

Time Code Reader - Network Time Protocol Server
for
Windows 2000[®]/Windows NT[®]



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INTRODUCTION

The Masterclock, Inc. Time Code Reader - Network Time Protocol server (TCR-NTP server) is an NTP version 3 compliant mode four server for use with MCR-series Master Clock Reference cards and TCR-series time code reader cards. It is specifically designed for networks where local and uninterrupted timing information is necessary or networks with limited Internet connectivity. Using the Network Time Protocol (NTP), accurate timing information can be distributed over many types of platforms using many freely available or proprietary NTP clients and secondary servers.

MODES OF OPERATION

The TCR-NTP server was specifically designed to operate as a primary (NTP stratum 1) reference server. The server is directly coupled to the MCR-series or TCR-series card kernel mode driver installed by the time synchronization software that came with the card (GPCPC + MCR and TCRSync respectively). Coupled with a time source such as the Masterclock GPS-200A, the TCR-NTP server becomes a very accurate primary server.

The TCR-NTP server will not operate in a peer to peer mode. It is not designed to synchronize to any other reference server. This does not mean that the TCR-NTP server is not scalable, if other servers use the TCR-NTP server as their primary reference server, a timing network can be established that can service the timing needs of thousands of platforms with accurate time.

The TCR-NTP server has two modes of operation. The first mode of operation sets up the TCR-NTP server as the only NTP server on the network. Each NTP client then sends a time request to the TCR-NTP server for its timing information. This approach is satisfactory for small to mid-size networks as shown in Figure 1.

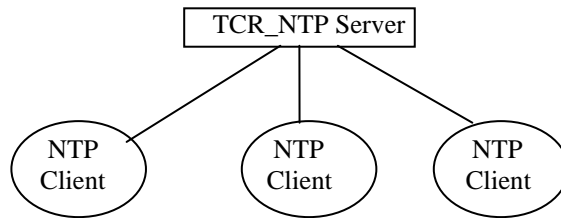


Figure 1. A representation of a small network using NTP

The second mode of operation sets up the TCR-NTP server as the primary (NTP stratum 1) server. Secondary (NTP stratum 2) reference servers then synchronize to the TCR-NTP server. The secondary reference server then provides the NTP client with its timing information. With this approach, many platforms can be serviced in large networks as shown in Figure 2.

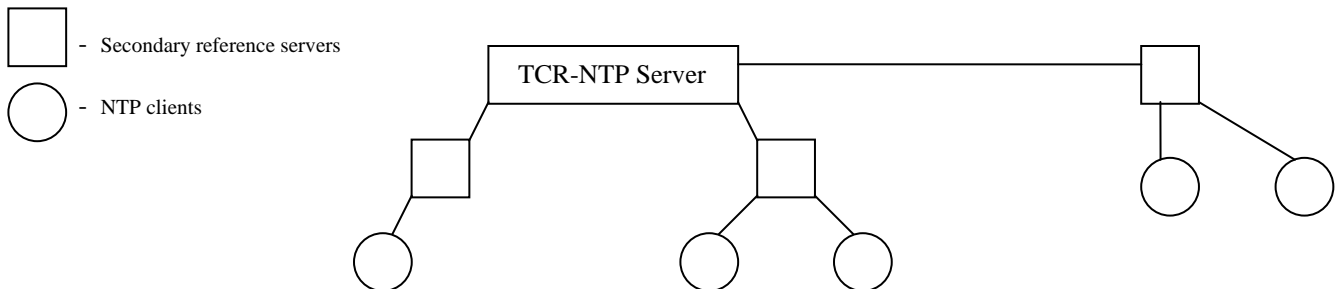


Figure 2. A representation of a larger network using NTP

As with any socket application, there is a limit to the number of clients that can be serviced in a timely manner. This limits the number of simultaneous requests the socket application can service without allowing data packets to “time-out”. This doesn’t mean the NTP client platforms will not synchronize to the TCR-NTP server if it has reached a saturation point. Most well behaved NTP clients will re-transmit their request when they recognize that their original request has timed out. At some point in this loop, the client software will be serviced and the platform will be synchronized.

There is no set rule governing when a network should utilize secondary reference NTP servers. Empirical analysis of the NTP client software to determine how many times the client software must submit a NTP request before being serviced is about the easiest method to determine if secondary servers are needed. If the TCR-NTP server is not servicing your NTP clients in a manner acceptable to your timing needs, you probably need secondary reference servers on your network.

REQUIREMENTS FOR TCR-NTP INSTALLATION

TCR-NTP server requirements:

- Microsoft Windows 2000 Advanced Server, Server, or Professional, or Microsoft Windows NT Server or Workstation, version 3.51 or higher.
- Windows 2000/NT TCP/IP network services installed
- 2 MB free disk space on the drive on which TCR-NTP server will be installed
- Either:
 - GPSPC + MCR for Windows 98, NT & 2000 installation, or
 - TCR500 for Windows 2000/NT installation utilizing SMPTE time code at UTC - no offset.
- User must have local “administrator” permission on machine
- System resolution must be a minimum of 256 color VGA

Notes:

1. TCR-NTP server must be on a computer with a static IP address. It will not work using an IP address assigned by a DHCP server.
2. TCR-NTP server will operate on any type of hardware that will support a 2000 or NT installation, but for optimal performance we recommend a minimum of a Pentium or equivalent processor on a PCI bus architecture.
3. You should have the latest version of the appropriate Windows 2000 or NT service pack applied to your system. Service packs perform upgrades on and correct problems in the Windows 2000 and NT operating systems. The latest service packs for Windows 2000 and NT are available on the Internet at <<http://www.microsoft.com>>. Contact Microsoft technical support for additional information.

Using TCR-NTP with MCR-series cards and the GPSPC + MCR

The GPSPC + MCR software ships with the MCR-series cards. It contains the hardware drivers for the card and the McrSync service. You should have a separate disk and software manual for the GPSPC + MCR software. GPSPC + MCR must be installed and working correctly before TCR-NTP is installed. TCR-NTP utilizes the MCR-series card’s kernel mode driver that is installed into your system by GPSPC + MCR. **Therefore, if you have an MCR-series card, you must install GPSPC + MCR before installing TCR-NTP.**

It is important that McrSync be working correctly before TCR-NTP is installed. If McrSync is not properly synchronizing the local machine’s time then TCR-NTP will also fail to distribute time information.

TCR-NTP does not synchronize the time on the system it is running on. The McrSync service performs this function.

Consult the GPSPC + MCR software manual for information on installing and troubleshooting the MCR drivers and the McrSync service.

TCR-NTP's relationship to TCR500 and TCRSync

The TCR500 and TCRSync software products ship with the TCR-series cards. You should have separate disks and software manuals for TCR500 and TCRSync. The TCR500 software must be installed and working correctly before TCR-NTP is installed. TCR-NTP utilizes the TCR-series time code reader card's kernel mode driver that is installed to your system by the TCR500 software. **Therefore, if you have a TCR-series card, you must install TCR500 and TCRSync before installing TCR-NTP.** Since TCR-NTP does not synchronize the system time of the computer is it installed on, we recommend using the TCRSync-PRO software to perform this function, but TCRSync is not required for TCR-NTP to function correctly.

Date in Time Code

Some time code generators do not encode date into the SMPTE or IRIG-B time code signals. When date is not available, you should answer 'No' to the date availability question during TCR-NTP install. In this scenario, TCR-NTP will use the operating system's date as the date reference. This less reliable configuration requires the operator to maintain a valid/correct date on the server.

Consult the TCR500 and TCRSync software manuals for information on installing and troubleshooting these products.

TCR-NTP Requires TCP/IP Networking Services

TCP/IP support must be installed and working correctly on your system for TCR-NTP to operate. The computer must be assigned a hostname and have a static IP address. Running TCR-NTP on a computer that gets its IP address from a DHCP server is not supported. Consult your Windows 2000/NT manual for proper installation of TCP/IP

INSTALLING TCR-NTP SERVER

Insert the TCR-NTP for Windows 2000/NT installation diskette into a floppy drive.

***Note:** If re-installing the TCR-NTP server, the installation will stop the NTP Server service if it is running.

If installing under Windows 2000:

- Select the *Start* button on the taskbar then choose *Settings* and *Control Panel*
- Select the *Add/Remove Programs* icon in the Control Panel.
- Select the *Add New Programs* button.
- Select the *CD or Floppy* button and follow the instructions given.

If installing under Windows NT 4.0:

- Select the *Start* button on the taskbar then choose *Settings* and *Control Panel*
- Select the *Add/Remove Programs* icon in the Control Panel.
- Select the *INSTALL* dialog button and follow the instructions given.

If installing under Windows NT 3.51:

- From the Program Manager's *File* Menu choose *Run*.
- In the edit box enter the drive in which you inserted the installation diskette followed by *setup.exe*. For example, if you inserted the installation diskette in drive A: you would enter: `a:setup.exe`.
- Select the *OK* button to begin the installation.

Most installation dialog boxes are self explanatory except for the following:

Special Installation Configuration

Freewheeling Dialog Box

The TCR-NTP Server can determine if the primary source of time is a Masterclock GPS-100/200 or a Masterclock MCRGPS card. Under special conditions such as but not limited to unstable atmospheric condition, heavy snowfall, or an insufficient

numbers of satellites in view, the GPS unit will not synchronize to the time transmitted by the GPS satellites for short periods of time. This is a normal phenomenon experienced by almost all equipment that accesses GPS satellite information. The GPS-100/200 continuously monitors for this phenomenon. When the GPS determines it is no longer synchronized with the time transmitted from the GPS satellites, it relies upon a highly accurate (within 170 msec/day) internal counter to maintain its reference time while GPS time is being reestablished. This mode of operation is called “freewheeling”. Freewheeling provides a sufficiently accurate source of time for most applications but might not be appropriate for certain applications.

The TCR-NTP server can be configured to continue serving time if the GPS is in a freewheeling mode. If your timing needs require you to have a time source with greater accuracy than several milliseconds, do not enable the freewheeling mode on the TCR-NTP server, the server will continue to operate but will respond to clients with packets that have the “alarm condition” set, signaling invalid data. The NTP clients will not synchronize to the TCR-NTP server until a valid packet is transmitted. A valid packet will only be transmitted when the TCR-NTP server recognizes the GPS unit is no longer in its freewheeling mode. If freewheeling is not an issue in your network, accept the default setting.

Note - This dialog box is only displayed if your time source is either a Masterclock GPS 100/200 or an MCRGPS card.

Stratum Dialog Box

Otherwise (MCRPCI or TCR-series without a GPS source), you must decide the stratum level of your TCR-NTP server. Stratum classification is only necessary if you plan to use the TCR-NTP server as a primary server to synchronize secondary servers. The stratum classification is encoded into the NTP packet and has a weight value for peer to peer synchronization (server to server). TCR-NTP server only operates as a primary server (mode 4) and cannot be synchronized in the peer to peer mode.

If you have other NTP servers in your system and their time source is of greater accuracy than the time source of the TCR-NTP server, it is suggested that you use a stratum number of 2 or greater. If the TCR-NTP server is the primary source of time in your network and other servers will be synchronizing to the TCR-NTP server, then choosing stratum 1 is acceptable. Otherwise choose the default setting.

Note - This dialog box is only displayed if your time source is not a Masterclock GPS-based source. If your time source is either a Masterclock GPS 100/200 or an MCRGPS card, your server will set itself as a stratum 1 server, and you will not see this dialog box.

Date Availability Dialog Box

When TCR-NTP is installed with a TCR200/500 time code reader card this question may be asked.

Some time code generators do not encode date into the SMPTE or IRIG-B time code signals. When date is not available, you should answer ‘No’ to this question. If you do not know the answer to this question, consult the documentation for the time code source (master clock).

If date is not available in time code TCR-NTP will use the operating system’s date as the date reference. This less reliable configuration requires the operator to maintain a valid/correct date on the server.

NTP Broadcast Dialog Boxes

The TCR-NTP server can be configured to send NTP broadcast messages. If you want your NTP server to do this, select “Yes” in the dialog box. Upon selecting “Yes” the following additional parameters can be specified:

1. Port on which to send broadcasts – the default is 123, acceptable for most networks.
2. Frequency on which to send broadcasts (in minutes) – the default is 2.

INSTALLATION ERRORS

TCR-NTP installation may fail for the following reasons:

The TCR-NTP server installation script generates the following error and warning messages. The error messages will be displayed by the installation script and are set up in the following format:

Error message - Description

Cause:

Solution:

- **ERROR_2000_NT_OS** - This software will only run under Windows 2000 or Windows NT.
Cause:
 - The TCR-NTP server is being installed in a non-2000 or NT operating system.Solution:
 - Install TCR-NTP server on a computer running Windows 2000 or NT.

- **ERROR_NEW_REGISTRATION** - Could not write registration information. Consult manual for further details.
Cause:
 - The installation script cannot write registration information to the installation disk.Solution:
 - Ensure installation disk is not write-protected. Rerun installation setup program. If the problem persists, contact the factory.

- **ERROR_NO_MCR_DLL** - Installation script cannot find the MCR DLL. Install the GPSPC + MCR software before installing the NTP server.
Cause:
 - The installation script could not find the MCR DLL.Solution:
 - Reinstall the GPSPC + MCR software.

- **ERROR_NO_MCR_TCR_INSTALL** - No clock synchronization software is installed on your computer. Install TCRSync software (for TCR cards) or GPSPC + MCR software (for MCR cards) prior to installing TCR NTP.
Cause:
 - The TCR-NTP server calls the TCRSync (with TCR cards) kernel mode driver or the GPSPC + MCR (with MCR cards) for its timing information. TCR-NTP server checks if one of these kernel mode drivers is installed. The TCR-NTP server will not install if one of these kernel mode drivers is not installed.Solution:
 - Ensure TCRSync or GPSPC + MCR is properly installed prior to installing TCR-NTP server.

- **ERROR_NO_REBOOT** – Setup failed to reboot the system.
Cause:
 - Installation program failed to automatically reboot machine. Some possible causes are that the user does not have administrator privilege on the machine or that a running process is blocking the reboot.Solution:
 - Ensure the user installing TCR-NTP server has administrator privilege so required entries to the registry can be completed successfully. If the installation fails to automatically reboot, manually reboot the machine and check for proper operation of TCR-NTP server.

- **ERROR_NO_TCR_DLL** - Setup cannot find the TCR DLL. Install the TCR500 driver software before installing the NTP server.
Cause:
 - The installation script could not find the TCR DLL.Solution:
 - Reinstall the TCR500 software.

- **ERROR_REG_CORRUPT** - NTP setup has determined registration information has been invalidated or corrupted
 - Cause:
 - The installation script runs a checksum on the registration information of the disk. If this checksum is incorrect, the registration has either been corrupted or tampered with.
 - Solution:
 - Contact factory for instruction.

- **ERROR_REG_FAILURE** - Cannot determine previous registration information
 - Cause:
 - The installation script has determined that the copy of TCR-NTP server being installed has been previously installed. While trying to retrieve registration information, installation script has determined that registration information has been corrupted.
 - Solution:
 - Contact the factory

- **ERROR_WRONG_MCR_KERNELDRV_VER** - Installation script has determined that you have the incorrect MCR kernel mode driver version, contact the factory for a update.
 - Cause:
 - The installation script checks the kernel mode driver version number. If the version is not current, the installation script will abort the installation.
 - Solution:
 - Contact the factory for current kernel mode driver. Install the driver.

- **ERROR_WRONG_TCR_KERNELDRV_VER** - Installation script has determined that you have the incorrect TCR kernel mode driver version, contact the factory for a update.
 - Cause:
 - The installation script checks the kernel mode driver version number. If the version is not current, the installation script will abort the installation.
 - Solution:
 - Contact the factory for current kernel mode driver. Install the driver.

OTHER ERRORS

The installation script can generate other system errors. These errors may be due to current system configuration not meeting the minimum system requirements for the scripting engine to operate or incorrect privilege by the current user to install the TCR-NTP server. Ensure user of the system has “administrator” privilege and the system is operating in 256 color VGA resolution. If you are still having problems, please contact the factory.

INSTALLATION WARNINGS

- **WARNING_NODATE** - This configuration of TCRSYNC-NTP must rely on date information from the Windows NT operating system because your time code source does not provide date information. Operation under this configuration may not be desirable for mission-critical applications. Consult the manual or Masterclock, Inc. technical support for more information.
 - Cause:
 - The time code that is being supplied to the TCR does not contain date information.
 - Solution
 - Use a time code signal that has the date information encoded in it.
- **WARNING_NO_README** - Could not load README.TXT.
 - Cause:
 - TCR-NTP installation script could not find or read the TCR-NTP server installation README file.
 - Solution:
 - This README file is located in the same location where you chose to install the TCR-NTP server. Go to this directory and read file with a text editor such as Notepad or Wordpad.
- **WARNING_PRE_TCR-NTP** - A previous version of TCR-NTP Server has been identified on your system. If you continue with the installation, you will overwrite the current installation. Do you want to continue?
 - Cause:
 - TCR-NTP installation script has found a previous version of TCR-NTP server install on the system.
 - Solution:
 - If you continue with the installation, the installation script will overwrite the previous installation.
- **WARNING_PRE_REG** - TCR-NTP setup has determined this copy of TCR-NTP server has been previously registered.
 - Cause:
 - TCR-NTP installation script has determined that the version of TCR-NTP server being installed has been previously installed.
 - Solution:
 - The TCR-NTP server will still continue to install but registration will still be to original owner. The MC Software License Agreement ("License") permits you to use one copy of the MC software product ("Software") on any single computer, provided the Software is in use on only one computer at any time. If you have multiple Licenses for the Software, then at any time you may have as many copies of the Software in use as you have Licenses. The Software is "in use" in a computer when it is loaded into the temporary memory (i.e., RAM) or is installed into the permanent memory (e.g., hard disk, CD-ROM, or other storage device) of that computer. However, a copy installed on a network server for the sole purpose of distribution to other computers is not "in use." If the anticipated number of users of the Software will exceed the number of applicable Licenses, you must have a reasonable mechanism or process in place to assure that the number of persons using the Software concurrently does not exceed the number of Licenses. If the Software is permanently installed on the hard disk or other storage device of a computer (other than a network server), then the person authorized to use such computer also may use the Software on a portable computer, laptop, and home computer. If such person's authorization to use such computer ceases for any reason (e.g. termination of employment), then such person's authority to use the software on a portable computer, laptop, and home computer shall cease. To fulfill the software license agreement, contact Masterclock for purchase of more licenses.

NORMAL OPERATION

The TCR-NTP server is designed to have minimum intrusions on the day to day operation of the computer it is installed on. With that philosophy, the TCR-NTP server will automatically obtain the IP address of the machine installed on, check for required services, initialize and bind the NTP port, and configure itself as a service. When these requirements have been met, the TCR-NTP server will start.

When started, the TCR-NTP server will make an application event log entry noting its startup time. It will make a second entry to the application log no longer than one minute after it has started noting that its has synchronized to its time source. These are the only two notations that the TCR-NTP server will make to the application log during normal operation.

TCR-NTP server is designed to monitor its internal state. Under a severe error, TCR-NTP server will terminate itself if it senses a condition where it will not be able to output accurate timing information. It will make an application log entry to what caused the severe error. These errors are described in the next section.

The TCR-NTP server will only send one warning message to the application log. If at some point the TCR reader card fails to interrupt, the TCR-NTP server will issue a warning message that it has not received an interrupt from the TCR reader card for 90 seconds. Usually the cause of this message is the loss of the SMPTE time source into the TCR reader card. It will log a warning message when communication with the TCR reader card is lost and when communication with the TCR reader card was re-established. The TCR-NTP server will continue to operated but will flag the NTP packets outputted as invalid until the time it has reestablished communication with the TCR reader card.

TCR-NTP SERVER OPERATIONAL ERRORS

The TCR-NTP Server can generate the following error and warning messages.

Severe Messages

The following error messages are generated by the TCR-NTP server and are set up in the following format:

Error message - Description

Cause:

Solution:

- **TCR-NTP_ERR_CREATEFAIL** - TCR-NTP server experienced a socket initialization error.

Causes:

- Socket error reporting routines failed to start
- The network subsystem or the associated service provider has failed.
- Messaging service is not installed or failed to start.

Solution:

- Ensure adequate resources on the machine for proper operation.
- Ensure TCP/IP is properly installed on the system and is responding.

- **TCR-NTP_ERR_INIT_DLL** – Unable to load DLL.

Cause:

- The DLL file has been moved, deleted, or corrupted.

Solution:

- Reinstall the MCR/TCR driver software. If problems persist, contact the factory.

- **TCR-NTP_ERR_LOAD_DLL_PROC** – Unable to load a DLL procedure.

Cause:

- The DLL file has been moved, deleted, or corrupted.

Solution:

- Reinstall the MCR/TCR driver software. If problems persist, contact the factory.

- **TCR-NTP_ERR_NULL_PROC** – Failed calling a DLL procedure.
Cause:
 - The DLL file has been moved, deleted, or corrupted.
 Solution:
 - Reinstall the MCR/TCR driver software. If problems persist, contact the factory.

- **TCR-NTP_ERR_BINDFAIL** - TCR-NTP Server failed to bind socket.
Cause:
 - The TCR-NTP server has failed to bind its socket to TCR-NTP port (123). This is usually caused by TCP/IP not being installed or another process such as a NTP client/server already installed on the NTP port.
 Solution:
 - Ensure TCP/IP is properly installed.
 - Ensure no other process is using the NTP port.

- **TCR-NTP_ERR_DRVINITFAIL** - TCR-NTP server cannot get the handle to TCRDrv driver. The TCR kernel-mode driver might not be loaded.
Cause:
 - TCR-NTP Server communicates with the TCR-200/500 card via the kernel mode driver installed when the TCR500 driver software is installed. The TCR-NTP server will check for this driver. If the driver is not found, the server will not start.
 Solution:
 - Ensure that TCR500 is properly installed and is operational prior to installing and starting the TCR-NTP Server

- **TCR-NTP_ERR_NOCONFIG** - TCR-NTP Server registry configuration data is not available or failed to load during installation. Ensure TCR-NTP Server Registry information is present in Registry.
HKEY_LOCAL_MACHINE\\SYSTEM\\CurrentControlSet\\Services\\TCR-NTP Server.
Cause:
 - TCR-NTP server depends upon certain registry settings to configure itself at startup. If the TCR-NTP server cannot retrieve this information from the registry, this error occurs. The major cause of this error is outside modification of registry information by individuals or other program.
 Solution:
 - Reinstall the TCR-NTP server from disk.

- **TCR-NTP_ERR_NOHOSTNAME** - TCR-NTP Server cannot determine hostname of machine. Ensure hostname and TCP/IP networking is installed on system prior to installing TCR-NTP Server.
Cause:
 - The major cause of this error is improper Network installation.
 Solution:
 - Ensure proper network and TCP/IP installation.

- **TCR-NTP_ERR_NOIPINFO** - TCR-NTP Server cannot determine IP address of machine. Ensure machine is configured with TCP/IP networking.
Cause:
 - The cause of this error is improper Networking installation.
 Solution:
 - Ensure proper network and TCP/IP installation.

- **TCR-NTP_ERR_MISS_READ** - TCR-NTP Server has experienced 10 consecutive misreads. Possible failure of time source into TCR card. TCR-NTP Server shutdown.
Cause:
 - The cause of this error is due to improper SMPTE packets being passed to the TCR-NTP server. The TCR-NTP server compares the current SMPTE packet to the previous packet. If it determines that the current packet is invalid, it uses its last good SMPTE packet as its reference point. If 10 consecutive packets are flagged “bad” (10 minutes), the server will generate this error message and shutdown.
 Solution:
 - Ensure that the SMPTE time source is outputting proper SMPTE packets for the time desired. You can use the Time Code Viewer that is installed with TCRSync to see what time the SMPTE time source is outputting. Correct SMPTE time source.

- **TCR-NTP_ERR_IMPROPER_IO_REQ** - TCR-NTP Server unknown I/O asynchronous communication with TCR card. TCR-NTP Server shutdown
Cause:
 - This exception occurs when the TCR-NTP server has received a return code from the kernel mode driver that it does not understand. This exception is for future use and should not occur.
 Solution:
 - Contact factory for instruction.

Warning Messages

- **TCR_ERR_NOINT_DESC** - Time code reader card has not sent an interrupt in 90 seconds. Possible loss of time code source or malfunction of time code reader card.
Cause:
 - The TCR-NTP server monitors interrupts from the TCR card to ensure that accurate time is always available. If the TCR-200/500 card is operating correctly and time code is present, the TCR card will interrupt one time per minute at the bottom of each minute (30 second mark). If this interrupt is not sense, the TCR-NTP server will commence a 90-second countdown. At the end of this countdown, the TCR-NTP server will invalidate the TCR-NTP packets until proper operation of the time code reader card is recognized.

UNINSTALLING TCR-NTP

To uninstall TCR-NTP from your Windows NT system, follow the instructions below for your operating system version. Never manually delete the NTP server folder from your computer.

TCR-NTP supports the Windows 2000/NT 4.0 Add/Remove Programs mechanism. To uninstall TCR-NTP from a Windows NT 4.0 system:

- Select the **Start** button on the taskbar then choose **Settings** and **Control Panel**
- Select the **Add/Remove Programs** icon in the Control Panel
- Select **TCR-NTP Server** from the list of installed program
- Select the **Add/Remove** dialog button

To uninstall TCR-NTP from a Windows NT 3.51 system:

- Select the **Program Manager** and **TCR-NTP** folder
- Select Uninstall icon in the folder

After removing the software you must restart your system for the change to take effect. Do not remove TCR-NTP software then attempt to re-install it without first restarting the system.

LIMITED SOFTWARE WARRANTY

To the original customer only, Masterclock, Inc. (hereinafter MC) provides the following Limited Warranty.

30 Day Satisfaction Guarantee

For thirty (30) days after date of delivery of the SOFTWARE to you, if you are dissatisfied with the SOFTWARE for any reason you may return the complete product, with your receipt, to MC, postage prepaid, during the thirty (30) day period for a full refund.

Limited Warranty For Next 60 Days

MC warrants that for the sixty (60) days following the initial thirty day period, as evidenced by a copy of your receipt, that:

- (1) The SOFTWARE will perform substantially the functions described in the documentation provided by MC
- (2) The media on which the SOFTWARE is furnished will be free from defects in materials and workmanship under normal use.

Your sole remedy under the warranty during this sixty (60) day period is that MC will undertake to correct within a reasonable period of time any reported "SOFTWARE Error" (failure of the SOFTWARE to perform substantially the functions described in the documentation), correct errors in the documentation, and replace any magnetic media which proves defective in materials or workmanship on an exchange basis without charge. In order to make a claim under this warranty you must return the defective item with your receipt to MC, postage prepaid, within ten (10) days after the warranty period. If MC is unable to replace defective media or if MC is unable to provide corrected SOFTWARE or corrected documentation within a reasonable time, MC will, at its sole and exclusive option, either replace the SOFTWARE with a functionally equivalent program at no charge to you or refund the license fee of the SOFTWARE. These are your sole and exclusive remedies for any breach of warranty during this sixty (60) day period.

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