

Model: MC-1-U
Doc Ref. No:-m05om201
Issue No:-13



masibus®

User's Manual

GPSmasTER CLOCK



Sonepar India Pvt. Ltd.

B/30, GIDC Electronics Estate,
Sector-25, Gandhinagar-382016, Gujarat, India

☎ +91 79 23287275-76-77-78 📠 +91 79 23287281-82

Email: support.masibus@soneparindia.com

Web: www.masibus.com

LIMITED WARRANTY

Masibus Automation and Instrumentation Pvt. Ltd. Provides limited warranty for its manufactured product against the defects in material shipped, workmanship under normal use and service for the period of 12 months or as per the warranty period terms agreed, from the date of shipment of product. This warranty shall not apply if the product is used contrary to the instructions in its manual or is otherwise subject to misuse, abnormal operations, accident, lightning or transient surges, repairs or modifications not performed by Masibus Automation and Instrumentation Pvt. Ltd.

Necessary items packed with GPS Master Clock such as antenna, lightening arrestor, antenna line amplifier and other accessories are also provided with limited warranty of 12 months from the date of shipment.

Masibus Automation and Instrumentation Pvt. Ltd. Obligation under this warranty are limited to in-factory service and repair, of the product or the component thereof, which is found to be defective. If the defect for which Masibus Automation and Instrumentation Pvt. Ltd. Is found not responsible for the defect or the cause of defect in product, the service or repair will be done on the charge basis.

For warranty service or repair, products if returned to a service facility at Masibus Head Office, buyer shall prepay all shipping charges to Masibus. Masibus highly recommends that prior to returning equipment for service work, our technical/Customer support department be contacted to provide trouble shooting assistance while the equipment is still installed.

EXCEPT FOR THE LIMITED WARRANTY STATED ABOVE, MASIBUS AUTOMATION AND INSTRUMENTATION PVT. LTD. DISCLAIMS ALL WARRANTIES OF ANY KIND WITH REGARD TO ITS PRODUCTS OR OTHER MATERIALS PROVIDED BY MASIBUS, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Masibus Automation and Instrumentation Pvt. Ltd. shall have no liability or responsibility to the original customer or any other party with respect to any liability, loss, or damage caused directly or indirectly by its product, material, or software sold or provided, replacement parts or units, or services provided, including but not limited to any interruption of service, excess charges resulting from malfunctions of hardware or software, loss of business or anticipatory profits resulting from the use or operation of the Masibus product or software, whatsoever or howsoever caused. In no event shall Masibus be liable for any direct, indirect, special or consequential damages whether the claims are grounded in contract, tort (including negligence), or strict liability.

TABLE OF CONTENT

1. Unpacking GPS Master Clock Model MC-1-U.....	8
1.1 Standard Items	8
1.2 Optional Accessories (Extra cost)	8
1.3 Ordering Code	8
2. Introduction	9
3. GNSS Fundamentals	11
4. GPS Specification	13
5. Unit Front and Rear Panel Description	19
5.1 GPS Master Clock Model MC-1-U Front Panel	19
5.2 GPS Master Clock Model MC-1-U Rear Panel	20
6. GPS Master Clock Model MC-1-U Installation	24
6.1 GNSS Antenna Installation	25
6.1.1 GNSS Antenna Installation	26
6.1.2 Mounting the Antenna	27
6.1.3 Verifying Antenna and Cable Operation	29
6.1.4 Antenna Surge Suppressor	30
6.1.5 Technical Details on GNSS Antennas and Cables	30
6.2 Unit Installation	32
6.3 Connection Diagram	33
6.4 Hardware Jumper Setting	34
6.5 Relay Contact Output Configurations:	35
6.5.1 Power Relay Contacts:	35
6.5.2 GPS LOST Relay Contacts:	36
6.5.3 WATCHDOG Relay Contacts:	36
6.6 COM1 terminal RS232 / RS485 output configurations:	36
6.7 COM2 terminal RS232 / RS485 output configurations:	37
7. GPS Master Clock MC-1-U Power ON	38
7.1 Receiver Boot-up mode	38
7.2 Battery Backup RTC and GPS receiver RAM Configurations:	39
7.3 Startup Operation	39
7.4 Basic Normal Run Mode Operation	41
7.5 Firmware Upgradation:	42
8. Unit Setup Configuration	43
8.1 Keypad based configuration	43
9. Serial Communication and Configuration	47
9.1 Serial Port Setup and Serial Cable Configuration	47
9.2 Configuration Commands	50
9.2.1 General Commands:	50
9.2.2 Serial Terminal Communication and Time Frame Commands:	53
9.2.3 LCD Display Parameters Commands:	56
9.2.4 Standard Event's Command:	56
9.2.5 Additional Event's Command:	56
9.2.6 Antenna Cable Propagation Delay command:	57
9.2.7 Network Setting Command:	58

9.2.8	Miscellaneous Command:	59
9.2.9	Example to illustrate unit commands:	62
9.3	Network settings (NTP1/NTP2 Port) of GPS using PC windows as Telnet Client:	66
10.	NTP Timing Outputs – Serial, IRIG-B / IEEE 1344.....	79
10.1	Timing Output - Serial	79
10.1.1	NMEA-0183 RMC Time frame output	79
10.1.2	T-Format Time frame output:	79
10.1.3	NGTS Time frame output:	80
10.2	Timing Output IRIGB / IEEE 1344 C37.118-2005	81
10.2.1	Introduction:.....	81
10.2.2	Time Code Output:	81
10.2.3	Standard IRIG-B Output:	81
10.3	Timing Output – NTP	86
10.3.1	NTP Introduction:.....	86
10.3.2	GPS Master Clock MC-1-U NTP Output:	86
10.3.3	NTP Client Synchronization:	88
10.3.4	NTP Hierarchical Time Distribution:	88
11.	Relay and Pulse Outputs	91
11.1	Relay Contact Outputs (Optional output)	91
11.2	Pulse Outputs.....	92
11.2.1	1PPS Output.....	92
11.2.2	Event Output (PPM/PPH).....	92
11.2.3	Additional Event Outputs (Programmable Pulse Outputs).....	92
12.	Ethernet Communications: Telnet, SNMP	93
12.1	Telnet	93
12.2	SNMP	94
12.2.1	SNMP Addressing:	94
12.2.2	Protocol Detail:	94
12.2.3	SNMP Operation:	95
12.2.4	SNMP Traps:	100
12.3	Webserver.....	102
13.	Holdover Mode.....	108
14.	Options.....	109
14.1	Optional Input Power Supply	109
14.1.1	Option 1: AC/DC Power Input	109
14.1.2	Option 2: DC Power Input	109
15.	Appendix List	110
16.	Troubleshooting	111
16.1	Unit not getting Power ON	111
16.2	Antenna Troubleshooting.....	111
16.3	Wrong time at Unit Power ON.....	114
16.4	GPS Master Clock MC-1-U display time not as per Local time	115
16.5	Cannot establish Serial communication with rear RS232/RS485 Terminal.....	115
16.6	Not able to receive time frame on rear RS232/RS485 Terminal at every second.....	115
16.7	Cannot establish Serial communication with rear Terminal.....	115
16.8	Not able to do the configuration through rear terminal	115
16.9	Problem with getting unit LOCK to GPS satellites	116
16.10	IRIG-B / IEEE 1344 client synchronization fail.....	116
16.11	No response to Ping Command.....	116

Issue No:-13

16.12	Not able to configure the IP address of Ethernet Port	117
16.13	NTP client not synchronizing with GPS NTP output port.....	117
16.14	Loss of time synchronization by NTP Client during GPS Unlock	118
16.15	Loss of time accuracy in NTP, IRIG-B, event outputs during Unit Power ON in Unlock conditions.....	118
16.16	Cannot establish telnet communication	118
16.17	Cannot establish SNMP communication	118
16.18	Not able to receive SNMP traps.....	119
16.19	Not Able to set SNMP parameter.....	119
17.	Release Note	120
17.1	Main Controller	120
17.2	Supporting Controller.....	121
18.	Abbreviations	124

LIST OF FIGURES

Figure 3-1 The Basic of GPS	11
Figure 4-1 GPS Master Clock Model MC-1-U Model	13
Figure 4-2 GPS Master Clock Model MC-1-U Mechanical Dimens	18
Figure 5-1 GPS Master Clock Model MC-1-U Front Panel Description	19
Figure 5-2 GPS Master Clock Model MC-1-U Rear Panel Description	20
Figure 5-3 Power supply terminal.....	20
Figure 5-4 Relay and Standard Event terminal	21
Figure 5-5 Additional Events terminal	21
Figure 5-6 GPS Ethernet NTP terminal	21
Figure 5-7 1PPS BNC terminal.....	21
Figure 5-8 IRIG-TTL, AM BNC terminal.....	22
Figure 5-9 COM1 terminal	22
Figure 5-10 COM2 terminal	22
Figure 5-11 GPS Antenna terminal	23
Figure 6-1 Antenna Mounting with Lightning Arrestor	27
Figure 6-2 GPS Master Clock MC-1-U Connection Diagram	33
Figure 6-3 GPS Master Clock Model MC-1-U Main board (Top View)	35
Figure 6-4 COM1 terminal RS-232/RS-485 Configuration	37
Figure 6-5 COM2 terminal RS-232/RS-485 Configuration	37
Figure 8-1 Front Panel Keypad Layout.....	43
Figure 9-1 Path of HyperTerminal	47
Figure 9-2 HyperTerminal View	48
Figure 9-3 Terminal Cable Connections	48
Figure 9-4 LCD Display – Terminal port Settings of GPS Master Clock MC-1-U	49
Figure 9-5 HyperTerminal Configuration	49
Figure 10-1 IRIG-B waveforms	82
Figure 10-2 NTP frame format.....	87
Figure 10-3 NTP Time distributions in Hierarchical Arrangement	89
Figure 12-1 MC-1-U Web server login	103
Figure 12-2 MC-1-U Web server home page	103
Figure 12-3 MC-1-U Web server Network Configuration page	104
Figure 12-4 MC-1-U Web server SNMP Configuration page.....	105
Figure 12-5 MC-1-U Web server NTP Configuration page.....	106
Figure 12-6 MC-1-U Web server User Configuration page	106

LIST OF TABLES

Table 5-1 GPS Master Clock Model MC-1-U Front Panel Key Definitions	20
Table 6-1 Antenna Mounting.....	31
Table 6-2 Power Relay Configuration	35
Table 6-3 GPS Lost Configurations.....	36
Table 6-4 WATCHDOG Relay Configurations	36
Table 8-1 Key Functions.....	43
Table 9-1 Default ETH0 Command parameters	59
Table 9-2 Default Command parameters	61
Table 10-1 NMEA-0183 Time string format.....	79
Table 10-2 T-Format Time string format	80
Table 10-3 NGTS Time string format	80
Table 10-4 Assignment of CF Segment for IEEE 1344 (C37.118-2005)	83
Table 11-1 Relay contact status chart during operation	91
Table 12-1 Configuration Parameter through TELNET	93

1. Unpacking GPS Master Clock Model MC-1-U

1.1 Standard Items

GPS Master Clock device model MC-1-U model is shipped with below standard items.

- GPS Master Clock model MC-1-U unit
- GPS Antenna and 0.5 Meter SS Antenna mounting rod integrated - 1 No.
- 2 Meter RJ45 Ethernet Cable - 1 No.
- 2 Meter RS-232 GPS Configuration Cable - 1 No.
- Windows based NTP Client Synchronization software - Download from Website
<https://www.masibus.com/downloads/softwares//Net-T-Sync-V-1.0.2.1.rar>
- Documents – User Manuals, Test Certificates - 1 Set

NOTE: Antenna Cable type (RG6/RG11) and antenna cable length (15 meters / 30 meters / 50 meters / 100 meters / customized) is shipped only as per customer order.

1.2 Optional Accessories (Extra cost)

GPS Master Clock device model MC-1-U model can also be shipped with the below optional items only as per customer order.

- mLA01: Lighting Arrestor (Surge Suppressor) - 1 No.
- S-lineamp: Line Amplifier - 1 No.

1.3 Ordering Code

Model		Power Supply		Antenna Cable Length
MC-1-U	X		X	
	U1	90-264VAC /90-300VDC	0	None
	U2	18-72V DC	1	15 Meter
			2	30 Meter
			3	50 Meter
			4	100 Meter
			5	Special

Note:

X - Specify From Table

The standard outputs consist of:

- 1 No's PPS over BNC
- 1 No's IRIG-B (Modulated) over BNC
- 1 No's IRIG-B (TTL) over BNC
- 2 No's NTP/SNTP over RJ45 Ethernet
- 2 No's Serial over DB9 (RS232/RS485, site-selectable)
- 4 No's Event over MSTB Connector
(Programmable pulses: PPS, PP5S, PPM, PPQH, PPHH, PPH, PPD)
- 3 No's Relay over MSTB Connector
(1: GPS Lock, 2: Watchdog, 3: Power Fail)

2. Introduction

masibus GPS Master Clock MC-1-U has been developed to address key power and process industry timing requirements. Whether it's the monitor, control or analysis of the power system, GPS Master Clock MC-1-U is the cost-effective GPS time synchronization solution.

To begin with, GPS Master Clock MC-1-U offers precise timing accuracy using GPS satellites; it generates accurate output pulses and time codes in multiple formats. It's necessary every time to Lock GPS once after power ON to ensure better accuracy.

GPS Master Clock MC-1-U synchronizes with a wide variety of microprocessor-based power system equipment including SCADA systems, remote terminal units (RTUs), protection relays, sequence of event recorders, digital fault recorders, tariff meters, Slave Display Units, Data Loggers and other Intelligent Electronic Devices (IEDs). Being a Field-programmable device using HyperTerminal, a very common application in Windows or 8 key Keypad provided on the front panel, GPS Master Clock model MC-1-U allows the user to alter the settings or choose from Time codes. The serial Terminal(RS232) is provided for that purpose. Each output can feed directly to different areas through electrically isolated ports which ensure reliable operation in a harsh substation environment.

GPS Master Clock MC-1-U generates a wide range of timing signals via multiple output ports. Standard configurations of GPS Master Clock MC-1-U is equipped with two Ethernet ports, and 1 NMEA on RS232/RS485.

GPS Master Clock MC-1-U is available with optional feature outputs such as NTP/SNTP, 4 additional PMOS relay-based pulse outputs each configurable from a second to a day time, IRIG-B127 / IEEE 1344/C37.118-2005 Amplitude modulated output (field configurable), rear panel Serial port provides NMEA-GPRMC format, rear panel serial port is configurable for either NGTS or T-format and a very accurate pulse per second with an accuracy of ($\pm 500\text{ns}$ to UTC).

Time synchronization protocol (NTP) standard as Server mode is implemented in GPS Master Clock MC-1-U to provide time synchronization to different network Clients which are supporting NTP protocols (NTPv3, SNTP).

GPS Master Clock MC-1-U units feature a front panel display, giving both installation teams and users visual feedback about the time data being generated on the outputs. LED indicators to provide "at a glance" status information.

The optimized Receiver/Antenna system employed in GPS Master Clock MC-1-U provides time information from the GPS satellite constellation. Dynamic T-RAIM processing is used to eliminate any aberrant satellite signals from the timing solution. The result is timing precision on all outputs with accuracy similar to that normally seen only in laboratory instruments.

GPS Master Clock MC-1-U unit is Rack Mount, and its mechanical dimensions are 482.6(W) x 44(H) x 324(D) mm (IP 20 Enclosure). It is supplied with hardware and software required (Depends upon commercial terms & condition also, as per order) as per the ordering code. masibus GPS Master Clock model MC-1-U has been developed to address key power and process industry timing requirements. Whether it's the monitor, control or analysis of the power system, GPS Master Clock Model MC-1-U is the cost-effective GPS time synchronization solution.

To begin with, GPS Master Clock model MC-1-U offers precise timing accuracy using GPS satellites; it generates accurate output pulses and time codes in multiple formats. It's necessary every time to Lock GPS once after power ON in order to ensure the better accuracy.

GPS Master Clock Model MC-1-U synchronizes a wide variety of microprocessor-based power system equipment including: SCADA systems, remote terminal units (RTUs), protection relays, sequence of event recorders, digital fault recorders, tariff meters, Slave Display Units, Data Loggers and other Intelligent

Electronic Devices (IEDs). Being a Field programmable device using HyperTerminal, a very common application in Windows or 8 key Keypad provided on the front panel, GPS Master Clock Model MC-1-U allows the user to alter the settings or choose from Time codes. The serial port COM2 (RS232/RS485 Factory configurable) is provided for that purpose. Each output can feed directly to different areas through electrically isolated ports which ensure reliable operation in a harsh substation environment.

GPS Master Clock Model MC-1-U generates a wide range of timing signals via Seven output ports. Standard configurations of GPS Master Clock Model MC-1-U is equipped with two serial ports, a 1PPS Port, 1 IRIG-B TTL / IEEE 1344 (field configurable) and three PFC relay outputs for POWER, WATCHDOG, GPS LOST alarm and standard PMOS relay-based pulse output of PPM/PPH or RTC ON event. GPS Master Clock Model MC-1-U is available with optional feature outputs such as NTP/SNTP, 4 additional PMOS relay-based pulse outputs each configurable from a second to a day period time, IRIG-B127 / IEEE 1344/C37.118-2005 Amplitude modulated output (field configurable). Com1 Serial port provides NMEA-GPRMC format. Com2 serial port is configurable for either NGTS or T-format. Another fixed output provides a very accurate pulse per second with accuracy of ($\pm 500\text{ns}$ to UTC). Time synchronization protocol (NTP) standard as Server mode is implemented in GPS Master Clock Model MC-1-U to provide time synchronization to different network Clients which are supporting NTP protocols (NTPv3, SNTP).

GPS Master Clock Model MC-1-U units feature a front panel display, giving both installation teams and users visual feedback about the time data generated on the outputs. LED indicators provide “at a glance” status information.

3. GNSS Fundamentals

GPS Master Clock MC-1-U device is a GPS/GNSS-based receiver clock device that provides accurate time output with a 1PPS signal. Satellite Navigation system is a system of satellites that provide autonomous geo-spatial positioning with global coverage. It allows small electronic receivers to determine their location (longitude, latitude, and altitude) to high precision (within a few meters) using time signals transmitted along a line of sight by radio from satellites. GNSS is a satellite navigation system that uses multiple navigation systems, mainly GPS and GLONASS and NAVIC. GNSS also includes satellite navigation systems of SBAS, QZSS, Galileo systems, etc.

GPS satellite navigation system is maintained by the United States of America since 1994 which consists of at least 24 operational satellites out of 32 satellites in six orbital planes orbiting at an altitude of approximately 20,200 km. In a typical GPS operation, four or more satellites must be visible to obtain an accurate result. Satellite-based navigation systems use a version of triangulation to locate the user, through calculations involving information from many satellites.

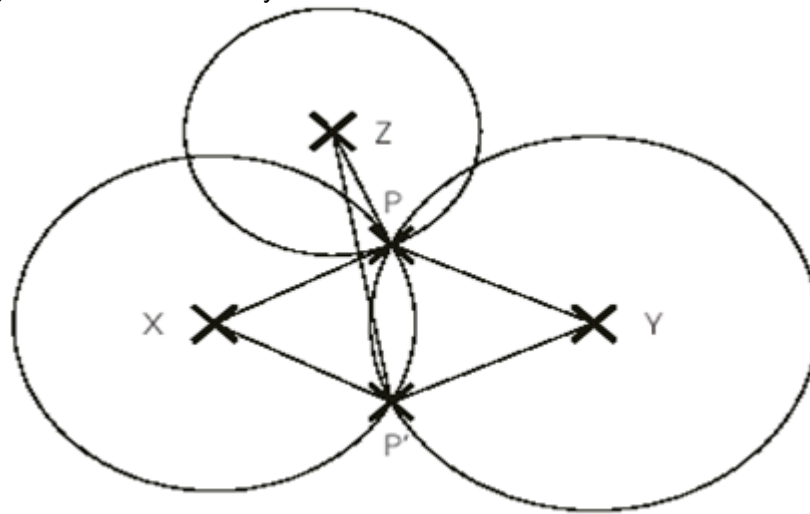


Figure 3-1 The Basic of GPS

If one considers Figure 1 which shows a flat plane. X and Y are two known fixed points on the plane. P is an unknown point. If the distances PX and PY can be measured, then the position of point P can be calculated. There is an ambiguity in that point P' would also fit the measurements. This can be resolved if the position of a third fixed point Z is known since PZ is different from P'Z. This can be summed up by saying that the unknown point P lies at the intersection of three circles based on the known points X, Y, and Z. When the plane becomes three-dimensional spaces, the circles become spheres. The intersection of two-sphere is a circle, and the intersection of three spheres is a pair of points analogous to the points P and P' of the flat plane case. For the flat plane case, a measurement from an extra fixed point is required to resolve the ambiguity, although in many cases the ambiguous point would be below the surface of the world. Thus, to achieve the objective, GPS must provide an accurate measurement of the distance from the unknown location of the receiver to 4 known points.

The GLONASS-based satellite navigation system is maintained by Russia, a fully functional navigation constellation in 1995. After the collapse of the Soviet Union, it fell into disrepair, leading to gaps in coverage and only partial availability. It was recovered and fully restored in 2011. It provides an alternative to Global Positioning System (GPS) and is the second alternative navigational system in operation with global coverage and of comparable precision.

A fully operational GLONASS constellation consists of 24 satellites, with 21 used for transmitting signals and three for in-orbit spares, deployed in three orbital planes. The three orbital planes' ascending nodes are separated by 120° with each plane containing eight equally spaced satellites. The orbits are roughly circular, with an inclination of about 64.8°, and orbit the Earth at an altitude of 19,100 km, which yields an orbital period of approximately 11 hours, 15 minutes. The overall arrangement is such that, if the

constellation is fully populated, a minimum of 5 satellites is in view from any given point at any given time. This guarantees continuous and global navigation to worldwide users.

A characteristic of the GLONASS constellation is that any given satellite only passes over the same spot on the Earth every eighth sidereal day (1 sidereal day = 23 hours, 56 minutes, 4.0916 seconds). However, as each orbit plane contains eight satellites, a satellite will pass the same place every sidereal day. For comparison, each GPS satellite passes over the same spot once every sidereal day. To oppose the GPS the ground track of the GLONASS satellites, do not repeat after one day. This avoids the resonance effects which makes station keeping of GPS satellites difficult and expensive.

In a GPS navigation system, all satellites operate at the same frequency at 1.57542 GHz (as L1 signal) and 1.2276 GHz (as L2 signal) using CDMA technique whereas GLONASS navigation system, all satellites operate on different frequencies using originally a 25-channel frequency FDMA technique spanning from 1602.5625 MHz to 1615.5 MHz, known as the L1 band.

The NavIC (Navigation with Indian Constellation) receiver system is a satellite-based navigation system developed by India's Indian Space Research Organization (ISRO). It is a regional navigation satellite system (RNSS) that provides accurate position information services over India and the surrounding region, extending to about 1,500 km from its boundary.

As GNSS uses a navigation satellite system of GPS, GLONASS, and other available systems in space, GPS receivers can easily observe 10 to 12 satellites at a time. As more satellites are visible, more accuracy in the receiver's output signals is achieved.

Each visible satellite broadcasts two types of information in its message format, i.e. Almanac and Ephemeris. Almanac data is coarse orbital parameters for all visible satellites. Each visible satellite broadcasts Almanac data for all visible satellites. This Almanac data is not very precise and is considered valid for up to several months. Ephemeris data, by comparison, is very precise orbital and clock correction for each visible satellite and is necessary for precise positioning. Each visible satellite broadcasts only its Ephemeris data. The ephemeris is updated every 2 hours and is usually valid for 4 hours.

4. GPS Specification



Figure 4-1 GPS Master Clock Model MC-1-U Model

RECEIVER CHARACTERISTICS	Timing Accuracy <15 ns with GPS receiver (the receiver is locked on a fixed position). <±0.0005 ppm (OCXO) accuracy while GPS Is Unlock* <±0.5 ppm (TCXO) accuracy while GPS Is Unlock* Resynchronization Delay: - < 5 Min Positioning Accuracy <10mts SEP (with Selective Availability [SA] Disabled). Receiver Input 1575.42 MHz to 1602 MHz L1 C/A Code. Tracking 22 parallel channels. Acquisition Time Hot Start : <5 s Warm Start : <38 s Cold Start : <45 s Memory Backup Internal 17mAh cell, Sufficient for 2 weeks of backup time Needs 72 hours run for full charging. Antenna Active L1 GNSS (GPS+GLONAS) 40 dB gain Cable: RG 6 / RG 11 Maximum Length: 100 meters (Up-to 400 meters using additional line amplifier) Coverage: 360 Degree Ingress Protection: IP67 * If GPS is supplied with OCXO/ TCXO and available on request.
FIXED OUTPUTS	1 PPS Accuracy: ±150 ns Accuracy with GPS locked Output: TTL into 250 Ω Pulse Width: 200 (200 mS High & 800 mS Low signal) Interface: BNC Female connector (Rear Panel) No. of Ports: 1

	Alarms Three Isolated Dry Contacts to 230 VAC / 24VDC, 10 A: 1. GPS Lost 2. Power 3. Watchdog Interface: 8-Way Terminal Strip Event/RTC ON One Event per minute or per hour or RTC ON/OFF (Configurable) Interface: 8-Way Terminal Strip (Rear Panel) Event contact capacity: 350V DC, 120mA maximum IRIGB-TTL - DC Level Shift / IEEE 1344/C37.118-2005 Format: IRIG-B(007) [IRIGB TTL] or IEEE 1344/C37.118-2005 (field selectable) Output: TTL into 50 Ω Interface: BNC Female connector (Rear Panel) No. of Ports: 1 Serial COM1 Protocol: NMEA-0183 (RMC) Port Settings: 9600-8-N-1 Output: RS232/RS485** (Factory Configurable) Interface: DB9 Female Connectors (Rear Panel) No. of Ports: 1 COM2 Protocol: NGTS/ T-Format Port Settings: 4800/9600-7/8-N/E/O-1/2 (Configurable) Output: RS232/RS485** (Factory Configurable) Interface: DB9 Female Connectors (Rear Panel) No. of Ports: 1 ** RS232 is factory set
OPTIONAL OUTPUTS	IRIGB-TTL - DC Level Shift / IEEE 1344/C37.118-2005 Format: IRIG-B (007) 100 Hz PWM signal Output: 5.5 Vp-p TTL signal into 50Ω IRIG-B PWM Differential RS485 Output (Optional/ On Request) Interface: BNC Female connector (Rear Panel) IRIGB-Modulated / IEEE 1344/C37.118-2005 Format: IRIG-B (127), 1 KHz AM signal With Modulation ratio: 3:1 Signal: 1 kHz AM Signal Modulation Ratio: 3:1 Output: 3 Vp-p, into 100Ω $\pm$10% IRIG-B Output as per IEEE Standard C37.118 or IEEE 1344 standard configurable Interface: BNC Female connector (Rear Panel)

	Ethernet Output Time Synchronization protocols: NTP/SNTP Server [Factory settable] NTP: Network Time Protocol (Version 3) RFC: RFC- 1119, RFC- 1305 SNTP: SimpleNetwork Time Protocol (Version 3) Protocols: IPv4, SNMP v2, Telnet, TCP, UDP RFC: RFC- 1361(SNTP) Internet protocol: IPv4 Mode: Server Time format: UTC Network Interface:10/100 Mbps Interface: RJ-45 Connector (Rear Panel) No. of Ports: 2 Additional Event Outputs Four independent configurable Event outputs Configurable event period (PPS, PP5S, PPM, PPQH, PPHH, PPH, PPD) with on time from 50 milliseconds to 50% of total period PMOS Relay output with status LED, Rating: 350V DC/120mA Configuration: Individual configurable time period and pulse ON time Time Period: 1 to 86400 seconds (24 Hr.) max (Configure 0 to Disable) ON Time: min. 50 milliseconds and max 50% of time period set for a particular event Event contact capacity: 350 VDC, 120mA maximum Interface: 8-Way Terminal Strip (Rear Panel)
INTERFACE	Display 2x20 LCD with Backlit, 85x19.8 mm with Backlight Displayed data Time of Day (HH:MM:SS) with Local/UTC information Date (DD/MM/YY) with Day of week Day of Year Status of GPS receiver Latitude, Longitude, Height Number of satellites available Data Format on Terminal (Rear Panel) Product Firmware Version & Date Product Serial Number

Keypad

KEY	FUNCTION
MENU	For Entering into Configuration mode.
HELP	To Display help about every parameter configurations.
OK	To save the final Configurations.
ESC	To come back into Run mode.
UP	Scroll between various parameters in ascending order in the main menu and change parameters value in a submenu.
DOWN	Scroll between various parameters in descending order in the main menu and change the parameter's value in the submenu.
LEFT	To select various available options for the particular parameter in the main menu and scroll between various parameters in the submenu.
RIGHT	To select various available options for the particular parameter in the main menu and scroll between various parameters in the submenu.

Status LED

POWER : Red
 1PPS : Red
 Watchdog : Red
 Event : Red
 GPS Locked : Bi-colour: Green (GPS LOCK) Red (GPS UNLOCK)

Configuration Modes

Front Keypad
 Rear panel RS-232 DB9 serial Terminal port
 Telnet, Webserver, SNMP (ethernet RJ45 port)

Programmable parameters:

Global Time zone correction
 12/24 Hrs Format of Time
 COM2 serial port setting
 COM2 data format selection (NGTS or T-FORMAT)
 Duration of Standard & Programmable repetitive event generation output via dry contact (Per Minute or Hour).
 Password Protection

Network Settings:

IP addresses, Subnet mask, Gateway and SNMP Manager IP addresses configurable through Telnet remote login.
 All network configurations are password protected.

POWER SUPPLY

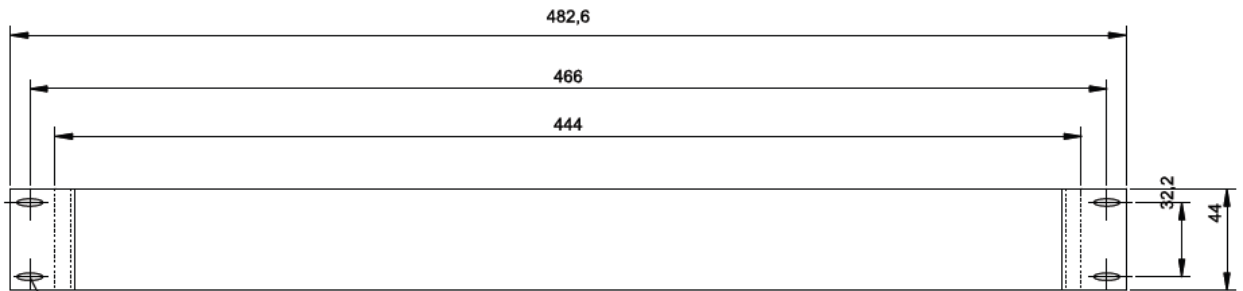
AC: 90 to 264 V, 47 to 63 Hz
 DC: 90-300V
 Power Consumption: <15W Typical

OPTIONAL POWER SUPPLY

DC: 18 – 72 V
 Power Consumption: <15W

PHYSICAL DIMENSIONS	19" Rack Mountable Width: 482.6 mm (19") Depth: 324 mm (12.0079") Height: 1 U – 44 mm (3.46") Weight: 3 Kg (approx.)
ENVIRONMENT	Temperature Operating: 0° C to +55° C Storage: -20° C to +80° C Humidity 20 - 95% RH (non-condensing)
EXTRA MODULES (OPTIONAL)	SURGE ARRESTOR (Ordering code- mLA01) LINE AMPLIFIER (Ordering code- S-lineamp)
TYPE TEST ***	EMI / EMC Tests Electrostatic Discharge – IEC 61000-4-2 Radiated Susceptibility – IEC 61000-4-3 Electrical Fast Transient – IEC 61000-4-4 Surge Immunity Test - IEC 61000-4-5 Conducted Susceptibility - IEC 61000-4-6 Power Frequency Magnetic Field – IEC 61000-4-8 Voltage Dips & Interruption Test – IEC 61000-4-11 Damped Oscillatory Wave Immunity Test – IEC 61000-4-18 Conducted Emission - IEC61000-6-4 Radiated Emission - IEC61000-6-4 Environmental Tests Cold Test – IEC 60068-2-1 Dry Heat – IEC 60068-2-2 Damp Heat Test - IEC 60068-2-30 Vibration – IEC 60255-21-1 Shock Test – IEC 60255-21-2 Dielectric Test – IEC 60255-5-0 * Note: Tests marked with an asterisk (*) are currently in progress.
Isolation (With-standing voltage)	Between primary terminals* and secondary terminals**: At least 1500 V AC for 1 minute Between primary terminals* and grounding terminal: At least 1500 V AC for 1 minute Between grounding terminal and secondary terminals**: At least 1500 V AC for 1 minute Between secondary terminals**: At least 500 V AC for 1 minute * Primary terminals indicate power terminals and relay output terminals. ** Secondary terminals indicate Output Ports. Insulation resistance: 20MΩ or more at 500 V DC between power terminals and grounding terminal. Note: No Isolation between IRIGB-TTL and PPS Output

4.1 Mechanical Dimensions Layout



4 NOS. - THRU SLOTS SIZE- 7.5(W) X 10.4(L) FOR MOUNTINGS.

FRONT VIEW

Figure 4-2 GPS Master Clock Model MC-1-U Mechanical Dimens

5. Unit Front and Rear Panel Description

This section provides description of GPS Master Clock Model MC-1-U unit front panel and back panel user applicable interface.

5.1 GPS Master Clock Model MC-1-U Front Panel

Below image shows GPS Master Clock Model MC-1-U model front panel. The front panel is equipped with 20 x 2 line LCD display, 4 LED status indicators, Power LED indicator and keypad interface.

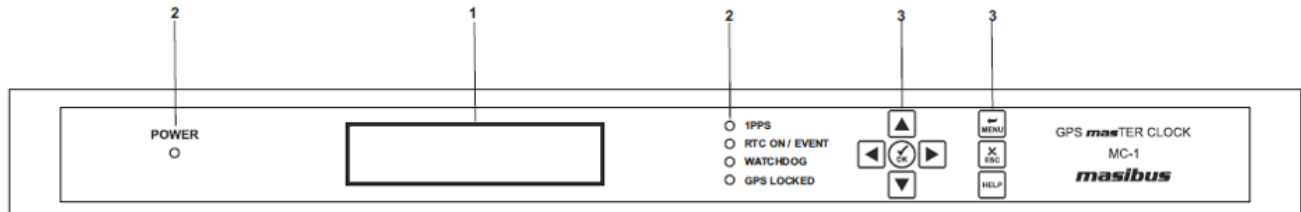


Figure 5-1 GPS Master Clock Model MC-1-U Front Panel Description

1. **LCD Display:** GPS Master Clock Model MC-1-U mode is equipped with 20 character x 2 line display. This displays various parameters such as Clock parameters (time, date, day of the year, day of the week, GPS LOCK/UNLOCK status, GPS satellites data (latitude, longitude, antenna height, total number of satellites available), Keypad configurable parameters, etc.
2. **LED status Indicators:** There are 5 LED indicators including power led indication and four other status indicators.
 - **POWER:** This LED illumination is RED color. It indicates the presence of power in the unit.
 - **PPS:** This LED indicates the presence of 1PPS signal from GPS receiver module. It blinks at every one second. The illumination is of RED colour.
 - **RTC ON / EVENT:** This LED illumination is RED color. This LED indication functionality depends on the type of feature available with ordered GPS Master Clock Model MC-1-U device.
 1. If the customer has ordered unit with EVENT output, this LED illuminates as per the configured Standard Event period. If the configuration of EVENT output is PPM (Pulse per Minute), this LED blinks at every 1 minute with respect to time on LCD display and will remain ON for 1 second. If the configuration of EVENT output is PPH (Pulse per Hour), this LED blinks at every 1 hour with respect to time on LCD display and will remain ON for 1 second. Configuration can be done through front panel keypad or through COM2 terminal on rear panel.
 2. If the customer has ordered unit with RTC ON feature, this LED will blink when there is no GPS signal present (in UNLOCK condition) and unit is running on its internal clock..
 - **WATCHDOG:** This LED illumination is RED color. It is ON when the unit becomes unhealthy due to GPS receiver module failure or internal failure.
 - **GPSLOCKED:** This LED illuminates GREEN color if the GPS satellites are available and GPS is LOCKED otherwise LED illuminates' RED color.
3. **KEYPAD:** GPS Master Clock Model MC-1-U device is equipped with keypad buttons to configure various parameters of the unit. Functionality/usage of each key is described below:

	KEY	FUNCTION
	MENU	To enter in Configuration mode.
	HELP	To Display help about every configurable parameter.

	OK	To save the final configuration changes done.
	ESC	To come back into the Run mode or main menu.
	UP	Scroll between various parameters in ascending order in the main menu and change the parameter's value in a submenu.
	DOWN	Scroll between various parameters in descending order in the main menu and change the parameter's value in a submenu.
	LEFT	To select various available options for the particular parameter in main menu and scroll between various parameters in submenu.
	RIGHT	To select various available options for the particular parameter in main menu and scroll between various parameters in submenu.

Table 5-1 GPS Master Clock Model MC-1-U Front Panel Key Definitions

5.2 GPS Master Clock Model MC-1-U Rear Panel

Below figure 5.2 shows the GPS Master Clock Model MC-1-U model rear panel.

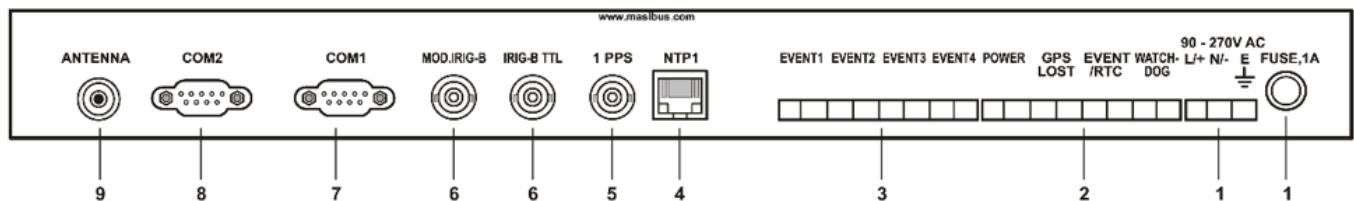


Figure 5-2 GPS Master Clock Model MC-1-U Rear Panel Description

Various outputs of GPS Master Clock Model MC-1-U device is provided at rear panel of unit. Below is the description of all possible outputs as per GPS Master Clock Model MC-1-U configurations with 1 NTP, 1 IRIG-B AM output and 4 additional pulse outputs. There may be other optional outputs present (as per ordered configuration) apart from standard outputs.

1. Power Input and Fuse Connector:

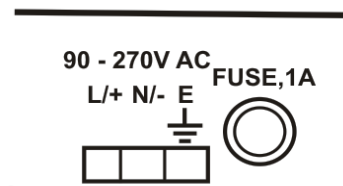


Figure 5-3 Power supply terminal

2. Relay and Event contacts:

GPS Master Clock Model MC-1-U provide three relay outputs for Power, Watchdog and GPS LOST alarm and OptoMOS pulse output through 8 pin female connectors. Factory set Relay contact provided on rear panel connector are C-NO terminals.



Figure 5-4 Relay and Standard Event terminal

Please refer Relay output section 12.1 for various configurations.

3. **Additional Event outputs:**

GPS Master Clock Model MC-1-U has the capability to provide multiple event outputs in addition to standard PPM/PPH event output. The single event output provides pulse at configured event interval with pre-configured pulse width. This pulse outputs are OptoMOS output (optically coupled solid state Relay output) provided through 8 pin female connectors.



Figure 5-5 Additional Events terminal

GPS Master Clock Model MC-1-U model is available with optional Additional Event Outputs.

4. **Ethernet Output Connector:**

GPS Master Clock Model MC-1-U is equipped with 10/100 Mbps Ethernet output for NTP, SNMP and Telnet communication as shown in figure 5.6.

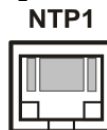


Figure 5-6 GPS Ethernet NTP terminal

GPS Master Clock Model MC-1-U model is available with max. 2 NTP optional outputs.

5. **1PPS Connector:**

GPS Master Clock Model MC-1-U provides 1PPS output at TTL signal level through BNC connector on rear panel of unit as shown in figure 5.7.



Figure 5-7 1PPS BNC terminal

GPS Master Clock Model MC-1-U model is available with 1 x 1PPS output as standard option.

6. **IRIG-B output:**

GPS Master Clock Model MC-1-U provides IRIG-B TTL / IEEE-1344 TTL and IRIG-B AM / IEEE 1344 AM output through their respective BNC connector on rear panel of unit as shown in figure 5.8.

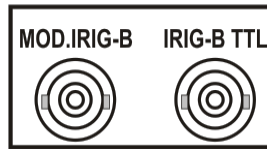


Figure 5-8 IRIG-TTL, AM BNC terminal

GPS Master Clock Model MC-1-U model is available with 1 x IRIG-B / IEEE 1344 TTL as standard option with 1 x IRIG-B / IEEE 1344 AM as an optional output.

7. COM1 terminal:

COM1 terminal on back plane is RS-232/RS-485 electrical standard DB-9 female connector as shown in figure 5.9.

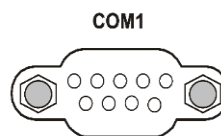


Figure 5-9 COM1 terminal

GPS Master Clock Model MC-1-U provides serial time frame NMEA format on its COM1 terminal. This terminal provides NMEA time output either in RS-232 electrical standard or RS-485 electrical standard as per specified during unit order. If nothing specified, the factory set settings of COM1 terminal is as per RS-232 electrical standard output.

If Configuration of COM1 terminal is as per RS-232 standard, cross cable (having connection on Pin2, 3 and Pin5) can be used to provide NMEA serial time frame to other peripherals. Pin 4 of COM1 connector is used to provide 1PPS signal in RS-232 format.

If Configuration of COM1 terminal is as per RS-485 standard, Pin 7 of DB-9 connector will act as D+ line and Pin 8 will be D- line.

GPS Master Clock Model MC-1-U model is available with 1 NMEA serial output as standard option.

8. COM2 terminal:

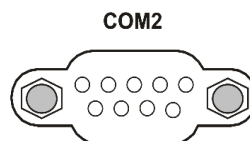


Figure 5-10 COM2 terminal

COM2 terminal on back plane is RS-232/RS-485 electrical standard DB-9 female connector as shown in figure 5.10. GPS Master Clock Model MC-1-U provides serial time frame T-format / NGTS format on its COM2 terminal and can also be used for GPS Master Clock Model MC-1-U configuration. This terminal connection will be as per RS-232 electrical standard or RS-485 electrical standard as per specified during unit order. If nothing specified, the factory set settings of COM2 terminal is as per RS-232 electrical standard output.

If Configuration of COM2 terminal is as per RS-232 standard, cross cable (having connection on Pin2, 3 and Pin5) can be used for configuration and to provide serial time frame to other peripherals. Pin 4 of COM2 connector is used to provide 1PPM signal in RS-232 format.

If Configuration of COM1 terminal is as per RS-485 standard, Pin 7 of DB-9 connector will act as D+ line and Pin 8 will be D- line.

9. GPS Antenna connector:

ANTENNA



Figure 5-11 GPS Antenna terminal

GPS Master Clock Model MC-1-U device have a BNC female connector at its rear panel for connecting GPS antenna as shown in figure 5.11. This connector provides 5 VDC supply to antenna. Refer Antenna Installation section 6 for connecting GPS Antenna.

6. GPS Master Clock Model MC-1-U Installation

Before beginning with unit installation, please follow important safety statements for avoiding installation practices causing malfunctioning of the device as mentioned below.

	OPERATION RELIABILITY To minimize the possibility of fire or shock hazards, do not expose this instrument to rain or excessive moisture Do not use this instrument in areas under hazardous conditions such as excessive shock, vibration, dirt, moisture, corrosive gases or oil. The ambient temperature of the areas should not exceed the maximum rating specified
	WARNING It is recommended to get the installation of this product to be done by authorized service personnel of the manufacturing company or by the trained and qualified operator in coordination with authorized service personnel of the manufacturer company. Installation of the equipment is to be complied with per local and national electrical codes.
	This equipment is sensitive to Electrostatic Discharge (ESD). Observe all ESD safeguards while using this equipment
	OPERATION RELIABILITY This equipment can be damaged if incorrect power source voltage is applied. This equipment can be damaged if the power source is applied with incorrect polarity on its respective terminal. Never plug unit power supply connector or power supply cables in the terminal while the main power source is ON.

	WARNING This equipment should be always used with earth grounded. Never defeat the ground connector or operate the equipment in the absence of a suitable earth ground connection. 
	WARNING Never work on an open unit when the power of the unit is ON.
	WARNING The unit is equipped with an internal fuse. If it is blown Up or blowing again on its replacement, either the power source is probably incorrect or the power source connection is improper. The internal fuse should be only replaced with the same fuse type and same fuse rating as supplied from the manufacturer factory. Replacement of Fuse should be done in unit Power OFF condition only.

6.1 GNSS Antenna Installation

GNSS Antenna and Cable Information

GPS Master Clock Model MC-1-U comes complete with the necessary hardware to be able to receive GNSS signals: 50-feet of RG-6/RG11 cable and a GNSS antenna. The antenna cable is connected between the female TNC on the antenna and the female BNC connector at the rear panel of the clock.

This section should help you with installing the GNSS antenna and antenna cable(s) and connecting them to the model GPS Master Clock Model MC-1-U series clocks. It should also be a source of information if you should need to troubleshoot the antenna cable system. These clocks achieve their accuracy. By comparing and adjusting the internal clock signal to the incoming GNSS signal.

6.1.1 GNSS Antenna Installation

Refer steps for installation of GNSS antenna and antenna cable as described below.

Selecting a GNSS Antenna Site Outdoors

Select a site or antenna mounting position that...

- Is the highest point available?
- Offers a full 360° view horizontally, to within 10° vertically of the horizon
- Is higher than neighboring buildings/obstructions
- Is protected from strong radio frequency (RF) and microwave transmissions
- Is set away from RF-reflective surfaces that cause multipath interference
- Is set 3 ft. (1 m) away from other GNSS antennas

Avoid...

- Mounting the antenna between tall buildings or next to walls and equipment
- Cable type and cable length which runs from the antenna to the receiver that exceeds the specified length
- Patching multiple cables together to make a single cable run
- Running the cable through bulkheads and alongside high-energy cables
- Crimping or damaging the cable

Blocked signals and multipath cancellation may significantly increase satellite signals acquisition time. Multipath Cancellation is caused by reflected signals that reach the antenna out of phase with the direct signal due to vertical reflective objects positioned to the side and above the antenna. To solve these problems, the user must mount the antenna at least 1 meter away from and above the reflecting surface.

To properly receive satellite signals, the Antenna needs to be mounted clear of buildings as surrounding elements or heightened obstacles may block the GPS/GLONASS/NAVIC signals transmission done with the satellites. For complete antenna signals coverage, the antenna needs to have a clear view of the sky and if the antenna is mounted in a less favorable location, it may work however GPS/GLONASS/NAVIC antenna signals reception capability may be somewhat limited/deteriorated during certain hours of the day.

6.1.2 Mounting the Antenna

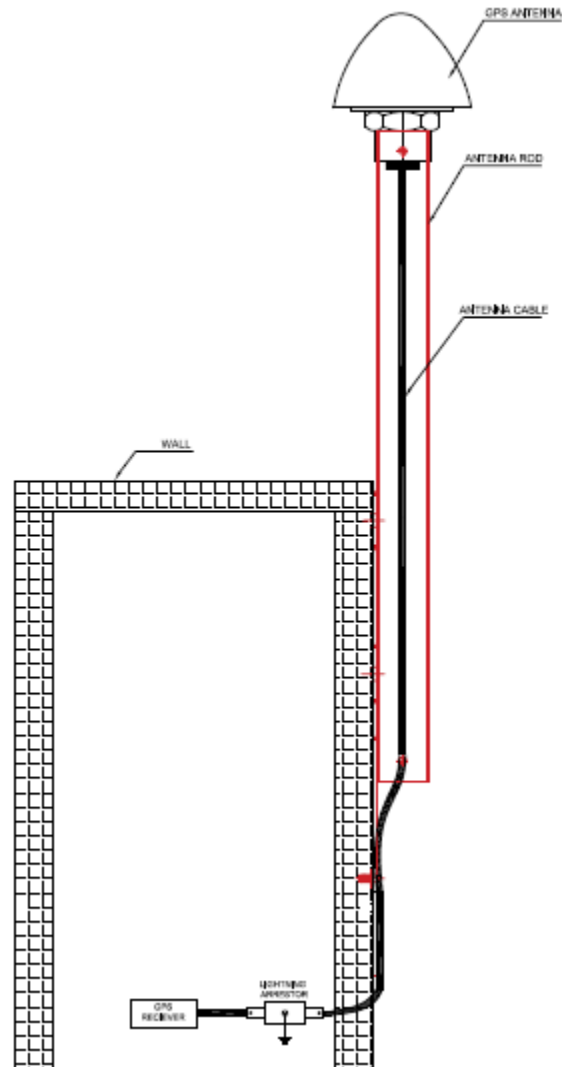


Figure 6-1 Antenna Mounting with Lightning Arrestor

Mount the GNSS antenna on an antenna mast (recommended) or on the peak of a building. The GNSS antenna kit (P/N no.: m-MK-AMC-40-1) includes special mounting Pole with Antenna Cable. To ensure a trouble-free installation the strain must be taken off the Cable by looping the cable.

Note: In case of Lightning arrestor, it will be connected directly to the receiver (At the receiver clock card where Antenna" is written) & then at the other end of Arrestor, the RG6 antenna cable is to be connected which is coming from the antenna. Lightning arrestor must be earthed (at the screw provision given on the body of arrestor to fix the "u" or "ring" type of lug for earth) properly for grounding the high potential which may travels through lightning.



FUNCTIONALITY

- Use GNSS antenna cable supplied from the factory or as recommended in manual. If an antenna cable other than recommended is to be used, contact Masibus Customer Service representative.
- Do not cut the antenna cable to shorten its length. Instead, bundle the excess cable to shorten antenna cable length.
- The model MC-1-U requires a 5 Volt-compatible antenna. Antennas not rated for 5 V will be damaged.
- Use a splitter to connect a single GNSS antenna to multiple GPS Master Clock Model MC-1-U units. Avoid using BNC "T" connectors.

6.1.2.1 GNSS -related Accessories

The following options/accessories can be ordered:

1. Protect against lightning and field-induced electrical surges.
2. Connect multiple GPS Master Clock Model MC-1-U receivers to a single antenna.
3. Extend the range of the GNSS antenna cable.

1. Lightning Arrestor

Lightning may damage GNSS system components and receiving equipment, even without a direct hit, resulting in costly repairs and critical interruption of service. The lightning arrestor is designed to work in conjunction with a low-resistance, low-inductance ground to protect your GPS receiver and elements of the antenna system from lightning discharges and field-induced electrical surges. lightning arrestor should be mounted between the antenna Port of GPS master clock and the BNC Cable of Antenna cable.



Note: Please make sure that lightning arrester is earthed properly with the earth connection of Aux Power supply. (In above mentioned image, yellow wire indicates the earth connection)

2. Antenna Splitter

An antenna splitter may be used to drive multiple GPS receivers using a single antenna. With built-in amplification to overcome splitter losses, the Active Splitters may be conveniently cascaded without adding separate amplifiers and bias-tees between splitters. Power is conveniently obtained from the GPS receiver(s) connected to the amplifier, eliminating the need for separate dc power supply and wiring.

3. In-Line Antenna Amplifier

In-line amplifiers overcome signal attenuation by amplifying the signal (GPS/GLOANASS/NAVIC). Use the in-line amplifier for cable runs of 100 to 200 meters. Please contact a masibus Sales Representative for information on how to extend the distance from the antenna to the receiver.

6.1.3 Verifying Antenna and Cable Operation

	WARNING Please ensure that while doing the below-mentioned procedure for checking antenna voltage/current while the unit is in POWER ON condition, do not short the antenna supply +5 Vdc and GND, in any case, failure of which will damage the unit internal electrical supply.
	This equipment is sensitive to Electrostatic Discharge (ESD). Observe all ESD safeguards while using this equipment. Otherwise, there is the danger that the unit may get damaged through ESD.

6.1.3.1 Checking the Antenna Voltage

GPS Master Clock Model MC-1-U unit provides +5 Vdc to the GNSS antenna through its Antenna connector on the unit rear panel, which is carried through the antenna cable. The nominal antenna current is 10 mA. Check the voltage at the antenna connector on the unit rear panel antenna connector. Without the +5Vdc supply on the antenna connector of the unit, the antenna and GPS Master Clock MC-1-U will not synchronize with the GNSS satellites signal and can generate a GNSS UNLOCK alarm.

6.1.3.2 Power Supply Check

The Antenna Voltage test (mentioned above in section 6.1.3.1) tests the main power supply voltage for all models of GPS Master Clock MC-1-U. This voltage should be between 4.9 and 5.1 V dc.

6.1.3.3 Checking the Antenna Resistance

Checking the internal resistance of the GNSS antenna is not as useful as verifying the antenna current mentioned above in section 6.1.3.1. Antenna resistance measures several mega ohms with Multi-meter probes at one polarity and less so if you change the Multi-meter probe polarity.

6.1.4 Antenna Surge Suppressor

If the GNSS Surge Suppressor kit is available with a purchase order, the user should mount it in line with the antenna cable. Additional information on grounding GNSS antennas, and grounding in general, are available from the Masibus Customer Support division (Kit P/N:m-LA-01).

6.1.5 Technical Details on GNSS Antennas and Cables

Antenna Cable

Length and Loss Considerations

Standard Antenna Cable

The standard antenna cable assembly included with GPS Master Clock MC-1-U is constructed using a 15-meters (50-foot) length of RG-6 type low-loss coaxial cable, terminated with TNC male and BNC male connector. Optional lengths of RG-6 coax are separately available for longer runs; see the table 6-1

Effects of Cable Parameters

To receive GNSS signals and properly operate the clock, the type and length of the cable are important. Due to their effect on specific parameters described in the following paragraphs, any changes to the length and/or type of antenna cable should be made carefully. Damaged cables may also affect performance.

Cable Delay

The velocity factor and the physical length of the cable determine cable delay. The user has to enter the delay value according to antenna cable length.

For cable options, the delay is tabulated below. The formula for calculating cable delay is:

$$T = \lambda \frac{1}{CKv} + 1ns$$

Where:

T = Cable delay, in nanoseconds,
 λ = Cable length, in meters,
C = Speed of light (3 _ 108 meters per second),
Kv = Nominal velocity of propagation (0.85).

One nanosecond is added to the calculated value to account for the length and velocity factor of the short connecting cable inside of the clock.

Attenuation

Attenuation depends upon the cable length, and the loss per unit length. The total attenuation must be limited to 30 dB (maximum) at the GPS L1 frequency of 1575.42 MHz

DC Resistance

The cross-sectional area and length of the conductors in the cable determine the dc resistance. Since the power to the RF preamplifier in the antenna is supplied via the antenna cable, the excessive dc resistance will degrade performance. Because of the above factors, changes to the length and/or type of antenna cable should be made carefully. Damaged cables may also affect performance.

Available Antenna Cables and Accessories for Longer Runs

masibus offers longer antenna cables for use with all models of clocks when the standard 15 meters (50-foot) cable is inadequate. RG-6 cable runs up to 50 meters. **masibus** offers an in-line amplifier, (P/N: m-LA-01) for long antenna cable requirements up to 200 meters (656 feet).

Description	Delay, ns	Signal Level, dB
15-m (50-ft) cable, RG-6	60 ns	5dB
30-m (100-ft) cable, RG-6	120 ns	9dB
50-m (164-ft) cable, RG-6	200 ns	15dB
100-m (328-ft) cable, RG-6	393 ns	17dB

Table 6-1 Antenna Mounting

Connection to Antenna

The male TNC connector on one end of the antenna cable mates with the female TNC connector on the antenna.

Connection to GPS master Clock

The male Type BNC connector on the opposite end of the antenna cable connects to the female Type BNC connector on the rear panel of the GNSS Clock.

6.2 Unit Installation

After GNSS Antenna installation is complete, GPS Master Clock MC-1-U unit can be installed as per the below procedures.

1. It is necessary to provide the correct power supply to the unit as per the specified order or as per the power supply specification mentioned at the unit's rear panel.
2. Ensure that the power supply polarity connections are done as per mentioned Label on the specific power supply connector terminal on the rear panel.
3. It is recommended to not connect the NTP outputs in the installation site Ethernet network till proper network settings are done in the unit.
4. It is recommended to first get the GPS Master Clock MC-1-U unit LOCK before using all outputs for time synchronization to a client device to avoid time difference of GPS Master Clock MC-1-U w.r.t. UTC due to GPS Master Clock MC-1-U POWER ON in Unlock conditions or battery discharged due to long period (as per [section 7.2](#)) of a unit in Power OFF conditions.
5. After the power supply is connected properly, Power ON the unit. After the unit is Power ON, there are specific messages displayed on the screen till the time and date are displayed on the unit display screen. Refer to [section 7.3](#) for the Unit Power ON status.
6. At startup, the clock of the unit in Unlock conditions may not be correct if the unit was in Power OFF condition for a long duration. Refer to [section 7.1](#) and [section 7.2](#).
7. It is necessary to change the Ethernet addresses of unit NTP output ports individually (connecting NTP port directly with PC using Ethernet cable) before using GNSS as NTP server. Refer to [section 12.1](#) or [section 12.3](#) and [section 9.3](#).
8. Users can configure other configurable parameters of GPS Master Clock MC-1-U using the keypad and Terminal serial communication as explained in [section 8](#) and [section 9](#) respectively.
9. After unit settings and configuration is done, the user should provide a power restart to the unit.
10. After unit Power ON, the unit should be kept for the warm-up duration in LOCK condition.
11. Once the unit is Power ON, it is necessary to keep the unit in warm-up condition for a minimum of 1 hour in antenna LOCK condition for precise and accurate timing outputs during unit LOCK and Holdover conditions.

6.3 Connection Diagram

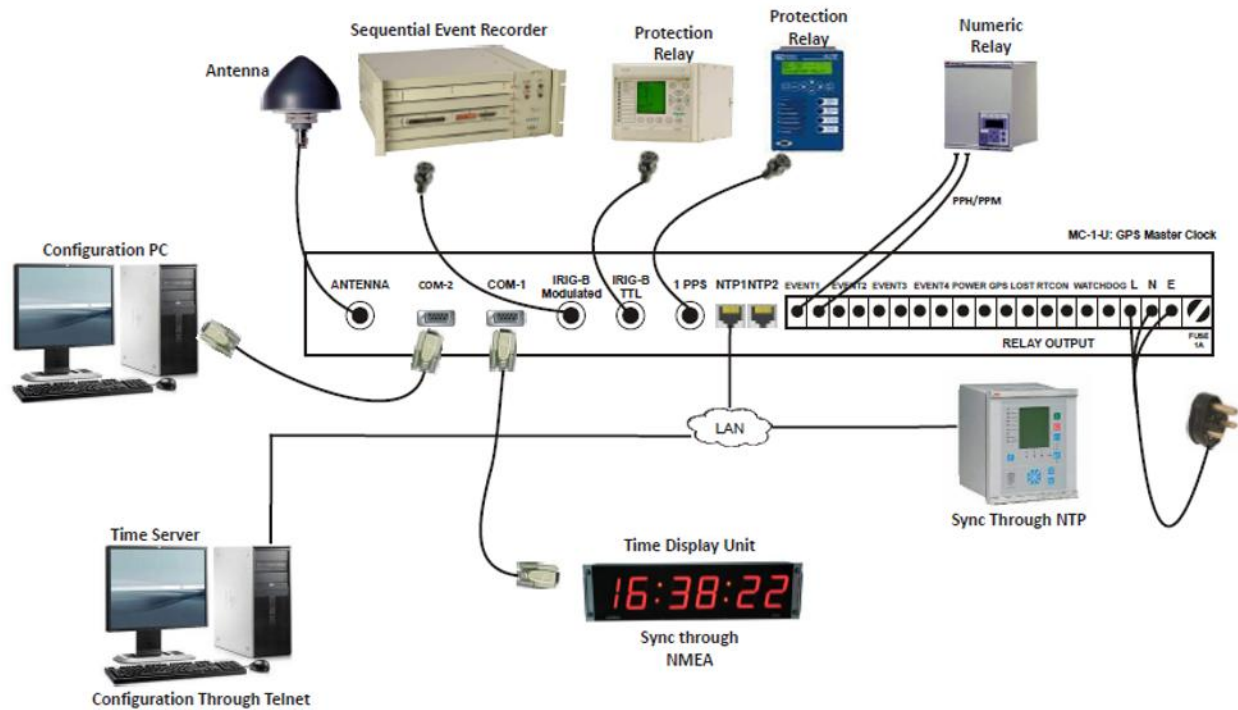


Figure 6-2 GPS Master Clock MC-1-U Connection Diagram

6.4 Hardware Jumper Setting

	FUNCTIONALITY Hardware jumper settings inside the unit should be done while the unit is in POWER OFF condition.
	This equipment is sensitive to Electrostatic Discharge (ESD). Observe all ESD safeguards while using this equipment. Otherwise, there is the danger that the unit may get damaged through ESD.

GPS Master Clock model MC-1-U device comes with complete system configurations as per factory set settings and if any, as per specified ordered configurations. There are few output options available that can be changed by the operator at its end i.e. Relay contacts configuration from C-NO to C-NC contacts in relay card and COM1 and COM2 terminal RS-232 to RS-485 electrical configurations. However, it is recommended to change the hardware settings after contacting the Masibus Customer Support department.

For changing above mentioned settings, jumpers are provided on the main card inside the unit. For changing any configuration, follow the below procedure step by step.

1. Power off the unit from the supply. Remove all the output connections/cables connected on the rear panel of the GPS Master Clock model MC-1-U unit.
2. If the unit is mounted inside the panel, please remove the unit from the panel.
3. Open the top black cover of the unit by unscrewing screws on the top cover. After removing the screws, remove the top cover.
4. Change jumper settings as described in respective applicable [section 7](#) as explained.
5. After changes are done, please refit the top black cover with screws.
6. After restarting the unit on Power ON, the user should take care of the cable connections done on rear panel connectors specifically those whose output configurations have been changed through internal jumpers.

Below Figure shows the location of Jumpers CN20, CN22, CN23 for Relay contacts, CN12, CN13 for COM1 terminal and CN16, CN18 for COM2 terminal on the main card (front top view).

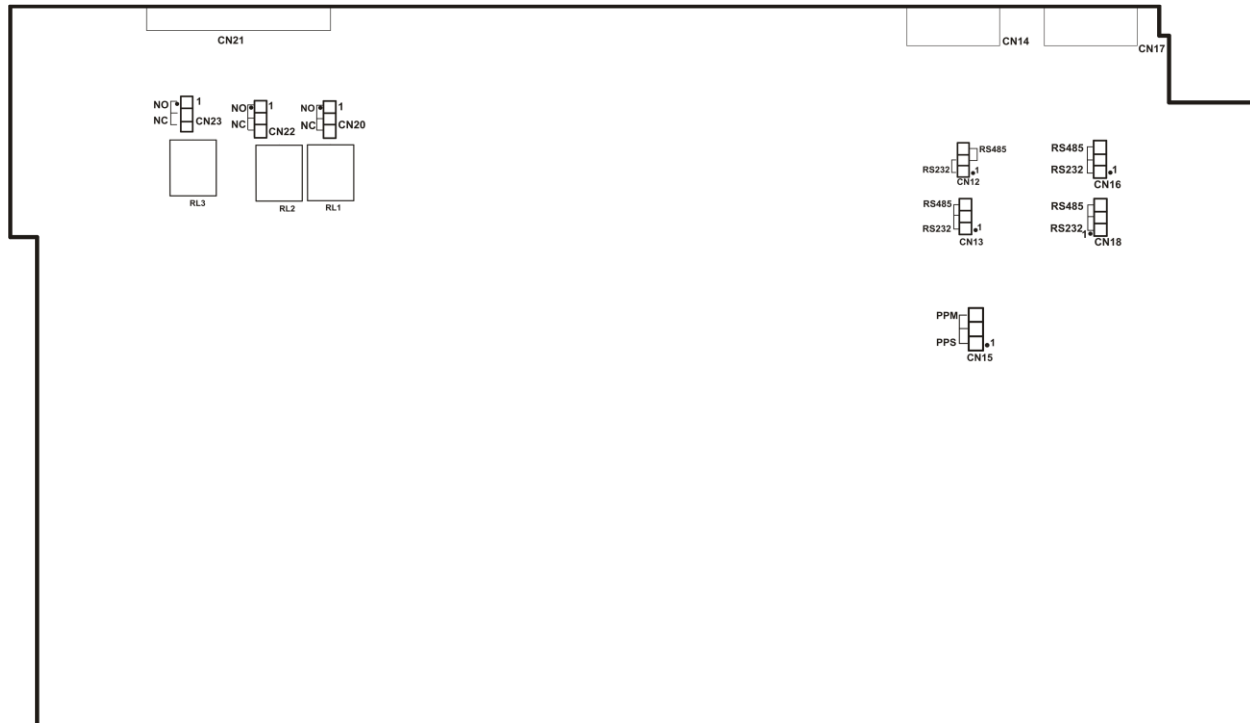


Figure 6-3 GPS Master Clock Model MC-1-U Main board (Top View)

6.5 Relay Contact Output Configurations:

The factory default settings of Relay contacts for Power, Watchdog and GPS LOST alarm, available on rear panel of unit are as per C-NO contacts (if any special request is not provided for setting relay output contacts configuration). If required, operator can change the relay contact from C-NO to C-NC contact as explained in below details.

6.5.1 Power Relay Contacts:

CN20 3-pin jumper on main card is used to change the relay contact for POWER relay contacts. Operator has to remove black jumper from its current position to required position as explained in below images. Refer below figure for C-NO jumper position configuration and C-NC jumper position configuration.

C-NO Configuration:	C-NC Configuration:
NO C NC CN20	NO C NC CN20

Table 6-2 Power Relay Configuration

6.5.2 GPS LOST Relay Contacts:

CN22 3-pin jumper on main card is used to change the relay contact for GPS LOST relay contacts. Operator has to remove black jumper from its current position to required position as explained in below images. Refer below figure for C-NO jumper position configuration and C-NC jumper position configuration.

C-NO Configuration:	C-NC Configuration:
NO C NC  CN22	NO C NC  CN22

Table 6-3 GPS Lost Configurations

6.5.3 WATCHDOG Relay Contacts:

CN23 3-pin jumper on main card is used to change the relay contact for Watchdog relay contacts. Operator has to remove black jumper from its current position to required position as explained in below images. Refer below figure for C-NO jumper position configuration and C-NC jumper position configuration.

C-NO Configuration:	C-NC Configuration:
NO C NC  CN23	NO C NC  CN23

Table 6-4 WATCHDOG Relay Configurations

6.6 COM1 terminal RS232 / RS485 output configurations:

COM1 terminal provides serial based NMEA time frame at every second once after unit boots. COM1 terminal can be configured to provide NMEA time frame on RS-232 electrical standard or RS-485 electrical standard. A COM1 terminal is configured as RS-232 output as factory default. CN12 and CN13 jumpers on main board of unit are used to change the configuration between RS232 to RS485 standard. Please refer below table showing the jumpers position required for RS232 and RS485 configuration.

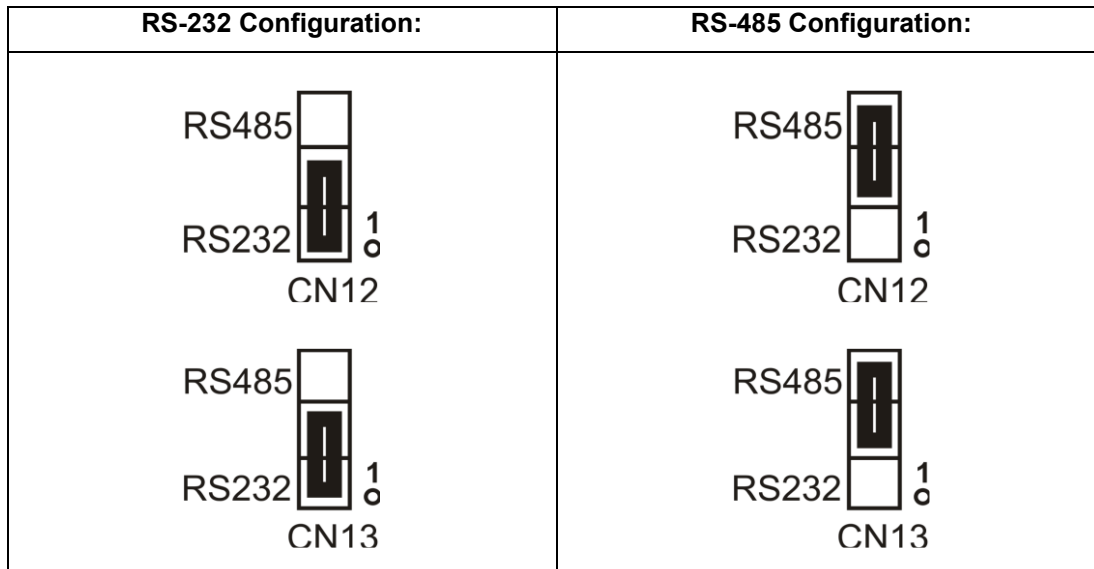


Figure 6-4 COM1 terminal RS-232/RS-485 Configuration

6.7 COM2 terminal RS232 / RS485 output configurations:

COM2 terminal provides serial-based T-format, NGTS time frame at every minute once after unit boots. This terminal is also used for GPS configuration. COM2 terminal can be configured for RS-232 electrical standard or RS-485 electrical standard based communication. A COM2 terminal is configured as RS-232 output as factory default. CN16 and CN18 jumpers on main board of unit are used to change the configuration between RS232 to RS485 standard. Please refer below table showing the jumpers position required for RS232 and RS485 configuration.

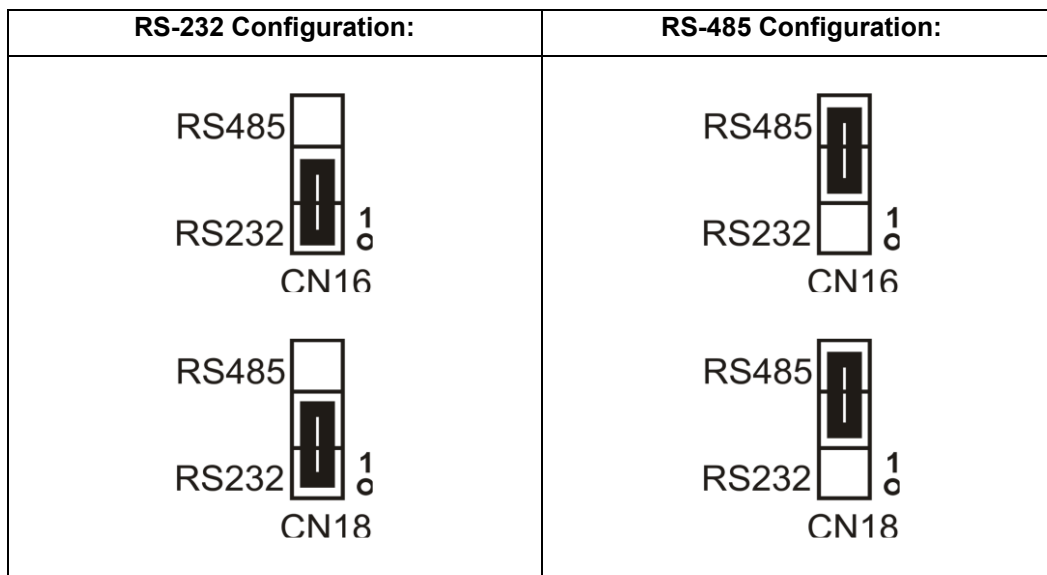


Figure 6-5 COM2 terminal RS-232/RS-485 Configuration

7. GPS Master Clock MC-1-U Power ON

7.1 Receiver Boot-up mode

When GPS Master Clock MC-1-U unit is power-up, the time of the unit depends on the GPS receiver RTC data. At every Power ON, the unit is in UNLOCK mode initially. If the GNSS antenna is connected after Power ON or was already connected while powering up the unit, the time to getting unit LOCK depends on the duration for which the unit was in Power OFF condition. Also, if the unit was in UNLOCK condition during the normal operation of the unit, the time taken by the unit to get LOCK after the antenna is connected depends on the duration for which unit was in UNLOCK condition.

Refer to the explanation below for the time taken by the unit to get LOCK after Power off or UNLOCK condition.

For a receiver to obtain a position fix, it must download the almanac and ephemeris information from the satellite through a satellite frame. The receiver must download almanac and ephemeris information to achieve a position fix. Depending on the parameters such as valid almanac, ephemeris data of previously visible satellites, last position of the receiver, and time stored, the boot process (Cold start / Warm start / Hot start) mode is determined.

Cold start: If the GPS receiver does not have any initial data regarding the current almanac, ephemeris data (case when backup battery is discharged) or it has invalid data for almanac and ephemeris information, on boot up the receiver will enter in Cold start mode. To get current almanac data, the GPS receiver should receive at least one satellite frame. Typically, TTFF (Time to First Fix) for a position in Cold start is less than <45 seconds (when GNSS Antenna is placed in open sky conditions without any obstacle interference) because each GPS receiver may take few seconds to get initialized on boot up and as each satellite frame takes 30 seconds to transmit single frame.

Since each satellite transmits a total of 25 frames as satellite complete broadcast message, complete almanac data is transmitted by satellite in 12.5 minutes. So, to have very highly accurate position and time data, to reach 90% confidence level after acquiring complete almanac data from each satellite, Cold start for TTFF (Time to First Fix) can be < 15 minutes, it will acquire almanac and ephemeris data for visible satellites and thereafter receiver will enter in its normal operation mode. In this case, the antenna must be located in an open environment having no immediate obstacles.

If the device is moved to a very far location in hundreds of kilometres from its last operation position and the system is made ON, then the receiver will try to identify visible satellites data and compare it with previously stored almanac data. If this does not match, the receiver will start as in Cold start mode.

Warm or Normal start: In the warm start mode, when the receiver boots and if the information of current almanac satellite data, time which receiver knows is within 20 seconds from the satellite time, receiver position to within 100 km but do not have ephemeris information or ephemeris information may be invalid, the receiver enters Warm start mode. Typically, the time required for position fix in Warm mode is less than 38 seconds (when GNSS Antenna is placed in open sky conditions without any obstacle interference) as each satellite transmits its ephemeris data every 30 seconds.

If the receiver does not have valid almanac data, it enters the Cold start mode.

Hot start: When receiver boots up, if the information/data of current almanac, position, the current time is stored and are valid, receiver enter Hot start mode and provides accurate time within few tens of seconds.

7.2 Battery Backup RTC and GPS receiver RAM Configurations:

Backup batteries are used to keep the RAM and the Real-Time Clock (RTC) in the receiver running even after unit Power OFF to retain setup and status information, Time, Date, Last Calculated Receiver Position, Almanac and Ephemeris information along with receiver specific parameters allowing resumption of GNSS operation automatically once unit mains power is restored. In this “Warm Start” scenario when the unit power is restored, the receiver scans the RTC to check how much duration has elapsed since power was removed, calculates which satellites should be visible using the previously stored almanac information, and then proceeds to develop a fix information providing data.

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

Even on the Loss of the UTC Time Source, MC-1-U time server will revert back to its internal RTC time

Battery Specification:

Manganese lithium, 3.6 volts, 17 mAh,
Memory Retention Time: 15 days (approx.)



It is recommended that if the GPS Master Clock MC-1-U unit was in Power off condition for the duration of more than specified Memory retention time, the user should allow keeping unit in Power ON condition for 72hours to charge the RTC backup battery to full level.

Non-Volatile Memory Configuration:

The GPS clock maintains all configuration parameters internally in non-volatile memory, even when the power is off.

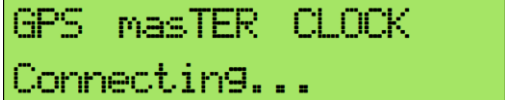
7.3 Startup Operation

Before powering up the GPS Master Clock MC-1-U device, the user has to ensure that power supply connections are done properly. When power is applied, below is the basic start-up sequence of the GPS Master Clock MC-1-U Device.

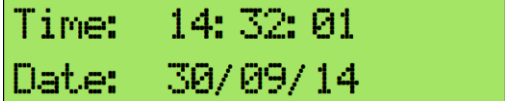
- While GPS is in Power off, all the outputs are disabled.
- As soon as Power is applied, GPS Display and GPS POWER LED in “Red” colour on the front panel illuminates, and as the GPS is in unlock condition at startup, GPS LOCKED LED illuminates in RED colour.
- There is a sequence of messages on LCD which are display one after another as mentioned below.

```
Masibus Auto. &  
Inst. Pvt. Ltd.
```

```
Com 1: 9600-N-8-1  
Com 2: 9600-N-8-1
```



GPS MASTER CLOCK
Connecting...



Time: 14:32:01
Date: 30/09/14

- Few seconds after the GPS unit is powered up, 1PPS LED will start flashing in RED colour which indicates the Pulse per second output available.
- When the time gets displayed on the unit display, all other outputs will become active.
- All messages showing unit LOCK/UNLOCK status, position information, day of the year, day of the week, date, rear panel terminal time frame format are displayed in rotation in the last line of LCD.
- If the unit was in Power off conditions for a duration longer than required as per battery backup requirement (refer to [section 7.1](#) and [section 7.2](#)), time of GPS Master Clock MC-1-U device will get reset to **default time** (Time: 23:59:59 and Date: 21/8/99), in such case all outputs such as time on display, NTP, IRIG-B, serial time outputs, all event outputs will be according to default time. Time will only be corrected after the MC-1-U Unit gets in LOCK condition after the GNSS antenna is connected to the device.
- There are other 5 status LED's on the front panel of the GPS Master Clock MC-1-U device. When Power is applied to the device, GPS LOCKED indication illuminates in RED colour. If GNSS Antenna is connected, after few minutes, GPS will get Lock and will be indicated by GREEN indication on GPS LOCKED LED. The time taken to get a GPS lock will depend on the start mode of the GPS receiver whether the GPS receiver is in Cold start or Warm Start or Hot start mode.
- GPS Master Clock MC-1-U device provides relay contacts on its terminal at the back panel of the unit for Power and GNSS Lost. Factory set configuration for relay contacts for all mentioned outputs is C-NO terminal.
- After GPS Master Clock MC-1-U device is Power ON, Power relay output is energized.
- After the time is displayed on the device display. If the unit becomes unhealthy after a few seconds the watchdog LED in the front panel will be ON. It will maintain its output status till the unit regains its healthy status.
- If GPS Master Clock MC-1-U is in LOCK condition, GPS LOST relay will be in energized condition and GPS LOCK LED on the front panel will be in green colour.
- All other event outputs (optional) are ON as per the respective event time configured.
- Factory set setting of all additional event outputs (optional) is set as 60 seconds event time with 50 milliseconds event ON period.
- Time and date displayed on the unit will be in I.S.T. format (UTC + 5:30 hrs)- Indian Standard Time format and all other parameters such as GPS lock status, GPS parameters, and others will be displayed in sequence at 5 seconds intervals.
- Once the unit is Power up and time is displayed, the unit will start transmitting the serial T-FMT/NGTS frame on the terminal located at the rear panel of the unit. Terminal output communication settings will be at 9600, 8, N, 1. NTP outputs will be at configured factory set factory IP address and will be active once NTP client requests are received on a particular NTP port. IRIG-TTL output will be at TTL voltage level i.e. 0(low level) and 5V(high level) and IRIG-AM (Amplitude Modulated) output will be available at 3.6Vpp.

7.4 Basic Normal Run Mode Operation

- After the unit is boot up completely and time is available on display, all the outputs of the unit i.e. event pulse outputs, IRIG, NTP, and serial time outputs will be available as per the unit clock.
- GPS Master Clock MC-1-U size unit display supports 20 x 2 lines LCD which displays parameters such as time, date, GPS LOCK/UNLOCK status, position information, day of the week, day of the year, type of serial frame format on rear panel Terminal.
- Parameter such as Time is always displayed on the first line of the LCD.
- Other parameters such as Date, GPS LOCK/UNLOCK status, and total satellites visible by the receiver, as position information, day of the week, day of the year, type of serial frame format on rear panel terminal are displayed on 2nd line of the display. These parameters are displayed in rotation as per fixed intervals.
- During the normal run mode of GPS Master Clock MC-1-U, there are several messages displayed on the LCD screen of the unit as per condition prevail. Below are messages which are available on the display screen of the unit.

Status Display: Date

```
Time: 14:32:01
Date: 30/09/14
```

Status Display: Day of Week

```
Time: 14:32:01
Day: Tuesday
```

Status Display: Day of Year

```
Time: 14:32:01
Day Of Year: 273
```

Status Display: Time frame available on Unit COM2 terminal

```
Time: 14:32:01
Format: $n9ts
```

Status Display: LOCK/UNLOCK information

```
Time: 14:32:01
GPS SIGNAL LOST
```

```
Time: 14:32:01
GPS LOCKED
```

Status Display: Total No. of Satellite available

```
Time: 14:32:01
Satellite avail:10
```

Status Display: Receiver Position information

```
Time: 14:32:01
Latt: 23"14.9208N
```

```
Time: 14:32:01
Long: 72"37.8405E
```

```
Time: 14:32:01
Height: +00024.3m
```

7.5 Firmware Upgradation:

In GPS Master Clock MC-1-U, remote firmware upgradation is possible.

For the same, you need to follow the steps given in the "**FIRMWARE UPGRADATION PROCESS**" or contact **Customer Support Team** if needed.

8. Unit Setup Configuration

GPS Master Clock MC-1-U offers the facility to the users for configuring communication parameters of serial port Terminal, Time format Option of Terminal, Display Format on LCD as well as Event Mode through its 8 key keypads.

8.1 Keypad based configuration

- The communication parameters include baud rate, number of stop bits, and parity.
- The user is free to choose either NGTS or T-Format on Terminal.
- The LCD Display Format includes Hour Mode and Time Format (UTC/LOCAL).
- Configuring four Standard & additional Events & Event On time.
- The parameters configurable through the keypad will have the same possible values as configurable through rear panel Terminal.

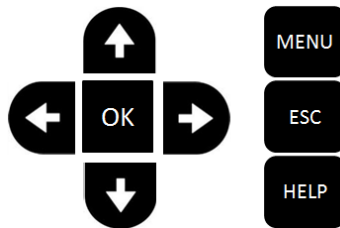


Figure 8-1 Front Panel Keypad Layout

Following is the list of keys & their functions on the front panel of GPS.

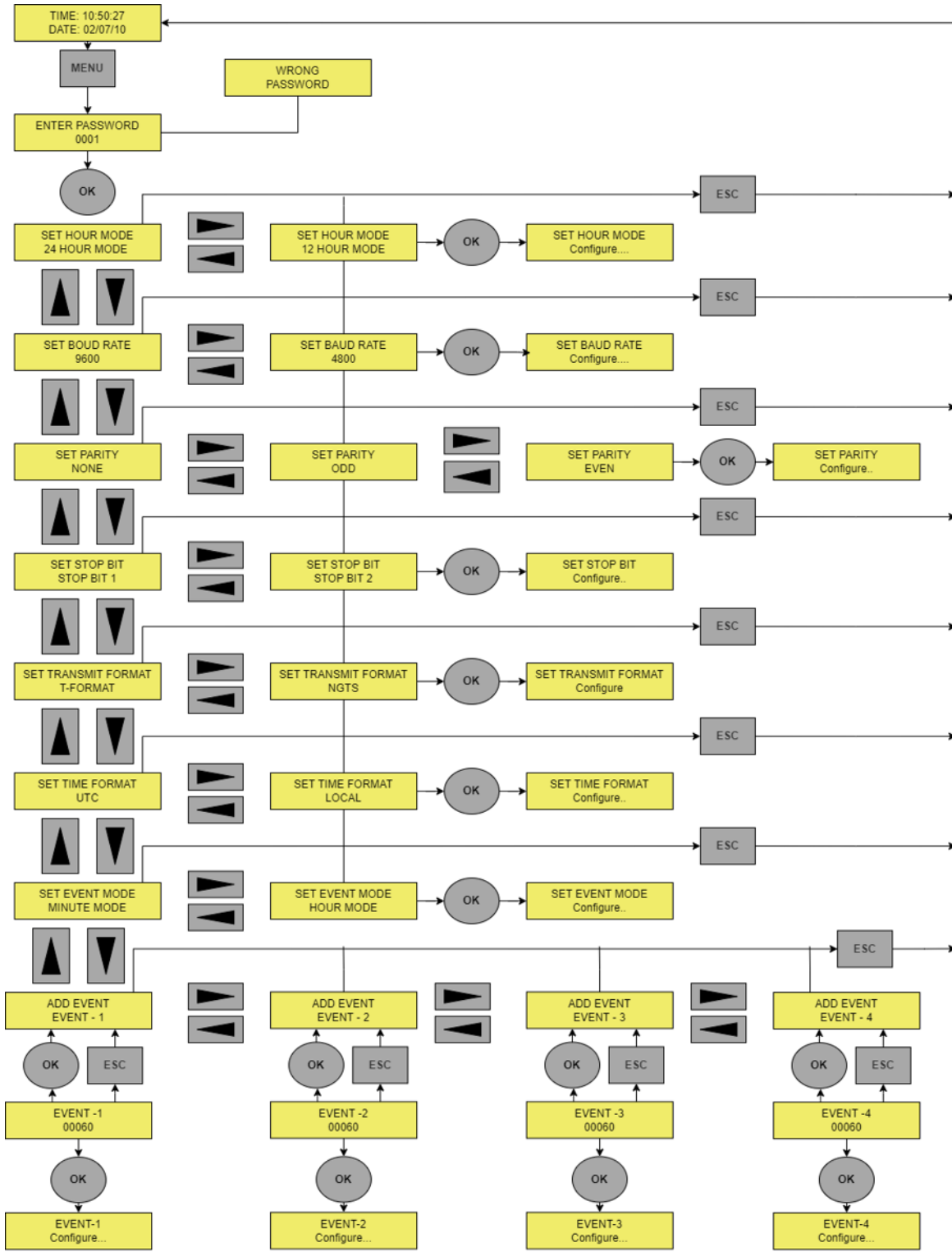
KEY	FUNCTION
MENU	For Entering into Configuration mode.
HELP	To Display help about every configurable parameter.
OK	To save the final Configurations.
ESC	To come back into Run mode.
UP	Scroll between various parameters in ascending order.
DOWN	Scroll between various parameters in descending order.
LEFT	To select various available options for the particular parameter.
RIGHT	To select various available options for the particular parameter.

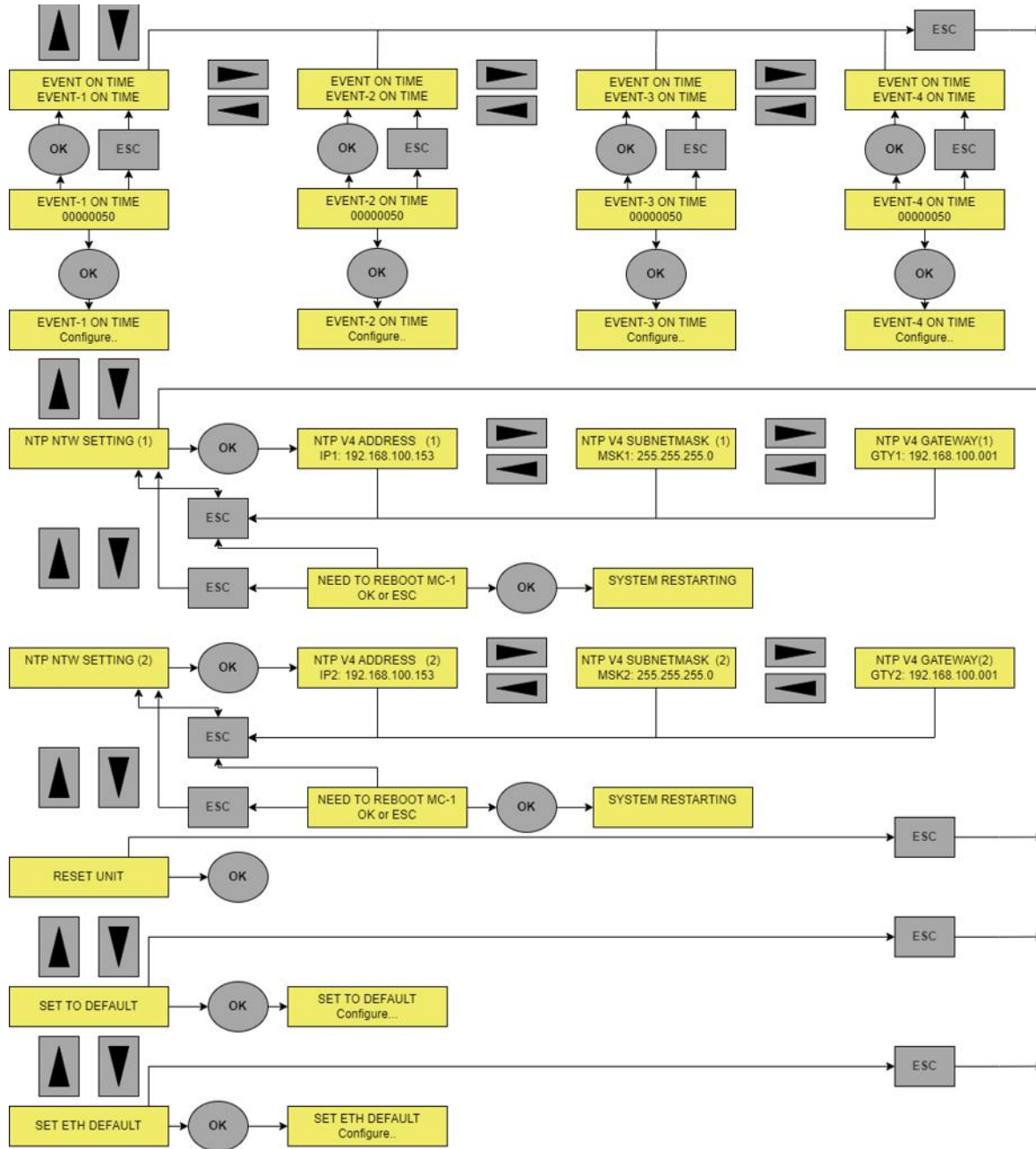
Table 8-1 Key Functions

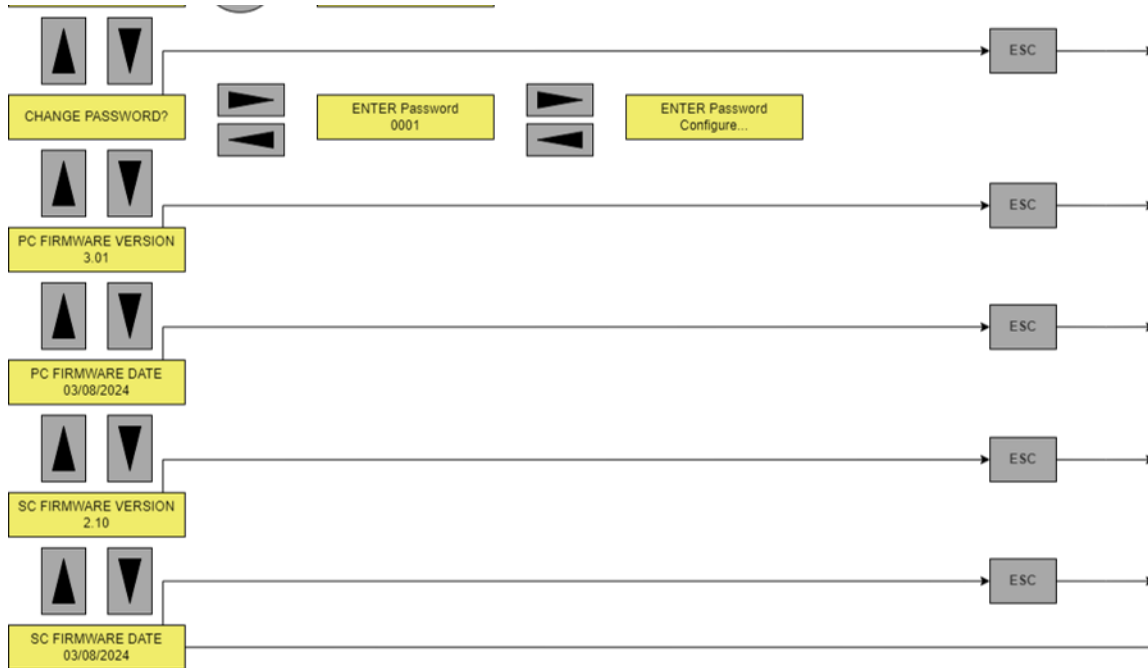
here are two passwords for configuring GPS Master Clock MC-1-U through the keypad. One is a user-defined password (0001 to 9999.), which can be changed by the user. By factory set, this password is '0001'. Another is Immortal Password that cannot be changed by any user and is kept confidential to Masi-bus Service Engineers. Users are recommended to change the user-defined password as per their requirements.

	• The password of configuration through keypad and password of configuration through the serial terminal is independent. • It is the operator's responsibility to remember the configured password if it is changed from the factory-set password. • It is necessary to press the OK key after changing any previous configuration through the keypad, failing which the particular parameter will restore to its previous setting.
---	---

The flowchart of the Keypad Menu is represented in the below figure.







Note:

- 1) During the configuration of Network settings by using front configurations keys, ensure you enter the correct value only. In case if any wrong value is entered in IP address, Mask or gateway then all other network parameters will be set to the last configured values.
- 2) Configuration can be done by a single method at a time. (i.e. Either from Telnet OR Serial OR Front configuration keys)
- 3) After Updating firmware user will be able to show correct firmware version on LHMI.

9. Serial Communication and Configuration

GPS Master Clock Model MC-1-U device has COM2 terminal at back panel of instrument which is female DB-9 connector operating on RS-232 electrical standards. This terminal can be used to configure GPS Master Clock Model MC-1-U device parameters only when COM2 terminal of GPS Master Clock Model MC-1-U device is connected to RS-232 terminal of computer using 9 pin CROSS Cable (refer below section for cable connections). The COM2 terminal also transmits serial based time signal (T-Format or NGTS depending on device configuration) only when Model device is not in configuration mode.

NOTE: COM2 terminal of Model device is also available as RS-485 electrical standards instead of RS-232 standards as an optional feature.

Configuration requires a standard 9-way D-type RS-232 cable and standard serial communication software in the PC, such as **HyperTerminal**.

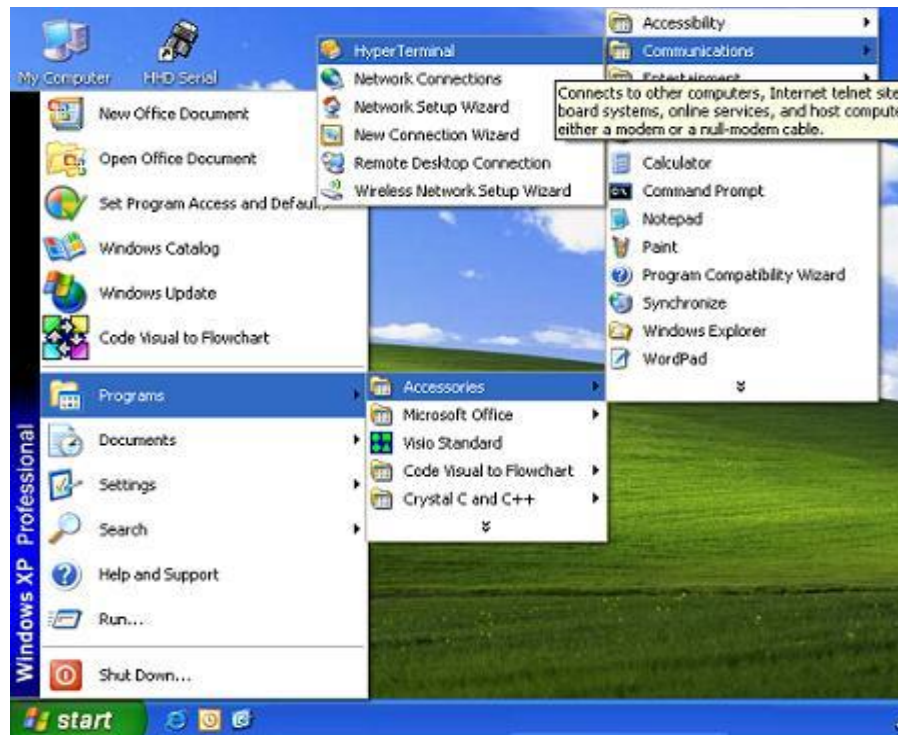


Figure 9-1 Path of HyperTerminal

9.1 Serial Port Setup and Serial Cable Configuration

The cable requirement for GPS Master Clock MC-1-U configuration is shown in figure 8. Connect one end of the cross cable to the Terminal of GPS Master Clock MC-1-U and the other end to an available serial port on your local computer. (If there is no RS-232 terminal in the user's computer, the user can use a USB-To-Serial convertor. Masibus do not provide a USB-To-Serial convertor as part of accessories supplied with the GPS Master Clock MC-1-U device).

Open the **HyperTerminal** and start a **new connection** on **COMx** of your PC. (x can be any available serial RS232 port number) as shown below figure. Users can enter any name in the "NAME" option.

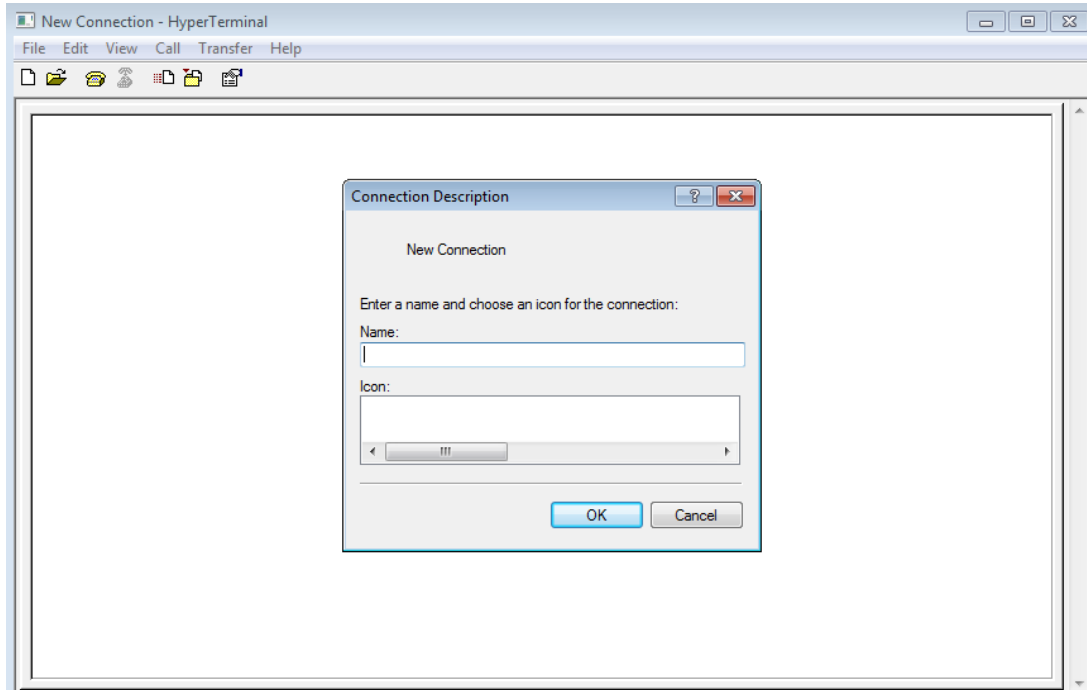


Figure 9-2 HyperTerminal View

In using **HyperTerminal**, it is recommended to select **File\Properties\Settings** and set **Emulation to ANSI**, to avoid auto-detect making unwanted changes to the settings.

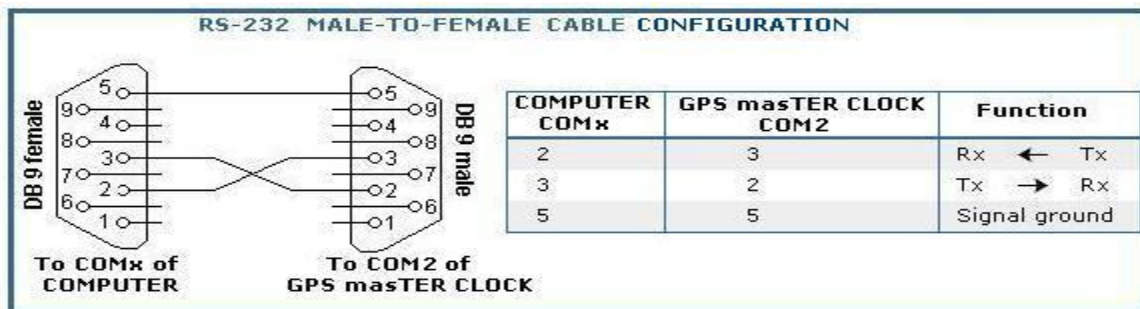


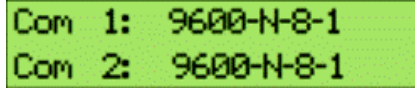
Figure 9-3 Terminal Cable Connections



- Cross cable connection as mentioned in the above figure is necessary to communicate with the serial Terminal.
- Ensure Terminal serial communication setting done in GPS Master Clock MC-1-U unit and end device should be same for proper communication.

The port settings in **HyperTerminal** and the COM2 port of GPS Master Clock Model MC-1-U must match each other for fruitful communication. The factory set settings of COM2 of **GPS Master Clock Model MC-1-U** are set 9600(baud rate), 8 (data bits), N(Parity-None),2 (stop bit) and may be checked by observing the LCD on boot up. It is necessary that user have to select "NONE" option in "Hardware Flow Control" option while doing communication parameters settings in HyperTerminal. User can check GPS Master Clock Model MC-1-U COM2 communication settings from Keypad Menu available on front panel of GPS Master Clock Model MC-1-U. Refer "USER CONFIGURATIONS" section in manual for keypad menu operation.

The settings of the **HyperTerminal** must be set the same as that observed on LCD to initialize the communication. To re-configure the settings, first, disconnect (refer to page 42) the communication on the **HyperTerminal**.



Com 1: 9600-N-8-1
Com 2: 9600-N-8-1

Figure 9-4 LCD Display – Terminal port Settings of GPS Master Clock MC-1-U

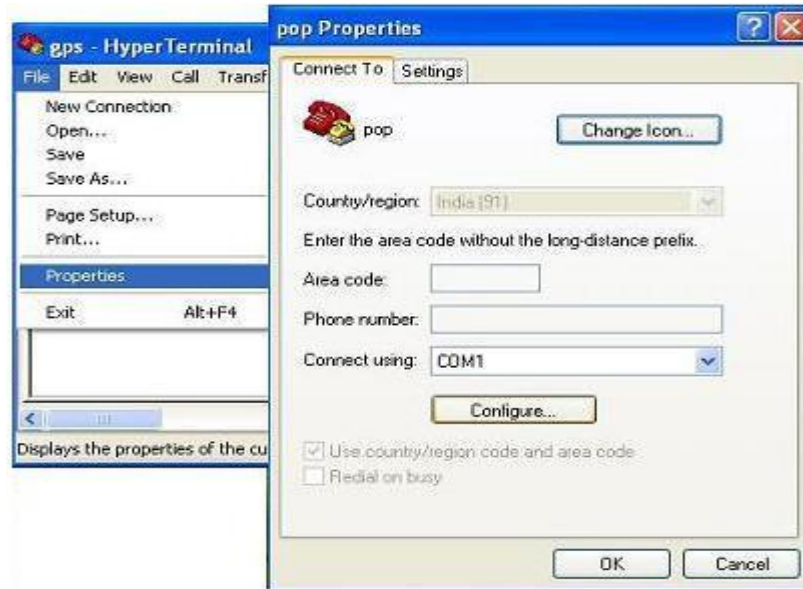


Figure 9-5 HyperTerminal Configuration

After the connection is set up successfully, the user can see the time frames coming from the unit's serial Terminal on HyperTerminal. By factory set, GPS Master Clock MC-1-U device is configured to provide NGTS output at 9600(baud rate), 8 (data bits), N(Parity None),2 (stop bit) communication settings. NGTS output will be transmitted at every minute concerning GPS Master Clock MC-1-U time. Refer to the below image.

T1101022120101
T1101022120201
T1101022120301
T1101022120401

NOTE:

1. The unit will enter the configuration as soon as it will receive the CONFIG command followed by an "Enter".
2. Once the configuration mode is entered, the unit will stop sending time frames on serial Terminal.
3. If the user hits the "Enter" key of the PC keyboard without giving any command, the unit will come out of configuration mode and the time frames will start getting transmitted from Terminal again.
4. In case of improper entry of command, the following message will appear on the screen:

INVALID COMMAND
ENTER COMMAND TO CONFIGURE PARAMETER

TO CONTINUE PRESS ENTER

9.2 Configuration Commands

GPS Master Clock Model MC-1-U COM2 terminal can be used for configuring communication parameters of serial port settings for COM2 terminal, output time string format (T-format / NGTS) on COM2 terminal, time display format, general parameters settings, time zone offset, password, standard and additional event time outputs, antenna cable propagation delay, configuring Ethernet ports, defaulting Ethernet port addresses.

All commands types are mentioned as subtitle name in below descriptions.

9.2.1 General Commands:

- **Command: CONFIG**

This command lets the user enter the configuration mode. After giving the command '**CONFIG**' and pressing **Enter** key, the unit will stop transmitting serial time output on Terminal and the unit will ask the user to enter the password on HyperTerminal, as shown below:

```
-----  
T1101022120401  
T1101022120501  
CONFIG  
ENTER PASSWORD :  
-----
```

- **Message: ENTER PASSWORD**

There are two passwords for GPS Master Clock MC-1-U. One is the user-defined password, which can be changed by the user through the password configuration command and the other is the master password which cannot be configured or visualized in menu settings. The user-defined password factory set is '**MASIBUS**'. If the user changes the user password by configuration command, the user has to enter a new password instead of the factory-set password.

If the user changes the user password by configuration command, the factory-set password will change from '**MASIBUS**' to the new password entered. The user has to remember if the new password is configured by the user as there is no option to read the set password.

There is an inbuilt master Password that cannot be changed by the user. Please contact the Masibus Customer Service department if the user forgets their set password.

The unit will enter the configuration mode if the correct password is typed and then press '**Enter**'. If the user enters the correct password, the below messages will be seen.

```
-----  
ENTER PASSWORD : *****  
  
PASSWORD OK
```

**ENTER COMMAND TO CONFIGURE PARAMETER.
H FOR HELP MENU.
L FOR PRESENT SETTINGS.
Z FOR TIME-ZONE SETTINGS.**

—

Only after the user successfully entering configuration mode as shown in the above messages, user can now provide other commands for device configuration.

If the entered password is wrong, the following message will be displayed:

ENTER PASSWORD : ****

**WRONG PASSWORD
TO CONTINUE PRESS ENTER**

T0701022120501

...

To re-enter into the configuration mode if the wrong password is entered, again start by giving the '**CONFIG**' command and enter the correct password.

- **Command: H [HELP Command]**

Description: The 'H' command is a general HELP menu and will list all the commands to configure GPS Master Clock MC-1-U. It lists all the possible values with their meaning of a particular command which are applicable and considered as a valid command. Values other than specified in the output of the help command are considered Invalid values.

The HELP is displayed below:

**H FOR HELP MENU.
L FOR PRESENT SETTINGS.
Z FOR TIME-ZONE SETTINGS.**
H
GPS MASTER CLOCK SYSTEM
Version No: 101
UART commands:
STx : Set hour mode to 12 or 24.(For Display)
1 : set it to 12 hour mode
2 : set it to 24 hour mode
SBxx : Set baud rate
24 : 2400 baud rate
48 : 4800 baud rate
96 : 9600 baud rate
19 : 19200 baud rate
SPx : Set parity bit
0 : parity bit set to none
1 : parity bit set to odd
2 : parity bit set to even
SSx : Set stop bit
1 : stop bit set to 1
2 : stop bit set to 2
SUx : Set UTC OR IST time. (default set to 2)
1 : UTC time
2 : LOCAL time

H : Show help list
SPd(xxxxxx): 1PPS Cable Delay Correction command(Propagation Delay).
: Range: 0 to 99999 ns
: Default value: 0 ns
: Resolution: 1 ns
TC2x : Set rear panel TERM2 transmit mode.
1 : NGTS mode
2 : T-format mode
Ex : Set Event mode
1 : minute mode
2 : hour mode
P(password) : To change password.(max upto 9 character.)
M(time&date): Manual Time Setting Mode
: Enter command M(hh:mm:ss,dd/mm/yy)
R : Reset the controller.
D : Set to Default Setting.
ETH0: Set to Default Network Settings.
IPx: Set IP Address of NTP1/NTP2.
MASKx: Set Subnet mask of NTP1/NTP2.
GTyX: Set Gateway of NTP1/NTP2
ETx : To configure additional Events.
EWx : To configure additional Events ON Time.
TLx: Telnet Disable/Enable(0/1).

**ENTER COMMAND TO CONFIGURE PARAMETER
OR PRESS ENTER TO CONTINUE.**

If the user presses the '**Enter**' key before writing any command, the unit will come out of configuration mode and the operator has to enter '**CONFIG**' and password again. Any pressing of '**Enter**' instead of command will result in a jump out of the configuration mode.

• **Command: L [LIST PRESENT CONFIGURATIONS]**

Description: This command lists all the general parameters with their current value or current configuration. Command type is listed in the first column, parameter current value in the third column, and the general meaning of the particular command in the last column in the output of the "L" command.

On writing 'L', it will display the present settings of the parameters of GPS Master Clock MC-1-U as shown below.

H FOR HELP MENU.
L FOR PRESENT SETTINGS.
Z FOR TIME-ZONE SETTINGS.
L

PRESENT SETTINGS

COMMAND	MODE NAME	VALUE(x)	MEANING
STx	Hour Mode	1	12 Hour Mode
SBx	Baud Rate	96	9600 Baud Rate
SPx	Parity	0	Parity None
SSx	Stop Bit	1	1 Stop Bit
SUx	Time Format	1	UTC time
TC2x	Transmit Mode	2	T-Format Mode
Ex	Event Mode	1	Minute Mode

ET1	Addi. Event1	00000001	Second Mode
ET2	Addi. Event2	00000001	Second Mode
ET3	Addi. Event3	00000001	Second Mode
ET4	Addi. Event4	00000001	Second Mode
EW1	Event1 ON Time	00000050	m.second Mode
EW2	Event2 ON Time	00000050	m.second Mode
EW3	Event3 ON Time	00000050	m.second Mode
EW4	Event4 ON Time	00000050	m.second Mode
SPD	Propagation Delay	00000000	n.second Mode
IP1	IP Address	192.168.100.153	
MASK1	Subnet Mask	255.255.255.000	
GTY1	Gateway	192.168.100.001	
IP2	IP Address	192.168.100.153	
MASK2	Subnet Mask	255.255.255.000	
GTY2	Gateway	192.168.100.001	

ENTER COMMAND TO CONFIGURE PARAMETER
 OR PRESS ENTER TO CONTINUE.

9.2.2 Serial Terminal Communication and Time Frame Commands:

	- The existing serial communication channel will break if the user changes any of the below serial communication settings through the serial communication command. - The user has to do a re-login to again communicate with the Terminal as per the explained procedure.
--	---

The communication commands change the parameters of serial communication terminal port of the **Model**. These include **SBxx**, **SPx**, and **SSx**.

These commands change the configuration of Terminal of GPS Master Clock MC-1-U while in configuration mode, hence the serial communication on Terminal between the unit and HyperTerminal stops.

To reinitialize the serial communication, first, **disconnect** the link and then enter into the **settings** of the HyperTerminal and set it the same as the present setting of GPS Master Clock MC-1-U Again **connect** the link.

- Command: SBxx [Baud Rate Command]**

Applicable Options: SB24 / SB48 / SB96 / SB19 (Please refer 'H' Command menu for applicable meanings of mentioned options)

- Suppose that the desired baud rate is 4800, the command should be **SB48** (See H: HELP). This will display the following on the **HyperTerminal**:

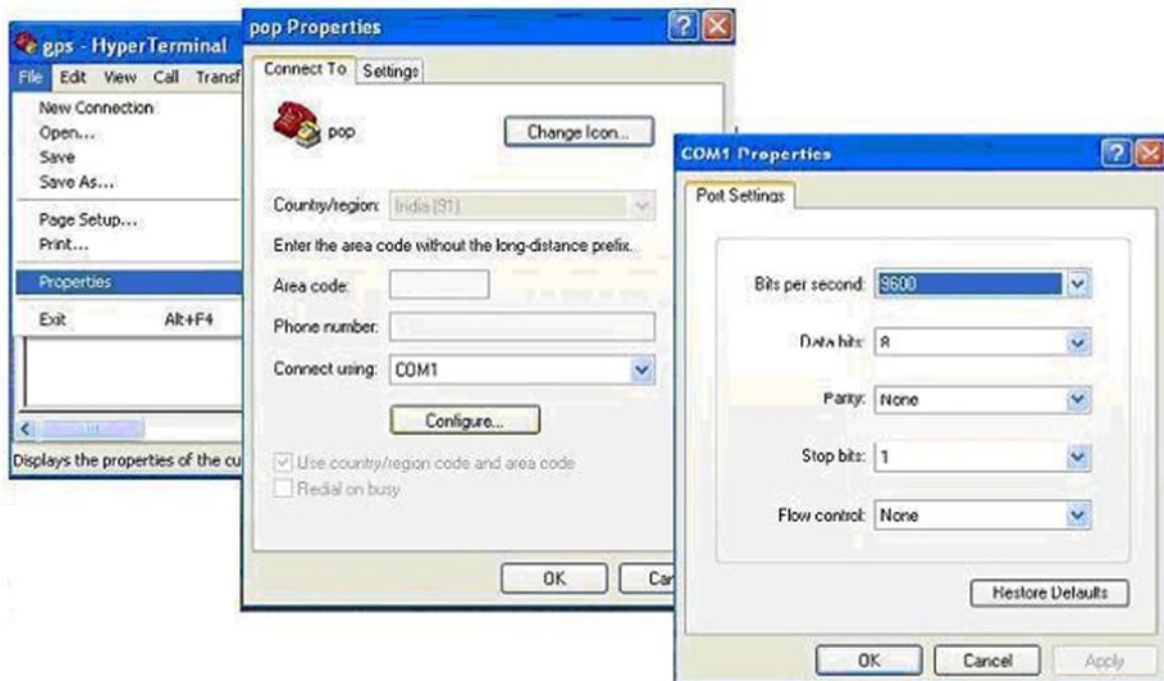
ENTER COMMAND TO CONFIGURE PARAMETER
 OR PRESS ENTER TO CONTINUE.
 SB48

Now, the communication must have stopped.

2. **Disconnect** the link by a right-click on **Call\disconnect**.



3. Enter the settings by following the path: **File\Properties\Connect To\Configure**.



4. Set the baud rate to 4800 and check for other parameters to be the same as that of GPS Master Clock MC-1-U.
5. After setting the parameters, reconnect the link by right click on **Call\Call**.



6. Now press **ESC** and **Enter** keys.
7. Once the connection is re-established, the time data will again be displayed on the HyperTerminal.

Now, without pressing 'Enter' any more times, if you enter any of the commands listed in help, you do not need to re-enter the 'CONFIG' and password. Press 'L' to check whether the baud rate change was accepted or not.

- **Command: SPx [Parity Command]**

Applicable Options: SP0 / SP1 / SP2 (Please refer to 'H' Command menu for applicable meanings of mentioned options)

The change of parity configuration can be done using this command. Different options for the parity settings are as below:

NOTE: It is necessary to change the value of data bits in HyperTerminal settings along with the Parity if the user changes the parity of GPS Master Clock MC-1-U Terminal as per the applicable value mentioned below:

- SP0:** No Parity
8 data bits
- SP1:** Odd Parity
7 data bits
- SP2:** Even Parity
7 data bits

Same as the **SBxx** command, the communication stops as soon as you finish the command and press 'Enter' once. This is because the protocol settings at GPS Master Clock MC-1-U and **HyperTerminal** do not match. To correct this, follow steps 2 and 3 of the **SBxx** command. Now correct the parameter to match with desired/set ones. In this case, take care of changing the data bits to 7, when the parity is either even or odd.

After setting the parity in this setting window, follow steps 5 and 6 of the **SBxx** command. The time data will again re-appear. You can check present settings using the 'L' command.

NOTE: The parity settings will not be effective in NMEA output on serial terminal on cpu back panel.

- **Command: SSx [Stop Bit Command]**

Applicable Options: SS1 / SS2 (Please refer to 'H' Command menu for applicable meanings of mentioned options)

The number of stop bits in the serial communication can be set as 1 or 2 using this command. The options are simply two:

- SS1:** One stop bit
- SS2:** Two stop bits

The steps to follow are the same as **SBxx** and **STx** commands.

- **Command: TC2x [Serial frame Command]**

Applicable Options: TC21 / TC22 (Please refer to 'H' Command menu for applicable meanings of mentioned options)

The rear panel terminal of GPS Master Clock MC-1-U allows the time format in two different ways: NGTS format and T-format. These formats are already explained before. These commands are:

- TC21:** NGTS mode
- TC22:** T-format mode

Remember that T-format sends the time frame each second while the NGTS sends the time frame each minute.

9.2.3 LCD Display Parameters Commands:

The 2x20 LCD on the front panel of GPS Master Clock MC-1-U displays the time as either UTC or LOCAL and 12/24-hour mode. The commands to set these modes are as explained below:

- **Command: STx [12 hour / 24 hour mode Command]**
Applicable Options: ST1 / ST2 (Please refer to 'H' Command menu for applicable meanings of mentioned options)
Suppose that initially, the display is in 12-hour mode. The command to change it to 24-hour mode will be **ST2**.
If the hour mode were 24 initially, then the command to convert it into 12-hour mode will be **ST1**.

ST1: 12 hour mode
ST2: 24 hour mode

- **Command: SUx [Local/UTC Time Command]**
Applicable Options: SU1 / SU2 (Please refer to 'H' Command menu for applicable meanings of mentioned options)
This command is used to select the displayed time from UTC or Local Time. There is a predefined time zone offset of any country's Local time wrt the UTC. The selection of local time using this command will add the offset to the GMT for display on the LCD as well as in the T-format and NGTS frame. The offset is entered by the user using the 'Z' command that is explained later.

The commands for selection of UTC or Local Time are:

SU1: UTC Time
SU2: LOCAL Time

9.2.4 Standard Event's Command:

- **Command:Ex [PPM / PPH Event Command]**
Applicable Options: E1 / E2 (Please refer 'H' Command menu for applicable meanings of mentioned options)
The pulse event signal is available at the terminal strip on the rear panel of GPS Master Clock Model MC-1-U. This signal triggers relay either every minute or every hour based on the configuration set by the command as listed below:

E1: 1 Minute mode
E2: 1 Hour Mode

9.2.5 Additional Event's Command:

The additional four-event signals(optional) are available at the terminal strip on the rear panel of GPS Master Clock MC-1-U. Users can configure these opto-relays through Serial terminal on rear plane for a time ranging from 1 to 86400 seconds individually for separate event outputs. Users can configure them, the time period as well as their ON time through the terminal port.

Time Period limit: 1 to 86400 seconds

(0 values are to inhibit/stop particular event output).

ON time limit: 50 milliseconds (min.) to 50% (max.) of a particular event time period. Ensure that the ON time value of all additional events is to be entered in **milliseconds**.
(If the time period is 0, the ON time will be also 0 by default).

Whenever the new time period is set, the new event timing counter will start from the very next minute and the contact will be energized after the settable time for that particular event. Please ensure to switch the power of the instrument OFF and ON once if the event time period settings are changed.

- **Command: ETx**

Applicable Options: ET1 / ET2 / ET3 / ET4 (Please refer to 'H' Command menu for applicable meanings of mentioned options)

This command is used to configure the Time Period of Additional Events. These Events can be configured to trigger at every second to every 86400 seconds (24 hr.). These configuration commands are listed below:

ET1: Additional Event1
ET2: Additional Event2
ET3: Additional Event3
ET4: Additional Event4

- **Command: EWx**

Applicable Options: EW1 / EW2 / EW3 / EW4 (Please refer to 'H' Command menu for applicable meanings of mentioned options)

This command is used to configure the ON Time of Additional Events. These Events can be configured to stay ON for a minimum of 50 milliseconds to 50% of its period. These configuration commands are listed below:

EW1: Event1 ON Time
EW2: Event2 ON Time
EW3: Event3 ON Time
EW4: Event4 ON Time

Example:

1. If the user has to configure event1 at every 60 seconds interval with a pulse ON time width of 50 milliseconds of event time, the below values are to be configured for event1 output.
ET1 = 60
EW1 = 50
2. If the user has to configure event1 at every 60 seconds interval with a pulse ON time width of 20% of event time, the below values are to be configured for event1 output.
ET1 = 60
EW1 = 12000
3. If the user has to configure event1 at every 60 seconds interval with a pulse ON time width of 50% of event time, the below values are to be configured for event1 output.
ET1 = 60
EW1 = 30000

NOTE:

a) Unit of ETx parameter is seconds and EWx parameter is milliseconds (i.e. 1 sec = 1000 milliseconds). Please ensure that the instrument should be power switch OFF/ON after changing the event time settings.

9.2.6 Antenna Cable Propagation Delay command:

- **Command:SPDxxxxx(1PPS cable correction command/Propagation Delay)**

Description: The timing receiver outputs a 1PPS signal, the rising edge of which is placed at the top of the GPS or UTC one second time mark epoch as specified by the Time Mode command. The 1PPS Cable Delay Correction command allows the user to offset the 1PPS time mark in one nanosecond increment relative to the measurement epoch.

This parameter instructs the GPS receiver to output the 1PPS output pulse earlier in time to compensate for antenna cable delay. Up to one millisecond of equivalent cable delay can be removed. Zero cable delay is set for a zero-length antenna cable.

The user should consult a cable data book for the delay per unit length for the particular antenna cable used to compute the total cable delay needed for a particular installation.

This parameter may also be employed by the user to adjust the position of the 1PPS to compensate for other system delays.

Range: 0 to 99999 ns
Default value: 0 ns
Resolution: 1 ns

The user is allowed to change propagation delay. The command for changing propagation delay is: "**SPDxxxx**"

The default propagation delay is 0 ns. Suppose, the user wishes to change it to 500 ns, then the command will be:

SPD500 and then press enter.

Remember that the propagation delay should not exceed 99999 ns. If the user enters a value that is out of applicable range, the device will show the error message "Invalid Command" and the previous value will be retained.



- Please refer the table 2 of [section 6.1.5](#) for proper value.
- This change in the value of this parameter will bring a shift in 1PPS and other output signal timing.

9.2.7 Network Setting Command:

The user is allowed to change IP Address, Subnet mask, Gateway of the network as per requirement. Commands to change network settings are listed below:

- **Command: IPx**

This command is used to change the IP address. IP1 for NTP1 and IP2 for NTP2. Default IP address for both Ethernet ports 192.168.100.153. All bytes should be in the range from 0 to 255. The first byte is neither 0 nor 255. The last byte of the IP address cannot be 255.

IP1: Set IP Address of NTP1

IP2: Set IP Address of NTP2

- **Command: MASKx**

This command is used to change the Subnet mask. MASK1 for NTP1 and MASK2 for NTP2. Default Subnet mask for both Ethernet ports 255.255.255.000. All bytes should be in the range from 0 to 255. The first byte cannot be 0, and the last byte of the Subnet mask can be 255. If the previous byte is 255 then only next byte range can be from 0 to 255 else invalid.

I.e.; 255.192.128.0 is Invalid, but 255.255.128.0 is valid.

MASK1: Set Subnet mask of NTP1

MASK2: Set Subnet mask of NTP2

- **Command: GTYx**

This command is used to change Gateway. GTY1 for NTP1 and GTY2 for NTP2. Default Gateway for both Ethernet ports 192.168.100.001. All bytes should be in the range from 0 to 255. The first byte is neither 0 nor 255. The last byte of the Gateway cannot be 255.

GTY1: Set Gateway of NTP1

GTY2: Set Gateway of NTP2

- **Command: TLx**

This command is used to enable or disable telnet services as required.

TL0: Telnet Services_Disable

TL1: Telnet Services_Enable

- **Command: ETH0 [Ethernet Default]**



It is recommended to remove all NTP outputs RJ-45 cable from the network before using this command and stop all the services such as NTP, SNMP, Telnet with GPS Master Clock MC-1-U because this command will set all NTP output ports IP address to the same IP address as a result of which there will be IP conflict in the network.

This command is used to set the default network settings of GPS Master Clock MC-1-U. After Applying this command network settings of all NTP output ports will be as below.

IP Address	192.168.100.153
Subnet Mask	255.255.255.0
Gateway	192.168.100.1
SNMP Manager1 IP	0.0.0.0
SNMP Manager2 IP	0.0.0.0
Read Community	masibus
Write Community	masibus
IRIG-B Time	local
IEEE-1344 C37.118-2005	disable
Telnet User Name	masibus
Telnet Password	masibus
Telnet Services	Enable

Table 9-1 Default ETH0 Command parameters

Users should change the IP address of each NTP port using Telnet connection with GPS Master Clock MC-1-U Refer [section 9.3](#). for configuring GPS Master Clock MC-1-U as Telnet Server.

9.2.8 Miscellaneous Command:

Other available commands are as follows:

- **Command: P(password) [Change Password]**

The user is allowed to change the password. The command for changing the password is:

P (password)

The factory-set password is 'MASIBUS'. Suppose the user wishes to change it to 'INDIA', then the command will be:

PINDIA

Remember that the password should not exceed 9 characters. If you try to keep a password that has more than 9 characters, the system will show an error "Invalid Command" and the previous password will be retained.



- Password of configuration through keypad and password of configuration through serial terminal are independent.
- It is operator's responsibility to remember the configured password if it is changed from factory set password.
- Default password for telnet is "masibus" which can be changed using telnet client. In case if user forgot the same then user must default the network settings with "ETH0" command, (Refer 10.2.9)
- **Note:** There is no master password for telnet login.

• **Command: Z [Time Zone Offset Command]**

This command is to enter the time offset of any particular region/country concerning the UTC. Every country's local time works at some time offset concerning UTC. Time offset can be positive or negative w.r.t. UTC. The table of the time zone offset can be found on the Internet.

All 15 minutes interval of time offset are valid. i.e., +05:00, +05:15, +05:30, +05:45, +06:00...

Time zone offset value should be between time ranges of **-12:00 to +12:00**.

Time offset value apart from the above range will be considered as an INVALID command.



The time zone will put a direct effect on the IRIG-B signal while it will affect the time on unit display, NGTS, and T-frame only if the unit is set in the LOCAL TIME DISPLAY mode, using the SUx command as explained further. However, time in the IRIG-B signal will depend on the format selection of UTC/LOCAL done through telnet configuration.

Example:

Z

ENTER THE TIME-ZONE OFFSET ADDED WITH THE DAYLIGHT-SAVING TIME, IF APPLICABLE.

FORMAT: (+/-)(HH):(MM)

ENTER NOW:

-02:00

COMMAND COMPLETE

ENTER COMMAND TO CONFIGURE PARAMETER.

TO CONTINUE PRESS ENTER

• **Command: M(hh:mm:ss,dd/mm/yy) [Set Manual Time]**

Description: The user can set time and date manually using this command. This command is used when the GPS receiver's battery got discharged and the antenna is not available then the user can enter the current time manually.

Manual Time setting Command format is: "**M(hh:mm:ss,dd/mm/yy)**", where

hh : Hours (0 to 23)

mm : Minutes (0 to 59)

ss : Seconds (0 to 59)

dd : Date (1 to 31)

mm : Month (1 to 12)

yy : Year (for 2012 enter 12).

When the antenna is connected to GPS and GPS is locked this command will not work. **“Restart GPS after this command”**.



Time entered in the Manual command will be considered as UTC, so to set the current local time user should enter the time considering the time zone offset require for local time. Once GPS gets locked, the set Manual time will be neglected and the correct time will be considered.

- **Command: R**

This command will reset GPS Master Clock MC-1-U.



- 1) The MC-1-U unit also reset from LHMI with the “RESET UNIT” command which will not change any parameters and just reset the unit.
- 2) This will reset GPS Master Clock Model MC-1-U unit. As a result of which, all the outputs will be stopped or there will be change in relay and pulse output till unit boots up again.

- **Command: D**

Description: This command sets the following parameters of GPS Master Clock MC-1-U to their default Value.

Keypad Parameter	Command	Value	Meaning
SET HOUR MODE	STx	2	24 Hour Mode
SET BAUD RATE	SBx	96	9600 baud rate for terminal
SET PARITY	SPx	0	NONE parity for terminal
SET STOP BIT	SSx	1	1 Stop Bit for terminal
SET TIME FORMAT	SUx	2	Local Time
SET TRANSMIT MODE	TC2x	2	T-format frame on terminal
Event Mode	Ex	1	Minute Mode
ADD EVENT	ETx	60	ET1, ET2, ET3, ET4 event at 60 seconds
EVENT ON TIME	EWx	50	Pulse width ON time of 50 milliseconds for all additional events
Propagation Delay	SPD	0	1PPS Cable Delay Correction
Telnet Services	TLx	1	Telnet Services Enable/Disable
Serial Password	P	MASIBUS	Default serial password

Table 9-2 Default Command parameters

If the user enters the default command in GPS Master Clock MC-1-U, then the serial Terminal communication parameters get default as per the above table. The user has to set the PC Serial terminal communication parameters to mentioned default values to continue with configuration mode on the rear panel terminal.



- The above settings are defaulted with the "SET TO DEFAULT" menu in keypad menu section. If user defaults GPS Master Clock Model MC-1-U settings using keypad menu. All the values given in above table will be set to default. User should take care of all outputs affected due to default i.e. time & date on GPS display, events connected to peripheral devices, time frame coming on COM2 terminal of GPS Master Clock Model MC-1-U device.
- This default command does not affect the NTP Ports IP address configuration, SPD value, Manual time.
- Password will be set to default in case of entering "SET TO DEFAULT" command either by LHMI OR through serial communication else it will be remained same as you configure earlier.

9.2.9 Example to illustrate unit commands:

Suppose that the initial LCD conditions are 12 Hour mode UTC. The event is in 1 Second mode with 50mSec ontime. The format available on Terminal is by default T-format.

The configuration steps to display time in **24 Hour mode Local**, trigger the event at **2 Second Mode** with **1000 mSec** ontime, change Terminal format to NGTS, set the time zone of India, and set the password to **INDIA** are explained below. The Local time of India is set 5 Hours and 30 Minutes ahead of the UTC.

NOTE: In the below example, **Big BOLD** Letters are the command which user has to provide and other texts are the messages returned by GPS Master Clock MC-1-U device to serial com port HyperTerminal.

H command can be used to view other parameter's applicable values.

...
CONFIG
 ENTER PASSWORD: *****

PASSWORD OK
 ENTER COMMAND TO CONFIGURE PARAMETER.
 H FOR HELP MENU.
 L FOR PRESENT SETTINGS.
 Z FOR TIME-ZONE SETTINGS.
L

PRESENT SETTINGS

COMMAND	MODE NAME	VALUE(x)	MEANING
STx	Hour Mode	1	12 Hour Mode
SBx	Baud Rate	96	9600 Baud Rate
SPx	Parity	0	Parity None
SSx	Stop Bit	1	1 Stop Bit
SUx	Time Format	1	UTC time
TC2x	Transmit Mode	2	T-Format Mode
Ex	Event Mode	1	Minute Mode
ET1	Addi. Event1	00000001	Second Mode
ET2	Addi. Event2	00000001	Second Mode
ET3	Addi. Event3	00000001	Second Mode
ET4	Addi. Event4	00000001	Second Mode

EW1	Event1 ON Time	00000050	m.second Mode
EW2	Event2 ON Time	00000050	m.second Mode
EW3	Event3 ON Time	00000050	m.second Mode
EW4	Event4 ON Time	00000050	m.second Mode
SPD	Propagation Delay	00000000	n.second Mode
IP1	IP Address	192.168.100.153	
MASK1	Subnet Mask	255.255.255.000	
GTY1	Gateway	192.168.100.001	
IP2	IP Address	192.168.100.153	
MASK2	Subnet Mask	255.255.255.000	
GTY2	Gateway	192.168.100.001	

ENTER COMMAND TO CONFIGURE PARAMETER
OR PRESS ENTER TO CONTINUE.

Z

ENTER THE TIME-ZONE OFFSET ADDED WITH THE DAY-LIGHT SAVING TIME, IF APPLICABLE.

FORMAT: (+/-)(HH):(MM)

ENTER NOW:

+05:30

COMMAND COMPLETE

ENTER COMMAND TO CONFIGURE PARAMETER.

TO CONTINUE PRESS ENTER

ST2

COMMAND COMPLETE

ENTER COMMAND TO CONFIGURE PARAMETER.

TO CONTINUE PRESS ENTER

SU2

COMMAND COMPLETE

ENTER COMMAND TO CONFIGURE PARAMETER.

TO CONTINUE PRESS ENTER

TC21

COMMAND COMPLETE

ENTER COMMAND TO CONFIGURE PARAMETER.

TO CONTINUE PRESS ENTER

E2

COMMAND COMPLETE

ENTER COMMAND TO CONFIGURE PARAMETER.

TO CONTINUE PRESS ENTER

PINDIA

COMMAND COMPLETE

ENTER COMMAND TO CONFIGURE PARAMETER.

TO CONTINUE PRESS ENTER

ET1

Event-1 Configuration

Please enter interval (Min. = 1 sec, Max. = 86400 sec):**2**

COMMAND COMPLETE

ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER
EW1

Event-1 ON Time Configuration
Please enter interval (Min. = 50 m.sec, Max. = 50% Of Interval):**1000**

COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER
L

PRESENT SETTINGS

COMMAND	MODE NAME	VALUE(x)	MEANING
STx	Hour Mode	1	12 Hour Mode
SBx	Baud Rate	96	9600 Baud Rate
SPx	Parity	0	Parity None
SSx	Stop Bit	1	1 Stop Bit
SUx	Time Format	1	UTC time
TC2x	Transmit Mode	2	T-Format Mode
Ex	Event Mode	2	Hour Mode
ET1	Addi. Event1	00000001	Second Mode
ET2	Addi. Event2	00000001	Second Mode
ET3	Addi. Event3	00000001	Second Mode
ET4	Addi. Event4	00000001	Second Mode
EW1	Event1 ON Time	00000050	m.second Mode
EW2	Event2 ON Time	00000050	m.second Mode
EW3	Event3 ON Time	00000050	m.second Mode
EW4	Event4 ON Time	00000050	m.second Mode
SPD	Propagation Delay	00000000	n.second Mode
IP1	IP Address	192.168.100.153	
MASK1	Subnet Mask	255.255.255.000	
GTY1	Gateway	192.168.100.001	
IP2	IP Address	192.168.100.153	
MASK2	Subnet Mask	255.255.255.000	
GTY2	Gateway	192.168.100.001	

ENTER COMMAND TO CONFIGURE PARAMETER
OR PRESS ENTER TO CONTINUE.

M(01:10:00,03/05/23)

COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER
ETH0

COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER

IP1

Enter IP Address for NTP1 : 192.168.100.100

COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER

IP2

Enter IP Address for NTP2 : 192.168.105.102

COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER

MASK1

Enter Subnet Mask for NTP1: 255.0.0.0
COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER

MASK2

Enter Subnet Mask for NTP2: 255.255.255.0
COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER

GTY1

Enter Gateway for NTP1: 192.168.10.2
COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER

GTY2

Enter Gateway for NTP2: 192.100.20.1
COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER

TL0

COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER

TL1

COMMAND COMPLETE
ENTER COMMAND TO CONFIGURE PARAMETER.
TO CONTINUE PRESS ENTER

9.3 Network settings (NTP1/NTP2 Port) of GPS using PC windows as Telnet Client:



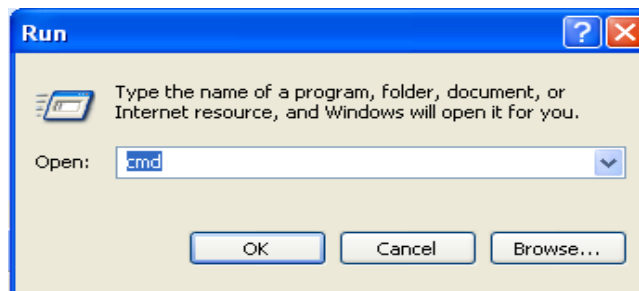
NOTE: The MC-1-U device will not reboot on changing any of configurations via Telnet.

➤ **For the first time setup follow the below procedure:**

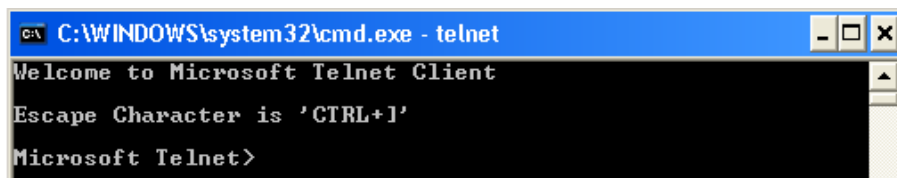
- 1) Masibus GPS has following default network settings:
IP : 192.168.100.153
Subnet Mask : 255.255.255.000
Gateway : 192.168.100.001
SNMP Manager1 IP : 192.168.100.073
SNMP Manager2 IP : 192.168.100.073
SNMP Read Community: masibus
SNMP Write Community: masibus
First connect the GPS directly with local computer using Cross cable. (Not in Network)
- 2) Make the computer IP 192.168.100.XXX (XXX is any value between 1 to 255)
- 3) Ping the GPS IP & response must come from GPS. Now follow the below procedure.

➤ **Follow below procedure for GPS network settings using windows as TELNET client.**

1. Open command prompt.



2. Enter Telnet and press Enter.



3. Enter "open 192.168.100.153" and press Enter.



4. Following screen will be displayed.

```
CA: Telnet 192.168.100.153
*****
Masibus Telnet Server
*****
Login:
```

5. Enter Login-name and press enter. Enter password and press enter. Login-name and password both are case sensitive. **Default Login- name and password both are “masibus”.**

```
CA: Telnet 192.168.100.153
*****
Masibus Telnet Server
*****
login:masibus
Password:*****
logged in successfully
Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

1) **H**

- This **HELP** command is used to see different commands and their functions.

```
Telnet 192.168.100.153
Press 'h' for help.
Press cc for current configurations.

H

-----
COMMAND      FUNCTION
-----
IP            Configure IP address
MASK         Configure SUBNET MASK
GTY          Configure GATEWAY
SIP1         Configure SNMP Manager IP1
SIP2         Configure SNMP Manager IP2
TRAP1        Configure TRAP feature in SNMP1
TRAP2        Configure TRAP feature in SNMP2
SRC          Configure SNMP Read Community
SWC          Configure SNMP Write Community
SLOC         Configure SNMP System Location
SDES         Configure SNMP System Description
STRT         Configure Stratum of Local Clock(Unlock Condition)
U            Configure Telnet Login-name
P            Configure Telnet Password
IRIG         Configure IRIG-B Time Code in UTC/Local Time mode
I_1344       Configure IEEE 1344 Protocol in IRIG-B Time Code

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

2) [Current Configuration]

- This command is used to see present Ethernet settings.

```
Telnet 192.168.100.153
CC

-----
Current Configuration
-----

IP Address           :192.168.100.153
Subnet Mask          :255.255.255.000
Gateway              :192.168.100.001
Snmp manager 1 IP    :000.000.000.000
Snmp manager 2 IP    :000.000.000.000
Trap Enabled.0       :No
Trap Enabled.1       :No
SNMP Read Community  :masibus
SNMP Write Community :masibus
SNMP System Location :Gandhinaga
SNMP System Description :GPS MC-1
Stratum of Local Clock
(Unlock Condition)   :01
Telnet user name     :masibus
Telnet Password      :masibus
IRIG-B Time Code in  :Local Format
IEEE 1344 implemented :No
```

3)

- This command is used to change IP address of GPS **mas**TER CLOCK.
- IP address should be entered in **xxx.xxx.xxx.xxx** form.
- Enter new IP address and press enter, to save the new IP address Press '**Y**' else press '**N**'.
- If you press **Y** new IP address will be saved and if you press **N** the previous IP address will be retained.
- IP address of GPS masTER CLOCK is 192.168.100.153 by default.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****

Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

IP
Enter IP address:192.168.100.156

Command complete,To save changes press 'y' else press 'n':Y_
```

4) **MASK**

- This command is used to change Subnet Mask of GPS **mas**TER CLOCK.
- Subnet Mask should be entered in **xxx.xxx.xxx.xxx** form.
- Enter new Subnet Mask and press enter. To save the new Subnet Mask Press '**Y**' else press '**N**'. If you press **Y** new Subnet Mask will be saved and if you press **N** the previous Subnet Mask will be retained.
- Subnet Mask of GPS **mas**TER CLOCK is 255.255.255.0 by default.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****

Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

MASK
Enter Subnet mask:255.255.255.0

Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

5) **GTY**

- This command is used to change Gateway of GPS **mas**TER CLOCK.
- Gateway should be entered in **xxx.xxx.xxx.xxx** form.
- Enter new Gateway and press enter, to save the new Gateway Press '**Y**' else press '**N**'.
- If you press **Y** new Gateway will be saved and if you press **N** the previous Gateway will be retained.
- Gateway of GPS **mas**TER CLOCK is 192.168.100.1 by default.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****

Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

GTY
Enter Gateway:192.168.100.1

Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

6) **SNMP**

- This command is used to enable or disable SNMP Service of GPS **master** CLOCK.
- If you press **Y** SNMP service will be enabled and if you press **N** the SNMP service will be disabled.

```
*****
Masibus Telnet Server
*****

Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

CC

-----
Current Configuration
-----

IP Address      :192.168.100.153
Subnet Mask     :255.255.255.000
Gateway        :192.168.100.001
SNMP Protocol Enabled :No
Stratum of Local Clock (Unlock Condition) :01
Login Username  :masibus
Login Password  :masibus
IRIG-B Time Code in :Local Format
IEEE 1344 implemented :No

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

SNMP
Press 'Y' to Enable SNMP Protocol else Press 'N':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

- If you enable SNMP service, it will allow you to change snmp configurations like snmp manager IPs, Trap Configurations and Read/Write communities like shown below.

```
Telnet 192.168.100.153
CC
-----
Current Configuration
-----
IP Address           :192.168.100.153
Subnet Mask          :255.255.255.000
Gateway              :192.168.100.001
Snmp manager 1 IP    :000.000.000.000
Snmp manager 2 IP    :000.000.000.000
Trap Enabled.0       :No
Trap Enabled.1       :No
SNMP Read Community  :masibus
SNMP Write Community :masibus
SNMP System Location  :Gandhinaga
SNMP System Description :GPS MC-1
Stratum of Local Clock (Unlock Condition) :01
Telnet user name      :masibus
Telnet Password       :masibus
IRIG-B Time Code in   :Local Format
IEEE 1344 implemented :No
```

7) **SIP1 & SIP2**

- These commands are used to change Manager IP of GPS **mas**TER CLOCK for SNMP version 1/2 protocol.
- IP should be entered in **xxx.xxx.xxx.xxx** form.
- Enter new manager IP and press enter, to save the new manager IP Press '**Y**' else press '**N**'.
- If you press **Y** new Manager IP will be saved and if you press **N** the previous Manager IP will be retained.
- Manager IP of GPS **mas**TER CLOCK is 192.168.100.073 by default.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****
Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

SIP1
Enter SNMP MANAGER IP1:192.168.100.73

Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

8) **TRAP1**

- User must Enable the TRAP1 in case GPS receiver's Lock and unlock status to be monitored on SNMP browser.
- This command will allow to send TRAPS to the SNMP manager IP address-1.
- Command for Enable or disable TRAP for the SNMP manager-1 IP is: '**TRAP1**'.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****

Login:masibus

Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

TRAP1
Press 'Y' to Enable TRAP on Receiver 1 else Press 'N':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

9) **TRAP2**

- User must Enable the TRAP2 in case GPS receiver's Lock and unlock status to be monitored on SNMP browser
- This command will allow to send TRAPS to the SNMP manager IP address-2.
- Command for Enable or disable TRAP for the SNMP manager-1 IP is: 'TRAP2'.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****

Login:masibus

Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

TRAP2
Press 'Y' to Enable TRAP on Receiver 2 else Press 'N':y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

10) **SRC**

- In GPS **masibus** MASTER CLOCK this command is used to change Read Community of SNMPv1 / SNMPv2c protocol.
- Read Community command accepts both upper/lower case as well as special characters.
- Enter new Read Community and then press enter, to save new Read Community Press 'Y' else press 'N'. If you press Y new Read Community will be saved and if you press N the previous Read Community will be retained.
- By default, Read Community of SNMPv1 / SNMPv2C is **masibus**.
- Maximum 20 characters can be entered to change the Read community.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****

Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

SRC
Enter New SNMP Read Community :masibus
SNMP Read Community is changed.
Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

11) **SWC**

- In GPS **mas**TER CLOCK this command is used to change Write Community of SNMPv1 / SNMPv2c protocol.
- Write Community command accepts both upper/lower case as well as special characters.
- Enter new Write Community and then press enter, to save new Write Community Press '**Y**' else press '**N**'. If you press **Y** new Write Community will be saved and if you press **N** the previous Write Community will be retained.
- By default, Write Community of SNMPv1 / SNMPv2C is **masibus**.
- Maximum 20 characters can be entered to change the Write community.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****

Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

SWC
Enter New SNMP Write Community :masibus
SNMP Write Community is changed.
Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

12) **SLOC**

- In GPS **mas**TER CLOCK this command is used to change System Location of SNMPv1 / SNMPv2c protocol.
- System Location command accepts both upper/lower case as well as special characters.

- Enter new System Location and then press enter, to save new System Location Press 'Y' else press 'N'. If you press Y new System Location will be saved and if you press N the previous System Location will be retained.
- By default, System Location of SNMPv1 / SNMPv2C is **Gandhinagar**.
- Maximum 10 characters can be entered to change the System Location.

Telnet 192.168.100.153

```
*****
Masibus Telnet Server
*****

Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

SLOC
Enter New SNMP System Location :g'nagar
System Location is changed.
Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

13) **SDES**

- In GPS **master** CLOCK this command is used to change System Description of SNMPv1 / SNMPv2c protocol.
- System Description command accepts both upper/lower case as well as special characters.
- Enter new System Description and then press enter, to save new System Description Press 'Y' else press 'N'. If you press Y new System Description will be saved and if you press N the previous System Description will be retained.
- By default, System Description of SNMPv1 / SNMPv2C is **GPS MC-1**.
- Maximum 10 characters can be entered to change the System Description.

Telnet 192.168.100.153

```
*****
Masibus Telnet Server
*****

Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

SDES
Enter New SNMP System Description :MC-1
SNMP Write Community is changed.
Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

14) **STRT**

- This command is used to change Stratum of GPS **mas**TER CLOCK in unlock condition.
- Stratum should be entered in **xx** form.
- Enter new Stratum and press enter, to save new Stratum Press '**Y**' else press '**N**'.
- If you press **Y** new Stratum will be saved and if you press **N** the previous Stratum will be retained.
- Stratum of GPS **mas**TER CLOCK in unlock condition is 1 by default.
- Stratum level can be changed between 1 to 16 any other value is not accepted.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****
Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

STRT
Enter the Stratum of Local Clock(01-16):01

Stratum of Local Clock is changed.
Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

15) **U**

- The user is allowed to change telnet Login name. The command for changing the Login name is: '**U**'.
- Then enter new Login name and press enter. To save the new Login name Press '**Y**' else press '**N**'. If you press **Y** new Login name will be saved and if you press **N** the previous Login name will be retained.
- The default Login name is 'masibus'.
- Remember that the login name should not exceed 10 characters and should not contain special characters. If you enter a login name with more than 10 characters, the system will display an error message saying 'Invalid Entry,' and the previous login name will be retained.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****

Login:masibus
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

U

Enter new Telnet Username:sonepar
Username changed.
Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

16) **P**

- User is allowed to change telnet password. Command for changing the password is: '**P**'.
- Then enter new password and press enter. To save the new password press '**Y**' else press '**N**'. If you press **Y** new password will be saved and if you press **N** the previous password will be retained.
- The default password is '**masibus**'.
- Remember that the login name should not exceed 10 characters and should not contain special characters. If you enter a login name with more than 10 characters, the system will display an error message saying 'Invalid Entry,' and the previous login name will be retained.

```
Telnet 192.168.100.153
*****
Masibus Telnet Server
*****

Login:sonepar
Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

P

Enter new Telnet Password:*****
Password changed.
Command complete,To save changes press 'y' else press 'n':Y
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

17) **IRIG**

- IRIG command is used to transmit either UTC or Local time on IRIG-B port.
- In IRIG-B output port by default Local time is being transmitted.
- Enter IRIG command then enter '**Y**' to transmit UTC time in IRIG-B port else press '**N**' to transmit Local time in IRIG-B port.

Telnet 192.168.100.153

```
*****
Masibus Telnet Server
*****

Login:masibus

Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

IRIG
Press 'Y' to Enable UTC Time or
Press 'N' to Enable Local Time in IRIG-B Frame:n
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

18) **I_1344**

- I_1344 command is used to implement IEEE 1344 (C37.118-2005) protocol on IRIG-B port.
- Enter I_1344 command then enter 'Y' to Enable IEEE 1344 protocol on IRIG-B port else press 'N' to disable IEEE 1344 protocol on IRIG-B port.
- By Default, IEEE 1344 Protocol is disabled.

```
Telnet 192.168.100.153

*****
Masibus Telnet Server
*****

Login:masibus

Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

I_1344
Press 'Y' to Enable IEEE 1344 Protocol else Press 'N':n
Command complete

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.
```

19) **Q**

- This command is used to close Telnet session.

C:\> Administrator: C:\Windows\system32\cmd.exe

```
*****
Masibus Telnet Server
*****

Login:masibus

Password:*****
Logged in successfully

Press 'q' to Logout.
Press 'h' for help.
Press cc for current configurations.

Q

Goodbye!

Connection to host lost.

C:\Users\Administrator>_
```

20) Important Points:

- GPS Telnet Server has timeout period of 5 minutes. If you do not press any character till 5 minutes, the session will be automatically closed with a message of Timeout, Session Closed.
- NTP service will be stopped while Telnet session is opened. When you Logout from the session or change IP address or after timeout the NTP service will be automatically started.
- Commands are case insensitive.
- Password and Username will be set to default in case of entering “SET TO ETH DEFAULT” command either by LHMI OR through serial communication else it will be remain same as you configure earlier.
- To set the network settings to default state,
i.e. IP Address : 192.168.100.153
Subnet Mask : 255.255.255.0
Gateway : 192.168.100.1
- There is GPS master clock serial command “**ETH0**”. Enter this command through serial com port2 of GPS master clock to set default Ethernet settings.

10. NTP Timing Outputs – Serial, IRIG-B / IEEE 1344

10.1 Timing Output - Serial

10.1.1 NMEA-0183 RMC Time frame output

GPS Master Clock MC-1-U transmits NMEA time frame from RS232/RS485 terminal at the rear panel of the unit at every 1 second at 9600 (baud rate), 8 (Data bits), N (NONE parity), 1 (1 stop bit). The NMEA-0183 \$GPRMC serial time string contains time and date of position fix, speed, and course information.

NOTE: The serial communication settings of the COM1 terminal including the type of frame, baud rate, parity, and stop bit are fixed and cannot be changed.

The full data message of this format shall consist of data fields as follows:

Field	Example	Comments
String ID	\$GPRMC,	
UTC Time	130525.00,	hhmmss.ss,
Status	A,	A = Valid/V = Invalid,
Latitude	4250.5589,	ddmm.mmmm,
N/S Indicator	S,	N = North/S = South,
Longitude	14518.5084,	dddmm.mmmm,
E/W Indicator	E,	E = East/W = West,
Speed over ground	000.1,	Knots,
Course over ground	245.0,	Degrees,
UTC Date	291206,	DDMMYY,
Magnetic variation	,	Degrees,
Magnetic variation	,	E = East/W = West,
Checksum	*25	*CC
Terminator	<CR>,<LF>	Non-displayable characters

Table 10-1 NMEA-0183 Time string format



The serial communication settings of the rear panel terminal including the type of frame, baud rate, parity, and stop bit are fixed and cannot be changed.

10.1.2 T-Format Time frame output:

GPS Master Clock MC-1-U transmits T-format time frame from Terminal at the rear panel of the unit at every 1 second at 9600 (baud rate), 8 (Data bits), N (NONE parity), 1 (1 stop bit). Users can change the serial communication settings using the keypad on the unit front panel as explained in [section 8](#) or the serial configuration method on the rear panel Terminal as explained in [section 9.2.2](#).

NOTE: GPS Master Clock MC-1-U can be configured to transmit T-format or NGTS time frame through its Terminal at the rear panel. The type of serial frame i.e. T-format or NGTS can be selected by the parameter “**SET TRANSMIT MODE**” through the keypad on the unit front panel as per [section 8](#) or serial configuration command “**TC22**” as per [section 9.2.2](#).

Description	Number of Characters	Character Position	Range of Value/Information
Code Identification	1	1	Capital T
Divider	1	2	:
Year in Century	2	3,4	0 to 99
Divider	1	5	:
Month	2	6,7	1 to 12
Divider	1	8	:
Day of Month	2	9,10	1 to 31
Divider	1	11	:
Day of Week	1	12	1 to 7
Divider	1	13	:
Hours	2	14,15	0 to 23
Divider	1	16	:
Minutes	2	17,18	0 to 59
Divider	1	19	:
Seconds	2	20,21	0 to 59
Divider	1	22	:
GMT Marker	1	23	0 or 1
Validity Marker	1	24	0 or 1
CR [Carriage return]	1	25	Non displayable character
LF [Line Feed]	1	26	Non-displayable character

Table 10-2 T-Format Time string format

10.1.3 NGTS Time frame output:

GPS Master Clock MC-1-U transmits NGTS time frame from Terminal at the rear panel of the unit at every 1 minute (i.e. NGTS frame is transmitted at every 59 seconds of every minute) at 9600 (baud rate), 8 (Data bits), N (NONE parity), 1 (1 stop bit). Users can change the serial communication settings using the keypad on the unit front panel as explained in [section 8](#) or the serial configuration method on the Terminal as explained in [section 9.2.2](#).

NOTE: GPS Master Clock MC-1-U can be configured to transmit T-format or NGTS time frame through its Terminal at the rear panel. The type of serial frame i.e. T-format or NGTS can be selected by the parameter “**SET TRANSMIT MODE**” through the keypad on the unit front panel as per [section 8](#) or serial configuration command “**TC21**” as per [section 9.2.2](#).

The NGTS time string shall consist of 14 printable characters and a concluding CR, LF as follows:

Description	Number of Characters	Character Position	Range of Value/Information
Code Identification	1	1	Capital T
Year in Century	2	2,3	0 to 99
Month	2	4,5	1 to 12
Day of Month	2	6,7	1 to 31
Day of Week	1	8	1 to 7
Hours	2	9,10	0 to 23
Minutes	2	11,12	0 to 59
GMT Marker	1	13	0 or 1
Validity Marker	1	14	0 or 1
CR [Carriage return]	1	15	Non displayable character
LF [Line Feed]	1	16	Non-displayable character

Table 10-3 NGTS Time string format

10.2 Timing Output IRIGB / IEEE 1344 C37.118-2005

10.2.1 Introduction:

This section should help you with understanding, choosing, and connecting the correct output from the GPS Master Clock MC-1-U to synchronize equipment, such as relays, breakers, meters, etc. Often, questions arise about how the output port should be connected, and how to connect cabling between model MTS2000L and the relay. Certain protective relays or digital fault recorders may use a different style connector than available at model MC-1-U outputs. This section will help to answer some common questions, like which type of cabling should be used? Coaxial or a twisted pair etc.

The steps involved in getting your devices synchronized to the model MC-1-U are fairly simple and should not take long to complete. To expedite the process, make sure that you know:

1. The type of timing signal each piece of equipment requires, and
2. How to enable the equipment to receive the timing signal.

Various methods are used to configure equipment for IRIG-B including setting a physical jumper, or setup program. Some equipment can auto-detect the timing signal so that nothing else is required other than connecting the cable.

10.2.2 Time Code Output:

This section will describe IRIG-B Time Code also the availability of the same in model MC-1-U configuration for the same. GPS Master Clock MC-1-U can generate different no of digital as well as analogue signals as described in this section. Model MC-1-U has also the facility to have an optional card in the model. Optional cards will have the same IRIG-B Time Code output, as on the standard output port.

10.2.3 Standard IRIG-B Output:

As per figure 5.2, the GPS Master Clock MC-1-U model has two, BNC, connectors that supply timing signals to external equipment. One of the outputs is designed for IRIG-BAM and the other for IRIG-B DCLS. Figure 5.8 shows the same two ports referenced as IRIG-B TTL. Where IRIG-B AM output is optional.

NOTE: On the back terminal plate of model MC-1-U IRIG-B DCLS time code signal is referred to as IRIG-B TTL.

10.2.3.1 Abstract of IRIG-B Time Code:

The transmission of coded timing signals began to take on widespread importance in the early 1950s. Especially the US missile and space programs were the forces behind the development of these time codes. The definition of time code formats was completely arbitrary and left to the individual ideas of each design engineer due to that hundreds of different time codes were formed, some of which were standardized by the "Inter Range Instrumentation Group" (IRIG) in the early '60s.

Today electronic systems such as communication systems, data handling systems require time of day/year for data correlation of data with time. IRIG-B is a serial time code that occurs once per second and depending on the protocol it contains the day of the year, hour, minute, seconds, year, and other important information. Except these, "IRIG Time Code" other format like IEEE1344 code which is an IRIG coded extended by information for time zone, leap second, etc.

IRIG-B is fully described in IRIG Standard 200-04, released by RANGE COMMANDERS COUNCIL of the US Army White Sands Missile Range. IRIG-B format standard allows

several configurations that are designated as IRIG-Bxyz, where x indicates the modulation technique, y indicates carrier signal frequency and z indicates data contained in the signal. IRIG-B time code consists of 100 bits out of 74 bits used for time, date, and control functions. The 74-time code bits are divided into:

- 30 bits for BCD value of Seconds, Minutes, Hours, and current day of the year
- 9 bits for year information
- 17 bits for the binary value of current day seconds
- 18 bits for control functions Also unused bits are filled with logical zero.

10.2.3.2 IRIG-B AM & IRIG-B DCLS signals:

The figure illustrates the primary difference between AM-Amplitude Modulated Signal and DCLS- (Pulse Width Modulated Signal). IRIG-B AM is distinctive because of the 1 kHz sine wave carrier. It is similar to IRIG-B DCLS since Pick-Pick values of the carrier signal follow the same form as IRIG-B DCLS, which contains information.

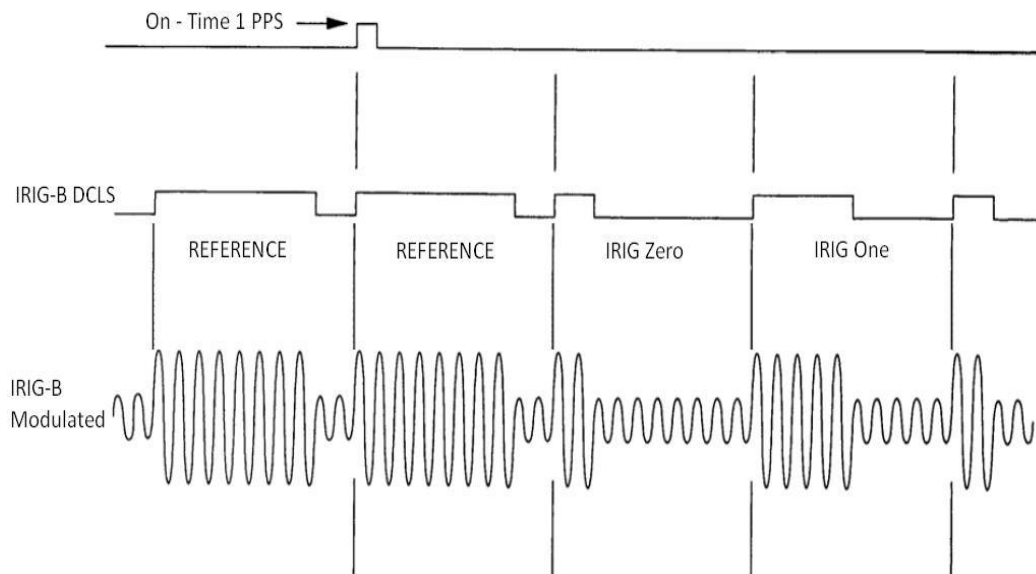


Figure 10-1 IRIG-B waveforms

10.2.3.3 IRIG-B IEEE 1344 Extension:

IEEE 1344 protocol has two versions available of which model MC-1-U supports is IEEE 1344-2005 which is defined in IEEE 1344.C37.118TM-2005 document. IEEE 1344.C37.118TM-2005 extends the Range Commanders Council document by using CF bits of IRIG 200-04. These CF bits contain information like Time quality, Time offset to get UTC from the frame, etc.

Bit no	Designation	Description
50	Year BCD Encoded, BCD 1	Low nibble of BCD encoded Year
51	Year BCD Encoded, BCD 2	
52	Year BCD Encoded, BCD 4	
53	Year BCD Encoded, BCD 8	
54	Separator always Zero	
55	Year BCD Encoded, BCD 10	High nibble of BCD encoded Year

56	Year BCD Encoded, BCD 20	
57	Year BCD Encoded, BCD 40	
58	Year BCD Encoded, BCD 80	
59	P6	Position Identifier #6
60	Leap Second Pending (LSP)*	Becomes 1 up to 59 Sec before leap second inserted
61	Leap Second (LS)*	0 = add leap sec, 1 = Delete leap Sec
62	Daylight Saving Pending (DSP)*	Becomes 1 up to 59 Sec before DST change
63	Daylight Saving Time (DST)*	Becomes 1 during DST
64	Time-zone Offset Sign	Time-zone Offset Sign :- 0=+, 1=-
65	Time-zone Offset BCD encoded, BCD 1	Offset from coded IRIG-B time to UTC time. IRIG coded time plus time offset (Including sign) Equals UTC.
66	Time-zone Offset BCD encoded, BCD 2	
67	Time-zone Offset BCD encoded, BCD 4	
68	Time-zone Offset BCD encoded, BCD 8	
69	P7	Position Identifier #7
70	Time Zone Offset 0.5 Hour	0 = none, 1=additional 0.5 hour time-zone offset
71	Time Quality	4-bit code representing approx. clock time error. 0000 =MC-1-U Locked, maximum accuracy 1111 =MC-1-U failed, data unreliable
72	Time Quality	
73	Time Quality	
74	Time Quality	
75	Parity	Parity on All preceding data bits including time of year
76	Not Used	Unassigned, Zero Value
77	Not Used	Unassigned, Zero Value
78	Not Used	Unassigned, Zero Value
79	P8	Position Identifier #8

Table 10-4 Assignment of CF Segment for IEEE 1344 (C37.118-2005)

To use these extra bits of information, protective Relays, RTU's and other equipment receiving the time code must be able to decode them.



In IEEE 1344 C37.118-2005 Leap Second, Leap Second Pending, Day Light Saving Time, Day Light Saving Time Pending bits are not supported in this firmware version.

10.2.3.4 Generated IRIG-B Time Codes:

GPS Master Clock MC-1-U supports different IRIG-B 00x/IRIG-B12x protocols. Supported protocols are listed below.

- a) IRIG-B007 : 100 pps, DCLS Signal, No carrier Frequency
BCDTOY, BCDYR, SBS (Time of Day)
- b) IRIG-B127 : 100 pps, AM Signal, 1 KHz carrier Frequency

- c) IEEE 1344 (C37.118-2005) : BCDTOY, BCDYR, SBS (Time of Day)
 : 100 pps, AM Signal, with 1 KHz Carrier frequency
 BCDTOY, BCDYR, SBS, IEEE1344 assignment of CF bits
 : 100 pps, DCLS Signal, No Carrier Frequency
 BCDTOY, BCDYR, SBS, IEEE1344 assignment of CF bits

10.2.3.5 Selection/configuration of IRIG-B Time Codes:

The time code generated can be selected/configured using the Telnet menu available on model MC-1-U Ethernet port NTP1 (NTP).

IRIG-B time code for model MC-1-U can be configured for

- 1) IEEE 1344 C37.118 – 2005 protocol enabling
- 2) UTC time on IRIG-B time code or Local time on IRIG-B time code.

IRIG-B DCLS time codes (IRIG-B 00x) and IRIG-B AM time codes (IRIG-B 12x) are always generated simultaneously. Using telnet if we configure the IRIG-B output for IEEE 1344 protocol then both IRIG-B00x and IRIG-B12x give IEEE 1344 protocol CF bits output. Similarly, we can configure IRIG-B output for UTC / Local time effect of configuration will be on both IRIG-B 00x and IRIG-B 12x. To configure IRIG-B please refer to Telnet Appendix.



- Configuration of IRIG-B time code using any other Ethernet port except Ethernet port NTP1 (NTP) will not reflect on the IRIG-B output port.
- All the IRIG-B time codes will have the same configuration as shown in the Telnet menu of Ethernet port NTP1(NTP).

10.2.3.6 Connecting IRIG-B Time Code:

GPS Master Clock MC-1-U time code outputs are designed to handle multiple loads. The output terminals of the IRIG-B time code are BNC type. Input devices have different types of IRIG-B time code input connectors. Co-axial cables can be connected directly from model MC-1-U to the end device. To adapt twisted pair cabling with model MC-1-U use BNC Breakout or other similar adapters.

NOTE: In case of shielded twisted pair cabling does not connect shielding of cable to model MC-1-U, ground it at the receiver end.

Following factors come into effect by transmitting time code to multiple/single devices over a long distance,

- 1) Resistive loss in cabling
 - 2) Electromagnetic interference
 - 3) Propagation delay
 - 4) The input impedance of the end device
- 1) **Resistive loss in cabling:** -Resistive loss in cabling affects the available output voltage at the input device. Wire has a certain resistivity associated with it that is determined by its metallic composition, and resistance is determined by the diameter and length.
 - 2) **Electromagnetic interference:** -Electromagnetic interference (EMI) includes a variety of sources of interfering signals, ranging from dc and low-frequency (50 or 60 Hz) up through the RF (Radio Frequency) and microwave region. All of these signals have the potential to interfere in one way or another with the accurate and reliable distribution of timing signals.
 - 3) **Propagation Delay:** -Electromagnetic waves travel at the speed of light (C) in free space/vacuum and a fraction of that speed through cabling which causes a delay in IRIG-B Time code output.
 - 4) **The input impedance of end-device:** -By connecting, multiple devices to GPS Master Clock MC-1-U results in the decrease of drive voltage due to an increase in load current.

In many cases, model MC-1-U time code output is “fanned out” to a no of devices. The exact no of possible loads can be determined from the input impedance of each connected device. To know the input impedance of connected devices please refer to the specific device manual.

10.2.3.7 Connecting IRIG-B DCLS:

To drive multiple loads from IRIG-B DCLS output connects all end devices in parallel. To determine load current for one IRIG-B DCLS output.

- Determine no of load devices to be connected
- Determine input impedance of each load device (R_{dev})
- Calculate load current of each device ($I_{dev} = 5V \div R_{dev}$)
- Sum all the load device current and compare with model MC-1-U load capacity current

GPS Master Clock MC-1-U IRIG-B DCLS time code output impedance is 50Ω @ 5V.

10.2.3.8 Connecting IRIG-B AM:

The main difference in computing the load capacity for IRIG-B AM and IRIG-B DCLS is that some of the modulated IRIG-B decoders are sensitive to the peak-to-peak voltage. Connecting multiple devices with MC-1-U IRIG-B AM output causes an increase in current flow which affects the Pick-Pick output voltage to decrease. GPS Master Clock MC-1-U IRIG-B AM Time code signal output impedance is 100Ω .

10.3 Timing Output – NTP

10.3.1 NTP Introduction:

NTP (Network time protocol) is a common method for synchronization of hardware clocks in local and global Ethernet networks. The software package NTP is an implementation of the actual version 3, based on the specification RFC-1305. NTP protocol is used to synchronize and maintain the time among distributed networks of servers and clients. NTP protocol is evolved from Time protocol but is designed to maintain accuracy and robustness even on the networks involving multiple gateways, high network path delays, and unreliable nets. NTP protocol is applied on the application layer on the UDP-based IP layer.

The purpose of NTP is to convey timekeeping information (in terms of UTC) from NTP servers to other time clients via the Internet and also to cross-check clocks and mitigate errors due to equipment or propagation failures. In NTP basic model, the NTP client device sends the NTP packet message over the wire to the NTP server (time source) at a prefixed/defined interval (as per NTP standard). The NTP server interchanges IP addresses and ports, overwrites certain fields in the message, inserts the current timestamp in the packet, recalculates the checksum, and returns the message immediately to the NTP client. The information included in the NTP message allows the client to determine the server time concerning local time and adjust the local clock accordingly. After the NTP message is received, the NTP client calculates time offset, owns local clock frequencies, and updates in its database at regular intervals to maintain the clock time synchronization with NTP server time. This may result in either a step-change or a gradual phase adjustment in time of the NTP client's local clock to reduce the offset to zero or as minimum as possible. The accuracies achievable by the NTP client depend strongly on the precision of the local clock frequency and stringent control of device and process latencies.

NTP architecture model consists of several primary reference sources, synchronized by wire or radio clock. There are other several multiple secondary time sources/clients which are arranged in a hierarchical manner in the network which request time from primary reference sources. Under normal circumstances, it is intended that the synchronization subnet of primary and secondary servers assumes a hierarchical-master-slave configuration with the primary servers at the root and secondary servers of decreasing accuracy at successive levels toward the leaves.

10.3.2 GPS Master Clock MC-1-U NTP Output:

GPS Master Clock MC-1-U device is equipped with a 10/100 Mbps-based Ethernet output port which provides the functionality of the NTP server. This NTP output is capable to synchronize the time of various NTP clients such as Windows PC, Unix/Linux machines, and other clients which support NTP protocol. GPS Master Clock MC-1-U operates at stratum 1 level which is the highest level (in terms of accuracy) after the atomic clock providing the NTP timestamp output resolution in milliseconds. Stratum level 1 indicates that a device synchronizes its clock from a radio clock or satellite clock. GPS Master Clock MC-1-U NTP output operates in Unicast mode in which the NTP server responds only when there is an NTP request from NTP clients. NTP clients operating at stratum levels lower than 1 (i.e. 2 to 16) can synchronize their time from GPS Master Clock MC-1-U NTP output.

GPS Master Clock MC-1-U continuous to provide NTP output even under Unlock conditions (when there is no satellite signal available) depending on its internal RTC clock time and accuracy. If required, the user can configure stratum level (2 to 16) of NTP output only for holdover conditions which are applicable when the GPS Master Clock MC-1-U device is in Unlock condition. This feature indicates NTP client devices whenever GPS Master Clock MC-1-U device enters holdover mode during ideal run conditions. Under Lock conditions, GPS Master Clock MC-1-U NTP output will always operate at stratum level 1 which cannot be changed.

Users should change the stratum level of the GPS Master Clock MC-1-U device carefully, after knowing its NTP Server-Client network hierarchical level architecture. Stratum level decreases by 1 at every NTP server-client level stage concerning GPS Clock device stratum level. (Stratum at the topmost level (primary GPS servers) is assigned as one and each level downwards (secondary servers) in the hierarchy assigned as one greater than the preceding level). If the stratum level of GPS Master Clock MC-1-U device is

configured at 16 under Unlock conditions, no NTP client will synchronize its time with NTP server output as level 16 is the last limit of a stratum as per NTP standard.

```
Network Time Protocol
Flags: 0x1c
 00.. .... = Leap Indicator: no warning (0)
 ..01 1... = Version number: NTP Version 3 (3)
 .... .100 = Mode: server (4)
Peer Clock Stratum: primary reference (1)
Peer Polling Interval: 14 (16384 sec)
Peer Clock Precision: 0.000001 sec
Root Delay:      0.0000 sec
Root Dispersion: 0.0000 sec
Reference Clock ID: Global Positioning Service
Reference Clock Update Time: Feb  7, 2036 06:28:18.2679 UTC
Originate Time Stamp: Feb  7, 2036 06:28:18.2679 UTC
Receive Time Stamp: Oct 15, 2009 11:33:29.3930 UTC
Transmit Time Stamp: Oct 15, 2009 11:33:29.3930 UTC
```

Figure 10-2 NTP frame format

Below is the list of some of all NTP packet parameters which are functionally significant concerning the NTP server.

Mode: 3-bit integer representing the mode with value “4”, means that GPS Master Clock MC-1-U device act as NTP server device and can provide time output for synchronization to NTP client devices but will never be synchronized by clients.

Peer clock stratum: 8-bit integer representing the stratum with value “1”, which means that GPS Master Clock MC-1-U acts as the primary reference source. Stratum value will be fixed at 1 during GPS Master Clock MC-1-U Lock conditions. However, it can be configured between 2 to 16 (via telnet) which will only be applicable during GPS Master Clock MC-1-U Unlock conditions.

Clock precision: This is an eight-bit signed integer indicating the precision of the local clock, in seconds to the nearest power of two. GPS Master Clock MC-1-U is having an internal clock precision of 1 us (1 microsecond = 0.000001s).

Reference Clock identifier: This is a 32-bit code identifying the particular reference clock. As GPS Master Clock MC-1-U is stratum 1 primary reference source, its reference identifier is designated as “GPS”.

Transmit Timestamp: Time of the server when the NTP response is left for the NTP client, in NTP timestamp format. NTP timestamps are represented as a 64-bit unsigned fixed-point number, in seconds relative to 0h on 1 January 1900 in terms of UTC. The integer part is in the first 32 bits and the fraction part in the last 32 bits. GPS Master Clock MC-1-U provides time format in seconds and fractional timestamp with a millisecond resolution.



If the stratum level of GPS Master Clock MC-1-U device is configured at 16 under Unlock conditions, no NTP client will synchronize its time with NTP server output as level 16 is the last limit of a stratum as per NTP standard

10.3.3 NTP Client Synchronization:

GPS Master Clock MC-1-U NTP output port can be used to synchronize Windows PC based PC in networks. Please refer to **Appendix H** for procedure/settings for making PC operate as an NTP client by using Net T sync Software. It is recommended to visit the website www.ntp.org for installing and configuring Unix/Linux-based PC as an NTP client.

GPS Master Clock MC-1-U is available with NTP Utility software which can be used to synchronize Windows PC as an NTP client device. If NTP Utility software is used, there is no need to do re-edit settings in Windows PC for NTP client configuration.

NTP Client time accuracy depends on multiple factors such as Client local clock frequency ppm, network load and congestion, type of clock synchronization algorithm in NTP Client devices other than Unix/Linux PC, hierarchical arrangement of NTP servers and NTP clients in-network, and GPS Master Clock MC-1-U NTP Clock output accuracy during holdover conditions (when the device is Unlock as per ppm of internal clock crystal), etc.

Since the NTP client sends NTP requests to the NTP server at fixed intervals which can be from few seconds to minutes, as during the interval, the time of the NTP client depends on its local clock ppm. If there is too much network load and congestion, there is the possibility that NTP requests, as well as NTP responses to and from NTP clients to NTP servers, can be delayed by significant milliseconds at irregular intervals, or NTP packets may be discarded by the network (as NTP packet is UDP based transmission packet) since it may cross packet TTL (Time To Live) value in the network.

10.3.4 NTP Hierarchical Time Distribution:

NTP architecture model consists of the number of primary reference sources, synchronized by wire or radio clock. There are other several multiple secondary time sources/clients which are arranged in a hierarchical manner in the network which request time from primary reference sources. Under normal circumstances, it is intended that the synchronization subnet of primary and secondary servers assumes a hierarchical-master-slave configuration with the primary servers at the root and secondary servers of decreasing accuracy at successive levels toward the leaves.

NTP server-client architecture is generally arranged in the hierarchical arrangement in the network. Refer to figure 11.3 to understand the time distribution model in a hierarchical arrangement.

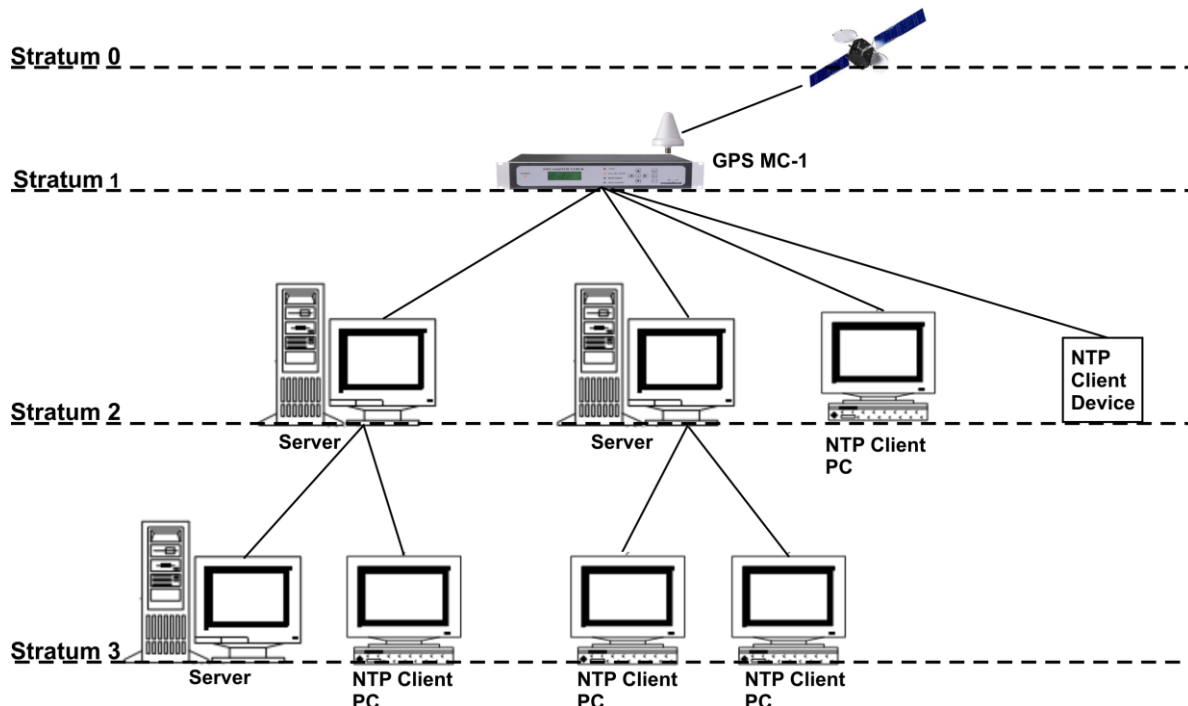


Figure 10-3 NTP Time distributions in Hierarchical Arrangement

As shown in figure 11.3, GPS Master Clock MC-1-U receives time from GPS Satellites. According to NTP protocol, GPS satellites are considered to be operating at stratum level 0 as the most accurate time source. As the devices pass down to other levels of network architecture, the stratum level increases by 1. GPS Master Clock MC-1-U model operates at stratum level 1 which is considered the next accurate time source to GPS Satellites. Other NTP client's stratum level increases by 1 as NTP devices goes downwards in network layers. Stratum level can be up to a maximum of 14 to be considered as a valid NTP time source.

NTP client accuracy also depends on the hierarchical arrangement of NTP servers and NTP clients in-network because the stratum value increases by 1 at every hierarchical stage in-network and as stratum value increases, the accuracy of NTP client decreases depending on the type of NTP server's clock accuracy in the hierarchy, processing capabilities of multiple NTP requests and transmission delays.



- If the stratum level of GPS Master Clock MC-1-U device is configured at 16 under Unlock conditions, no NTP client will synchronize its time with NTP server output as level 16 is the last limit of a stratum as per NTP standard.
- The stratum of GPS Master Clock MC-1-U under Unlock conditions should be such that the last NTP client in the hierarchical arrangement should be at stratum level 16 so that can be continuously synchronized with its superior level NTP source device.



- I.P. address of two NTP ports in GPS should not be the same if both NTP ports are to be used in the same network domain.
- It is recommended that NTP output in the network should be used only when once GPS Master Clock MC-1-U is Lock after being power UP. If the GPS Master Clock MC-1-U device was in Power OFF condition for a very long duration, the RTC battery may get discharged and RTC time will reset to its default time. (Please check the applicable battery backup period mentioned in the RTC section).

NOTE:

- Factory set IP of NTP ports are **192.168.100.153(NTP1) & 192.168.100.154 (if NTP2 is available as optional output)**.
- I.P. address of two NTP ports in GPS should not be the same if both NTP ports are to be used in the same network domain.
- Among all applicable NTP parameters in NTP packet format, only stratum value can be modified for GPS Master Clock MC-1-U Unlock condition only. If GPS Master Clock MC-1-U NTP output stratum value is configured as 16, all NTP clients in the network will continue to ignore GPS Master Clock MC-1-U NTP output as a valid time source.
- As NTP protocol is based on UDP transmission protocol (as UDP is a connectionless protocol as there is no acknowledgement for failed packet delivery), NTP requests from NTP clients to NTP servers and NTP responses from NTP servers to NTP clients can be delayed at irregular intervals or rarely discarded if there too much Ethernet packets load/congestion in the network.
- There may be a rare case that NTP Server responses to some NTP requests from NTP clients may be discarded if there is a large number of simultaneous NTP requests to a single NTP server port.
- It is recommended that NTP output in the network should be used only when once GPS Master Clock MC-1-U is Lock after being power UP. If the GPS Master Clock MC-1-U device was in Power OFF condition for a very long duration, the RTC battery may get discharged and RTC time will reset to its default time. (Please check the applicable battery backup period mentioned in the RTC section).
- If GPS Master Clock MC-1-U was Lock for once after being Power UP, *GPS Master Clock MC-1-U* will retain accurate NTP output in holdover conditions (according to its local clock ppm accuracy).
- NTP Client time accuracy depends on multiple factors such as Client local clock frequency ppm, network load and congestion, type of clock synchronization algorithm in NTP Client devices other than Unix/Linux PC, hierarchical arrangement of NTP servers and NTP clients in-network, and GPS Master Clock MC-1-U NTP Clock output accuracy during holdover conditions (when the device is Unlock as per ppm of internal clock crystal), etc.
- GPS Master Clock MC-1-U NTP output is compliant with NTP version 4 NTP request but does not support various authentication schemes as per NTPv4.

11. Relay and Pulse Outputs

11.1 Relay Contact Outputs (Optional output)

GPS Master Clock Model MC-1-U device is equipped with 3 Relay contact outputs for indication of POWER failure alarm, WATCHDOG alarm and GPS LOCK status alarm on back panel of unit. Factory set configuration for relay contacts for all three mentioned outputs is C-NO terminal. The relay output configuration can be changed to C-NC if required through hardware jumpers only (refer to [section 6.4](#) and [section 6.1](#)) Below table represents the relay contact status in various modes.

Relay Contact Configuration: C – NO

MODE	Contact on Terminal	POWER RE-LAY STATUS	WATCHDOG RELAY STATUS	GPS LOST RELAY STATUS
Unit Power OFF	C-NO	Contact Open	Contact Open	Contact Open
At Power ON	C-NO	Contact Close	Contact Close only after 6 seconds once time is displayed on unit Screen	Contact Close (if GPS is LOCK) or Contact Open (if GPS is UNLCOK)
Power fail	C-NO	Contact Open	--	--
Unit Healthy	C-NO	Contact Close	Contact Close	Contact Close (if GPS is LOCK)
GPS LOCK	C-NO	--	--	Contact Close

Relay Contact Configuration: C – NC

MODE	Contact on Terminal	POWER RE-LAY STATUS	WATCHDOG RELAY STATUS	GPS LOST RELAY STATUS
Unit Power OFF	C-NC	Contact Close	Contact Close	Contact Close
At Power ON	C-NC	Contact Open	Contact Close but Contact Open only after 6 seconds once time is displayed on unit Screen	Contact Close (if GPS is UNLOCK) or Contact Open (if GPS is LCOK)
Power fail	C-NC	Contact Close	--	--
Unit Healthy	C-NC	Contact Open	Contact Open	Contact Open (if GPS is LOCK)
GPS LOCK	C-NC	--	--	Contact Open

Table 11-1 Relay contact status chart during operation

11.2 Pulse Outputs

11.2.1 1PPS Output

GPS Master Clock MC-1-U device provides 1PPS output at every 1 second through its BNC terminal on the rear panel of the unit. This is a TTL signal of 0(low level) to 5V (high level) value. The Pulse width of the 1PPS signal is 20% duty cycle i.e. 200 milliseconds (high level) and 800 milliseconds (low level).

11.2.2 Event Output (PPM/PPH)

GPS Master Clock Model MC-1-U device is equipped with the standard feature of providing event output at every PPM (Pulse per Minute) / PPH (Pulse per Hour) with fix pulse width of 1 second. This event provides pulse output according to configured time interval i.e. Minute / Hour through front panel keypad or COM2 terminal on back panel. Please refer section 8 for method of configure standard event output through serial and section 10.2.6 to configure through keypad on device. Refer technical specification section 4 for electrical characteristics of event output.

11.2.3 Additional Event Outputs (Programmable Pulse Outputs)

GPS Master Clock MC-1-U device is equipped with the (optional) feature of providing 1 to 4 additional event outputs. These events provide pulse output according to a configured time interval and ON time. Each event time can be configured with a time interval ranging from 1 sec to 86400 seconds and pulse ON time (pulse width) from min. 50 milliseconds to the max. 50% of the configured time interval of that particular event in terms of milliseconds through the front panel keypad or Terminal on the rear panel. Please refer to [section 9.2.4](#) for a method of configuring additional event outputs through serial and [section 8](#) to configure additional event outputs through the keypad on the device. Refer to technical specification [section 4](#) for electrical characteristics of additional event outputs.

12. Ethernet Communications: Telnet, SNMP

12.1 Telnet

After the network connection is established the GPS Master Clock MC-1-U can be configured remotely from a work station using the command-line interface (Telnet). Telnet configuration GPS Master Clock MC-1-U is password protected. GPS Master Clock MC-1-U model several parameters can configure using Telnet are shown in Table. To set up a Telnet connection please refers to [section 9.3](#). Model MC-1-U supports only one Telnet session at a time. If the system is not disconnected properly then the Telnet session will be timed out and disconnected after 10 minutes.

Command	Description	Reference
H	Command list supported by model MC-1-U Model	section 9.3 .
CC	To view the Current Configuration of model MC-1-U model.	
IP	Sets the network IP address, Ethernet port, of model MC-1-U. After this command connection to the Telnet, the prompt will be lost and the user needs to reopen Telnet prompt. Factory set value is: 192.168.100.153	
MASK	Sets the Network IP mask address, Ethernet port, of model MC-1-U. Factory set Value is: 255.255.255.0	
GTY	Sets the Network IP Gateway (factory set route address), Ethernet port, of model MC-1-U. Factory set Value is: 192.168.100.001	
SNMP	Used to configure SNMP Service Enable/Disable of model MC-1-U. Factory set Value is No - SNMP Service Disabled	
SIP1	Sets the IP address of SNMP manager which should receive any Trap messages generated by model MC-1-U Agent. Factory set value is 0.0.0.0	
SIP2	Sets the IP address of SNMP manager which should receive any Trap messages generated by model MC-1-U Agent. Factory set value is 0.0.0.0	
SRC	Sets the SNMP Read Community. The input could be any ASCII string with 1-20 characters. Factory set value is: masibus For detail of Read Community refer to section 12.2.2	
SWC	Sets the SNMP Write Community. The input could be any ASCII string with 1-20 characters. Factory set value is masibus For detail of Write Community refer to section 12.2.2	
STRT	Used to modify stratum of model MC-1-U when it is not synchronized. The factory-set value is 1. For detail about stratum refer to section 10.3.2 .	
U	Sets the User name Telnet session, current Ethernet port, of model MC-1-U. Factory set Value is masibus (case sensitive).	
P	Sets the Password Telnet session, current Ethernet port, of model MC-1-U. Factory set Value is masibus (Case Sensitive).	
IRIG	Used to configure UTC/Local time on IRIG output port. Factory set Value is No – Transmit local time on IRIG-B Port.	
I_1344	Used to configure IEEE-1344 C37.118-2005 protocol on the IRIG-B output port. Factory set Value is No-Disable IEEE 1344. For detail about IEEE 1344 refer to section 10.2	
Q	Quit the telnet configuration	

Table 12-1 Configuration Parameter through TELNET

NOTE: 1) NTP output stops during Telnet session in progress.



- NTP output stops during the Telnet session in progress.
- Refer to Manual [section 9.3](#) for Procedure to Connect and Configure MC-1-U model through Telnet session.

12.2 SNMP

The Simple Network Management Protocol (**SNMP**) has been created to achieve a standard for the management and monitoring of different devices connected on the same network from some remote location. SNMP has SNMPv1 and SNMPv2c standards available. SNMP is operating on the application layer and uses different transport protocols (like TCP/IP and UDP), so it is network hardware independent. SNMP protocol is having client-server architecture, where the server is called an agent and the client is called a manager.

GPS Master Clock MC-1-U device supports and operates as SNMPv1 / SNMPv2c agent, designed especially to handle SNMP requests for model MC-1-U specific status information. GPS Master Clock MC-1-U SNMP agent is also capable of handling SET requests to manage the configuration via SNMP if SNMP management software also supports this feature. Users need to configure the SNMP manager IP address for a particular GPS Ethernet IP address using a telnet session with that particular Ethernet port.

The elements (objects/variables) are organized in data structures called Management Information Base (MIB). The agent is also responsible for controlling the database of control variables defined in the product's MIB.

12.2.1 SNMP Addressing:

SNMP addressing is structured as a very large tree database. A root node address is an integer value that ranges from 0 to some very large number. Conceptually, there are no limits to the numbers of sub-nodes either. SNMP addressing is written in "dotted decimal" notation. For example, the address of GPS Master Clock MC-1-U product name Enterprise MIB variable is "1.3.6.1.4.1.38306.1.1.0", this is also known as OID (Object Identifier). The address fragment 1.3.6.1.4.1 is fixed by the IANA (Internet Assigned Number Authority) and is the address of the SNMP Private Enterprise MIB's. The 38306 is the address assigned by IANA to **masibus** for our Enterprise MIB's. **masibus** assigns the addresses after that at our discretion and design.

12.2.2 Protocol Detail:

SNMP operates in the Application Layer of the Internet Protocol Suite. The manager may send requests from any available source port to port 161 to the agent. The agent will respond to the manager's address on port 162. The manager receives notifications (Traps and Inform-Requests) on port 162. SNMPv1 specifies five core protocol data units (PDUs). Two other PDUs, Get-Bulk-Request, and Inform-Request were added in SNMPv2. The seven SNMP protocol data units (PDUs) are as follows:

- GET-Request:** This PDU is used to get the values of a list of variables from a particular host.
- Get-Next-Request:** This PDU is used to get the next value for multi-valued data items (for example the entries in a routing table). The manager specifies one or more variables for value, and the agent returns the current value for each of the requested variables.
- Set-Request:** This PDU is used to set the values of a list of variables for a particular host.
- Get-Bulk-Request:** This PDU is an optimized version of Get-Next-Request, used to request multiple iterations of Get-Next-Request. It allows the caller to specify – non-repeaters, range of single-valued variables, max-repetition, no of values to be returned by the call.

- v) **Response:** Agent returns this PDU in response to above all PDUs. It contains the requested data items along with a result code.
- vi) **Trap:** This PDU is quite different from other PDUs. Agent generates it in response to, particularly important events. An agent only at the request of an SNMP manager application generates a trap PDU.
- vii) **Inform-Request:** This PDU introduces a new pattern of communication (Manager to Manager communication). In manager-to-manager communication, one manager sends information from a MIB view to another manager.

12.2.3 SNMP Operation:

GPS Master Clock MC-1-U model can work as SNMPv1 and SNMPv2c agent. SNMP Read and Write community used to monitor as well as configure SNMP parameters of model MC-1-U model from some remote location. Read and Write community of model MC-1-U agent is same for both SNMPv1 and SNMPv2c. model MC-1-U model supports max 2 SNMP managers.

- **Read Community:** SNMP manager must know Read Community of model MC-1-U agent to monitor model MC-1-U from a remote location. MC-1-U model supports 20 character length of Read community. It can be modified using Telnet or SNMP Configuration. For Telnet configuration refer to [section 12.1](#). Once Read community modified manager needs to remember for further use.
Factory set Value: masibus
- **Write Community:** SNMP Manager must know the Write community of model MC-1-U agent to configure SNMP parameters. MC-1-U model supports 20 character length of Write Community. It can be modified using Telnet or SNMP Configuration. For Telnet configuration refer to [section 12.1](#). Once Write community modified manager needs to remember for further use.
Factory set Value: masibus
- **Trap Receiver IP Address:** Trap Receiver IP Address also known as SNMP manager IP address. SNMP manager IP address must be configured to receive asynchronous events like model MC-1-U synchronized / Not Synchronized via Traps. SNMP manager IP address can be configured using Telnet or SNMP Configuration. For Telnet configuration refer to [section 12.1](#). The factory-set value of both SNMP managers is the same.
Factory set Value: 0.0.0.0
- **Trap Enable:** Trap enable field in OID is 1.3.6.1.4.1.38306.2.1.1.2 must be set to 1 to enable trap generation for manager IP. By default, the Trap Enable variable is enabled to generate traps.
Factory set Value: 1 (Enable to generate Traps)



- SNMP manager's IP address must be configured to receive asynchronous traps.
- Please note that a particular trap will only be sent if that parameter is configured for the trap by Trap enabled option through SNMP.
-

GPS Master Clock MC-1-U can be configured via several user interfaces. Besides the possibility to set up parameters of SNMP using direct shell access via Telnet, SNMP based configuration is also available. To use the SNMP configuration, you need to fulfil the following requirements:

- i) GPS Master Clock MC-1-U model MIB file must be present as well as included on the client software.
- ii) Write community of the client software and GPS Master Clock MC-1-U model must be the same.

The mentioned MIB file can be found from the CD enclosed with the model MC-1-U model or you can contact the masibus support team at support@masibus.com. For reference here, we have used the Ireasoning MIB browser. Below are the steps to configure model MC-1-U using SNMP.

i) Load MIB file to Browser:

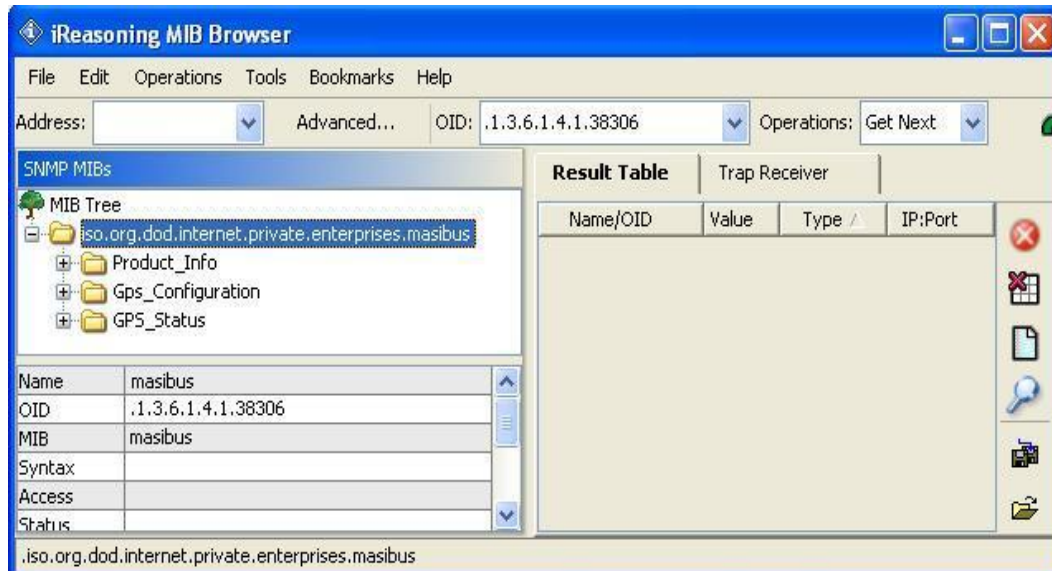
Install MIB browser from iReasoning

Open Browser from Start ☐ All Programs ☐ iReasoning ☐ MIB Browser.

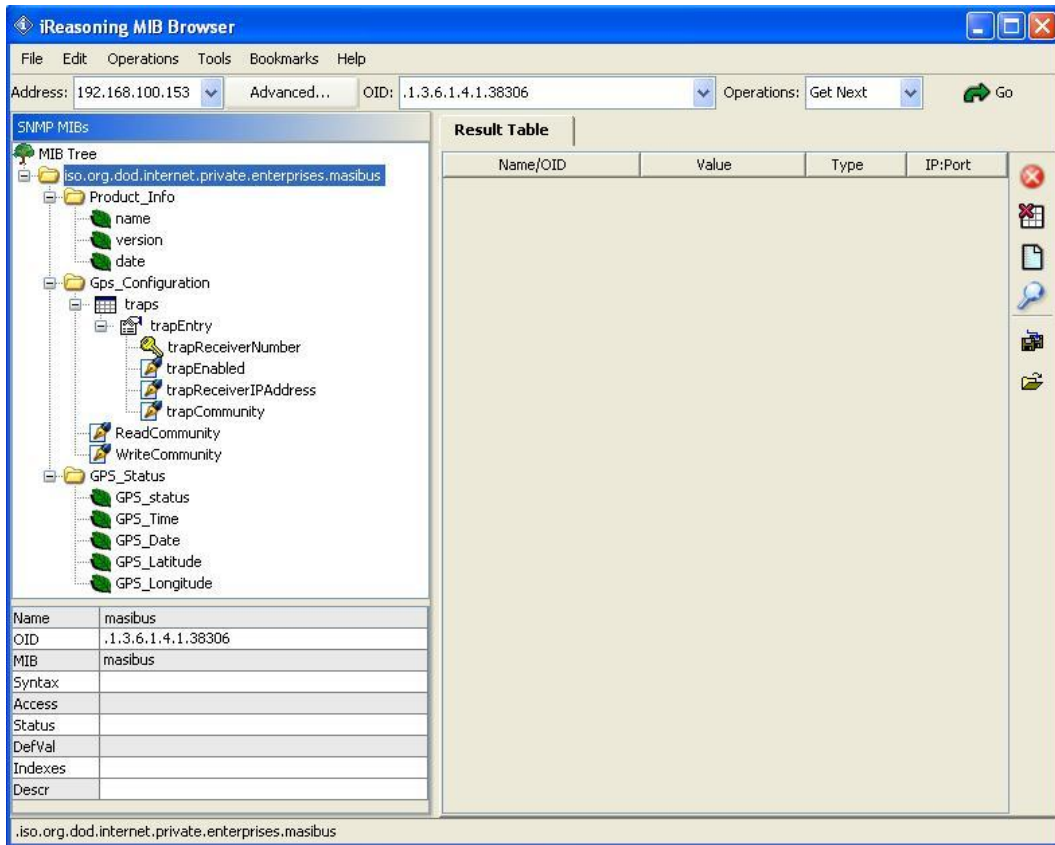
Unload All MIB files from File ☐ Unload MIB

Now load masibus GPS.mib from File ☐ Load MIB ☐ Path where the file is saved.

You can find that the MIB file is loaded in the SNMP MIBs column.

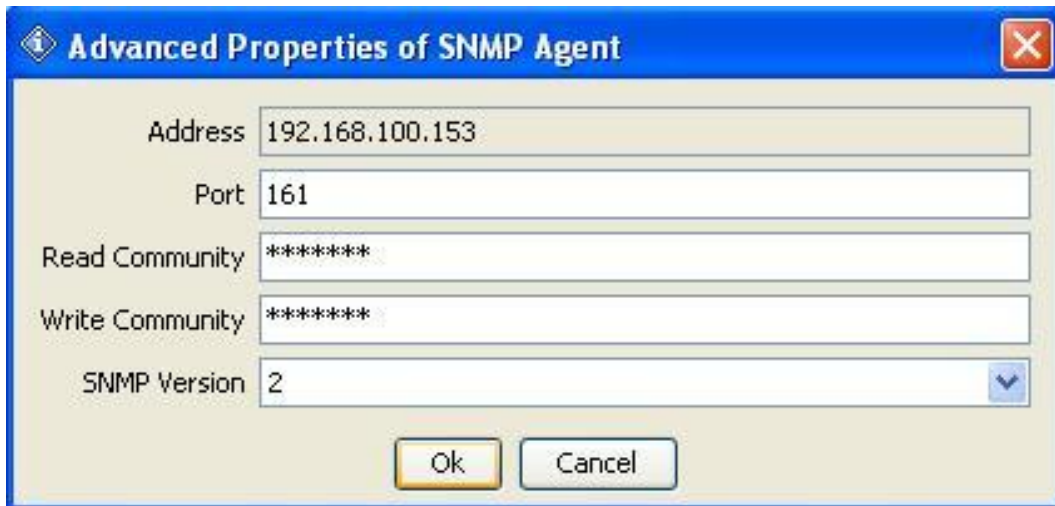


ii) Enter IP address of model MC-1-U in address Tab:



NOTE: Enter IP address in xxx.xxx.xxx.xxx format.

iii) **Enter Community/ SNMP version/ Port:**



Port: 161

Read Community: masibus (Factory set Value)

Write Community: masibus (Factory set Value)

SNMP Version: 1 or 2 (Select from Dropdown menu)

NOTE: Above value of reading & Writing, the community is factory set, once they configured SNMP manager need to remember to operate or monitor from a remote location.

iv) **MIB Tree view:**

The MIB of the masibus model MC-1-U includes the following parts:

SNMP Object & OID	Name & OID	Value	Description
Enterprises.38306	masibus 1.3.6.1.4.1.38306	-	Root Node of The masibus MIB
masibus.1	Product_Info 1.3.6.1.4.1.38306.1	String	Masibus model MC-1-U Product information
masibus.2	GPS_Configuration 1.3.6.1.4.1.38306.2	String	Masibus model MC-1-U SNMP configuration variable
masibus.3	GPS_Status 1.3.6.1.4.1.38306.3	String	Masibus model MC-1-U Status variables

SNMP Object Product_Info variables:

SNMP Branch & OID	Variable & OID	Data Type	Description
Product_Info	Name 1.3.6.1.4.1.38306.1.1.0	String (R)	A read Only variable displays Name of Product
Product_Info	Version 1.3.6.1.4.1.38306.1.2.0	String (R)	A read Only variable displays Firmware Version
Product_Info	Date 1.3.6.1.4.1.38306.1.3.0	String (R)	A read Only variable displays Firmware Release Date
Product_Info	Date 1.3.6.1.4.1.38306.1.4.0	String (R)	A read Only variable displays Firmware Release Version
Product_Info	Date 1.3.6.1.4.1.38306.1.5.0	String (R)	A read Only variable displays Firmware Release Date
Product_Info	Date 1.3.6.1.4.1.38306.1.6.0	String (R)	A read Only variable displays Serial Number.

SNMP Object GPS_Configuration variables:

SNMP Branch	Variable & OID	Data Type & Value	Description
GPS_Configuration	Traps 1.3.6.1.4.1.38306.2.1	N.A	Not Accessible
Traps	TrapEntry 1.3.6.1.4.1.38306.2.1.1	N.A	Not Accessible
TrapEntry	TrapReceiverNumber 1.3.6.1.4.1.38306.2.1.1.1	Integer(R) (0-1)	A read Only variable indicating no of SNMP manager supported by model MC-1-U Agent
TrapEntry	TrapEnabled 1.3.6.1.4.1.38306.2.1.1.2	Integer(R/W) (0-1)	Enable/Disable reception of traps to the SNMP manager. 0 – Disable Traps 1 – Enable Traps
TrapEntry	TrapReceiverIPAddress 1.3.6.1.4.1.38306.2.1.1.3	String(R/W)	SNMP Manager IP address (IPv4)
TrapEntry	TrapCommunity 1.3.6.1.4.1.38306.2.1.1.4	String(R/W) (1 – 20 Characters)	Trap Community
GPS_Configuration	ReadCommunity 1.3.6.1.4.1.38306.2.2.0	String(R/W) (1 – 20 Characters)	SNMP Community which has Read-Only Access can be only

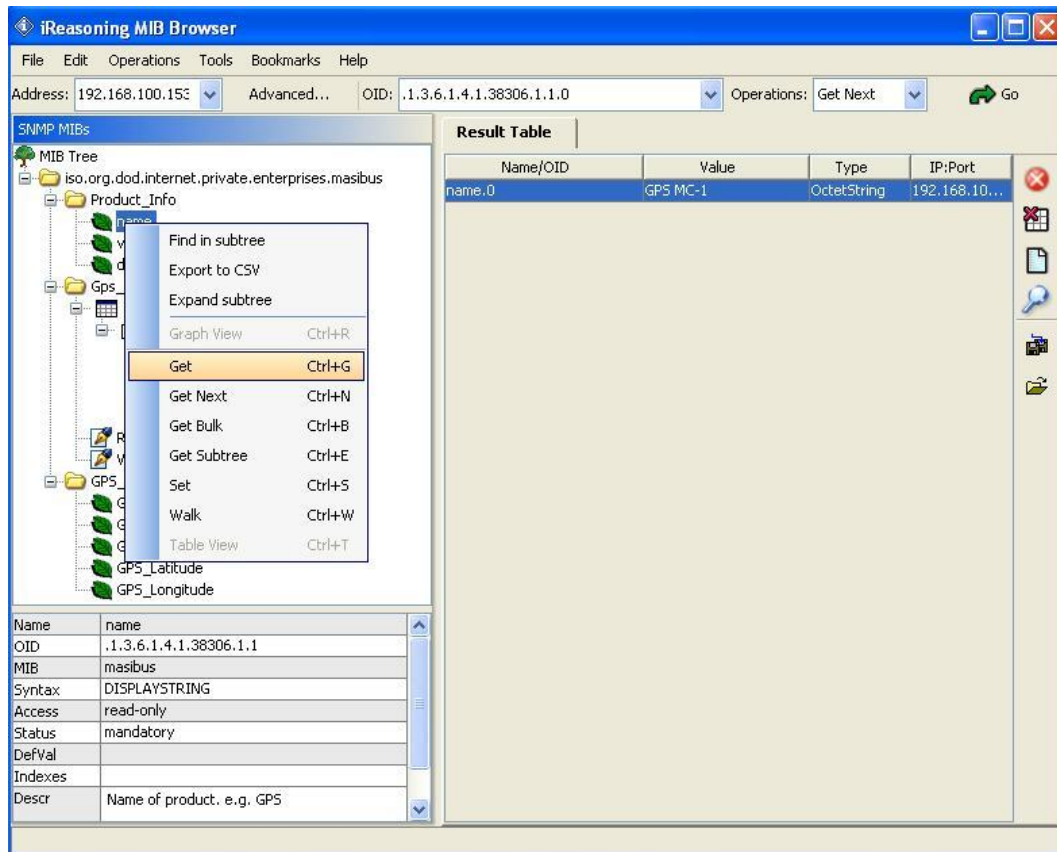
GPS_Configuration WriteCommunity String(R/W)
1.3.6.1.4.1.38306.2.3.0 (1 – 20 Characters)

used to monitor status variables and configuration values.
SNMP Community which has read-write access, can be used to monitor status variables and Get/Set SNMP configuration parameters

SNMP Object GPS_Status variables:

SNMP Branch	Variable & OID	Data Type & Value	Description
GPS_Status	GPS_Status 1.3.6.1.4.1.38306.3.1.0	Integer (R) (0-1)	Variable indicating masibus model MC-1-U reference clock Synchronized / not Synchronized 0 - Not Synchronized 1 – Synchronized
GPS_Status	GPS_Time 1.3.6.1.4.1.38306.3.2.0	String (R) (1 - 8 Characters)	Variable of string indicating Current masibus model MC-1-U Time in hh:mm:ss format
GPS_Status	GPS_Date 1.3.6.1.4.1.38306.3.3.0	String (R) (1 – 10 Characters)	Variable of string indicating Current masibus model MC-1-U Date in dd/mm/yyyy format
GPS_Status	GPS_Latitude 1.3.6.1.4.1.38306.3.4.0	String (R) (1 – 11 Characters)	Variable of string indicating masibus model MC-1-U position latitude in xxDyy.yyyy N/S format
GPS_Status	GPS_Longitude 1.3.6.1.4.1.38306.3.5.0	String (R) (1 – 12 Characters)	Variable of string indicating masibus model MC-1-U position longitude in xxxDyy.yyyyE/W format

v) **Get / Get Next / Get Bulk / Set / Walk Command:**



To perform any of the Get / Get Next / Get Bulk / Set / Walk commands you need to first select a variable (corresponding OID).

12.2.4 SNMP Traps:

MC-1-U can send SNMP traps a maximum of up to two SNMP managers if configured. Available traps in model MC-1-U model are described below.

In trap viewer, you can check traps as shown figure. The factory set status of Trap Enable variable is 1 meaning model MC-1-U agent enabled to generate traps for SNMP Managers.

GPS Status: When the MC-1-U model gets synchronized or unsynchronized SNMP trap receiver will receive the trap, where value 1 indicates model MC-1-U synchronized and 0 indicates not synchronized.

The screenshot shows the iReasoning MIB Browser interface. The MIB tree on the left is expanded to show the configuration for the trap receiver. The right pane displays the trap receiver configuration details, including the source IP address, timestamp, and specific trap details.

Description	Source	Time	Severity
Specific: 1; .iso.org.dod.internet.private.enterpris...	192.168.100.153	2014-11-01 22:11:13	
Specific: 1; .iso.org.dod.internet.private.enterpris...	192.168.100.153	2014-11-01 22:11:08	

Source: 192.168.100.153 Timestamp: 12 minutes 47 seconds SNMP Version: 1
 Enterprise: .iso.org.dod.internet.private.enterprises.masibus
 Specific: 1
 Generic: enterpriseSpecific
 Variable Bindings:
 Name: .iso.org.dod.internet.private.enterprises.masibus.GPS_Status.GPS_status.0
 Value: [Integer] GPS_LOCK(1)
 Description:



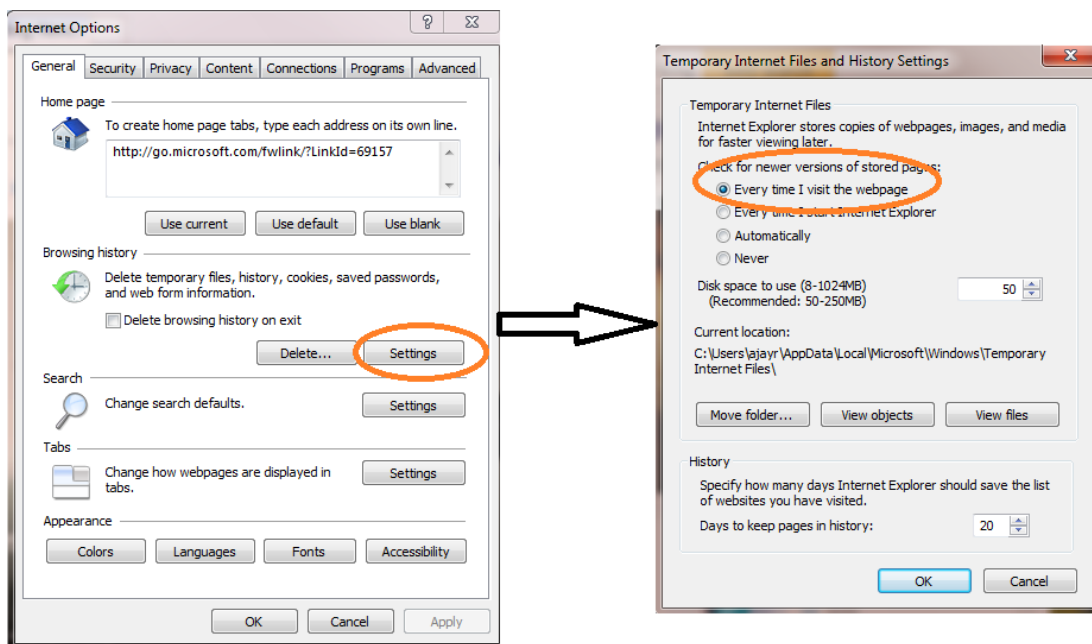
- SNMP manager's IP address must be configured to receive asynchronous traps.
- Please note that a particular trap will only be sent if that parameter is configured for the trap by Trap enabled option through SNMP.

12.3 Webserver

User/Operator need to carefully read and apply applicable notes before using the MC-1-U webserver.

Note:

1. MC-1-U configuration through web server should be accessed through a single computer at a time to avoid any configuration conflict through multiple computer systems.
2. It is recommended to use IE 9.0+, Mozilla Firefox 46+ web-browser software for the MC-1-U webserver. Use shortcut "Ctrl + F5" instead of other ways to refresh the webpage.
3. It is recommended to clear cache and cookies before starting the MC-1-U webserver.
4. It is recommended to clear cookies and cache files from the web browser after power-on of the MC-1-U unit. This will avoid any user conflict with old caches files of the MC-1-U device in web-browser with current MC-1-U data.
5. If the user is using IE (Internet Explorer) for the webserver, the user needs to do the following changes in IE settings. Go to **Internet Options -> Browsing history -> Settings -> select option "Every Time I Visit the Webpage"** -> **OK**. This option will make the web browser load the latest webpage from the MC-1-U webserver. Refer to two images for detail.

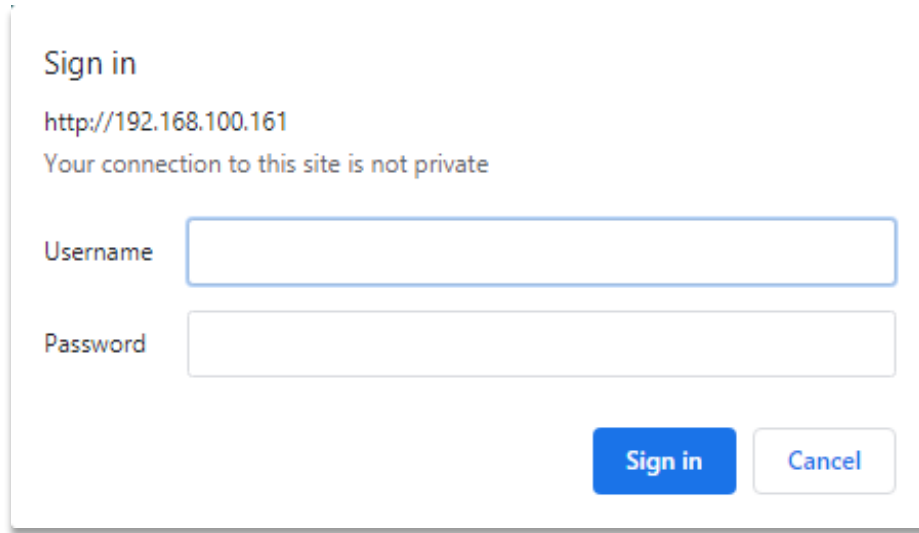


For configuration through the Web server, the user needs to enter the IP address in web browser software as explained below:

For HTTP connection with

MC-1-U: <http://192.168.100.153> on IPv4

Once, the user gives the above address in web browser software, the login page of the MC-1-U page will open as shown below.



The login page features a white background with a light gray border. At the top, it says "Sign in" in blue. Below that is the URL "http://192.168.100.161" and a warning "Your connection to this site is not private" in orange. There are two input fields: "Username" and "Password", both with blue borders. At the bottom right, there are two buttons: a blue "Sign in" button and a white "Cancel" button with a blue border.

Figure 12-1 MC-1-U Web server login

Users need to enter the username and password on the login page to gain access to other web pages of MC-1-U [**User:** masibus and **Password:** masibus]

➤ **“Home” Webpage:**

Once the user login in webserver, the MC-1-U home web page will be displayed as below:

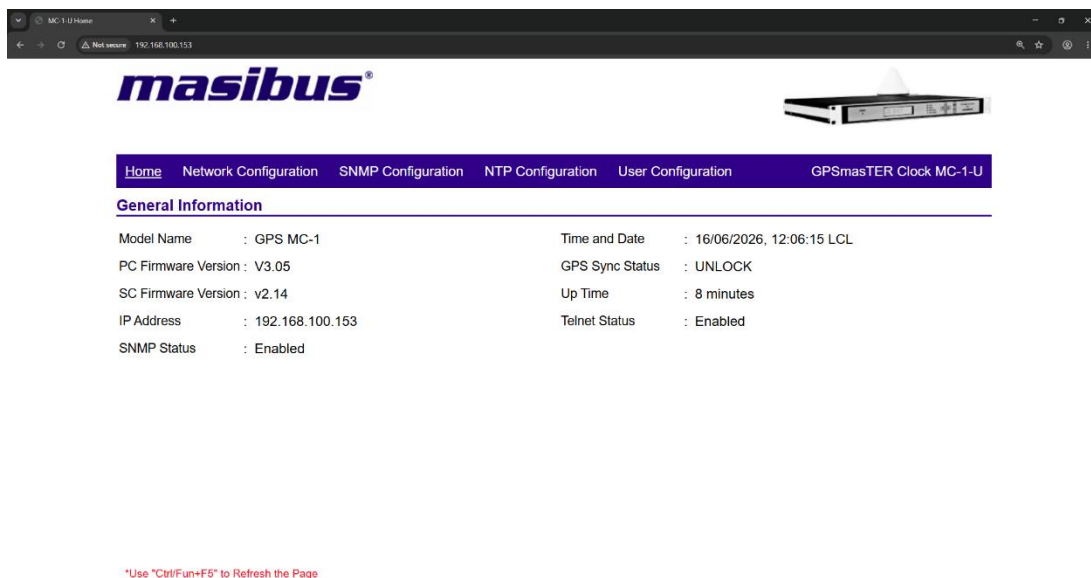


Figure 12-2 MC-1-U Web server home page

Tabs shown in the menu bar have a link to the Home page, Network Configurations, SNMP Configurations, NTP Configuration and User Configuration. Users can navigate through several options and the selected tab will be marked with a background “Green” colour.

Once any main menu is selected, that particular menu is marked with green background on that particular page as shown below example.

E.g. If a user in Home in webserver, it will be highlighted as below



MC-1-U home page displays the status of few mentioned parameters. The Model Name, Software version number, IPv4 address, Current Time and date, GPS sync status, SNMP status and System Uptime. Below is the description of the parameters.

Time/Date - Displays the time and date with LOCAL/UTC zone mode information

GPS Sync Status – Display “LOCK” and “UNLOCK” information of MC-1-U.

Uptime – This represents the duration since the device is powered up.

➤ “Network Configuration” Webpage:

For MC-1-U network settings, the user needs to navigate and select the “Network Configurations” option in the menu bar. After, selecting the below webpage will be displayed.

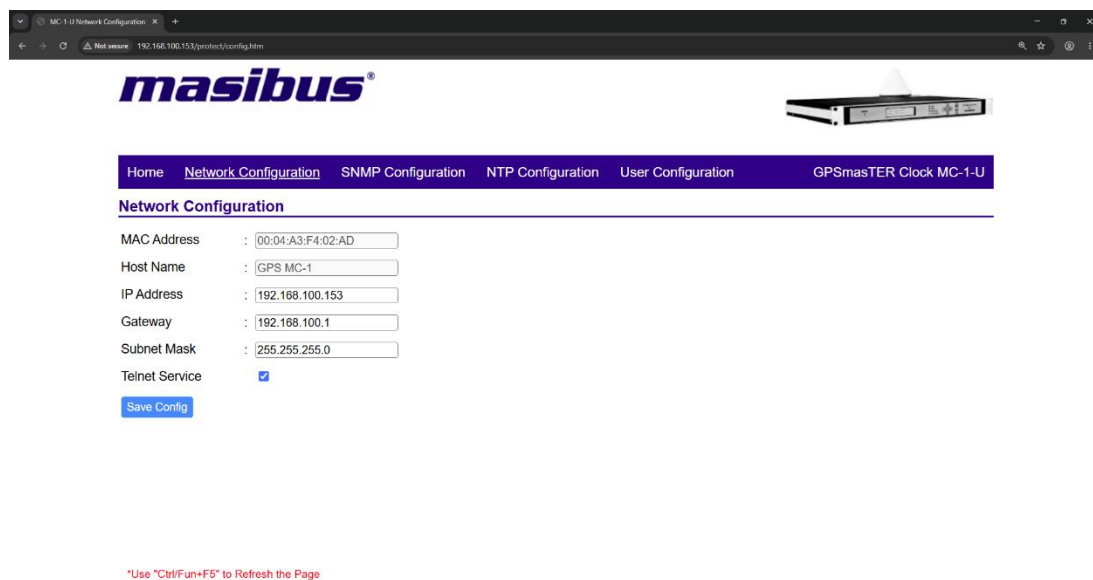


Figure 12-3 MC-1-U Web server Network Configuration page

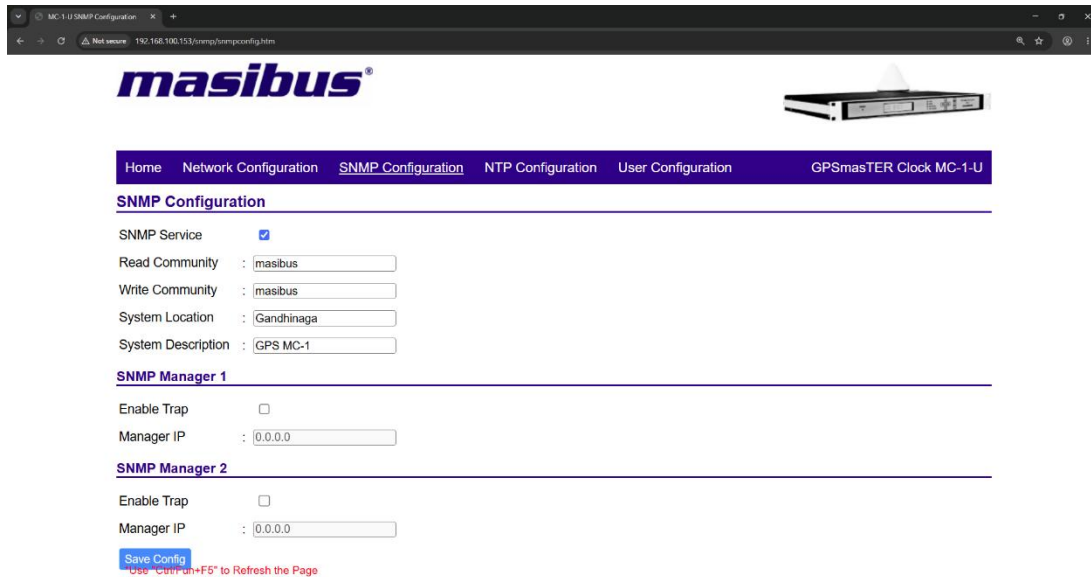
For the Ethernet interface, IP Address, Gateway, Subnet Mask and Start/Stop Telnet services can be configured in IPv4 format from here.

Once the user modifies the required data, click on the “Save Config” options provided at end of the page. This will save the changed parameters in GPS Master Clock MC-1-U.

The system will get a reboot on the change of any of these parameters. In case of IP address modification, the user needs to reopen the web application using a new IP address.

➤ “SNMP Configuration” Webpage:

For MC-1-U SNMP settings, the user needs to navigate and select the “SNMP Configuration” option in the menu bar. After, selecting the below webpage will be displayed.



The screenshot displays the 'SNMP Configuration' page for the 'GPSmasTER Clock MC-1-U'. The page has a navigation bar with links: Home, Network Configuration, **SNMP Configuration**, NTP Configuration, User Configuration, and GPSmasTER Clock MC-1-U. The main content area is titled 'SNMP Configuration' and includes the following fields:

- SNMP Service:** ☒
- Read Community:**
- Write Community:**
- System Location:**
- System Description:**

Below these are two sections for SNMP Managers:

- SNMP Manager 1:**
 - Enable Trap:** ☐
 - Manager IP:**
- SNMP Manager 2:**
 - Enable Trap:** ☐
 - Manager IP:**

At the bottom, there is a **Save Config** button and a note: "Use 'Ctrl+Fn+F5' to Refresh the Page".

Figure 12-4 MC-1-U Web server SNMP Configuration page

SNMP services like Read community, Write community, System Location, System Description, Trap1 Enable/Disable, SNMP Manager IP1, Trap2 Enable/Disable, SNMP Manager IP2 can be configured from here.

MC-1-U is an SNMP agent, it can communicate with two different SNMP Manager.

Once the user modifies the required data, click on the “Save Config” options provided at end of the page. This will save the changed parameters in GPS Master Clock MC-1-U.

For a detailed understanding of each parameter refer to [section 12.2](#).

➤ “NTP Configuration” Webpage:

For MC-1-U NTP settings, the user needs to navigate and select the “NTP Configuration” option in the menu bar. After, selecting the below webpage will be displayed.

For MC-1-U NTP Service, Local Clock Stratum can be configured in the webserver.

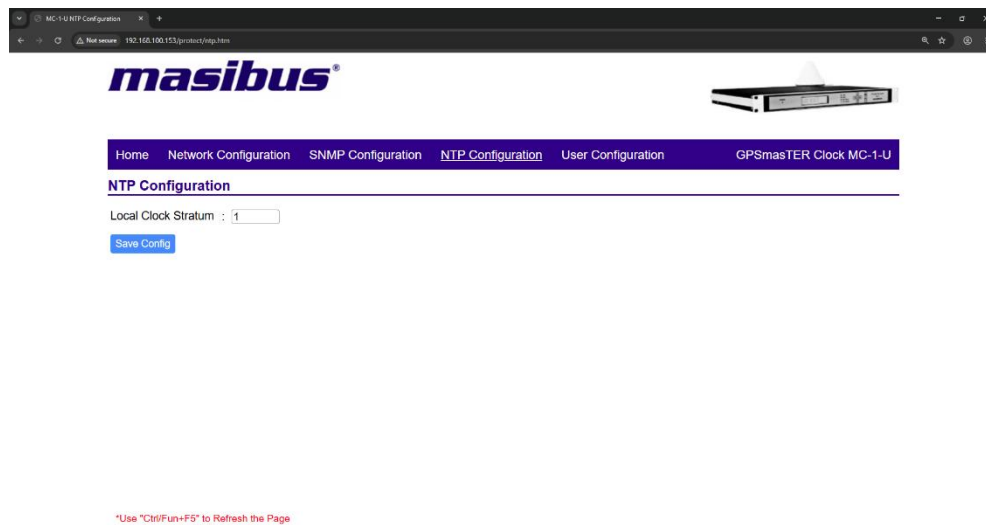


Figure 12-5 MC-1-U Web server NTP Configuration page

Once the user modifies the required data, click on the “Save Config” options provided at end of the page. This will save the changed parameters in GPS Master Clock MC-1-U.

Detailed explanation mention in [section 10.3](#). Refer to it for more understanding of all parameters.

➤ “User Configuration” Webpage:

For MC-1-U User Settings, the user needs to navigate and select the “User Configurations” option in the menu bar. After, selecting the below webpage will be displayed.

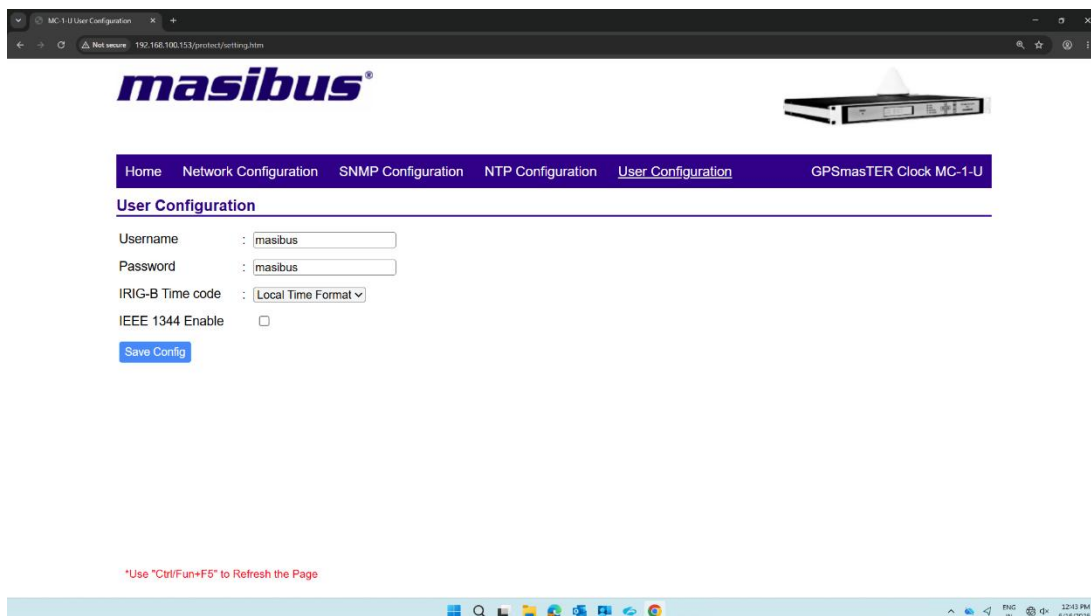


Figure 12-6 MC-1-U Web server User Configuration page

Model: MC-1-U

Doc Ref. No:-m05om201

Issue No:-13



masibus[®]

For web application and telnet session, Username, Password, IRIG-B Time code, IEEE 1344 Standard Enable can be configured from here.

Once the user modifies the required data, click on the "Save Config" options provided at end of the page. This will save the changed parameters in GPS Master Clock MC-1-U.

After changing the username and/or password User has required to re-Login.

13. Holdover Mode

If GPS Master Clock MC-1-U is Power ON in Unlock conditions, the unit will provide time output depending on the data of its internal RTC clock time which is available with battery backup (refer to [section 7.2](#)). However, if the provided battery backup to RTC is discharged due to a very long Power OFF period of GPS Master Clock MC-1-U, at Power ON conditions in unlocking conditions; all outputs of GPS Master Clock MC-1-U device will have factory-set time value and not the correct time. Once the GPS Master Clock MC-1-U device gets locked, all outputs will get proper time data.

GPS Master Clock MC-1-U device enter Holdover mode when the unit goes into Unlock condition from Lock condition and thereafter provides time output depending on the internal clock crystal accuracy. The accuracy of all time outputs (including 1PPS output) of the unit will degrade depending on the duration during which the unit is in Holdover mode and also on the internal clock crystal frequency accuracy. If the Unit again enters the Lock condition from Unlock condition, all the time outputs will become accurate as per UTC. Holdover mode conditions do not exist if the GPS Master Clock MC-1-U unit gets a power reboot while the unit was in Unlock condition. GPS Master Clock MC-1-U outputs will regain their accuracy only when the unit gets in lock condition once after Power ON.

14. Options

GPS Master Clock MC-1-U model can be configured for Optional Power Supply.

14.1 Optional Input Power Supply

GPS Master Clock MC-1-U model is available with optional power input connects to Plug-in screw terminal. For AC supply operation connect LINE to (L) terminal, Neutral to (N) terminal and safety ground earth to "E" terminal, whereas for DC Supply operation connect the positive lead to the (+) Positive terminal, connect the negative lead to the (-) Negative terminal and safety ground to "E" terminal when viewing instrument from the rear.

14.1.1 Option 1: AC/DC Power Input

Input voltages are 90-264 Vac, 47-63 Hz or 125-300Vdc, less than 15 VA typical.

Input Power

AC Voltage Range	:	90 – 264 V _{AC}
Frequency	:	47 – 63 Hz
DC Voltage Range	:	90 – 300 V _{DC}
Power Consumption	:	< 15 W (Typical)

Fuse

Current Rating	:	1 Ampere
Voltage Rating	:	250 Volt

14.1.2 Option 2: DC Power Input

Input voltages are 18-72Vdc, less than 15 VA typical.

V_{DC} DC Power Supply Input : 18 – 75 V_{DC}

Power Consumption : < 15 W (MAX)

Fuse

Current Rating	:	1 Ampere
Voltage Rating	:	250 Volt

NOTE: This power consumption is for MC-1-U without optional output.

15. Appendix List

Below is the list of GPS Master Clock MC-1-U supported manuals.

Appendix H – Masibus Net T Sync Software User Guide

16. Troubleshooting

16.1 Unit not getting Power ON

Below mention, points need to be check to troubleshoot this problem.

1. Check Power input cable is connected properly
2. Check Power input cable connected to respective terminal as described in [section 14.1](#)
3. Check Input power is available.
4. Check a fuse is melted or not? If the fuse is melted, please contact the masibus support department.

16.2 Antenna Troubleshooting

Below mention, points need to be check to troubleshoot this problem.

1. To check the internal GNSS receiver Healthiness:

(NOTE: All masibus make time server can be checked by using below procedure, see the port where Antenna is mentioned. The reading of receiver will be remained common for all model.)

Remove Antenna cable from the “Antenna” port of time server available at back side.

Measure **+5VDC**; across the BNC female connector marked as “Antenna” with the help of multi meter.

Connect **+Ve** Probe of multimeter at inner female part of the BNC connector and **-Ve** probe of multimeter at outer part of the BNC as shown below –



If +5VDC is Ok, it means Internal GPS Receiver is working fine and you need to go for further check of Antenna & Antenna cable.

In case if the 5 VDC is not receiving then contact masibus support team.

2. To Check the Healthiness of GNSS Antenna Cable:

First Option to check the Antenna cable is as following:

Remove the Antenna cable from the Rear side of time server and arrange the multimeter

Now make the multimeter settings in Diode mode and check the reading of Antenna between inner pin of Male BNC w.r.t. to outer part of the BNC connector of Antenna cable.

The reading should be compared as per the actual type of antenna (refer procedure to check healthiness of Antenna) which you are using.



Second Option to check the antenna cable healthiness is to check the 5 VDC of GNSS receiver throughout the cable.

First, connect the Antenna Cable to Antenna port of the time server and go to the other end of the Antenna cable (i.e. at roof) and remove the Antenna cable from Antenna.

Now measure the “+5VDC” at the inner pin of the N-type BNC Connector of Antenna cable w.r.t. outer part of the N-type BNC connector of Antenna cable, if it is Ok, it means Antenna cable is Ok.

Third option is to check the continuity of cable's positive & shield

Remove the Antenna cable from both end (time server side as well as from Antenna side) and then short the inner pin & outer body by using short link & check other side of antenna cable by using multimeter, whether continuity is receiving or not? After removing the short link; continuity should not be received.

3. To Check the Healthiness of GNSS Antenna

(Model: TW3010/TW3030/TW3040/ RDM-LA2-6646-9F-X-001)

Check the sticker given on antenna and see if “Tallysman/Raltron” is mentioned then only user needs to check the Model of Antenna which should be TW3030, TW3010 & TW3040/ RDM-LA26646-9F-X-001 etc.

If you found the make & Model as specified above then refer below procedure (In case if you found other than above said model of antenna then email the photographs along with Model details to support.masibus@soneparindia.com)

Remove the Antenna and make the multimeter settings in Diode mode and check the mV at inner female pin of Antenna BNC w.r.t. to outer part of the Antenna BNC.

It should be approx. **1V in forward bias** (Inner part of the BNC is +ve and Outer part of BNC is -ve) as shown below –

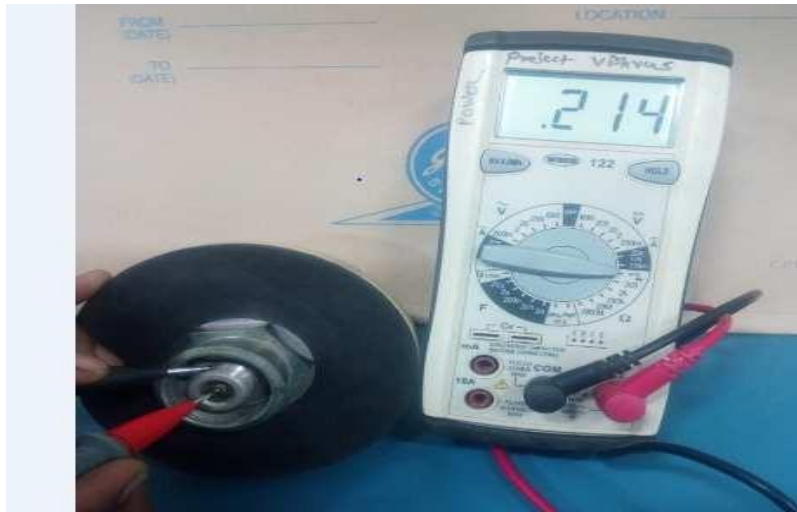


If it is Ok, it means Antenna is Ok, otherwise Antenna is faulty and contact to masibus HO.
Note: In reverse bias no reading will be displayed.

(Obsolete Models: Type-1)

Remove the Antenna and make the multimeter settings in Diode mode and check the reading at inner female pin of Antenna BNC w.r.t. to outer part of the Antenna BNC.

It should be approx. **0.214 forward bias** (Inner part of the BNC is +ve and Outer part of BNC is -ve) as shown below –



It should be shown the same reading in reverse bias as shown below –



(Obsolete Models: Type-2)

(Look wise Type-1 & Type-2 are same only. Readings are different)

Remove the Antenna and make the multimeter settings in Diode mode and check the reading at Inner Female pin of Antenna BNC w.r.t. to outer part of the Antenna BNC.

It should be approx. **0.700 Forward bias & 0.600 in reverse bias.**

16.3 Wrong time at Unit Power ON

If the unit was kept in Power OFF conditions for more than 15 days, as mentioned in [section 7.2](#), the battery back of the internal RTC will get discharged completely. As a result, at unit Power ON, the time displayed on LCD and time provided in all-time outputs will be according to default internal time till the unit gets LOCKED after the GPS antenna is connected to the unit.

If the battery is discharged as mentioned above, it is necessary to keep the unit in Power ON condition for the duration mentioned in [section 7.2](#), for full charging of the internal battery. Full charging is necessary to avoid the possibility of wrong time output at unit Power ON.

16.4 GPS Master Clock MC-1-U display time not as per Local time

If GPS Master Clock MC-1-U time on display, NGTS & T-format time output, all event outputs is not as per Local time, the time zone offset w.r.t UTC may not be set as per required time offset for the region/country where the unit is installed. Please refer to [section 9.2.8](#) to set the time zone offset through serial configuration.

Apart from time zone offset, it is necessary that the setting of time format (UTC/LOCAL) should be set to LOCAL. For setting this parameter to LOCAL, the user can set it through the front panel keypad (parameter: "SET TIME FORMAT" as per [section 8](#)) or serial communication (parameter: SU2 as per [section 9.2.3](#)).

16.5 Cannot establish Serial communication with rear RS232/RS485 Terminal

RS-232 cable used for serial communication with rear Terminal should be cross cable as per figure 10.3. The serial communication of the end device should be 9600 (baud rate), 8 (Data bits), N (NONE parity), 1 (1 stop bit). Rear Terminal is used only to transmit NMEA serial time frames every second. The device which will be using the NMEA time frame from the GPS Master Clock MC-1-U unit should comply with serial frame format as per table 15.

16.6 Not able to receive time frame on rear RS232/RS485 Terminal at every second

Refer to troubleshoot index [16.4](#).

16.7 Cannot establish Serial communication with rear Terminal

RS-232 cable used for serial communication with rear terminal should be cross cable as per [section 9.1](#).

Also, the serial communication parameters such as baud rate, parity, stop bits of Terminal are configurable through the unit front panel keypad (refer to [section 8](#)). It is necessary to match the end device serial communication parameters as configured in GPS Master Clock MC-1-U unit.

16.8 Not able to do the configuration through rear terminal

Refer to troubleshoot index [16.6](#).

To configure GPS Master Clock MC-1-U unit through the serial configuration Terminal, it is necessary to enter the correct password (when asked for, refer to [section 9.1](#) and [section 9.2](#).) in the serial communication terminal software of the remote PC. Factory set password, when shipped

from the factory, is **masibus**. If the user changes the configuration password through serial configuration, the factory-set password will be replaced with a new configured password.

NOTE: Password used for unit parameters configuration through keypad and serial communication are different. If the user has forgotten their own configured password for the keypad menu or serial configuration menu, the user should contact the Masibus Service department.

16.9 Problem with getting unit LOCK to GPS satellites

- 1) It is always recommended to use factory provided antenna cable shipped with GPS Master Clock MC-1-U unit. If the antenna cable used for installation is other than provided with GPS Master Clock MC-1-U unit, please contact the Masibus Service department for assistance.
- 2) GPS Antenna must be installed properly as suggested in [section 6.1.1](#) and [section 6.1.2](#).
- 3) GPS Antenna cable must be connected at the antenna connection on the rear panel of the GPS Master Clock MC-1-U device.
- 4) Refer to [section 6.1.5](#) for antenna cable technical details.
- 5) Check Antenna cable continuity. Unplug the antenna cable connection from GPS Antenna and antenna connector on the GPS Master Clock MC-1-U rear panel. Short the Antenna cable at any one end and check the continuity at the other end using Digital Multimeter. If there is any break in continuity, contact the Masibus service department for rectification.
- 6) If the antenna cable is proper, refer to [section 6.1.3](#) for further diagnostics.
- 7) If the GPS Master Clock MC-1-U device can capture a very less number of satellites even if the weather and sky are clear, try to re-orient the GPS antenna or relocate the GPS antenna so that the maximum number of GPS satellites is visible.

16.10 IRIG-B / IEEE 1344 client synchronization fail

The following steps are to be checked for issues of IRIG-B synchronization failure or loss.

- 1) IRIG-B BNC cable should be tightly connected and locked at GPS rear panel IRIG terminal and IRIG-B client device terminal.
- 2) If the IRIG client device terminal is other than BNC type connector, ensure that IRIG connection is done with correct polarity at the client device terminal end.
- 3) A total number of IRIG-B/IEEE 1344 compatible devices connected on the IRIG TTL or IRIG-AM terminal of GPS Master Clock MC-1-U should be determined considering the maximum electrical load capacity as specified in GPS Master Clock MC-1-U specification. Refer to product specifications and [section 10.2.3.7](#) for further details.

16.11 No response to Ping Command

Below steps are to be checked for troubleshooting the mentioned issue:

- 1) GPS Master Clock MC-1-U is shipped with factory-set Ethernet configuration (IP, gateway and subnet address) depending on the provided standard and optional Ethernet ports.
- 2) Check the connection route from GPS Master Clock MC-1-U Ethernet port to end device and configuration of intermediate Ethernet switches and gateways. GPS Master Clock MC-1-U Ethernet port addresses of subnet and gateway should be configured as per network domain architecture.
- 3) If the unit is directly connected to a remote PC using an RJ-45 cable, it is recommended to connect the unit through an Ethernet switch or using a cross RJ-45 cable configuration.
- 4) The user should configure the IP address of all Ethernet outputs as per network domain configurations where the GPS Master Clock MC-1-U device is to be installed. Users can configure the IP address of the Ethernet port using a telnet connection with the respective Ethernet NTP port. It is recommended to Power recycle the unit after all Ethernet NTP ports are configured with the new IP address.

16.12 Not able to configure the IP address of Ethernet Port

- 1) Refer points 2 & 3 of troubleshooting index [16.10](#).
- 2) For configuring new network settings of a particular Ethernet port, the user should enter the old IP address of the GPS Ethernet port during telnet communication. Ensure that pinging with old/previous IP address of GPS Ethernet port should be stopped before proceeding for IP configuration. It is also recommended to stop all IP related processes such as NTP, SNMP with the old GPS IP address before starting IP configuration.
- 3) At a time, only one telnet communication with a particular Ethernet port of GPS Master Clock MC-1-U device is allowed.
- 4) It is necessary to exit the telnet communication after doing necessary Ethernet settings failing of which, GPS Master Clock MC-1-U will not allow reconnecting with telnet session on same IP address. Please refer to [section 12.1](#) & [section 9.3](#). for telnet session and configuration.

16.13 NTP client not synchronizing with GPS NTP output port

The following steps are to be checked for issues of NTP communication failure or NTP client time not synchronizing with the GPS NTP Server port.

- 1) The IP address of the GPS NTP port and NTP client device should be the same network domain.
- 2) Please verify the Ethernet connection between the GPS NTP port and the NTP server device by pinging the IP address of the GPS NTP port. If the IP address of the GPS NTP port is not reachable, NTP communication will be failed. Refer to troubleshooting indexes [16.10](#) and [16.11](#).
- 3) GPS NTP Server port IP address should be properly configured in the NTP client device.
- 4) Various NTP parameters should be configured properly in the NTP client device.
- 5) If the NTP client device is a computing machine based on Windows based, please refer to manual Appendix H for proper configuration and time synchronization method of the client device by using Net T sync utility.

- 6) Please refer manual Appendix H for understanding the NTP client time synchronization method.

16.14 Loss of time synchronization by NTP Client during GPS Unlock

If the NTP client loses time synchronization when GPS Master Clock MC-1-U is in Unlock condition and resume when GPS Master Clock MC-1-U comes in LOCK condition, check the configured NTP stratum value in the GPS Master Clock MC-1-U device. It should be less than 15 or an applicable value depending on NTP hierarchical architecture arrangement as explained in [section 10.3.3](#) and [section 10.3.4](#).

16.15 Loss of time accuracy in NTP, IRIG-B, event outputs during Unit Power ON in Unlock conditions

When GPS Master Clock MC-1-U comes in UNLOCK condition from LOCK condition during normal operation, the unit enters in holdover mode. Refer to [section 13](#) for a technical explanation of the holdover mode.

16.16 Cannot establish telnet communication

- 1) The IP address of the GPS Ethernet port and telnet device should be the same network domain.
- 2) Please verify the Ethernet connection between the GPS Ethernet port and telnet device by pinging the IP address of the GPS Ethernet port. If the IP address of the GPS Ethernet port is not reachable, the telnet connection will fail. Refer to troubleshooting indexes [16.10](#) and [16.11](#).
- 3) Provide the correct IP address of the GPS Ethernet port while trying to establish a telnet connection. Refer [section 9.3](#) for the procedure for telnet connection with GPS Ethernet port.

16.17 Cannot establish SNMP communication

- 1) The IP address of the GPS Ethernet port and SNMP manager should be in the same network domain.
- 2) Please verify the Ethernet connection between the GPS Ethernet port and SNMP manager by pinging the IP address of the GPS Ethernet port. If the IP address of the GPS Ethernet port is not reachable, the SNMP connection will fail. Refer to troubleshooting indexes [16.10](#) and [16.11](#).
- 3) SNMP Manager should be able to work on SNMPv1 and SNMPv2c protocol.
- 4) MIB file at manager side for model MC-1-U agent should be the same provided at the time of commissioning.
- 5) Read or Write Community of SNMP manager and model MC-1-U agent should be same.

16.18 Not able to receive SNMP traps

- 1) The IP address of the GPS Ethernet port and SNMP manager should be in the same network domain.
- 2) Please verify the Ethernet connection between the GPS Ethernet port and SNMP manager by pinging the IP address of the GPS Ethernet port. If the IP address of the GPS Ethernet port is not reachable, the SNMP connection will fail. Refer to troubleshooting indexes [16.10](#) and [16.11](#).
- 3) SNMP Manager should be able to work on SNMPv1 and SNMPv2c protocol.
- 4) SNMP manager IP should be configured in the model MC-1-U agent.
- 5) Trap enable variable should be enabled.

16.19 Not Able to set SNMP parameter

- 1) The IP address of the GPS Ethernet port and SNMP manager should be in the same network domain.
 - 2) Please verify the Ethernet connection between the GPS Ethernet port and SNMP manager by pinging the IP address of the GPS Ethernet port. If the IP address of the GPS Ethernet port is not reachable, the SNMP connection will fail. Refer to troubleshooting indexes [16.10](#) and [16.11](#).
 - 3) SNMP Manager should be able to work on SNMPv1 and SNMPv2c protocol.
 - 4) MIB file at manager side for model MC-1-U agent should be the same provided at the time of commissioning.
 - 5) Write Community of SNMP manager and model MC-1-U agent should be same.
- In a web application of MC-1-U, five web pages are there. The first home page shows the current status of the devices and is not configurable while the other four are.

17. Release Note

17.1 Main Controller

Update Instructions:

To ensure proper functionality and synchronization, please follow this update sequence when upgrading firmware:

1. Always update the firmware for the Primary Controller first.
2. Once the Primary Controller is updated successfully, proceed further to update the firmware for the Secondary Controller.
3. Before proceeding with the firmware upgrade, please read the firmware update procedure carefully read the firmware update procedure

By following this order, you will ensure a smooth and efficient update process.

CURRENT FIRMWARE: - 3.05 RELEASED DATE: - 06/17/2026.

MC-1-U Firmware for Main Controller (V 1.01 / V 3.05) - Changelogs

Current Version MC-1-U - 3.05

By publishing the changelogs of our older MC-1-U firmware versions, you will be informed about adaptations, updates, and fixes of our GPS Master Clock firmware.

*MC-1-U Release Notes: last changes on top *

MC-1-U Changelogs

Version 3.05 06.17.2026

Fix: Dual SPI issue
Fix: Time Zone limit Set,
Fix: Event time & Even On time limit set (Only numeric value)
Fix: IP Address limit set

Version 3.02 08.10.2024

Fix: Ethernet Port Name on the physical device and in LHMI are configured to the same.
Fix: Make the ethernet configurations user friendly via front keypad.

Version 3.01 03.08.2024

New: bootloader added for firmware upgradation through ethernet.
New: Firmware version and released date added on HMI (front LCD)
Fix: Firmware version corrected on SNMP retrieved data.
Fix: (Telnet client) Password policy modified. Earlier any combination of username & password was working and the same has been addressed.
Fix: (Telnet client) Remove the restart of unit on every change done through Telnet.

Version 3.00 01.03.2024

New: (Front Keypad/Console) facility to check the network settings for both ethernet ports and even able to configure the same by using keypad and console.
New: (Telnet client) Enable/disable functionality added in console port (COM2)
New: (Front keypad) Obtain the default settings of ethernet

Version 2.01 04.02.2021

fix: [TZ] Added Nepal Time zone +05:45 & -05:45

Version 2.00 21.10.2019

New: Due to change in receiver NMEA Structure Changes
Data extraction in variables modified.

Version 1.03 03.02.2017

Fix: At Power on Event O/P is there, which is not required

Version 1.02 11.12.2014

Fix: At power on receiver sometimes gives two serial frames simultaneously and on next second doesn't send the frame is resolved.

Version 1.01 17.08.2014

New: Change in receiver (Mot)& remove @@CF at watchdog.
New: Config Menu L command not proper, Manual Time setting command completed.

17.2 Supporting Controller

CURRENT FIRMWARE: - 2.14 RELEASED DATE: - 06/17/2026.

MC-1-U Firmware for Supporting Controller (V 1.05 / V 2.14) - Changelogs

Current Version MC-1-U - 2.14

By publishing the changelogs of our older MC-1-U firmware versions, you will be informed about adaptations, updates, and fixes of our GPS Master Clock firmware.

***MC-1-U Release Notes: last changes on top ***

MC-1-U Changelogs

Version 2.14 06.17.2026

Add: Web browser (HTTP)

Fix: Dual SPI Issue
Fix: IP Address limit set (Telnet)
Fix: Read write community (Special character error)

Version 2.11 08.10.2024

Fix: While configuring the network settings via keypad, Ping loss problem occurred that is resolved.

Version 2.10 03.08.2024

New: bootloader added for firmware upgradation through ethernet.
New: Firmware version and released date added on HMI (front LCD)
Fix: Firmware version corrected on SNMP retrieved data.
Fix: (Telnet client) Password policy modified. Earlier any combination of username & password was working and the same has been addressed.
Fix: (Telnet client) Remove the restart of unit on every change done through Telnet.

Version 2.09 27.02.2024

New: Changes related to SPI connection from the Main controller to read the IP Address for NTP1 & NTP2.

Version 2.08 28.05.2022

fix: Upgraded for watch dog

Version 2.07 19.04.2022

New: Due to change in controller model Structure Changes 575 to 470

Version 2.06 31.08.2021

Fix: IRIG-B IEEE-1344 frame correction for better performance.

Version 2.05 13.04.2021

Fix: Implemented Delayed start in IRIG-B and defaulted SNMP manager IP to 0.0.0.0 and disabled SNMP traps by default

Version 2.04 05.06.2018

New: Multicast & Broadcast Added. Server IP1,2 and Gateway value can be changed to 0.0.0.0 through telnet

Version 2.03 16.09.2015

Fix: Error resolved in IP configuration. Not allowed 255 and 0 entry in all four bytes.

Version 2.02 19.12.2014

Fix: Software Watchdog, microseconds Accuracy in NTP output and NTP o/p Disable when 1PPS or Serial frame is not available.

Model: MC-1-U
Doc Ref. No:-m05om201
Issue No:-13



masibus[®]

Version 2.01 01.10.2014

Fix: Calander function routine is changed

Version 2.00 11.07.2014

New: IRIGB Design along with PIC32 implemented

Version 1.06 29.03.2014

Fix: IRIG B Calibration rectified

Version 1.05 08.03.2014

Fix: Ethernet Phy resets at some conditions like ethernet cable is not connected though it is physically connected.

18. Abbreviations

1PPS	:	1 Pulse Per Second
AM	:	Amplitude Modulation
AC	:	Alternate Current
BNC	:	Bayonet Neill–Concelman Connector
BCD	:	Binary Coded Decimal
BCDYR	:	Binary Coded Decimal Year
BCDTOY	:	Binary Coded Decimal Time of Year
CE	:	Conducted Emission
CISPR	:	International special committee on Radio Interference
CF	:	Control Function
CR	:	carriage return
CRO	:	Cathode Ray Oscillator
CDMA	:	code division multiple access
DB9	:	D-Subminiature connectors, and houses 9 pins
dB	:	Decibels
DC	:	Direct Current
DCLS	:	Direct Current Level Shift
DST	:	Day-Light Saving Time
DSP	:	Day-light Saving Pending
ESD	:	Electrostatic discharge
EMI	:	Electro-Magnetic interference
FDMA	:	Frequency Division Multiple Access
GMT	:	Greenwich Mean Time
GPS	:	Global Positioning System
GNSS	:	Global Navigation Satellite System
IPv4	:	Internet Protocol version 4
IRIG	:	Inter Range Instrumentation Group
IP67	:	Ingress Protection Marking - 67
IED	:	Intelligent Electronic Device
IEC	:	International Electrotechnical Commissions
IST	:	Indian Standard Time
IEEE	:	Institute of Electrical and Electronics Engineers
IANA	:	Internet Assigned Numbers Authority
LCD	:	Liquid-Crystal Display
LED	:	light-emitting diode
LF	:	Line Feed
LSP	:	Leap Second Pending
LS	:	Leap Second
MIB	:	Management Information Base
mAh	:	milliAmpere Hour
mS/msec	:	milliseconds
Mbps	:	Megabits per Second
NTP	:	Network Time Protocol
NMEA	:	National Marine Electronics Association
OCXO	:	Oven Controlled Crystal Oscillator
OID	:	Object Identifier
PC	:	Personal Computer
ppm	:	Parts per million

Issue No:-13

PPH	:	Pulse Per Hour
PPM	:	Pulse Per Minute
PTP	:	Precision Time Protocol
UTC	:	Coordinated Universal Time
UDP	:	User Datagram Protocol
RCC	:	Range Commanders Council
RTC	:	Real Time Clock
RFC	:	Request For Comments
RE	:	Radiated Emission
RG-6/RG-8	:	Radio Grade - 6
RF	:	Radio Frequency
SA	:	Selective Availability
SBS	:	Straight Binary Second
SNTP	:	Simple Network Time Protocol
SNMP	:	Simple Network Management Protocol
TCP	:	Transmission Control Protocol
TCXO	:	Temperature Compensated Crystal Oscillator
TDR-4	:	Time Distribution Rack – 4
TDU-64	:	Time Display Unit - 64
Telnet	:	Telecommunication Network
TSR-4	:	Time Signal Repeater - 4
TTL	:	Transistor Transistor Logic