 12- or 24-hour time or display in either US [MMDDYY] or European [DDMMYY] formats
- Adjustable brightness control
- Display UTC time or local time

❖ NTP SERVER FUNCTION

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

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❖ 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

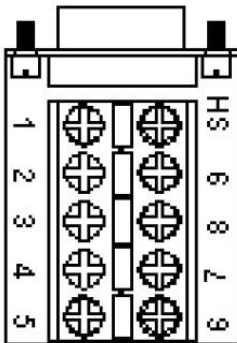
- Generates SMPTE 24, 25, 30-fps, non-drop frame, IRIG-B, 1 kHz, amplitude modulated and pulse width coded (unmodulated)
- Single-ended unbalanced output
- Fully configurable offset for Time Zone and DST
- Programmable delay offset with 1 mS resolution

❖ **TCG+**
ADVANCED TIME CODE GENERATOR

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

❖ **HSO: HIGH STABILITY OSCILLATOR**

- 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 μ seconds to 3 days
- Default is 1PPM (pulse per minute)
- Pulse output is 5Vpp from a low impedance source
- Pulse width selectable from 10 μ S to 100mS
- Accuracy is the same as the current reference source, whether GPS, Time Code or NTP

❖ **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. This is your primary detection, configuration and maintenance software. See 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 **MCR1000** 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 MCR1000 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-hour positive bias. The new US/Canada DST standard is: one-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, time changes are defined relative to the UTC time of day instead of local time of day (as in US).

To ensure proper hands-free year-around operation, the automatic daylight time adjustments must be configured using the **Daylight Savings 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. 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 MCR1000 with Telnet. The DHCP server can be utilized to provide the IP address of the associated device name that is registered.

Important Note:

An MCR1000 network device will not function properly if configured to use DHCP services when no DHCP server is present on the network. An MCR1000 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 MCR1000 can obtain its network configuration automatically from DHCP or BOOTP, when one or the other is available on the network. Utilizing DHCP/BOOTP, the MCR1000 will automatically be assigned its network configuration. This includes 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 MCR1000 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 MCR1000 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. NTD clock will treat addresses as primary and secondary DNS servers.
Network Time Protocol Server	42	Up to two server IP addresses may be specified. NTD clock will treat addresses as primary and secondary NTP servers.

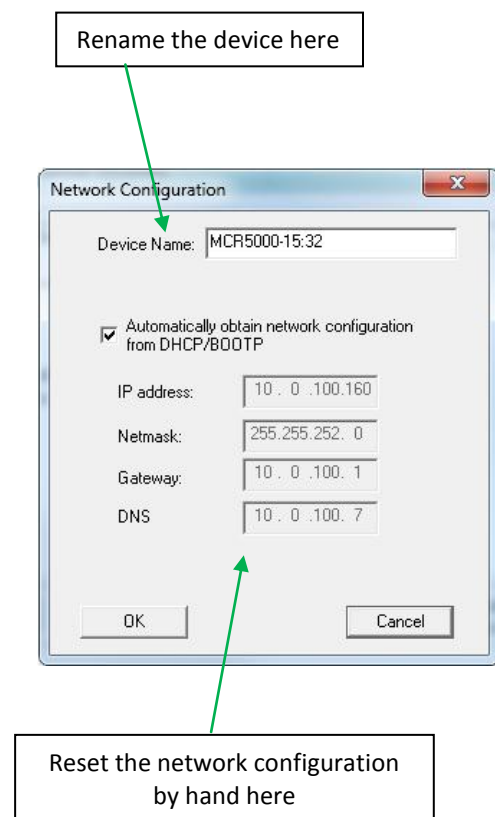
DEVICE NAME/DHCP NAME REGISTRATION

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 MCR1000 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 MCR1000 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 app).

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 Time ("Summer Time" in Europe).

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

<http://www.ntp.org>

The MCR1000 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 NTP client can be disabled to allow operation as a stand-alone unit without a network connection.

NTP SERVER OPTION

The MCR1000 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.

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

NTP ADDRESSING MODES

UNICAST - The MCR1000 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 MCR1000 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 MCR1000's ability to reply. The broadcast mode is a widespread or open-ended broadcast, not intended for any specific IP address.

The MCR1000 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 MCR1000 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. It sends packets only to receivers (clients) that want them.

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 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 MCR1000 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 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**.

The multicast address range from **224.0.1 to 224.0.24** is considered the **INTERNET WORK CONTROL BLOCK**. This address range is utilized for NTP traffic. Please refer to the RFC3171 for your specific application and implementation.

<http://www.rfc-editor.org/rfc/rfc3171.txt>

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.

<http://www.ietf.org/rfc/rfc2236.txt>

ANYCAST - The MCR1000 does not currently provide anycast capability.

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

Back Panel Interfaces

RELAY AND PROGRAMMABLE RELAY EVENT

The MCR1000 includes a low voltage dry contact 24V AC or DC relay that can be configured with an internal jumper to be either NO (normally open) or NC (normally closed) using the terminal block connector on the rear of the unit.

Factory default: Jump for NO (normally open).

The relay can provide two mutually exclusive functions.

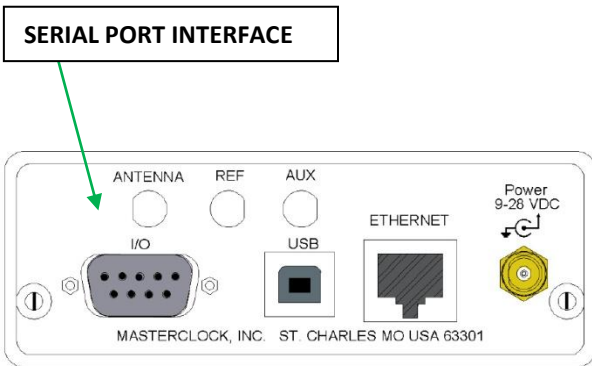
1. **By default:** The relay will actuate to indicate when the unit has lost synchronization (lock) with the external time reference.
2. The relay can be programmed to actuate at a single time (defined as HH:MM:SS start time) for a specified duration (in seconds) once per day.

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

PPS (PULSE PER SECOND) OUTPUT

The MCR1000 provides a PPS output. PPS is commonly used as an on-time mark for timing and synchronizing systems.

The PPS is a 5V TTL (Transistor-Transistor Logic) level signal that is locked to the currently selected and most accurate time reference (external or internal). The rising edge of the PPS signal provides the "On Time" mark. The PPS output is available on the shared I/O connector (Serial Port Interface) on the rear of the unit.

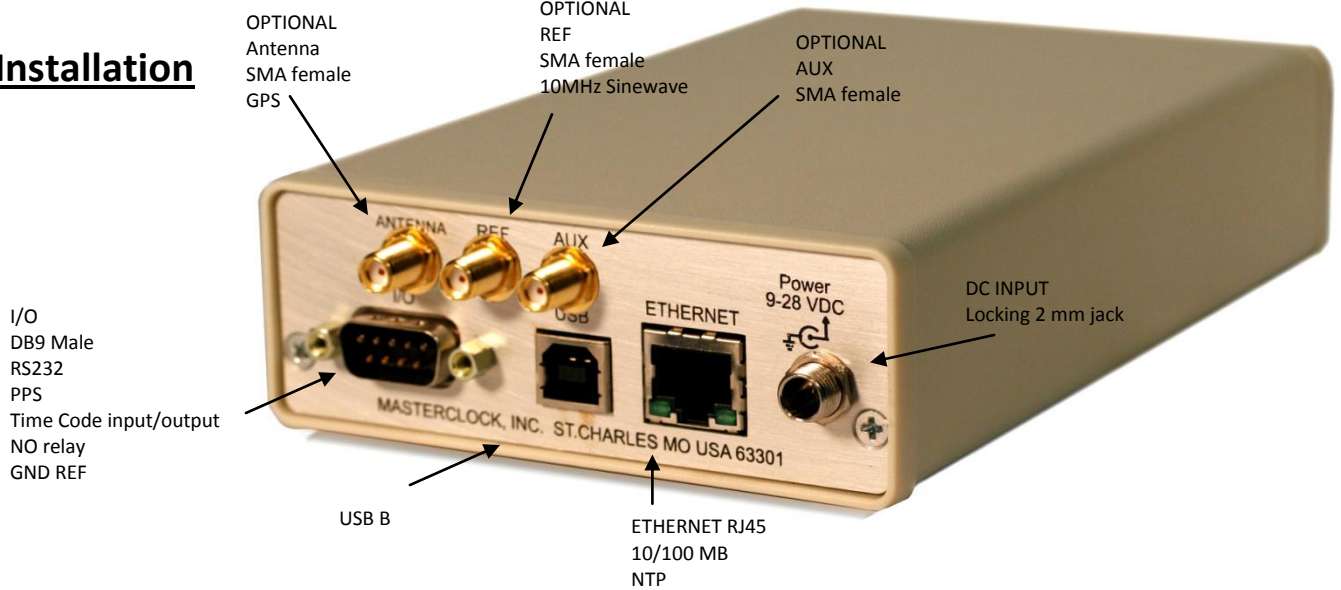


SERIAL PORT INTERFACE

The MCR1000 provides both an RS-232 null modem and USB-type B serial interface for serial communications and configuration. These communications include NENA 911, NMEA 0183 and Kinemetrics/Truetime.

CAUTION: Connecting input voltages or switching currents beyond the maximum ratings for the relay (up to 24VDC/VAC, 250 mA max) could damage the MCR1000. Such damage is not covered under your warranty.

Installation



PRE-INSTALLATION CHECKLIST

The MCR1000 is a network device with an NTP client enabled and configured for DHCP provided network settings and NTP server addresses (by default). Other settings are available.

Before installing an MCR1000 on a network one should be prepared with the following basic configuration information (see box at left). You may need to ask your network administrator for these numbers and information.

CHECKLIST

Dynamic Networking Configuration
(default for all MCR1000 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

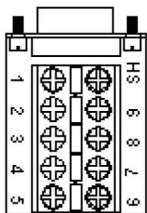
Primary and secondary DNS (domain name) servers

Gateway/router

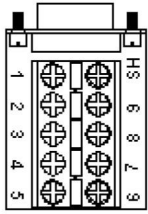
Primary and secondary NTP time sources

QUICK START INSTRUCTIONS

- Make all connections at the rear of the unit, but keep the power disconnected until the last step.
- Connect the MCR1000 device to your LAN (Local Area Network) hub/router/switch using Cat5 cable making the connection to the RJ45 connector labeled “**ETHERNET**”
- Make any additional desired input and output connections to the DB9 connector labeled “I/O” using either your own cable or an optional DB9 breakout adapter (item sold separately by Masterclock)
- 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.
- Apply power by inserting the supplied AC:DC power supply module into an appropriate AC power source and the DC power connector into the male Switchcraft-style locking power socket on the rear of the unit (labeled **Power 9-28VDC**).



DB9 Breakout Adaptor



Standard I/O connections using optional DB9 Breakout Adapter

- 1 - PPS
- 2 - RS232TX
- 3 - RS232 RX
- 4 - Relay Common
- 5 - Ground/Reference
- 6 - Time Code Output
- 7 - Time Code IN +
- *8- Time Code IN -
- 9 - Relay Contact

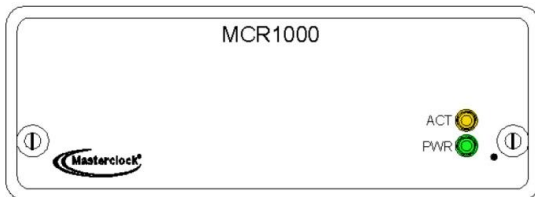
*If an unbalanced signal is desired, pin 8 should be tied to ground.

Please refer to the options sections of this user manual for making connections or configuring any installed options.

- If desired the unit can be operated from a nominal 12- VDC supply such as a battery (9-28 VDC range).

Caution: Observe voltage polarity as indicated on the rear panel. The center pin is positive +VDC, and is labeled 9 -28VDC.

- Monitor the front panel for power up status.
 - ✓ When power is first applied the initial sequence of the front panel LEDs are:
 - ✓ Front panel PWR and ACT indicators will be off, but after about 30 to 40 seconds...
 - ✓ Units with 6-digit or 9-digit LEDs will show all dashes followed by all 8s, then all LEDs extinguish briefly before displaying time
 - ✓ Amber (ACT) LED signifying NTP status: Off
 - ✓ Green (PWR) LED: Blinks twice per second, with numerals incrementing each second. This indicates lock to internal TCXO oscillator and acquiring lock to an external source, if applicable.
 - ✓ Green (PWR) LED: Blinks once per second. This indicates synchronization to an external reference



Note: when configured to obtain network configuration through DHCP, the display may hesitate on startup while DHCP is resolved.

CONFIGURE THE MCR1000 USING YOUR PREFERRED METHOD

At this time, the MCR1000 can communicate with WinDiscovery, which can detect and identify the MCR1000 through the exchange of broadcast messages, even when TCP/IP networking parameters are not configured on the same network.

Once the MCR1000 has a valid network configuration and the IP address of the unit is known, it can also be accessed and configured via Telnet by computers in the same network.

WinDiscovery Installation and Operation



Included on CD with your MCR1000 is the **WinDiscovery** software application for detection, configuration and management of all your NTP devices from Masterclock. The application operates in the Microsoft Windows OS.

INSTALLING WINDISCOVERY

If you haven't already done so, insert the CD that shipped with your MCR1000 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**.
3. Click the **[OKAY]** button.

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 them.

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 app.

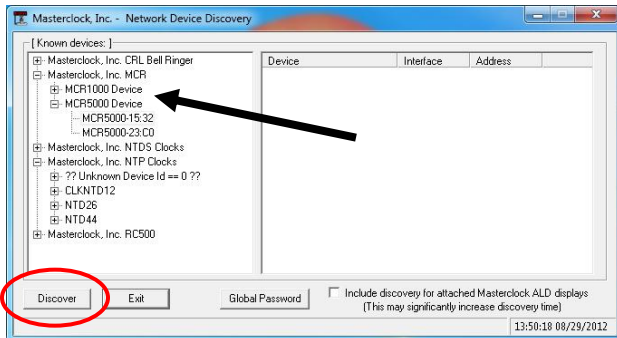
MENU

To open a **Menu of Options** window, including **Properties and Device Settings**, right click the device name.

Or

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

Both options will be covered in the following instructions.

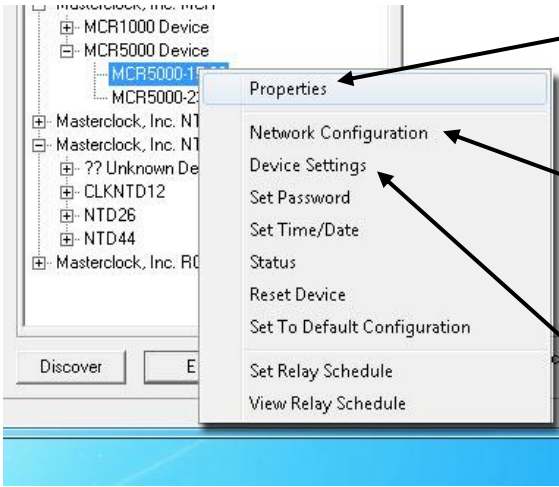


Note: Images here were pulled from a MCR5000 WinDiscovery connection. The MCR1000 is essentially the same.

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

INSIDE THE MENU OF OPTIONS WINDOW:

Click your choice (see below) to open the window for that function.



PROPERTIES

The device properties (lower far left) may be viewed in summary by clicking the **[Properties]** button.

NETWORK CONFIGURATION

The network configuration (lower near left) may be viewed in summary by clicking the **[Network Configuration]** button.

DEVICE SETTINGS (DS)

The Device Settings window (lower left) configures the MCR1000 to receive and display in the format that you prefer, using Time Zone offsets and DST settings to completely customize it relative to UTC time.

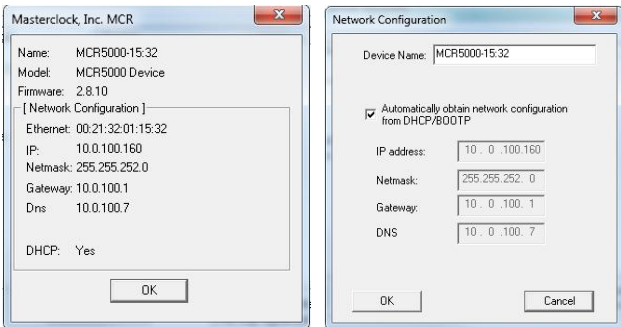
The top right section of the “Device Settings” window shows a list of the firmware and options associated with your MCR1000.

The rest of the “Device Settings” window includes access to all configuration options for the network. These include time reference inputs and outputs, display properties, relay control and administrative functions, such as password. There is also a status display to monitor remote clocks and devices from your computer screen using the free, included WinDiscovery software application.

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

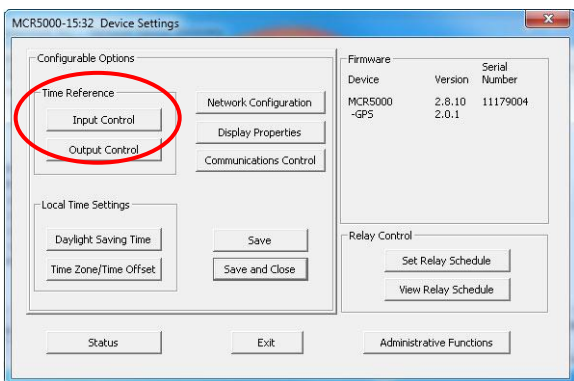
DS > INPUT CONTROL (IC)

The **[Input Control]** button provides access to the “Input Control” window, which provides buttons for NTP Client, Time Code Reader, NMEA Client and NENA Client.

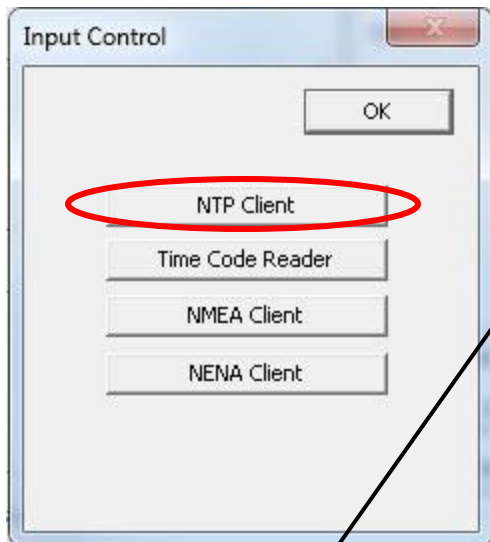


Properties

Network Configuration



Device Settings – Input Control is circled



DS > IC > NTP CLIENT

While on the “**Input Control**” window, click the [**NTP Client**] button to access settings for the NTP client.

ENABLE NTP CLIENT – is enabled by default. However, it may be desirable to disable the NTP client for certain applications, such as those in which the MCR1000 will not reside on a network during typical operation. Deselect “**Enable NTP client**” if desired.

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.

NTP CLIENT SETTINGS

QUERY NTP SERVER FOR TIME – is enabled by default. This is the **unicast** mode. The default configuration is to query the NTP server at 10-second intervals.

LISTEN FOR NTP VIA BROADCAST ADDRESS – The MCR1000 can be configured to listen to NTP broadcasts by selecting the “**Listen for NTP via broadcast address [255,255,255,255]**” checkbox. When this is selected, the broadcast timeout period (in seconds) is adjustable. To configure the device to only listen to NTP broadcasts, click the checkbox [**Listen for NTP broadcasts only**] and enter a “**Broadcast/ Multicast Timeout**” in seconds. The default timeout is 3600 seconds (1 hour).

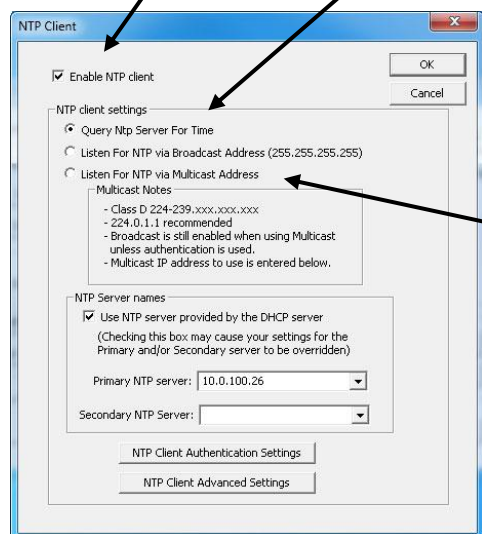
LISTEN FOR NTP VIA MULTICAST ADDRESS – The MCR1000 can be set up to listen to NTP using multicast addressing by selecting the “**Listen for NTP via multicast address**” checkbox. When multicast mode is selected, the client will also listen to broadcast messages.

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.

These group addresses are defined and governed by **RFC3171, IANA IPv4Multicast Guidelines**.

Typically, the multicast address range 224.0.1.0 to 224.0.1.255 is utilized for NTP traffic. Please refer to the **RFC3171** for your specific application.

<http://www.rfc-editor.org/rfc/rfc3171.txt>

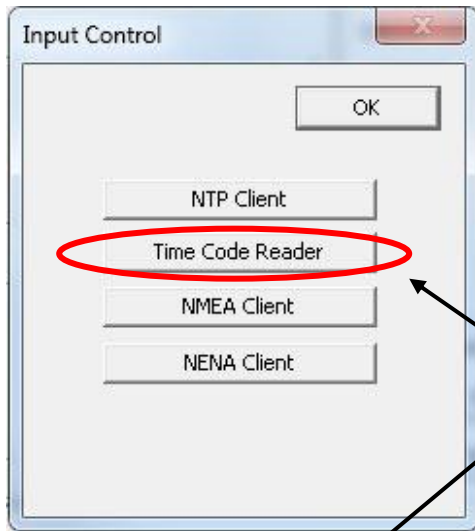


Note: Some NTP/SNTP clients will expect NTP servers to operate on port 123 and cannot be configured to utilize alternate ports.

NTP SERVER NAMES (see page 21) – By default the [Use NTP server provided by the DHCP server] box is checked 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.

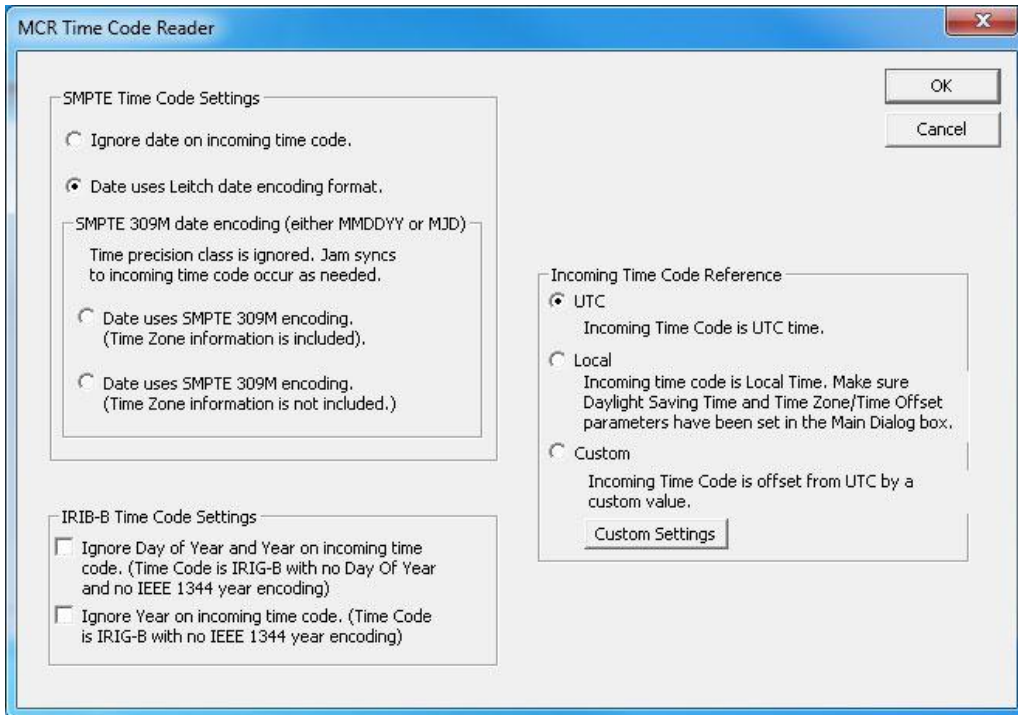
NTP CLIENT AUTHENTICATION SETTINGS – This window permits the entering of up to 15 MD5 key values to be trusted or allowed. Primary client settings permit the entry of a primary server key number, a secondary server key number and a broadcast key number.

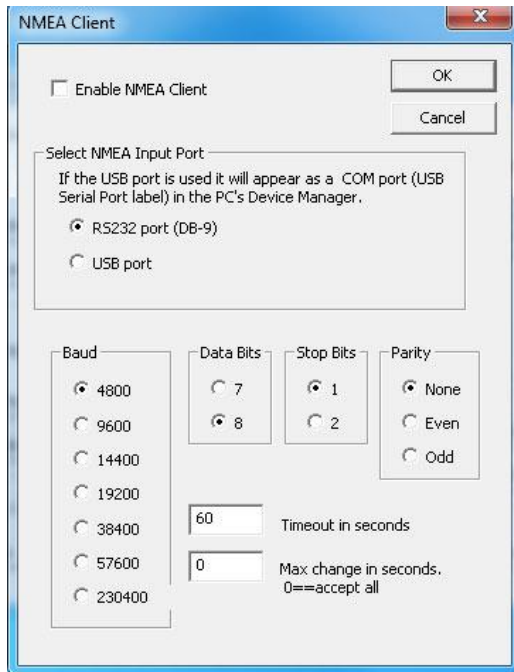
NTP ADVANCED SETTINGS – Advanced settings allow for the adjustment of additional network communication settings. Under most typical operating circumstances it is not necessary, nor is it suggested, to change the advanced settings options.



DS > IC > TIME CODE READER

The [Time Code Reader] button opens the “MCR Time Code Reader” window and will only operate when a Time Code reader is networked. Choose from the selections offered at lower left and click the [OK] button when complete.





DS > IC > NMEA CLIENT

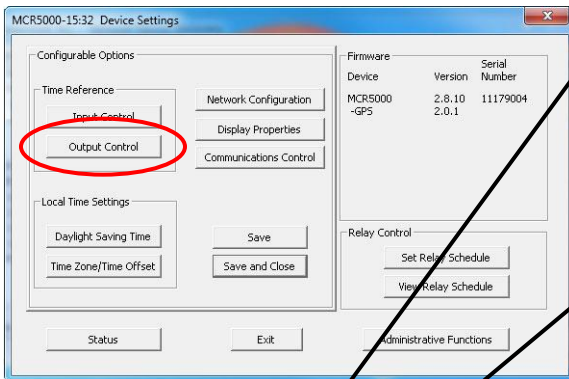
Click the [Enable NMEA Client] button (see page 22) to adjust the “Port, Baud rate, Data bits, Stop bits, Parity, Time out and Maximum change for NMEA in seconds” selections.

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 in seconds” selections. Yes, the NENA window is virtually identical to the NMEA window.

DS > OUTPUT CONTROL (OC)

On the Display Settings window (left) click the [Output Control] button to access the MCR1000 output options (see below). As before, any changes made in this window will not be applied until you click the [Save] button, or the [Save and Close] button on the “Device Settings” window.



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.

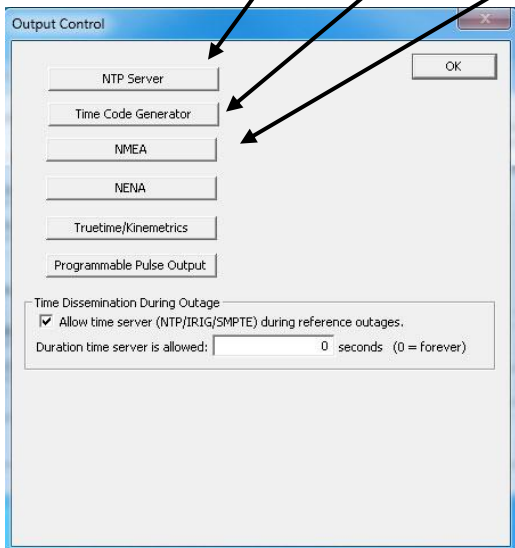
DS > OC > TIME CODE GENERATOR – This button operates only when a Time Code device is on the network. See page 35 for a sample of this window.

DS > OC > NMEA - The MCR1000 provides an **NMEA (National Marine Electronics Association) 0183** message output on the RS232 serial port. All MCR1000 units transmit the simple ZDA format NMEA message as it contains only time and date updates.

NMEA Message Output – is disabled by default.

Select the RS232 settings button to adjust the baud rate and communications settings for the MCR1000 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 **PuTTY** or the output may be connected to other devices or apps that accept NMEA 0183 messages.



Input and Output NMEA with GPS

The MCR1000 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 MCR1000 will use any one of the following NEMA messages for time synchronization.

\$GP ZDA

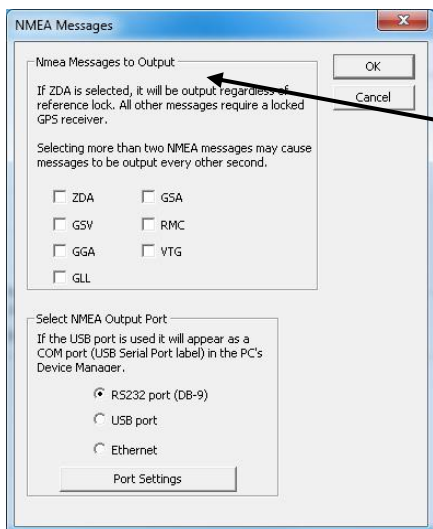
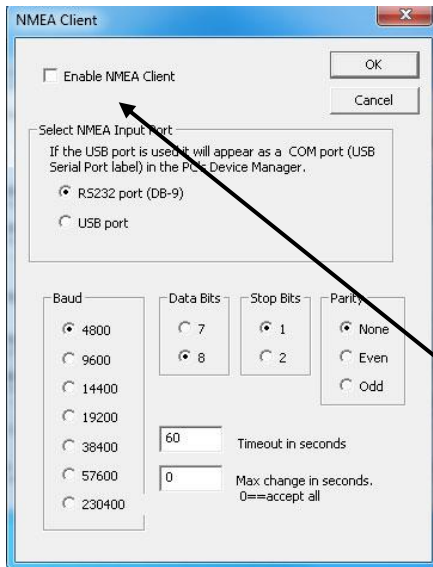
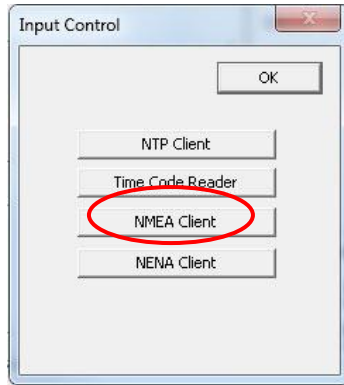
\$GP RMC

\$GP GGA

\$GP GLL

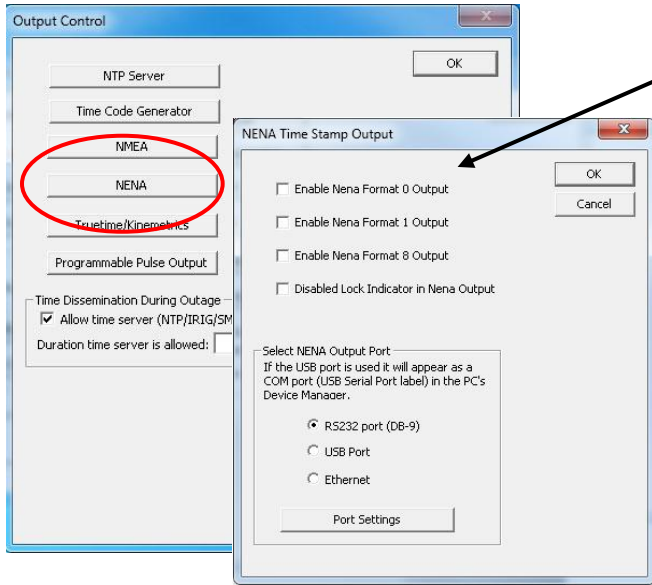
In order to activate and configure your MCR1000 for the NMEA option, please do the following:

1. Open WinDiscovery and click the [**Discover**] button. 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 1000** 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 these windows, but keep open the Device Settings
9. Click on the [**Output Control**] button
10. Click on [**NMEA**] to reveal the “NMEA Messages” window with the **NMEA Messages to Output** box. Here you may select which one of the seven GPS sentences (**ZDA/GSA/GSV/RMC/GGA/VTG/GLL**) is appropriate for your needs
11. Select a new “**NMEA Output Port**” if necessary
12. When done click the [**OK**] button.
13. Click [**OK**] on the NMEA Client window. Then click the [**Save and Close**] button on the Device Settings window.



Output NENA with GPS

The ability to access the NENA (National Emergency Number Association, otherwise known as the 911 system) signal is standard to the MCR1000, but requires the GPS option to operate to NENA requirements. To configure the **NENA** input see the instructions on page 24, which are identical to the **NEMA** input. To configure the **NENA** output settings, follow these instructions:



Open the Display Settings (DS) and the Output Control (OC).

Click on the **[NENA]** button – to provide access to the “**NENA Time Stamp Output**” window. Select your preferred format from the four choices. Select and modify the output port.

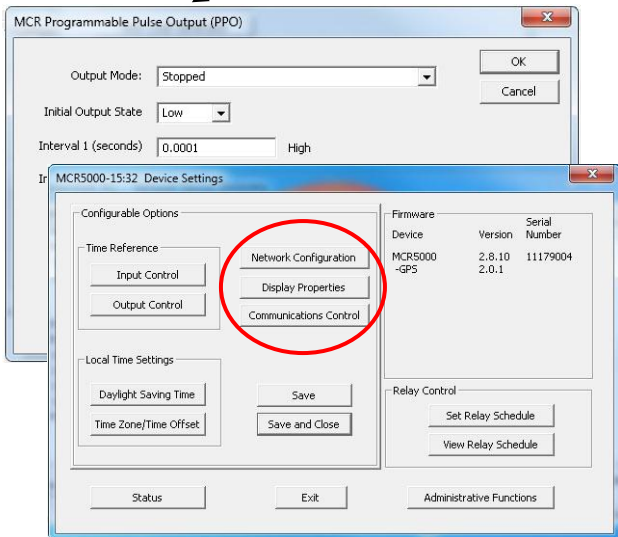
DS > OC > TRUETIME/KINEMATICS – This button enables selection of this output and adjustment of the port settings.

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** window may be viewed in summary by clicking the **[Network Configuration]** selection.

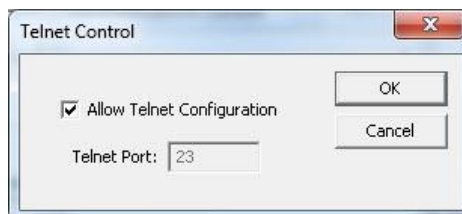
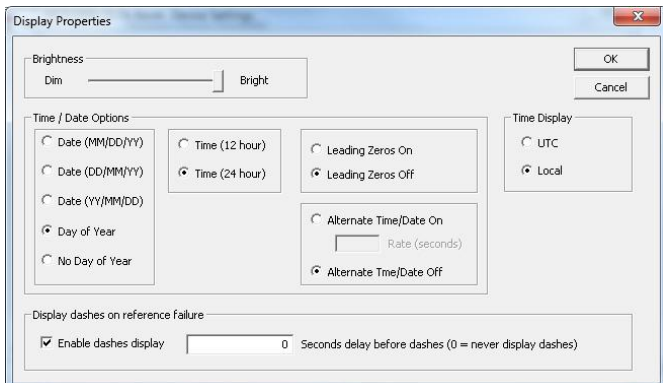


DS > DISPLAY PROPERTIES

Here (below left) 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. This gives access to the Telnet Control window (below), which you may allow and set a new port for, or retain the default port: **23**.



DS > 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.

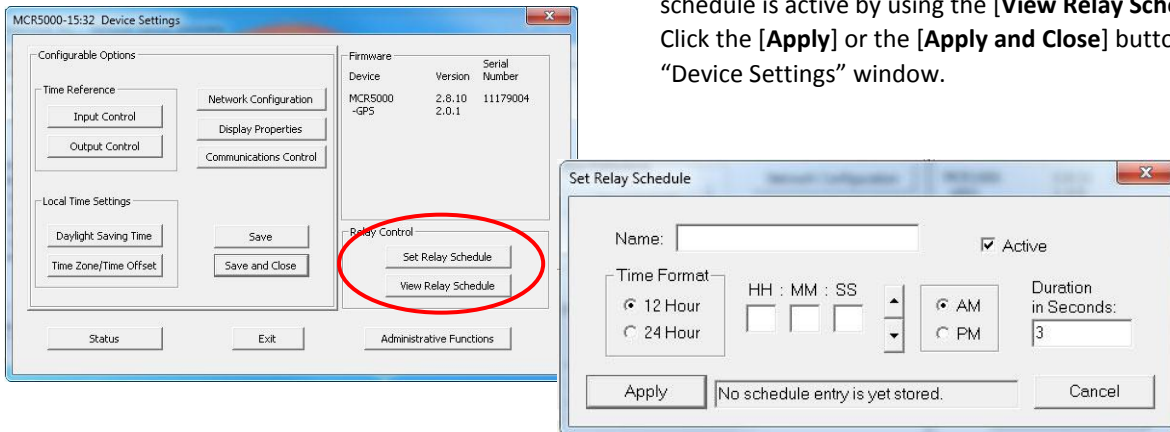
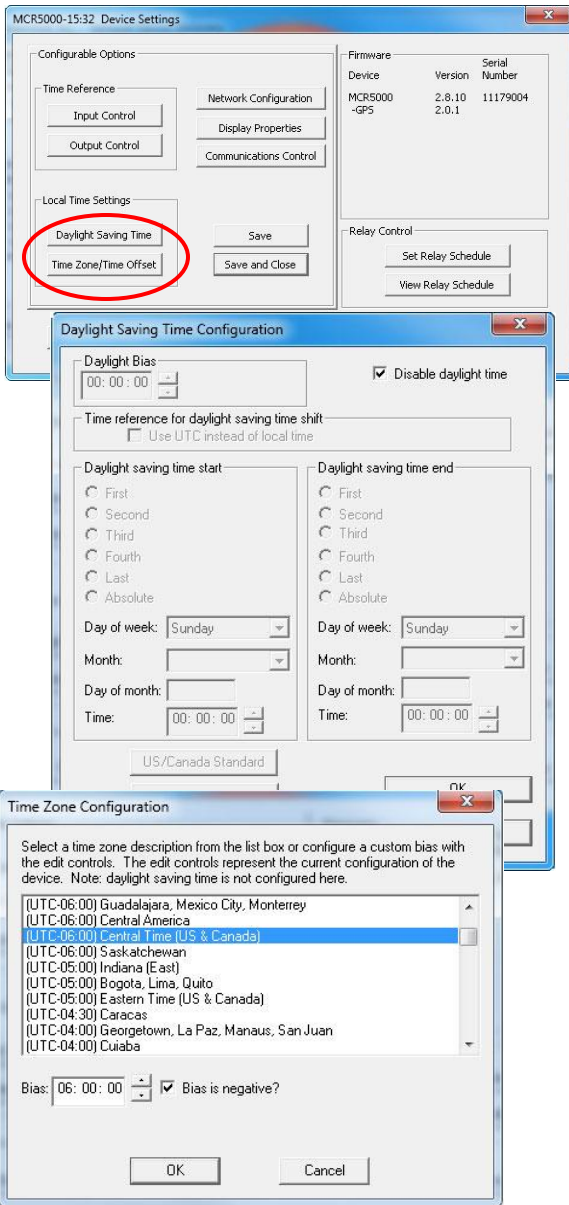
The DST rules will be saved when you click either the [Apply] button or the [Apply and Close] button on the “Device Settings” window.

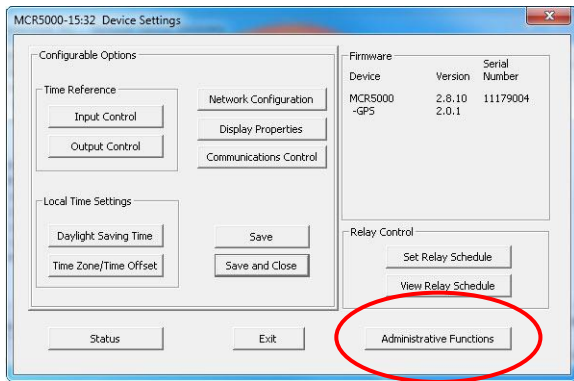
DS > TIME ZONE/TIME OFFSET

Click the [Time Zone/Time Offset] button 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. Click the [Apply] or the [Apply and Close] buttons on the “Device Settings” window.

DS > RELAY CONTROL: SET RELAY SCHEDULE VIEW RELAY SCHEDULE

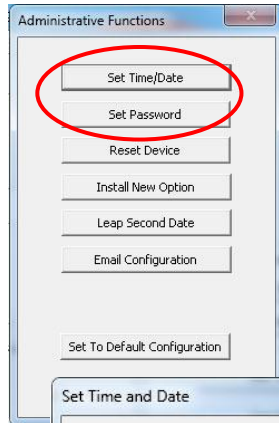
Set a schedule of relay switch events with the [Set Relay Schedule] button. Once a schedule has been applied to the MCR1000, the current relay schedule information can be retrieved to validate the entry was made correctly and the schedule is active by using the [View Relay Schedule] button. Click the [Apply] or the [Apply and Close] buttons on the “Device Settings” window.





DS > ADMINISTRATIVE FUNCTIONS (AF)

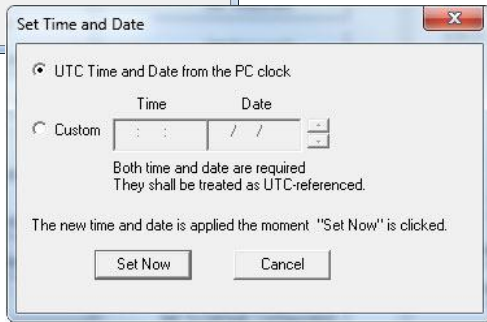
Click the **[Administrative Functions]** button to open a menu that is rarely accessed. These include: 1. **[Set Time/Date]** (for custom time, not UTC or local time); 2) **[Set Password]**; 3) **[Reset Device]**; 4) **[Install New Option]**; 5) **[Leap Second Date]** (input this whenever announced);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



DS > AF > SET TIME/DATE WINDOW

There may be situations where you do not want to display UTC or local time. This feature may be most useful for demonstrations, in lab situations or in environments where an external reference time signal is not available. Use this 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]**.



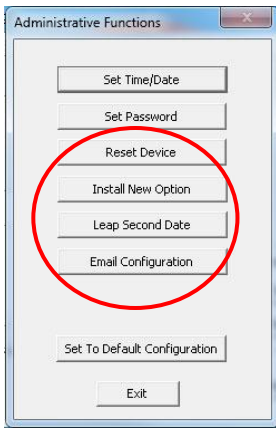
In the **"Set Time and Date"** window (left) click the **[Custom]** button to enter your new time and date. Click the **[Set Now]** button to activate your custom time. To return to UTC time choose **[UTC Time and Date from the PC clock]** then click **[Set Now]**.

DS > AF > SET PASSWORD

Click the **[Set Password]** button 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 have to reset the MCR1000 to its factory default settings. That reverts back to 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

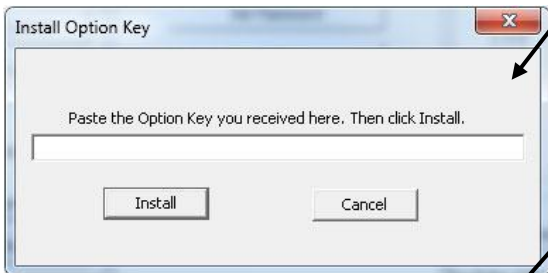
Click [**Rest Device**] to induce a soft reset. This procedure allows the MCR1000 to clear its current communications buffer and re-initialize its processing, which includes another software request for a DHCP address. This feature is intended to allow the user to remotely reset the unit and does not 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.



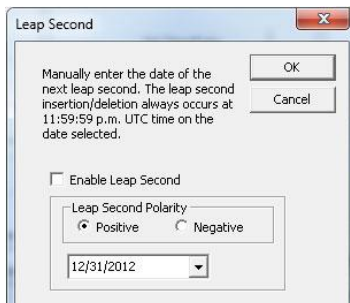
DS > AF > INSTALL NEW OPTION

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



DS > AF > LEAP SECOND DATE

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

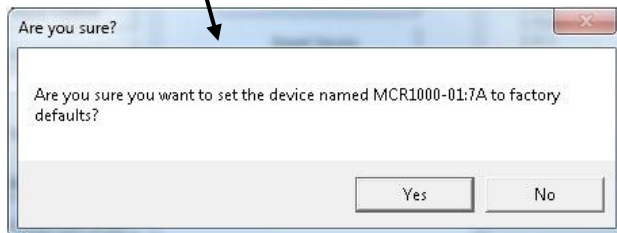
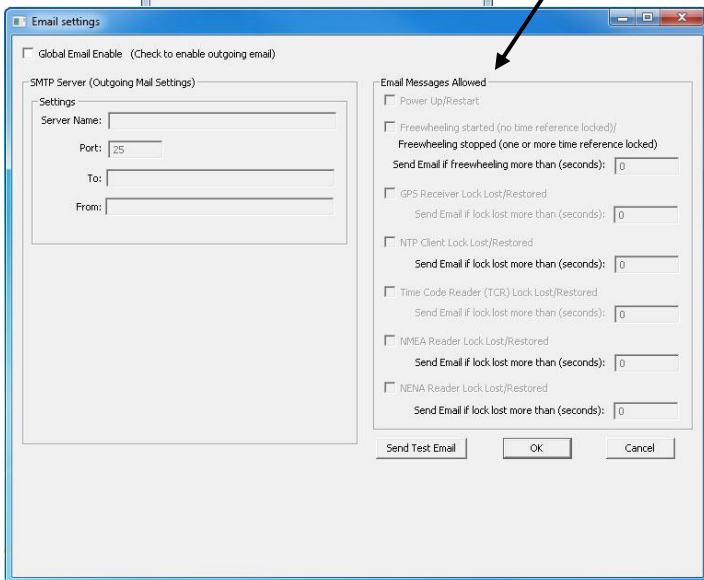


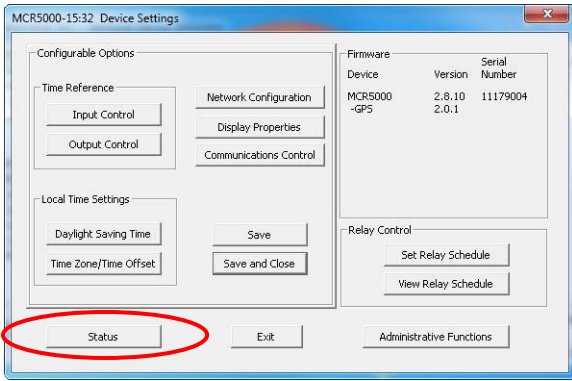
DS > AF > EMAIL CONFIGURATION

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

DS > AF > SET TO DEFAULT CONFIGURATION

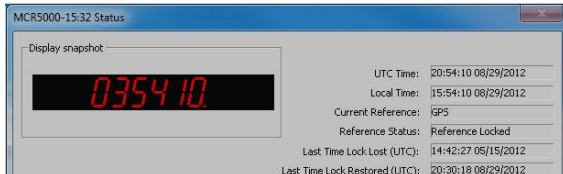
Click the [**Set to Default Configuration**] button to reset all of your previously entered options and customs settings back to the original factory settings. You will get the “Are you sure?” window. Click the [**Yes**] button if you are sure you want to return to the default configuration with the default password: **“public”**.





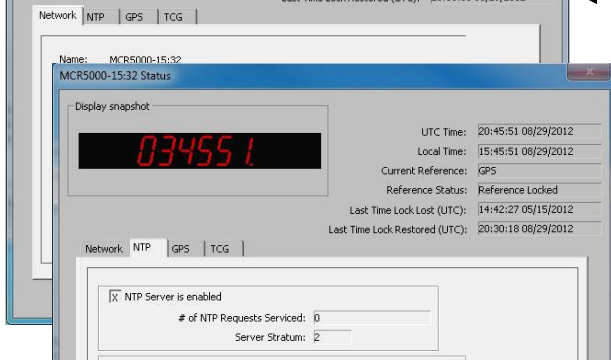
DS > STATUS

At the bottom left of the “MCR1000 Device Settings” window is the [Status] button. The “MCR1000 Status” window includes a “Display Snapshot” of a graphic digital clock representing the face of the actual MCR1000 in real time. 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.

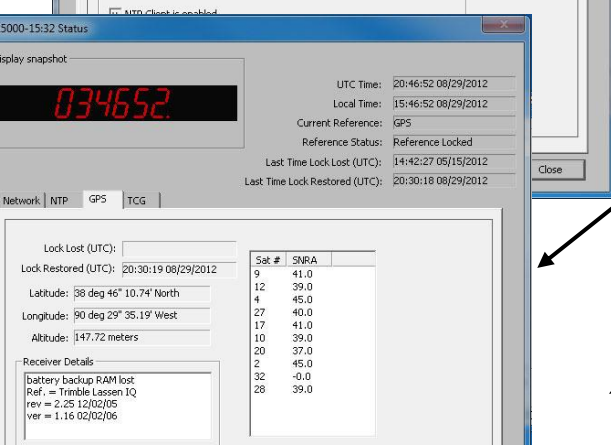


Below these listings are tabbed windows for **Network**, **NTP**, **GPS** and **TCG**.

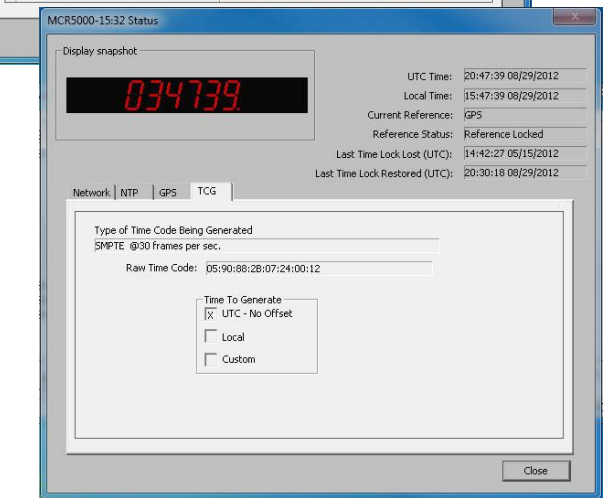
Network Tab - includes the name of the device, the model of the device and a summary of the network configuration, much of this data is repeated from the network configuration window described earlier (page 20).



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.

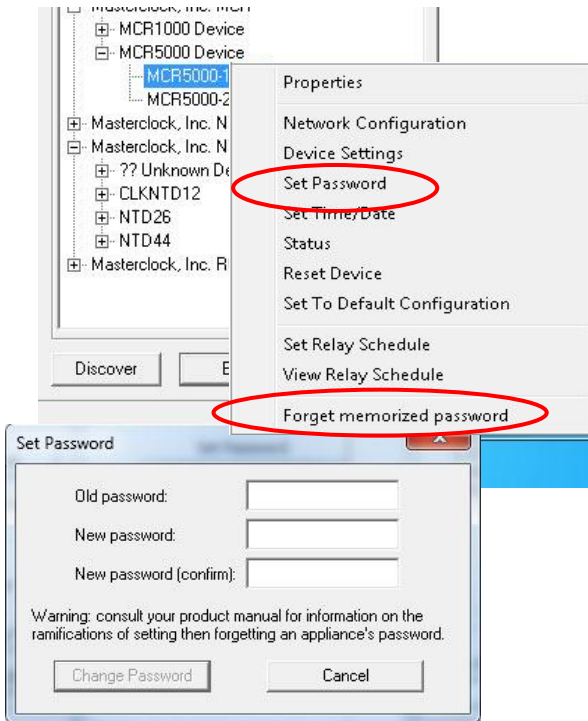


GPS Tab - includes time and date for Lock Lost (UTC), Lock Restored (UTC), your geographical position, receiver details and a list of the satellites the GPS antenna is listening to (in this case nine) and their individual SNR (signal-to-noise ratio, with 41.0 as the highest quality).



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

Right click the device to bring up this menu



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 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 it.

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]** button and you will not be prompted for the password, until you restart WinDiscovery. Or you can use the **Global Password** feature (see 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 password(s) again for each device.

You can also remove the incorrect password entry during a WinDiscovery session by going to the drop-down menu for the device (right click to see this) and selecting the **[Forget memorized password]** button.

GLOBAL PASSWORD

The **Global Password** feature allows the user to enter a single password once for all NTP devices. During subsequent sessions you will not have to reenter the password.

ENABLING / DISABLING GLOBAL PASSWORD

To enable the Global Password:

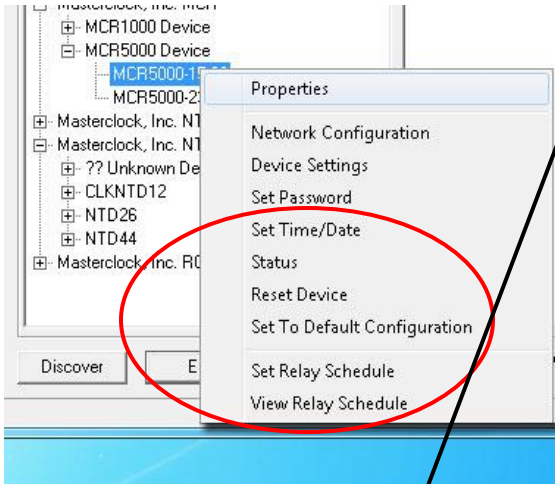
1. Check “**Enable Global Password**”
2. Type your password.
3. Click **[OK]**

To disable the Global Password:

1. De-select the “**Enable Global Password**” checkbox
2. Click **[OK]**.

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**”.

**FROM THE RIGHT CLICK PROPERTIES MENU
THE FINAL SIX CONFIGURATIONS:**



SET TIME/DATE

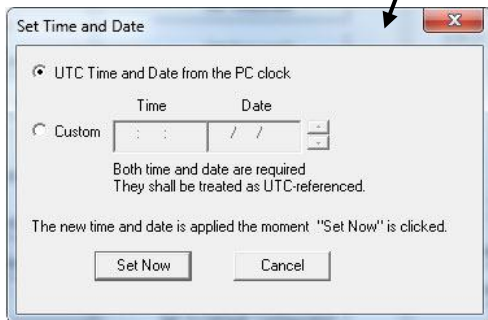
Click the [Set Time/Date] button and a window appears reminding the user, “This feature is only to be used to set the UTC time and date if the device is not locked to a reference and is free-wheeling.” Other cautionary remarks follow. At the bottom of the window you may choose to continue or not. If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

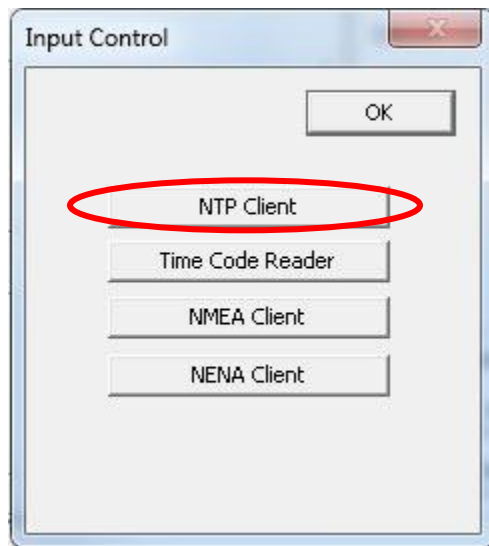
SET RELAY SCHEDULE

See “Set Relay Schedule” window, page 26.

VIEW RELAY SCHEDULE

See “View Relay Schedule” window, page 26.

How to Listen for NTP



DS > IC > NTP CLIENT

To access the NTP addressing modes in the “NTP Client” window, click on the [NTP Client] button on the “Input Control” window (at left).

NTP CLIENT SETTINGS BOX

QUERY NTP SERVER FOR TIME (UNICAST) – The MCR1000 supports this method of NTP packets transfer by default. There is a query and direct transfer of information from the NTP server to the NTP client. Whenever the broadcast or multicast modes are selected the unicast method is also supported simultaneously.

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] radio button.

The broadcast timeout is adjustable under the [NTP Client Advanced Settings] button at the bottom of this window. The default timeout is 3600 seconds (one hour).

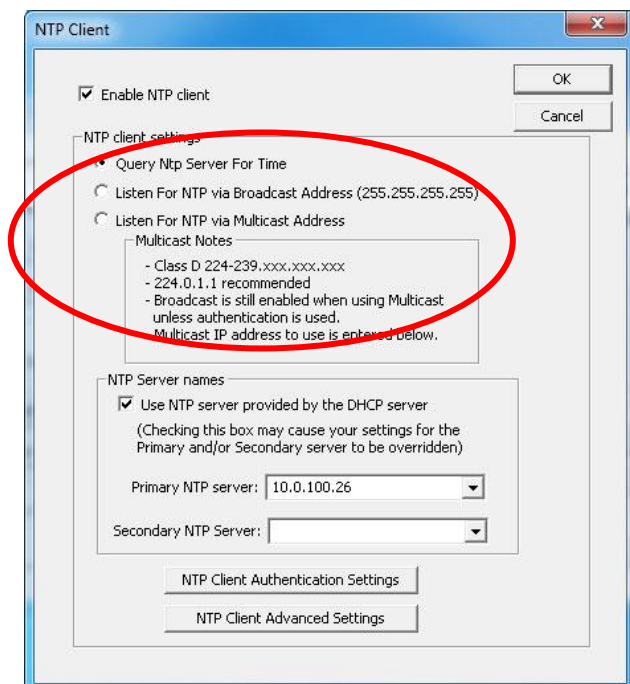
The default broadcast configuration is to query the NTP server at 10-minute intervals. In this mode the clock drift is ± 1 minute per year, with adjustments as needed.

MULTICAST – The network clock can be set up to listen to NTP using multicast addressing by selecting the [Listen for NTP via multicast address] radio button.

When enabled, the Multicast Class D/Group Address (Class D 224-239.xxx.xxx.xxx) may be specified as well as the frequency that multicast broadcasts will be issued. This can be changed as desired in the “Primary NTP server” and “Secondary NTP Server” menu boxes in this window. These groups (or Class D address ranges for multicasting) are defined and governed by **RFC3171, IANA IPv4 Multicast Guidelines**.

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

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



Note: The **ANYCAST** mode is not used.

NTP SERVER NAMES BOX

The default factory setting for network configuration is to [Use NTP server provided by the DHCP server] checkbox.

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**.

If you choose to deselect the default server, you must provide a static IP Address, here called the “**Primary NTP Server:**” Then provide a “**Secondary NTP Server:**”

Similarly, back under the “**Device Settings Window,**” click the [Network Configuration] button and de-select the [Automatically obtain network configuration from DHCP/BOOTP] checkbox. Then provide the IP address, Netmask, Gateway, Primary DNS appropriately.

Devices that cannot find the primary server and 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.

NTP CLIENT AUTHENTICATION SETTINGS

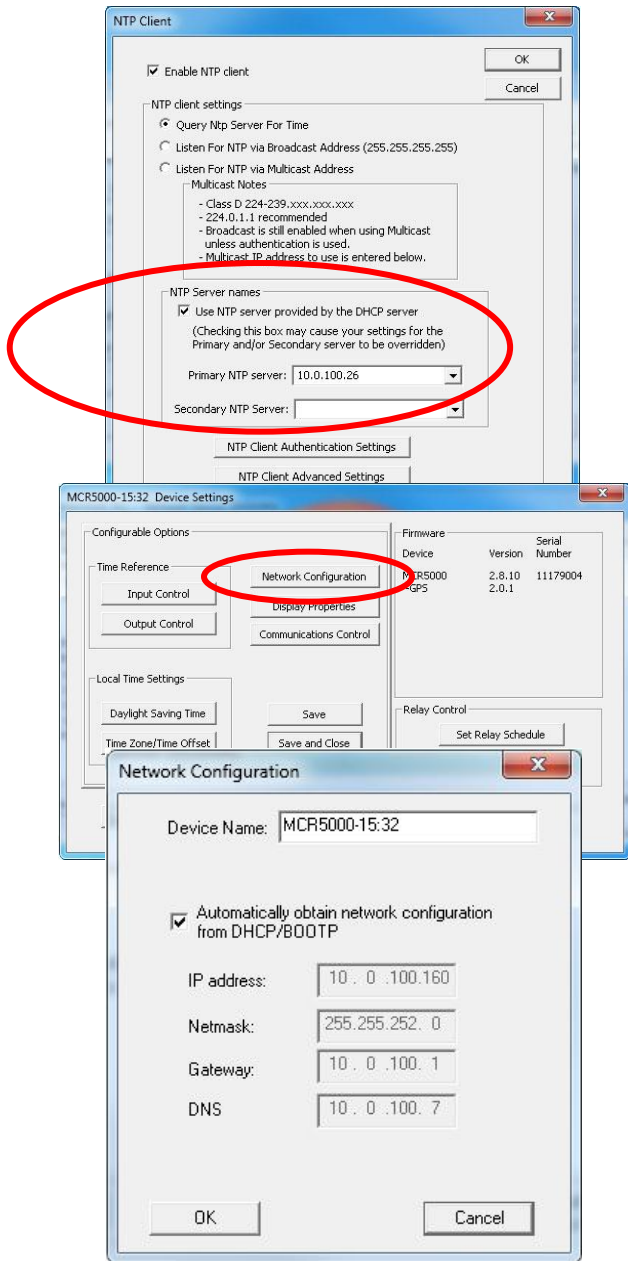
The NTDS series uses the **MD5 Message Digest Algorithm**, which is a widely used cryptographic hash function that produces a 128-bit hash value.

<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**”



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.

Using Telnet



TELNET OPTION

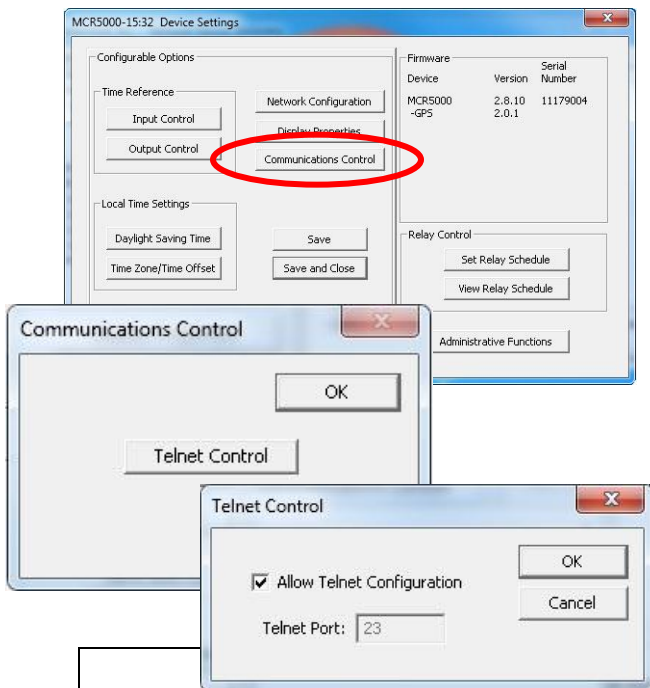
Typically in Windows OS you'll use the free WinDiscovery app to establish first-time networking configuration. However, in other operating systems you may use **Telnet** to configure your DHCP server.

To access the Telnet button, go back to “**Device Settings**” 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 MCR1000 is configured to obtain an IP address via DHCP. 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**.



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 Generator Option

If you have the Time Code Generator Option (page 9) you will need to open the “**Device Settings**” window for your MCR1000, then click the [Output Control] button, then click the [Time Code Generator] button.

The “**Time Code Generation**” window allows you to choose the “**Type of Time Code to Generate**” and the “**Coded Expression**”. Modify these options to fit your location.

Then, within the “**Time To Generate**” box, select **Local Time** or **Custom Time** if different than the **UTC** default.

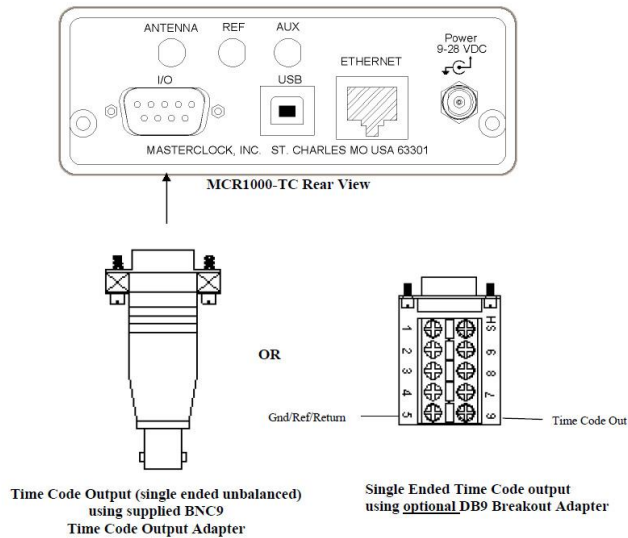
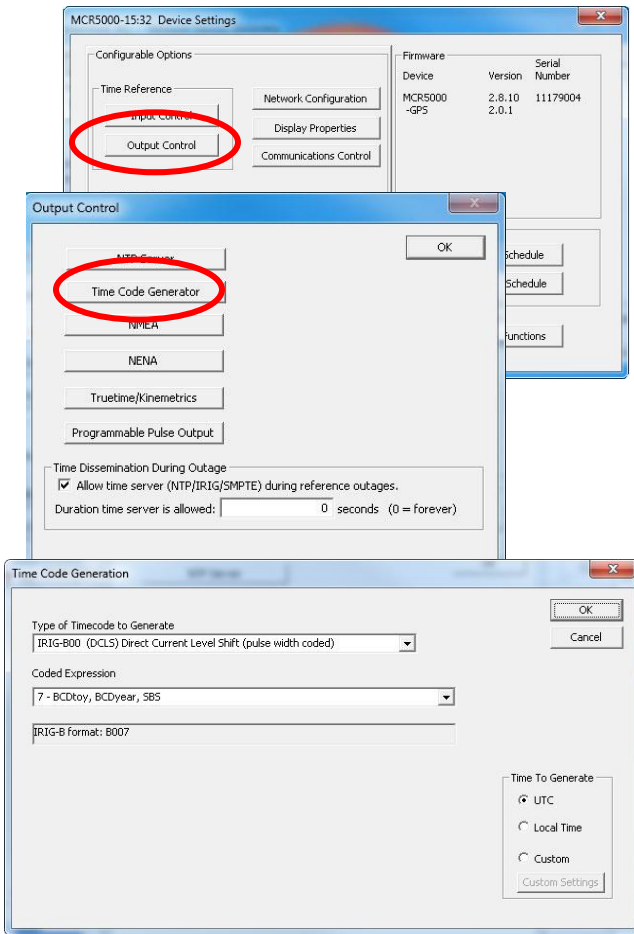
OTHER DROP DOWN MENUS

Depending on your options, other drop down menus will appear in this Time Code Generation window.

In the “**Type of Timecode to Generate**” window all IRIG choices create two further dropdown windows, as shown at left. SMPTE choices create one drop down menu and a checkbox.

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

Click the [OK] button when all your choices have been made.

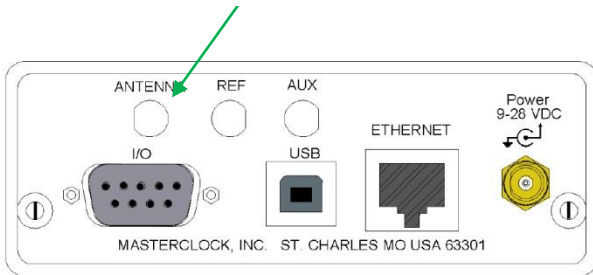


OUTPUT TIME CODE CONNECTIONS

Connect the Time Code signal cable to a DB9 breakout adapter supplied with the unit and then to a valid UTC referenced Time Code signal source.

GPS Input Option

GPS ANTENNA – SMA FEMALE



Note: All components of the GPS system (including the MCR1000 unit with GPS receiver, power supply, GPS antenna and antenna cable) are tested as a system at the factory before shipment.

Be sure:

- 1) the GPS antenna, the MCR1000 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 MCR1000 with GPS option installed since the unit has been factory tested as a system with the antenna cables and antenna before shipment.

With the GPS input option the MCR1000 derives precision UTC time from satellites. The MCR includes an internal receiver that requires a pre-amplified GPS antenna.

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 MCR1000 has achieved satellite lock (explained below). Route the antenna cable to the back of the MCR1000.
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 MCR1000.

START-UP AND GPS SATELLITE ACQUISITION

When the MCR1000-GPS is initially powered up the time to acquire satellites and extract correct time is typically 5 to 15 minutes. In less than 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 MCR1000 should start up much faster.

GPS LOCK RELATED ISSUES AND TROUBLESHOOTING TIPS

The following problems are specific to the MCR1000 with GPS option installed. These should be considered only after the 25-minute satellite acquisition time has elapsed.

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.



SYMPTOMS, REASONS AND 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 5, green, PWR) will flash once per second when locked to GPS.

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

The MCR1000 must first acquire an initial lock to GPS before it will serve accurate 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.

Some procedures to consider:

1. **Wait** at least 20 to 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 can be quite lengthy since the receiver must update its internal almanac and ephemeris data from the satellite signals.
2. **Make sure** the GPS 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 MCR 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 MCR1000 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 MCR1000 with a GPS option. Order your first MCR1000 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 MCR1000 with a GPS module installed requires a pre-amplified antenna. The MCR1000 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 MCR1000 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 MCR as you would any electronic device. Do not subject the assembly (particularly the antenna input connector) to electrostatic discharge (ESD) during handling. When handling or installing the device, observe proper ESD protection methods. At a minimum, discharge yourself to a convenient ground before handling the MCR. Preferably, use a static discharge wrist strap connected to Earth ground when handling, installing and/or configuring the device.
7. **Inappropriate power application:** The MCR-GPS 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 antenna) caused by a short circuit, make all 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 MCR-GPS receiver unit.
9. **Damage during installation:** The GPS antenna cables can be damaged by pulling and twisting the connectors. You should also avoid pinching and over-bending the cables. Such abuse 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.
10. **Coiling** If the cable is to be coiled for storage, the coil diameter should be at least six inches for quarter-inch cable, twice that for larger cable diameters.

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

NMEA and the RS-232 Interface

Pin	Signal	MCR1000 signal name
2	TxD	Transmit Data
3	RxD	Receive Data
5	SG	Signal/System Ground

DS > OC > NMEA

In order to receive NMEA (National Marine Electronics Association) 0183 sentences (messages), the RS-232 interface [DB-9 male connector] may be used to connect your PC with your MCR1000.

Unless the GPS option is included, only ZDA sentences will be output as they contain only UTC time and date signals. Other sentences with latitude and longitude data are available with the GPS option (page 40).

SERIAL PINOUT FOR RS-232

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 MCR1000 serial port pinout is defined at left. RS-232 communications from a standard IBM PC or compatible host computer use a standard straight thru cable (3 wires only: pins 2, 3 and 5).

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

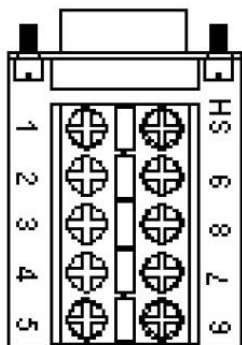
The RS-232 port can be configured for baud rates of 4800, 9600, 19200, 38400, and 57600; along with 7 or 8 data bits, 1 or 2 stop bit. The parity bits can be selected as None, Odd, and Even.

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

FOR OTHER TYPES OF RS-232 RECEIVERS

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 MCR1000 cannot decode TTL-level serial communications at pin 2 and 3 of the DB-9 connector.



DB9 Breakout Adapter
(item sold separately)

- Ensure that any cable you are using for communication with the MCR1000 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

ADDITIONAL NMEA MESSAGES TO OUTPUT WITH THE GPS OPTION

The MCR1000 can output additional NMEA 0183 sentences (aka: messages). If you have the GPS option these can be accessed by simply checking the appropriate boxes (at left) on the “NMEA Message” page.

ZDA - GSV GGA GLL GSA RMC VTG

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 sentences will be output with information coming in from at least four satellites per sentence. It would help to manually increase the baud rate (maximum = 57600) when adding additional sentences to help increase delivery capability.

SELECT NMEA OUTPUT PORT

The first two selections (**RS-232** and **USB**) produce a “**Port Settings**” window (lower left) with preselected [**Baud rate**], [**Parity**], [**Number of Data Bits**] and [**Number of Stop Bits**] buttons.

RS232 PORT SETTINGS

On the “**NMEA Messages**” window select the [**RS232 settings**] button. Click on the [**Port Settings**] button to adjust the baud rate and communications settings. Select from baud rates of 4800, 9600, 19200, 38400, 57600 and 230400.

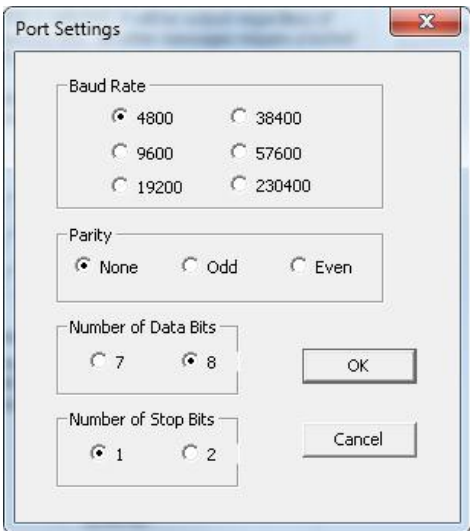
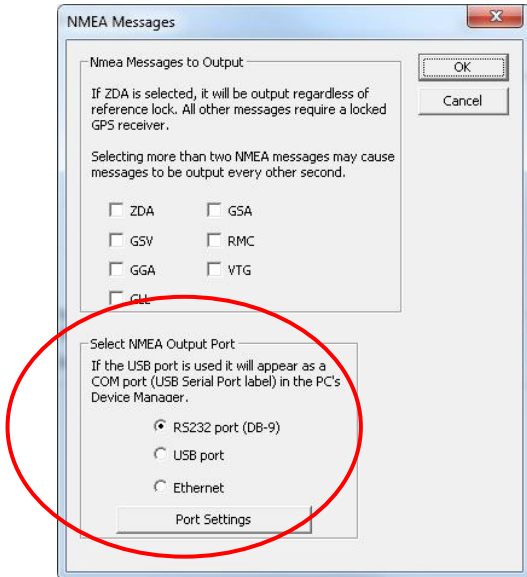
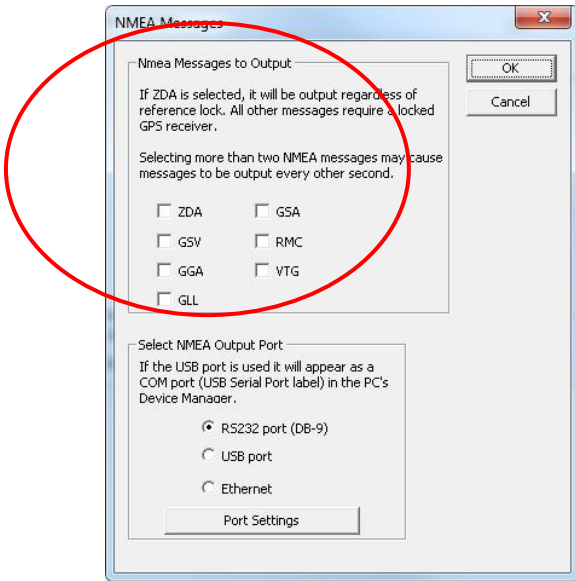
The parity bits can be selected as None, Odd, and Even.

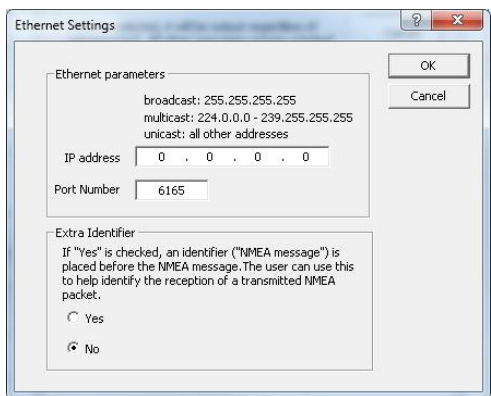
The number of Data Bits can be set to 7 or 8.

The number of Stop Bits can be set to 1 or 2.

The **default settings** are 4800 baud, 8 data bits, no parity, 8 data bits and 1-stop bit.

THE USB BUTTON REVEALS SIMILAR SETTINGS.

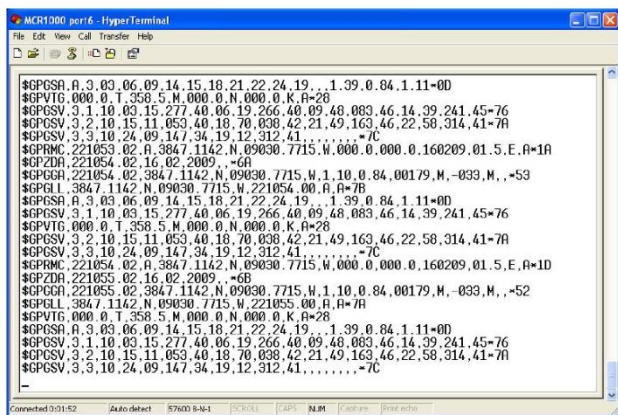




ETHERNET SETTINGS

The third selection from the “NMEA Output Port” box produces the window at left, “Ethernet Settings.” Here you may adjust the “IP Address” and “Port Number.”

You may also select to output an “Extra Identifier” to precede every NMEA message by clicking the [Yes] button.



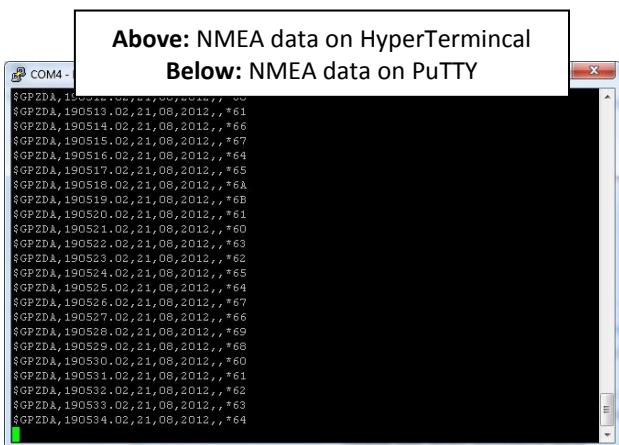
STREAMING NMEA DATA USING HYPERTERMINAL

Incoming NMEA sentences may be monitored on a legacy PC OS using HyperTerminal (at left) which was bundled with earlier versions of Windows. HyperTerminal Private Edition and HyperACCESS are paid upgrades that continue to support more recent versions of Windows. The HyperTerminal image at left was provided by a legacy system. It portrays several seconds of satellite data.

STREAMING GPS DATA USING PUTTY

For those of you with a more recent PC OS you may access several sentences of GPS data by using PuTTY.exe (at left).

1. Assuming all electronic connections have been made...
2. **Open** WinDiscovery.
3. **Click** on the [Discover] button.
4. **Right click** on your MCR1000 to reveal the **MCR1000 “Device Settings”** window.
5. **Click** on the [Output Control] button.
6. **Click** on the [NMEA] button.
7. That reveals the “NMEA Messages” window. In the upper box, **select ZDA** or any other NMEA sentence.
8. In the lower box (NMEA output port), **select the [USB port]** button and click on [Port Settings].
9. **Select** your BAUD rate (e.g. 9600). Parity = None. Number of Data Bits = 8. Number of Stop Bits = 1. Click [OK].
10. In the “NMEA Message” window, **click [OK]**.
11. When the “Output Control” window reappears, **click [OK]**.
12. When the MCR1000 “Device Settings” window reappears. **Click [Save and Close]**.
13. When the “WinDiscovery” window reappears. **click [Exit]**.



14. **Open PuTTY.exe.**

15. **Click** the **[Run]** button.

That reveals the “**PuTTY Configuration**” window. On the right **input** your basic options for your PuTTY session:

16. For “Connection Type,” **select** the **[Serial]** button.

17. That reveals “**Serial Line**” and “**Speed**” choices that are automatically filled in. If they need to be changed to match the settings you earlier input to WinDiscovery (step 9), then do so.

18. Click the **[OPEN]** button.

19. This reveals another PuTTY window displaying **streaming satellite data** (at left) incrementally delivered onscreen once per second. ZDA data delivers UTC time and date. Other sentences deliver geographical coordinates.

NTP Client Information

If you want to synchronize PCs, workstations and servers to your MCR1000 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 this client app from Masterclock).

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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>

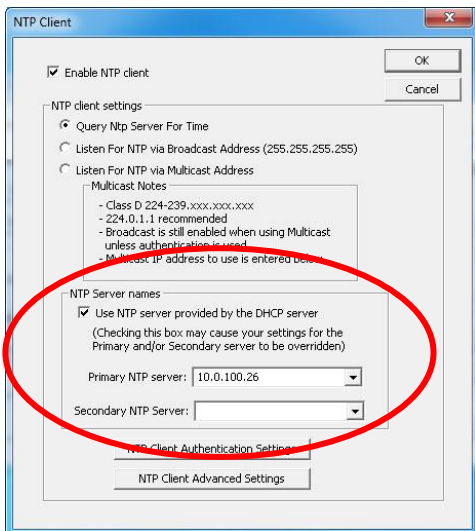
The software is provided as-is, as a courtesy to our customers, with no technical support provided. This application is developed to run under Windows 2000, Windows XP, 7, Server 2003 and 2008 SP-1.

“Soft” Restarts

A ‘soft’ restart may be performed periodically by the MCR1000 to automatically rectify problems it senses:

1. If the MCR is not receiving NTP poll responses;
2. If the MCR is not receiving broadcast responses;
3. Or if the MCR is set to use DHCP and cannot find it.

You will recognize a soft restart when the MCR1000 green PWR LED begins to blink twice per second for a short time. You may even hear a quiet relay click.



THE TIMEOUT PRIOR TO A SOFT RESTART IS TEN MINUTES OR MORE

Several factors can increase the time between soft restarts.

1. All soft restarts will be delayed by two hours if a connection is made by Telnet or WinDiscovery.
2. A 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 be automatically 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.

Synch Problems?

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, try returning the advanced settings to the **default values** shown above.

Also do this if the clock begins acting erratically, performing soft restarts, etc.

Troubleshooting Tips

Software Tip:

WinDiscovery uses bi-directional UDP messaging on port **6163** for both the discovery process and to communicate configuration. It also sends status packets to and from all Masterclock network devices on this port.

Delivery of UDP messages (packets) is NOT guaranteed.

Intermittent problems with WinDiscovery?

Try closing the current session and restarting the application. If this does not resolve the issue try some of the trouble shooting tips listed here. If this fails, switch to an alternate method of configuration, such as Telnet.

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**.

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

All MCR1000 units are fully checked and system tested at the factory for proper operation before shipment. Unless physical damage is found, the unit is probably functional.

The following problems can probably be readily solved by the customer/user.

PROBLEM:

Unable to find (discover) the new MCR1000 on the WinDiscovery network of devices

POSSIBLE REASONS/SOLUTIONS:

1. Verify that you have supplied power to the MCR.
2. Verify that all the network cables, hubs, etc. are in proper working order.
3. Be sure that no Ethernet crossover cables are being used where inappropriate.
4. After clicking the **[Discover]** button, wait until the status indicates 100% completion.
5. Verify that the MCR is a Masterclock brand device. WinDiscovery is not designed to work with products from other vendors.
6. Verify that the MCR is on the same physical network as the computer from which you are running WinDiscovery.
7. If the computer is separated from the MCR 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 (in both directions) UDP broadcasts on port **6163**
8. Unfortunately, some routers will not forward UDP broadcasts across networks, but WinDiscovery requires this. 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 (in both directions) UDP traffic on port **6163**.
9. Verify that the hub/router/switch is capable of supporting the 10/100MB speed the MCR requires.

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.

10. Verify that a DHCP/BOOTP server is present on the network. If the MCR has been configured to use DHCP for network configuration, but none is present, the MCR may not respond to discovery requests for up to twenty seconds after power-on.
11. Reset the MCR to initiate a new DHCP IP address request, or use the static IP address mode.
12. Consult your network system administrator to obtain a list or range of available IP addresses.

PROBLEMS:

1. WinDiscovery finds the MCR1000, but the status display is intermittent or not updating.
2. The MCR1000 clock is not responding to configuration changes made in WinDiscovery.
3. Now that the MCR1000 is hooked up other device(s) do not appear in WinDiscovery.
4. The status or settings characters are garbled.

POSSIBLE REASONS/SOLUTIONS:

1. WinDiscovery may have been left open too long and the MCR's configuration may have changed during the session. This can occur if the DHCP server has issued new or refreshed addresses without alerting you. Remedy: close and restart WinDiscovery.
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. Heavy network traffic reduces the bandwidth and/or causes collisions with the UDP messages/packets. Heavy traffic can cause WinDiscovery to show outdated or garbled information. Remedy: Press the [**Discover**] button again and wait until the process completes to refresh WinDiscovery.
6. Take steps to increase the bandwidth and/or reduce network traffic. If this is an ongoing problem, consider the Telnet method or move the MCR to an isolated LAN.

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 used, 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.

PROBLEMS:

1. MCR1000 name appears in RED in the WinDiscovery.
2. MCR1000 is assigned an IP address of 169.254.xxx.xxx.
3. MCR1000 is not maintaining its assigned IP address.
4. Function is erratic. Appears to periodically reset.

POSSIBLE REASONS/SOLUTIONS:

1. Incorrect network configuration may cause the MCR to receive a fallback IP address or perform soft restarts. Verify that the IP address is correct. If you manually enter (or DHCP assigns) an IP address that already exists on the network, this will create a conflict. The MCR 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 at the bottom of the **“MCR Status”** window for messages.
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. The DHCP is selected, but the MCR keeps falling back to the **169.254.xxx.xxx** address because the Ethernet interface keeps reinitializing. Once the MCR is successfully communicating with a DHCP server, the reinitializing will cease. Careful: if a discovery is performed while these fallbacks are occurring reinitialization could be delayed by two hours.

PROBLEM:

MCR1000 appears to 'reset' periodically.

POSSIBLE REASONS/SOLUTIONS:

1. Check the network connection and setup. If DHCP is enabled and a DHCP server is not active on the network the clock will hesitate periodically while attempting to resolve DHCP configuration. To correct the problem, switch to manual networking configuration (set a Static IP address) or determine why the local DHCP server is not operating.
2. If the MCR1000 cannot resolve its DHCP address in DHCP mode the MCR1000 will periodically perform a soft restart to reinitialize its communication port and DHCP configuration.
3. If the MCR1000 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:

MCR1000 Unable to communicate with Telnet.

POSSIBLE REASONS/SOLUTIONS:

1. If the MCR1000 has been configured to use DHCP for network configuration, but no DHCP/BOOTP server is present, the MCR1000 may not respond to discovery requests for up to twenty seconds after power-on.
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 MCR1000 does not have the Telnet interface disabled.

PROBLEM:

NTP/SNTP client is unable to communicate with the MCR1000

POSSIBLE REASONS/SOLUTIONS:

1. Verify that the MCR1000 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 MCR1000 is actually reachable from the client. Try “pinging” the IP address of the MCR1000. If this fails, it is possible that the MCR1000 has an invalid network configuration or that the network is down. Consult your network administrator for assistance.
4. Verify that the MCR1000 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 MCR1000 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 MCR1000 is providing invalid time, or has flagged time as invalid.

POSSIBLE REASONS/SOLUTIONS:

1. The MCR1000 will always answer NTP requests (unless the client is set to use symmetric active mode). The MCR1000 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 MCR1000 power up following a long period without power.
2. By default, the MCR1000 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 MCR1000 does not retain time settings when powered down or up.

POSSIBLE REASONS/SOLUTIONS:

The MCR1000 maintains its internal time in battery-backed memory located using a Real Time Clock (RTC). The battery supplies power, up to 24 hours, 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 (page 51) 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 MCR1000 to the factory default configuration (see page 6). Under factory defaults the MCR1000 will need to 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 MCR1000 you are trying to administer. Change the global password to match that of the MCR1000, 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 or call (636) 724-3666. You may also seek help in the support area of the 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)
- Unicast (Query) mode
- Multicast mode (RFC3171 IANA IPV4 multicast guidelines)

Configuration

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

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 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)

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

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

Serial Port

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

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)

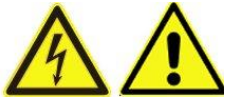
Accuracy NTP Client: Network Client
1-10mS typical
10 sec query (default)

Power Requirements

DC input voltage: 9-28 VDC

DC power consumption: <7.5

Caution: No user-serviceable parts are inside the MCR1000. Please contact the factory if you require servicing or repair.



Battery

3V,17 mAh, Coin Cell
Maintenance-free
Rechargeable manganese lithium
Panasonic ML1220/V1A
Supplies power to unit for up to 24 hours



Physical

Size: 4.2 x 6.5 x 1.75 in.

Weight: 1 lbs.

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
Type: DB-9 Male Pins
Pin 1: PPS
Pin 2: RS232 Tx
Pin 3: RS232 Rx
Pin 4: Common
Pin 5: Ground/Return
Pin 6: Time Code Output
Pin 7: Time Code Input (+)
*Pin 8: Time Code Input (-)
Pin 9: Relay Contact

***For unbalanced signal tie pin 8 to ground.**

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

Type: DB-9 Male Pins
Pin 1: PPS
Pin 2: RS232 Tx
Pin 3: RS232 Rx
Pin 4: Common
Pin 5: Ground/Return
Pin 6: Time Code Output
Pin 7: Time Code Input (+)
*Pin 8: Time Code Input (-)
Pin 9: Relay Contact

***For unbalanced signal tie pin 8 to ground.**

Output Impedance: 50 Ohm

Output Signal Level: SMPTE
4 Vpp into 600 Ohm,

High Stability (HS) Level 2 Option

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

Stability: <250mS/year
1x10-11 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 square wave
(AUX) BNC female connector "AUX"

Pulse accuracy: $\pm 200\text{nS}$ post reference loss
Pulse width: 5-20 uSec

GPS Receiver Option

Receiver: Internal,
12 Channel Simultaneous/Parallel

Antenna: Connector External
SMA Female "Antenna"

Frequency: L1, 1575 MHz \pm 10 MHz

RF Bias to antenna: 3V DC, center pin

Pulse duration: ± 50 uSec pulse when locked

Standard Antenna Option

External pre-amplified
antenna (required): L1 , 1575 MHz \pm 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 Options

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

Relay Rating

Input contact rating: up to 24 VDC
250 mA max

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

Programmable Pulse Output (PPO) Option

Type: Rising Edge Triggered, +5V, TTL

Output Impedance: 50 Ohm

Pulse Interval: 100 μ Sec to 3 days

Pulse Width: 10 μ Sec to 100 mSec

DB9 Connector RS-232 I/O Summary

Type: DB-9 Male Pins

Pin 1: PPS

Pin 2: RS232 Tx

Pin 3: RS232 Rx

Pin 4: Common

Pin 5: Ground/Return

Pin 6: Time Code Output

Pin 7: Time Code Input (+)

*Pin 8: Time Code Input (-)

Pin 9: Relay Contact

Accuracy: Same as currently selected
reference source

***For unbalanced signal tie pin 8 to ground.**

Limited Warranty

This Masterclock product warranty extends to the original purchaser.

Masterclock warrants this MCR1000 against defects in materials and workmanship for a period of one year 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 MCR1000 to Masterclock for repair service. Please contact the factory for **RETURN AUTHORIZATION** before returning the unit. When you return your MCR1000 for service, you must prepay all shipping charges, international duty, and taxes.

Contact Us

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