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A Sonepar Company

Model: MTS200L
Doc Ref. No:-m08Aom201
Issue No:-01

User's manual

masTER T-Sync

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1.1 Standard Items

*mas*TER T-Sync MTS200L model is shipped with below standard items.

- *mas*TER T-Sync MTS200L
- Antenna Cable RG6 as per specified cable length in Customer Order/quote.
- GPS Antenna and Antenna Clamp integrated
- 2 meters RJ45 Ethernet Cable – Qty: 1
- 2 meters RS-232 GPS Configuration Cable – Qty: 1
- Documents – User Manual and supporting Appendix manuals, Test Report, Test Certificates(On Customer Request only)

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

1.2 Optional Items

*mas*TER T-Sync MTS200L model can also be shipped with the below optional items only as per customer order.

- Unit Power Supply Cord
- Antenna Cable type and Antenna Cable length
- Lightening Arrestor
- In-Line Antenna Amplifier
- Antenna Splitter
- Antenna Cable GI Conduit

2. Introduction

masibus *mas*TER T-Sync MTS200L has been developed to address key power and process industry timing requirements. Whether it's the monitor, control or analysis of the power system, *mas*TER T-Sync MTS200L is the cost-effective GPS time synchronization solution.

To begin with, *mas*TER T-Sync MTS200L 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.

*mas*TER T-Sync MTS200L 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, *mas*TER T-Sync model MTS200L allows the user to alter the settings or choose from Time codes. The serial Teminal(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.

*mas*TER T-Sync MTS200L generates a wide range of timing signals via multiple output ports. Standard configurations of *mas*TER T-Sync MTS200L is equipped with two Ethernet ports, and 1 NMEA on RS232/RS485.

*mas*TER T-Sync MTS200L 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, front panel serial port is configurable for either NGTS or T-format and a very accurate pulse per second with an accuracy of (±500ns to UTC).

Time synchronization protocol (NTP) standard as Server mode is implemented in *mas*TER T-Sync MTS200L to provide time synchronization to different network Clients which are supporting NTP protocols (NTPv3, SNTP).

*mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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.

*mas*TER T-Sync MTS200L unit is Rack Mount and its mechanical dimensions are 482.6(W) x 44(H) x 251(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.

3. GPS Fundamentals

*mas*TER T-Sync MTS200L device is a GPS/GNSS-based receiver clock device that provides accurate time output with a 1PPS signal. A 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 is used multiple navigation systems mainly GPS and GLONASS. 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.

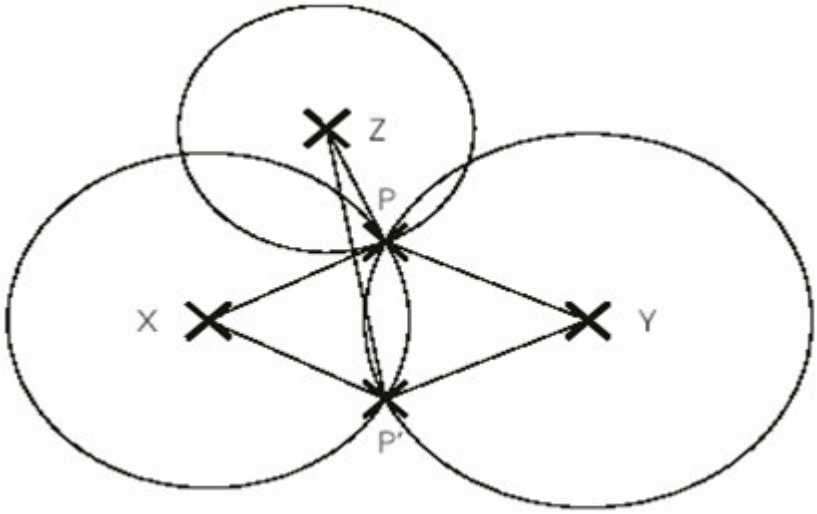


Figure 3-1 The Basic of GPS

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 are 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.

As GNSS uses a navigation satellite system of GPS, GLONASS, and other available systems in space, GNSS 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 broadcast two types of information in its message format i.e. Almanac and Ephemeris. Almanac data is course 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 *mas*TER T-Sync MTS200L Model

RECEIVER CHARACTERISTICS	**Timing Accuracy** <15 ns with GPS receiver (the receiver is locked on a fixed position). <±0.5 ppm (TCXO) accuracy while GPS Is Unlock***** **Positioning Accuracy** <10mts SEP (with Selective Availability [SA] Disabled). **Receiver Input** 1575.42 MHz L1 C/A Code. **Tracking** 12 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 GPS, 30 dB Gain Cable: RG 6 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	**Alarms** Three Isolated Dry Contacts to 230 VAC / 24VDC, 10 A: **1.** GPS Lost **2.** Power * Power Relay will be on the individual Power Supply Card

	Interface: Terminal Strip **Serial** **Rear Panel Terminal (TERM 1)** **Protocol:** NMEA-0183 (RMC) **Port Settings:** 9600-8-N-1 **Output:** RS232/RS485** (Factory Configurable) **Interface:** 4-way terminal Female Connectors (Rear Panel) **No. of Ports:** 1 **Front Panel Terminal (TERM 2)** **Protocol:** NGTS/ T-Format **Port Settings:** 4800/9600-7/8-N/E/O-1/2 (Configurable) **Output:** RS232/RS485** (Factory Configurable) **Interface:** DB9 Female Connector (Front Panel) **No. of Ports:** 1 **** RS232 is factory set**
OPTIONAL OUT-PUTS	**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) **IRIGB-Modulated / IEEE 1344/C37.118-2005** **Format:** IRIG-B(127)or IEEE 1344/C37.118-2005 (field selectable) **Signal:** 1 kHz AM Signal **Modulation Ratio:** 3:1 **Output:** 3.3Vp-p to 10Vp-p, into 100Ω **Interface:** BNC Female connector (Rear Panel) **Additional Event Outputs** Four independent configurable Event outputs **Configuration:** Individual configurable time period and pulse ON time **Time Period:** 1 to 86400 seconds (24 Hr.) max **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

LOCK / UNLOCK status
Latitude, Longitude, Height
Number of satellites available
Data Format on Terminal (Front Panel)

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

PPS : Red
Error : Red
Watchdog : Red
GPS Locked : bi-colour: Green(GPS LOCK) Red (GPS UNLOCK)

Configuration Modes

Front Keypad
Front panel RS-232 DB9 serial Terminal port
Telnet, Webserver, SNMP

Programmable parameters:

Global Time zone correction
12/24 Hrs. Format of Time
Duration of Programmable repetitive event generation output via dry contact (Optional).
Eth0 and ETH1* Network Settings
Password Protection

- ETH1 is optional

POWER SUPPLY	**AC**: 90 to 264 V, 47-63 Hz **DC**: 90-300 V **Power Consumption:** 35W max.
OPTIONAL POWER SUPPLY	**DC:** 18 – 36 V DC, 30W 36 – 75 V DC, 30W

ENVIRONMENT	**Temperature** Operating: 0° C to 50° C Storage: -20° C to +80° C **Humidity** 20 - 90%(Non-condensing)
EXTRA MODULES (OPTIONAL)	RS232-to-RS485 Converter LINE AMPLIFIER, SURGE ARRESTOR Time Distribution Rack (TDR-4) Time Signal Repeater (TSR-4) Time Display Unit (TDU-64) Netser (NGTS to NTP Convertor)
TYPE TEST ***	Radiated Emission on mains port (RE) – CISPR 22 Electro Static Discharge – IEC 61000-4-2 Radiated Susceptibility – IEC 61000-4-3 Electrical Fast Transient – IEC 61000-4-4 Surge - IEC 61000-4-5 Conducted Susceptibility - IEC 61000-4-6 Power Frequency Magnetic Field – IEC 61000-4-8 High-Frequency Disturbance – IEC 61000-4-10 Voltage Dips & Interruption Test – IEC 61000-4-11 Damped Oscillatory Magnetic Field – IEC 61000-4-12 Vibration – IEC 68-2-6 Cold Test – IEC 60068-2-1:2007 Shock Test – IEC 60255-21-2 Dry Heat – IEC 60068-2-2 Damp Heat Steady State Test - IEC 60068-2-30 Di-electric Test, Vibration Test, etc.
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

*** Testing underway

5. Unit Front and Rear Panel Description

This section describes the *masTER* T-Sync Model MTS200L unit front panel and back panel user applicable interface.

5.1 *mas*TER T-Sync Model MTS200L Front Panel

The below image shows the Mater T-Sync Model MTS200L model front panel. The front panel is equipped with a 20 x 2 line LCD, 5 LED status indicators including Power LED, and keypad interface.

Figure 5-1 *mas*TER T SyncModel MTS200L Front Panel Description

1. **LCD Display:** *mas*TER T-Sync Model MTS200L model 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 color..
   - **ERROR**: Reserved for future use.
   - **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:** Mater T-Sync Model MTS200L device is equipped with keypad buttons to configure various parameters of the unit. Functionality/usage of each key is described below:

	KEY	FUNCTION
MENU	MENU	To enter in Configuration mode.
HELP	HELP	To Display help about every configurable parameter.
OK	OK	To save the final configuration changes done.
ESC	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 sub-menu.
	RIGHT	To select various available options for the particular parameter in main menu and scroll between various parameters in sub-menu.

Table 5.1 *mas*TER T-Sync Model MTS200L Front Panel Key Definitions

4. **Terminal:** Master T-Sync Model MTS200L device is equipped with a Front serial console terminal RS-232 port for serial-based device configurations and T-format/NGTS output.

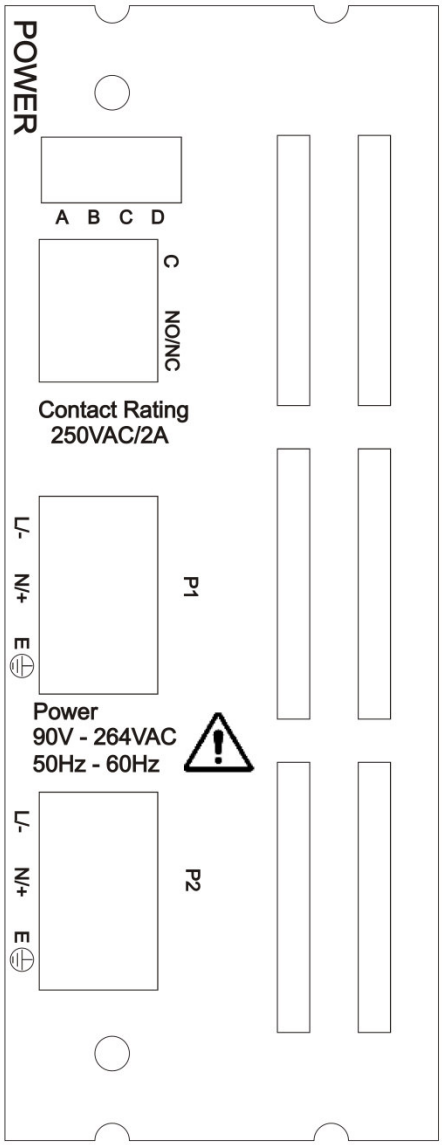
5.2 *mas*TER T-Sync Model MTS200L Rear Panel

Below figure 5.2 shows the Master Time Sync Model MTS200L model rear panel.

Figure 5-2 *mas*TER T-Sync Model MTS200L Rear Panel Description

The above figure is the rear view of the MTS200L model. Power Supply is fixed at Slot 1 and CPU card at Slot 3 from the right-hand side of the above image. All other cards are flexible to be placed in other available slots. Below is a description of all slot cards

1. Power Supply Card:



Input

- AC: 90-264V, 47 to 63 Hz&DC: 125-370V), Consumption: 40 W (max)
- Plug in screw terminals AWG max. 2.5 mm^2

Output

- Power LED status
- Power Fail Relay output
- Relay Rating: AC: 230 V@ 2A; DC: 30V@ 2A / 110V@0.3A/ 220 V@ 0.12 A (max)
- Plug in screw terminals AWG max. 2.5 mm^2

LED Status

Power: Green – indicates the Power of individual Card is available.

LED	Status
A	Power V1
B	Power V2
C	
D	Power

2. Clock Card:

Input

- GPS Antenna Input.

Relay Output

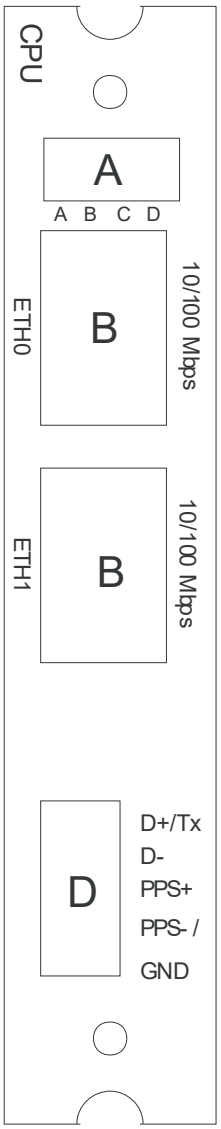
- Relay Rating: AC: 230 V@ 2A; DC: 30V@ 2A / 110V@0.3A/ 220 V@ 0.12 A (max)
- C, NO and NC output available
- Plug in screw terminals AWG max. 2.5 mm^2.

LED Status

- **Power**: Green – indicates Power to Clock Card is available
- **PPS**: Green – indicates PPS signal output of Clock card. Blinks at every 1PPS signal.
- **GPS LOCK**: Bicolor LED: RED / GREEN
  GREEN: GPS Clock Module is in LOCK condition.
  RED: GPS Clock Module is in UNLOCK condition.
- **LED-4:** Reserved for future use**.**

LED	Status
A	Power
B	PPS
C	GPS LOCK
D	LED-4

3. CPU Card:



Output

- 2* x 10/100 Mbps Ethernet port
- RS-232 / 485 NMEA (GPRMC) serial output
- 1PPS* Output (RS485 Differential / RS232)

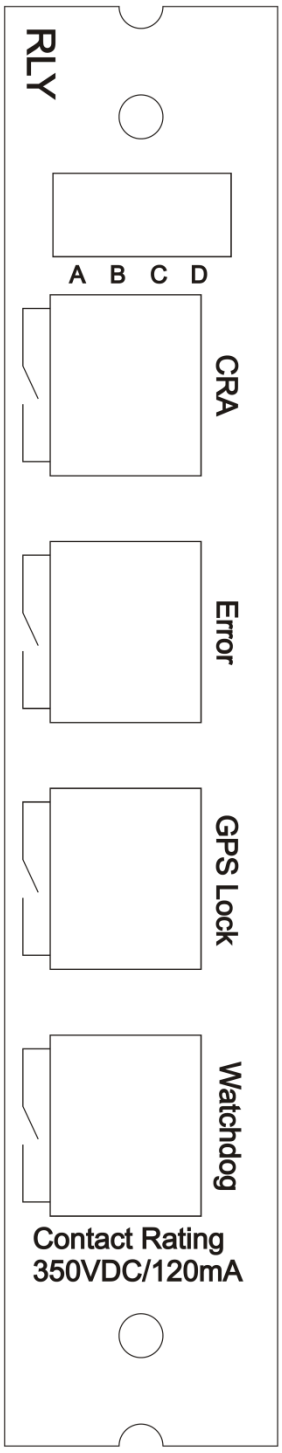
* Optional

LED Status

- **Power**: Green – indicates Power to Card is available
- **Clock1 / Clock2**: Reserved for future use.
- **LED-4**: Reserved for future use

LED	Status
A	Power
B	Clock1
C	Clock2
D	LED-4

4. Relay Card



Relay Output

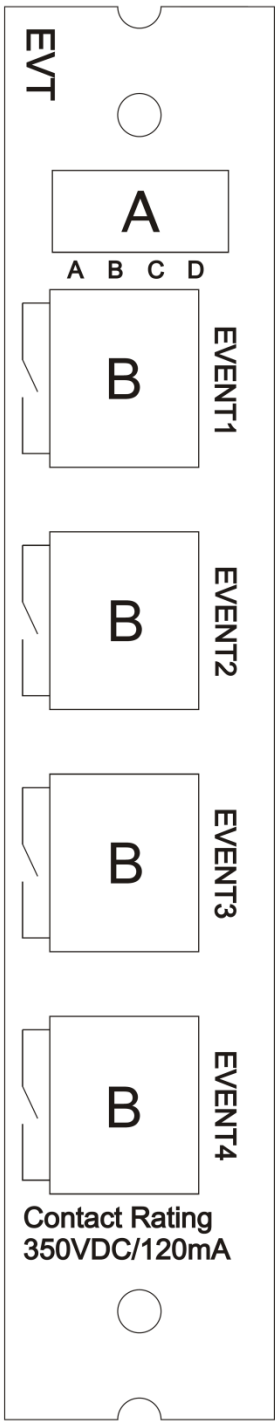
- Relay Rating: AC: 230 V@ 2A; DC: 30V@ 2A / 110V@0.3A/ 220 V@ 0.12 A (max)
- C - NO/NC selection is possible through hardware jumper.
- Four relay output CRA, Error, GPS Lock, Watchdog.
- Plug-in screw terminals AWG max. 2.5 mm2

LED Status

- **CRA**: Reserved for future use.
- **Error:** Reserved for future use.
- **GPS Lock:** Bicolor LED: RED / GREEN.
  RED: LED indicates MTS200L is in Unlock Condition.
  GREEN: LED indicates MTS200L is in Lock Condition.
- **Watchdog:** Bicolor LED: RED / GREEN
  RED: LED indicates some faulty condition in MTS200L.
  GREEN: LED indicates MTS200L is in healthy condition.

LED	Status
A	CRA
B	Error
C	GPS Lock
D	Watchdog

5. Event Card:



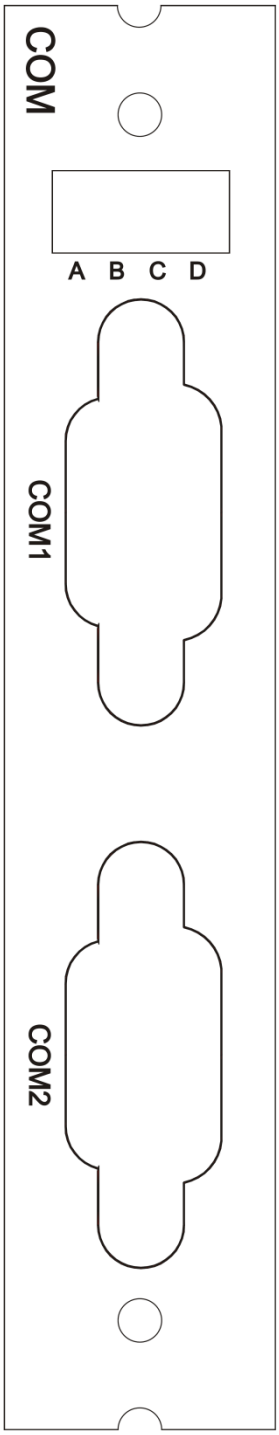
- *mas*TER T-Sync Model MTS200L can provide multiple event outputs in addition to standard PPM/PPH event output. The single event output provides a pulse at configured event interval with pre-configured pulse width. These pulse outputs are Opto-MOS output (optically coupled solid-state Relay output) provided through a 2 pin female connector.
- Event Contact Rating: 220 VDC@ 200mA
- Plug-in screw terminals AWG max. 2.5 mm2
- Four number of Event o/p is available.

LED Status

- **EVENT1-4**: LED indicates ON time of that particular event.

LED	Status
A	EVENT 1
B	EVENT 2
C	EVENT 3
D	EVENT 4

6. Serial Card:



Serial Output

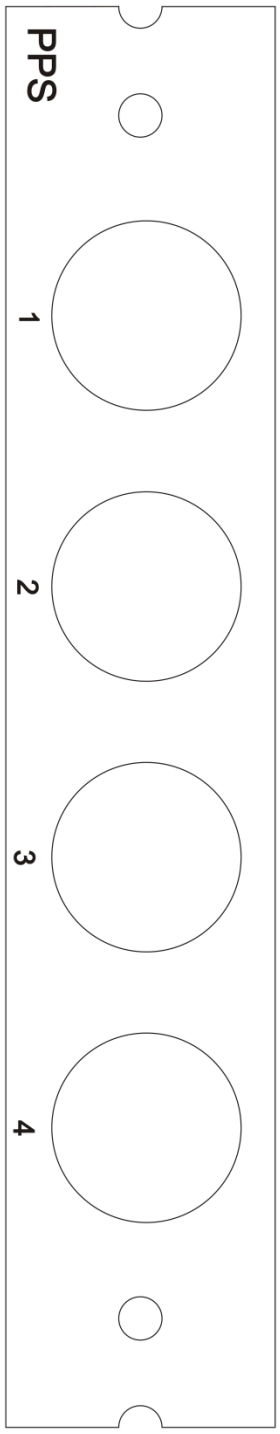
- COM1 and COM2 terminal is RS-232/RS-485 electrical standard DB-9 female connector.
- *mas*TER T-Sync Model MTS200L provides serial time frame NMEA/T-Format/NGTS format on its COM1 and COM2 terminal. NMEA and T-Format/NGTS frame is factory settable. Time format o/p can be changed on-site through hardware jumper settings. It is explained in xxxx section. This terminal provides time frame output
- Either in RS-232 electrical standard or RS-485 electrical standard as specified during unit order. If nothing is specified, the factory set settings of COM1 and COM2 terminal is as per RS-232 electrical standard output.
- If the Configuration of COM1 and COM2 terminal is as per RS-232 standard, cross cable (having a connection on Pin2, 3 and Pin5) can be used to provide a serial time frame to other peripherals. Pin 4 of the COM1 connector is used to provide a 1PPS signal in RS-232 format.
- If the Configuration of COM1 and COM2 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 for serial frame o/p. In the case of PPS differential O/P pin, 9 will act as a D+ line and pin no 6 will act as D- line. For PPS differential O/P need to specify during order.
- For specialized output please refer related appendix.

LED Status

- **Power**: Green – indicates Power to Card is available
- **COM1:** Green – indicates PPS signal output of serial card. Blinks at every time signal output.
- **COM2:** Green – indicates PPS signal output of serial card. Blinks at every time signal output.

LED	Status
A	Power
B	COM1
C	COM2
D	Reserved

7. IRIGB AM/TTL and 1PPS Card



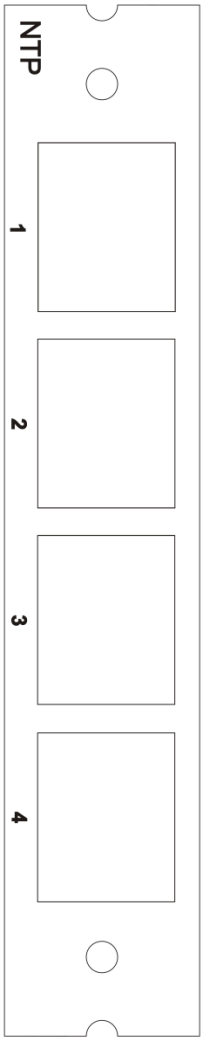
PPS Output

*mas*TER T-Sync Model MTS200L provides 1PPS output at TTL signal level through BNC connector. Four PPS output is available.LED Status is not available for IRIG-B AM/TTL and PPS o/p.

IRIG-B output:

*mas*TER T-Sync Model MTS200L provides IRIG-B TTL [DCLS] / IEEE-1344 TTL and IRIG-B AM / IEEE 1344 AM output through their respective BNC connector. *mas*TER T-Sync Model MTS200L model is available with 4 x IRIG-B / IEEE 1344 TTL as per standard option or 4 x IRIG-B / IEEE 1344 AM.

8. NTP Card

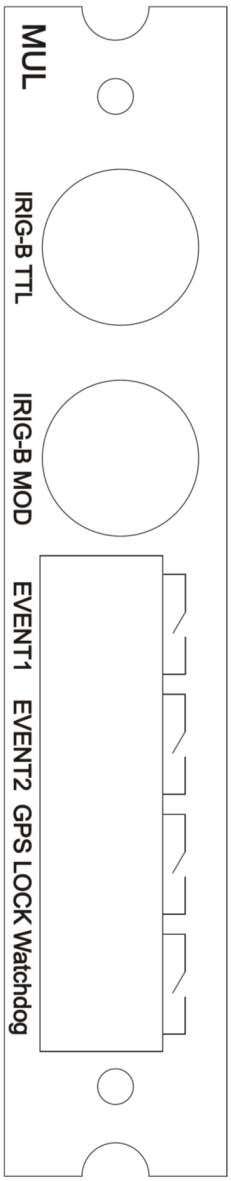


NTP Output

*mas*TER T-Sync Model MTS200L provides NTP output through an Ethernet connector. Four NTP is available on a single card. Configuration is provided through telnet.

Note: Configuration through telnet is explained in the appendix. Please refer

9. Multiple Output Card 1

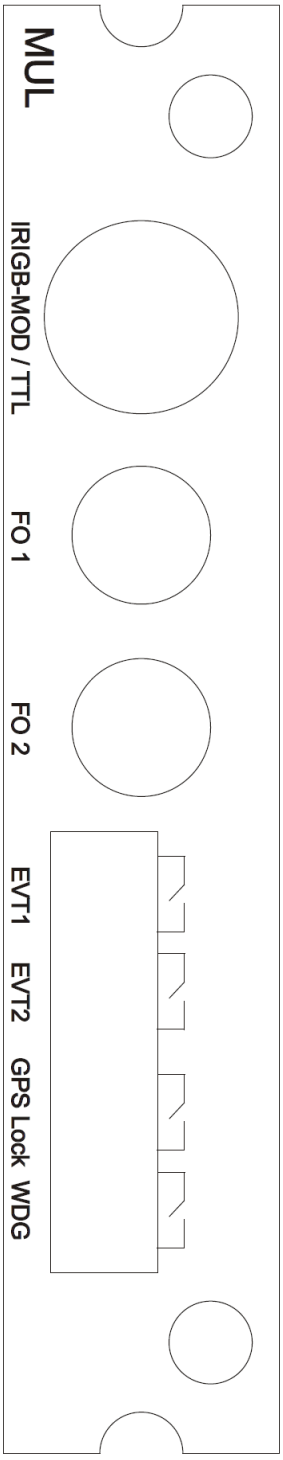


Multiple outputs

*mas*TER T-Sync Model MTS200L provides Multiple outputs cards. In multiple output cards, there is either two modulated output or two TTL outputs.

Two programmable events and 2 Alarm outputs are also there in the cards. If specialized relay card is already there in the unit then please ignore this two Watchdog and GPS Lock Relay outputs. These two alarm outputs are same as it is in the relay outputs

10. Multiple Output Card 2



Multiple outputs

*mas*TER T-Sync Model MTS200L provides Multiple output cards. In multiple output cards, there is either one modulated output or one TTL output. 2 Fiber optic outputs are available in the card. Fibre optic output can be TTL or PPS. It will be factory set only.

Two programmable events and 2 Alarm outputs are also there in the cards. If specialized relay card is already there in the unit then please ignore this two Watchdog and GPS Lock Relay output. These two alarm outputs are same as it is in the relay output.

5.3 Mechanical Dimensions Layout

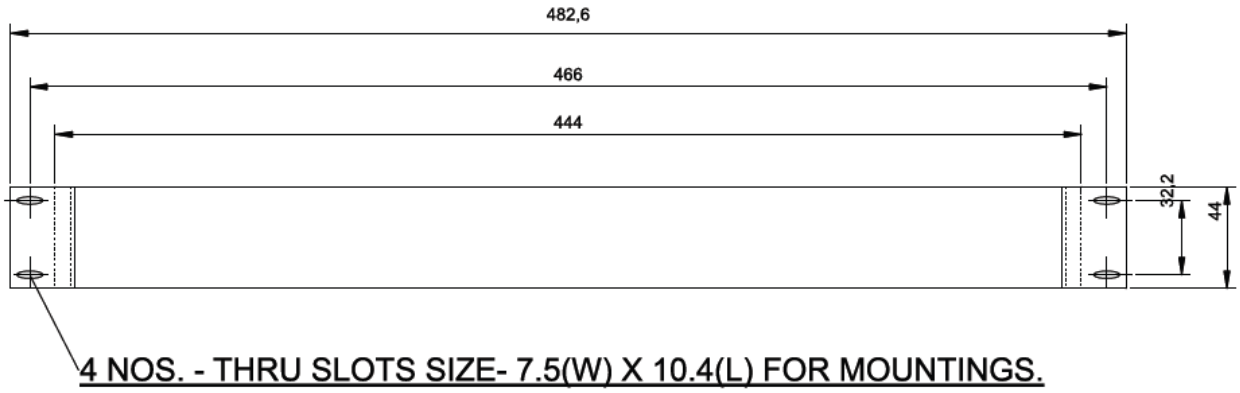


Figure 5-3 *mas*TER T-Sync Model MTS200L Mechanical Dimensions

6. *mas*TER T-Sync MTS200L Installation

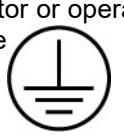
Before beginning with unit installation, please follow important safety statements for avoiding installation practices causing malfunctioning of the device as mentioned below.

	**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 conne 

	**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 GPS Antenna Installation

GPS Antenna and Cable Information

*mas*TER T-Sync MTS200L comes complete with the necessary hardware to be able to receive GPS signals: 50-feet of RG-6 cable and a GPS 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 GPS antenna and antenna cable(s) and connecting them to the model *mas*TER T-Sync MTS200L 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 GPS signal.

6.1.1 GPS Antenna Installation

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

Selecting a GPS 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 neighbouring 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 GPS 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 GPS 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 GPS signals, the GPS antenna needs to be mounted clear of buildings as surrounding elements or heightened obstacles may block the GPS 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 antenna signals reception capability may be somewhat limited/deteriorated during certain hours of the day.

6.1.2 Mounting the Antenna

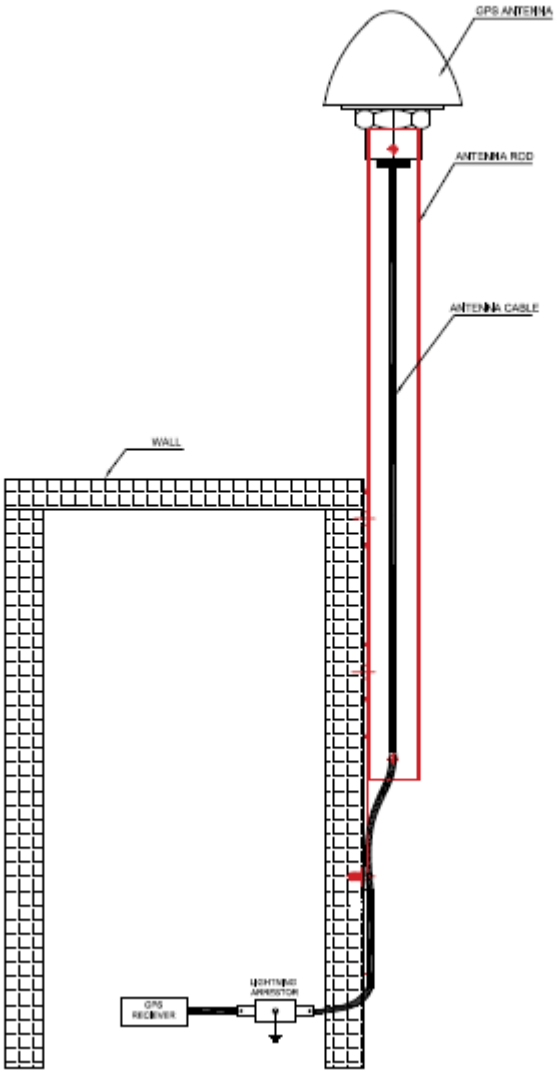


Figure 6-1 Antenna Mounting with Lightening Arrestor

Mount the GPS antenna on an antenna mast (recommended) or on the peak of a building. The GPS 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 GPS 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 shorter its length. Instead, bundle the excess cable to shorten antenna cable length. • The model MTS200L requires a 5 Volt-compatible antenna. Antennas not rated for 5 V will be damaged. • Use a splitter to connect a single GPS antenna to multiple *mas*TER T-Sync Model MTS200L units. Avoid using BNC "T" connectors.

6.1.2.1 GPS-related Accessories

The following options/accessories can be ordered:

1. Protect against lightning and field-induced electrical surges.
2. Connect multiple *mas*TER T-Sync MTS200L receivers to a single antenna.
3. Extend the range of the GPS antenna cable.

1. Lightning Arrestor

Lightning may damage GPS 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. In-line lightning arrestors are mounted between the antenna and the point where the cable enters the building and require no additional power or wiring except the ground lead.

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 a separate dc power supply and wiring.

3. In-Line Antenna Amplifier

In-line amplifiers overcome signal attenuation by amplifying the GPS signal. 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

*mas*TER T-Sync MTS200L unit provides +5 Vdc to the GPS 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 *mas*TER T-Sync MTS200L will not synchronize with the GPS satellites signal and can generate a GPS 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 *mas*TER T-Sync MTS200L. 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 GPS 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 GPS Surge Suppressor kit is available with a purchase order, the user should mount it in line with the antenna cable. Additional information on grounding GPS 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 GPS Antennas and Cables

Antenna Cable

Length and Loss Considerations

Standard Antenna Cable

The standard antenna cable assembly included with *mas*TER T-Sync MTS200L 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 Table 6.1, Cable Data and Accessory Information.

Effects of Cable Parameters

To receive GPS 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;
ƛ= 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 standard15 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 *mas*TER Time Sync

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 GPS Clock.

6.2 Unit Installation

After GPS Antenna installation is complete, *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L unit LOCK before using all outputs for time synchronization to a client device to avoid time difference of *mas*TER T-Sync MTS200L w.r.t. UTC due to *mas*TER T-Sync MTS200L 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 GPS as NTP server. Refer to section 12.1 or section 12.3 and Appendix E.
8. Users can configure other configurable parameters of *mas*TER T-Sync MTS200L 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

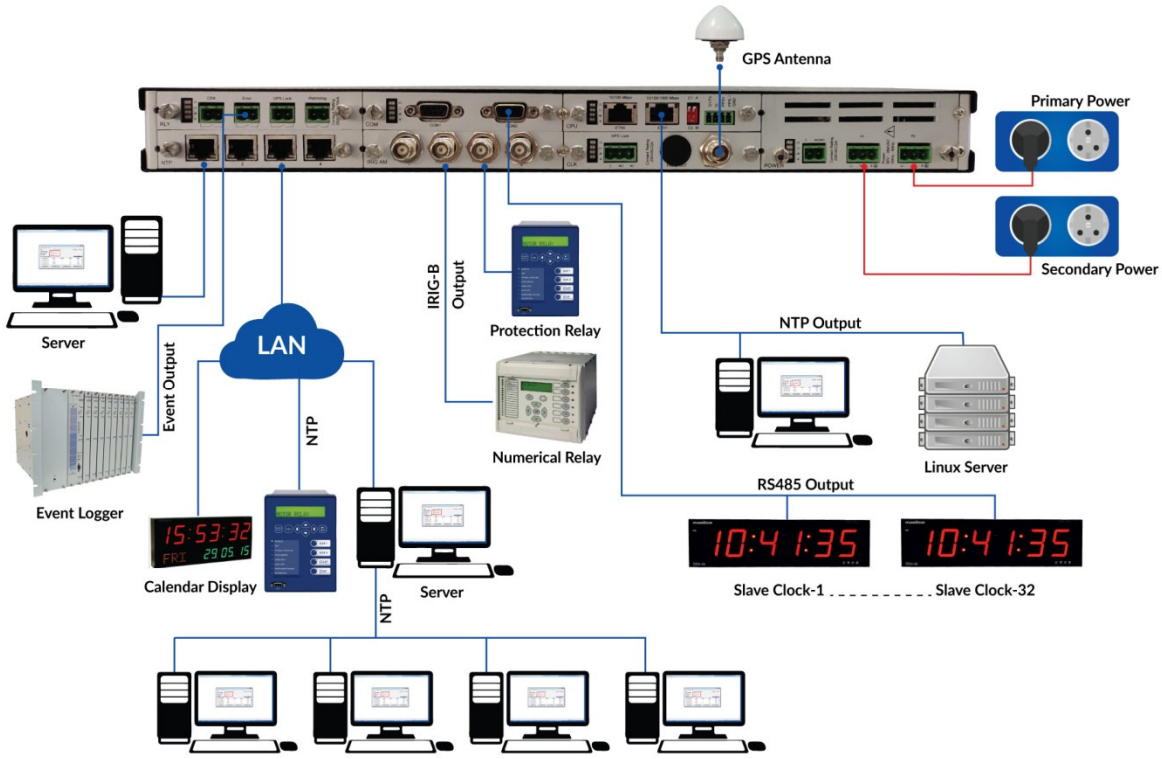


Figure 6-2 *mas*TER T-Sync MTS200L Connection Diagram

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.

*mas*TER T-Sync Model MTS200L 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 Mater T-Sync Model MTS200L 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 the jumpers 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.

6.5 Relay Contact Output Configurations:

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

6.5.1 Relay [RLY] Card - WATCHDOG relay:

CN8 3-pin jumper on the main card is used to change the relay contact for Watchdog relay contacts. The operator has to remove the black jumper from its current position to the required position as explained below images.
Refer to the below figure for C-NO jumper position configuration and C-NC jumper position configuration.

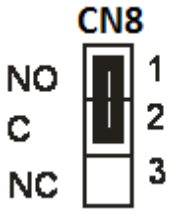
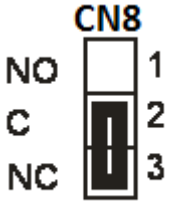
C-NO Configuration:	C-NC Configuration:
	

Table 6.2 WATCHDOG Relay Configuration

- The same will be followed for other relay output.
- CN4 and CN1 are used for GPS lock and CRA Relay output respectively.

6.5.2 COM1 and COM2 terminal RS232 / RS485 output configurations:

COM1 or COM2 terminal provides serial-based NMEA or T-Format /GPGGA/GPZDA time frame at every second once after unit boots. This terminal can configure to provide either an NMEA Time frame or T-format/NGTS/GPGGA/GPZDA. It is factory settable. A COM1 and COM2 terminal is configured as RS-232 output as factory default. CN2 and CN3 jumpers on the Additional serial card of the unit are used to change the configuration between RS232 to RS485 standard for COM1. Similarly, CN6 and CN8 are used for COM2. Please refer to the below table showing the jumpers position required for RS232 and RS485 configuration.

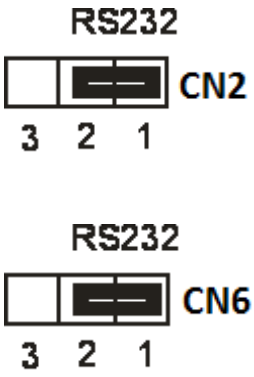
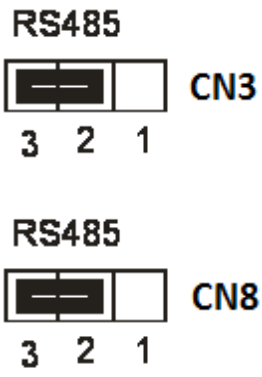
RS-232 Configuration:	**RS-485 Configuration:**
	

Table 6.3 COM1 and COM2 terminal RS-232/RS-485 Configuration

6.5.3 RS232 / RS485 output configurations in CPU Card:

4 pin terminal provides a serial NMEA time frame every second once after unit boots. This terminal can be configured for RS-232 electrical standard or RS-485 electrical standard-based communication. ured as RS-232 output is configured as factory default. CN3 and CN4 jumpers on the CPU board of the unit are used to change the configuration between RS232 to RS485 standard. Please refer to the below table showing the jumpers position required for RS232 and RS485 configuration.

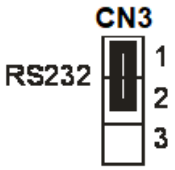
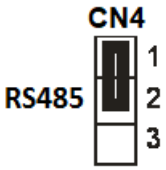
RS-232 Configuration:	RS-485 Configuration:
	

Table 6.4 WATCHDOG Relay Configuration

7. *mas*TER T-Sync MTS200L Power ON

7.1 Receiver Boot-up mode

When *mas*TER T-Sync MTS200L 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 GPS 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 below explanation 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 GPS 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 GPS 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 GPS 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.

Battery Specification:

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

	It is recommended that if the *mas*TER T-Sync MTS200L 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.

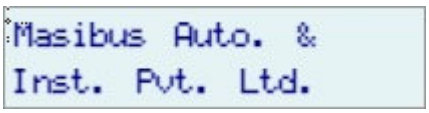
Non Volatile Memory Configuration:

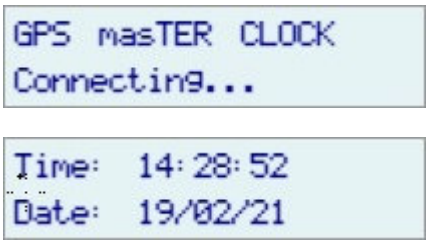
The GPS clock maintains all configuration parameters internally in non-volatile memory, even when the power is off.

7.3 Startup Operation

Before powering up the *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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.





- 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, front 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 *mas*TER T-Sync MTS200L 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 MTS200L Unit gets in LOCK condition after the GPS antenna is connected to the device.
- There are other 5 status LED's on the front panel of the *mas*TER T-Sync MTS200L device. When Power is applied to the device, GPS LOCKED indication illuminates in RED colour. If GPS 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.
- *mas*TER T-Sync MTS200L device provides relay contacts on its terminal at the back panel of the unit for Power and GPS Lost. Factory set configuration for relay contacts for all mentioned outputs is C-NO terminal.
- After *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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 front 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

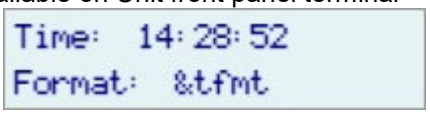
- After the unit is boot up completely and time is available on display, all the outputs of the unit i.e. event pulse outputs, IRIG, NTP, and serial time outputs will be available as per the unit clock.
- *mas*TER T-Sync MTS200L size unit display supports 20 x 2 lines LCD which displays parameters such as time, date, GPS LOCK/UNLOCK status, position information, day of the week, day of the year, type of serial frame format on front 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 front 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 *mas*TER T-Sync MTS200L, 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

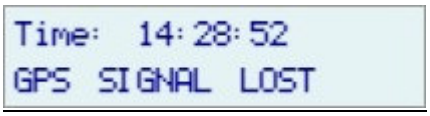
Status Display: Day of Week

Status Display: Day of Year

Status Display: Time frame available on Unit front panel terminal

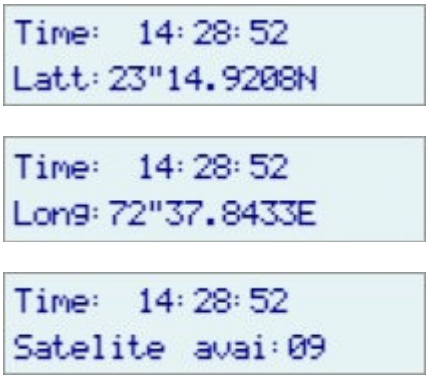


Status Display: LOCK/UNLOCK information



Status Display: Total No. of Satellite available

Status Display: Receiver Position information



8. Unit Setup Configuration

*mas*TER **T-Sync MTS200L** 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 additional Events & Event On time.
- The parameters configurable through the keypad will have the same possible values as configurable through Front panel Terminal.

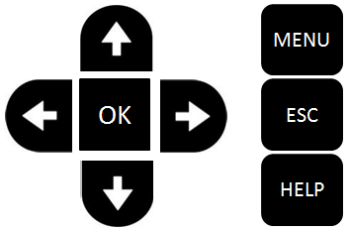


Figure 8-1 Front Panel Keypad Layout

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 *mas*TER **T-Sync MTS200L** 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 Masibus 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.

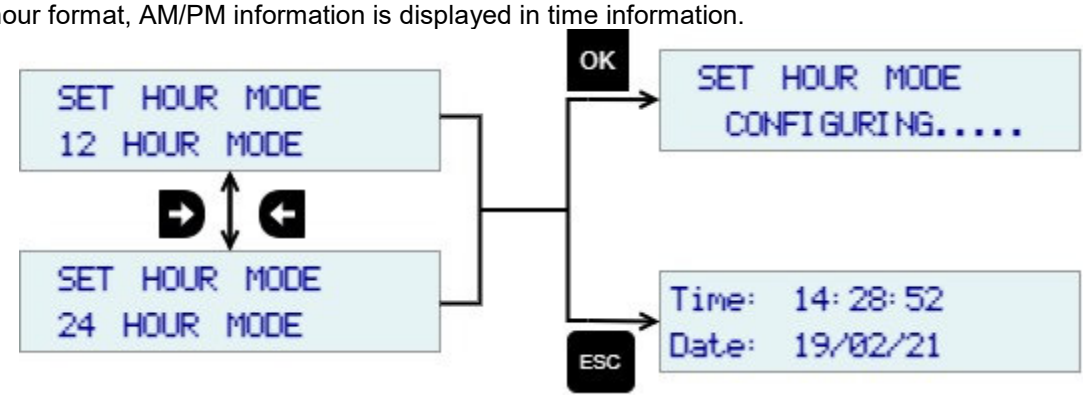

Time: 14:28:52
Date: 19/02/21
MENU
ENTER PASSWORD
0001
OK
SET HOUR MODE
12 HOUR MODE
SET BAUD RATE
9600
SET PARITY
NONE
SET STOP BIT
STOP BIT:0
TRANSMIT MODE
T-FORMAT
SET TIME FORMAT
LOCAL
ADD TIME
EVENT - 1 TIME
EVENT ON TIME
EVENT-1 ON TIME
ETH NTW SETTING (0)
ETH NTW SETTING (1)
RESET UNIT
CHANGE PASSWORD ?

GENERAL SETTINGS:

To enter the configuration mode of MTS200l using the front keypad, the user needs to press the “MENU” key and then enter the appropriate password. This will allow the user to enter the configurable parameters option and this parameter can be configured as explained in the below section.

1. SET HOUR MODE

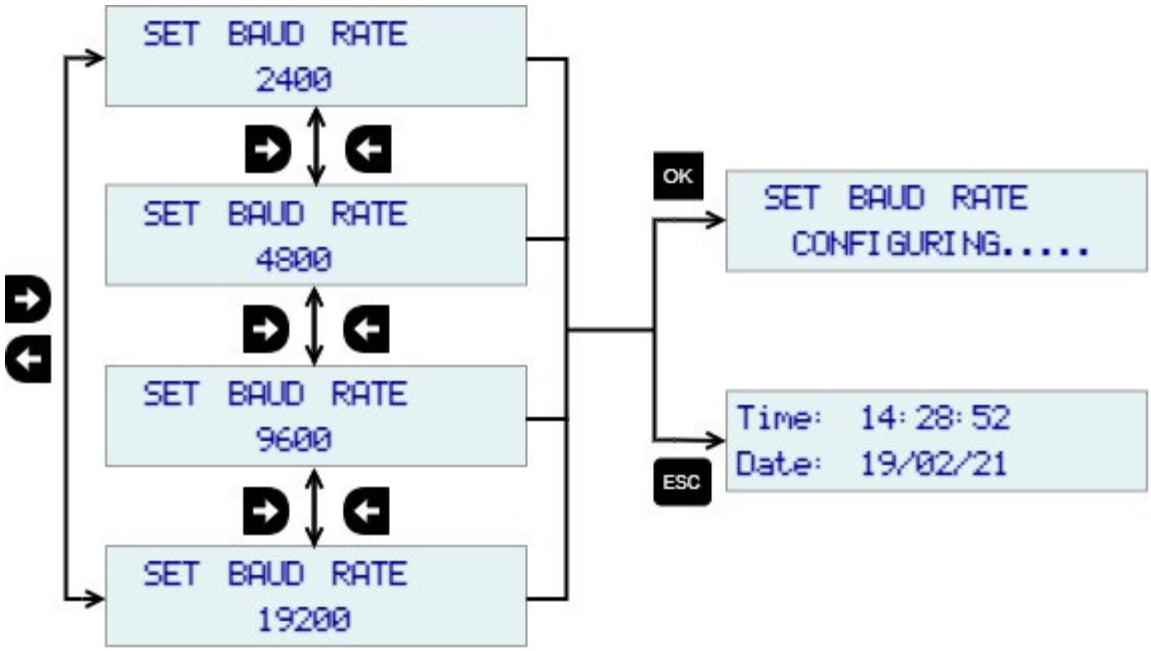
MTS200L provides its internal clock time information on the LCD, SNMP status and webserver home page. This time information can be configured for 12 hours or 24-hour format. Whenever the user selects a 12-hour format, AM/PM information is displayed in time information.



As shown above, the “LEFT” and “RIGHT” keys are used to change the setting of the HOUR MODE. The “OK” key will save the setting and the “ESC” key will reject the new setting and keep the old value of this parameter in effect and come out of configuration MENU mode to RUN mode.

2. SET BAUD RATE

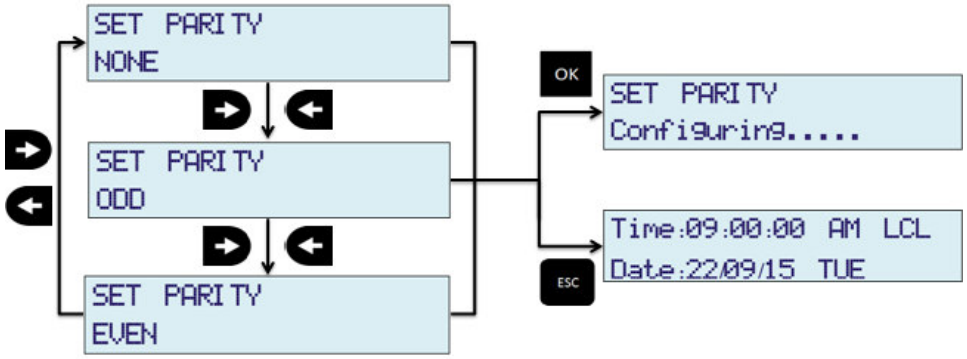
Front panel Terminal port output baud rate of MTS200L can be set by using this option. MTS200L is capable to provide a serial time frame on the front panel terminal at configurable baud rates of 2400 / 4800 / 9600 / 19200.



As shown above, the “LEFT” and “RIGHT” keys are used to change the setting of BAUD RATE. The “OK” key will save the setting and the “ESC” key will reject the new setting and keep the old value of this parameter in effect and come out of configuration MENU mode to RUN mode.

3. SET PARITY

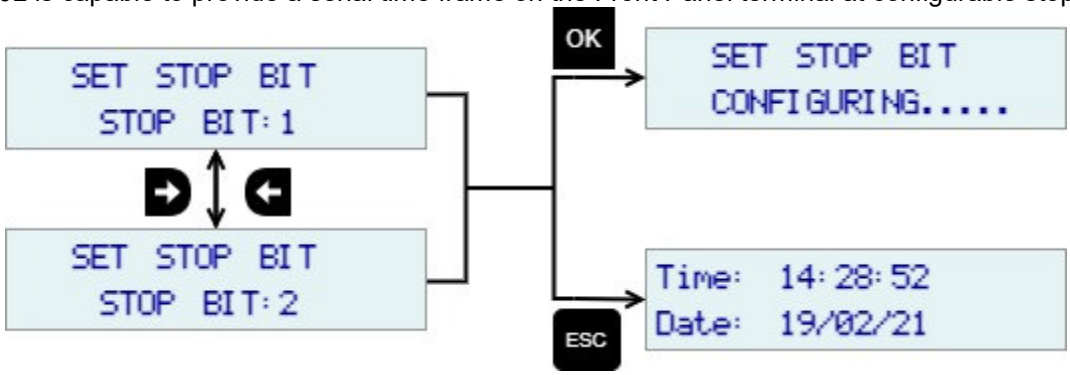
Terminal serial port output parity bit at the front panel of MTS200L can be set by using this option. MTS200L is capable to provide a serial time frame on the terminal at configurable parity options of NONE / ODD / EVEN.



As shown above, the “LEFT” and “RIGHT” keys are used to change the setting of PARITY. The “OK” key will save the setting and the “ESC” key will reject the new setting and keep the old value of this parameter in effect and come out of configuration MENU mode to RUN mode.

4. SET STOP BIT

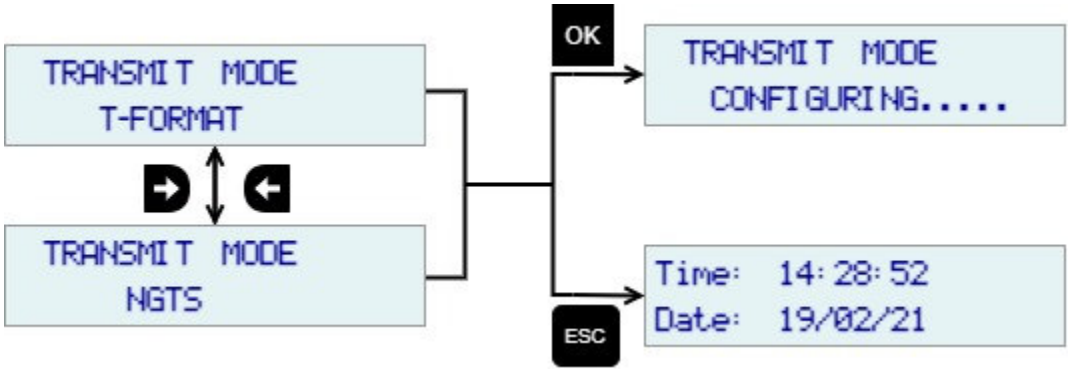
Terminal serial port output stop bit at the front panel of MTS200L can be set by using this option. MTS200L is capable to provide a serial time frame on the Front Panel terminal at configurable stop bits.



As shown above, the “LEFT” and “RIGHT” keys are used to change the setting of STOP BIT. The “OK” key will save the setting and the “ESC” key will reject the new setting and keep the old value of this parameter in effect and come out of configuration MENU mode to RUN mode.

5. Front Panel TRANSMIT MODE

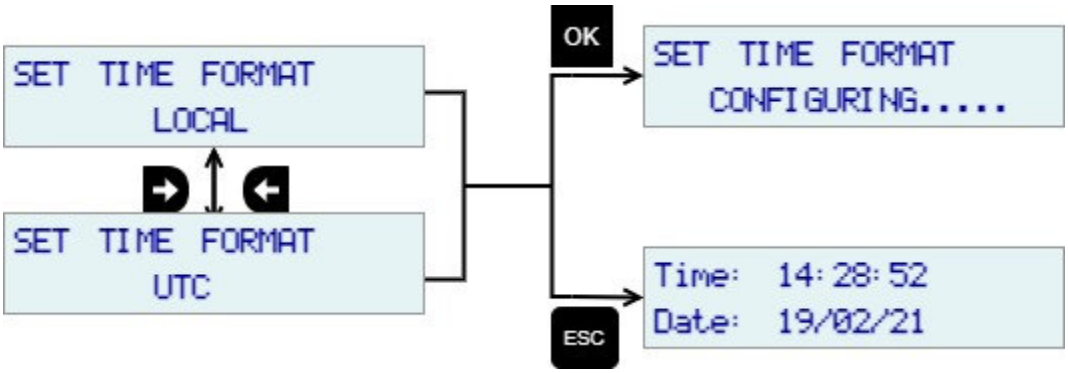
Front panel serial port output serial time string can be set by using this option. MTS200L is capable to provide different types of serial time strings such as T-format and NGTS on the Front panel terminal.



Serial Time frame T-format is transmitted at every 1 second while NGTS time frame is transmitted at every 1 minute. Refer to section 11.1 for a detailed description of each time string.
As shown above, “LEFT” and “RIGHT” keys are used to change the setting of TRANSMIT MODE “OK” key will save the setting and “ESC” key will reject new setting and keep the old value of this parameter in effect and come out of configuration MENU mode to RUN mode.

6. SET TIME FORMAT

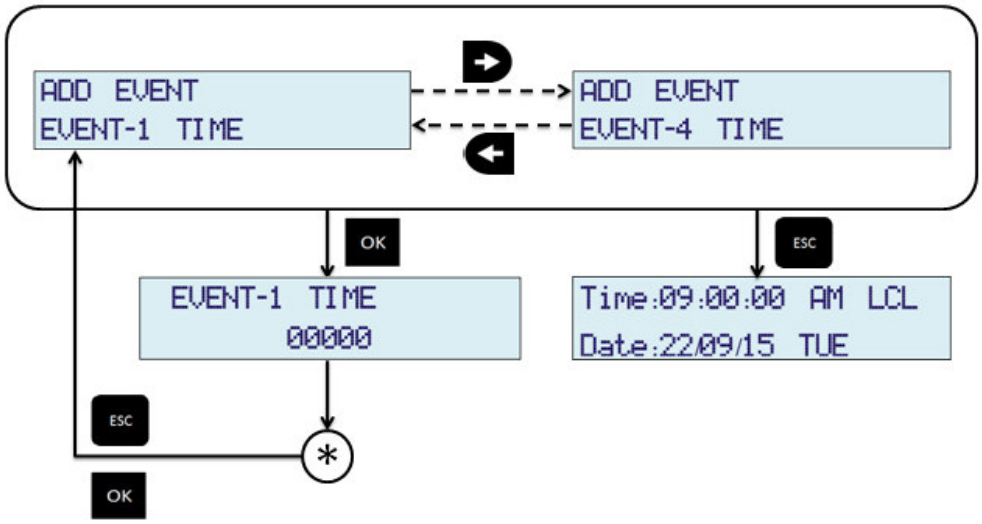
MTS200L provides its internal clock time information on the LCD, SNMP status and webserver home page. This time information can be set for UTC or LOCAL timezone. LOCAL time depends on UTC + timezone set.



As shown above, the “LEFT” and “RIGHT” keys are used to change the setting of TIME FORMAT. The “OK” key will save the setting and the “ESC” key will reject the new setting and keep the old value of this parameter in effect and come out of configuration MENU mode to RUN mode.

7. ADDITIONAL EVENT [1 to 4] (Optional)

In additional event output, MTS200L provides 4 event outputs. The output of This event can be configured from 1 second period to 86400 seconds (1 day) period. If these events are configured with 0 value, that particular event output will be disabled and hence no pulse output will be on that particular event. Users can also configure the duty cycle (ON time) of each event output as explained in next section.

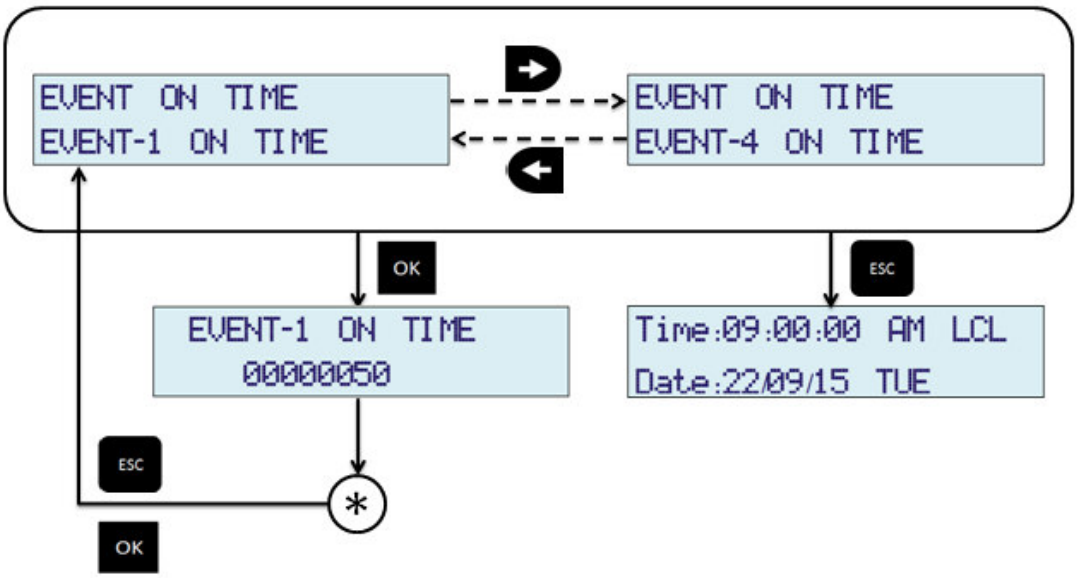


*: Cursor will start blinking once a user enters this mode by pressing the “OK” key. To change a specific digit, use the “UP” / “DOWN” arrow keys and to change the position of the blinking cursor use the “LEFT” / ”RIGHT” arrow keys. UP/DOWN arrow keys will update the digit on which the cursor is blinking.

After the value is edited, press “OK” again to save the parameter. After the user presses the “OK” key, the user will return to the main menu again.
Users can switch between EVENT1, EVENT2, EVENT3 and EVENT4 menus using the “LEFT” and “RIGHT” keys and follow the above steps to configure the parameter.

8. EVENT ON TIME

ALL additional events 1 to 4 outputs can be also configured for ON duration time (duty cycle) for the above configured respective event period time. The ON time can be configured from 50 milliseconds to a maximum of 50% of configured respective EVENT period in milliseconds. Units of EVENT ON Time for EVENT 1 to 4 is in milliseconds.



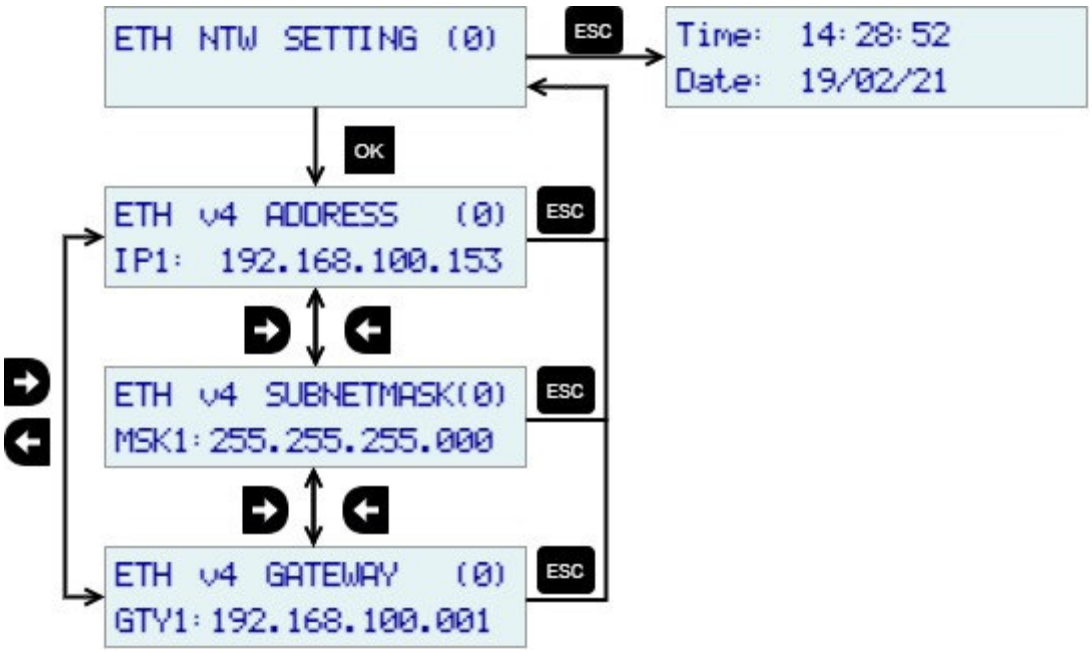
*: Cursor will start blinking once the user enters this mode by pressing the “OK” key. To change a specific digit, use the “UP” / “DOWN” arrow keys and to change the position of the blinking cursor use the “LEFT” / ”RIGHT” arrow keys. UP/DOWN arrow keys will update the digit on which the cursor is blinking.
After the value is edited, press “OK” again to save the parameter. After the user presses the “OK” key, the user will return to the main menu again. Users can switch between EVENT1, EVENT2, EVENT3 and EVENT4 menus using the “LEFT” and “RIGHT” keys and follow the above steps to configure the parameter.

ETHERNET PARAMETERS:

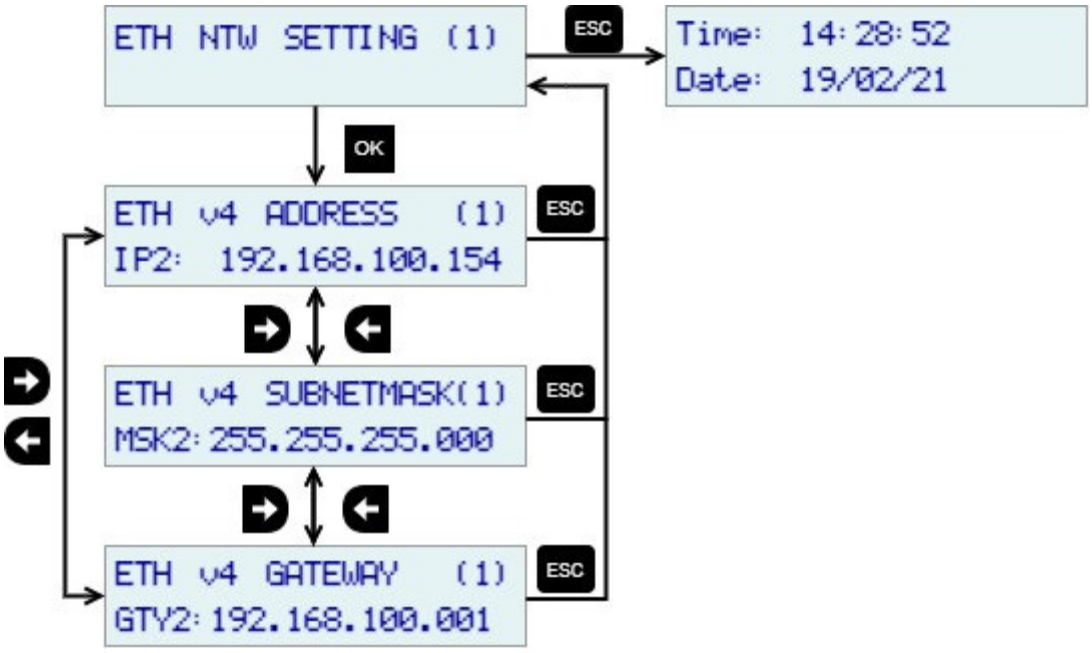
MTS200L is equipped with a standard 10/100 Mbps eth0 port and an optional 10/100 Mbps eth1 port on the rear panel of the device. The network settings for these ports can be done through the front panel keypad as shown below figure.
MTS200L displays live current applicable network settings of each ethernet interface such as IP address, Subnet Mask and Gateway on the main menu on LCD in ETH NTW SETTINGS (0) for eth0 and ETH NTW SETTINGS (1) for eth1. Users can configure any parameter related to the Ethernet port individually.

Users can view the network settings for both eth ports as shown below figure.

Network setting for port 1 (eth0):

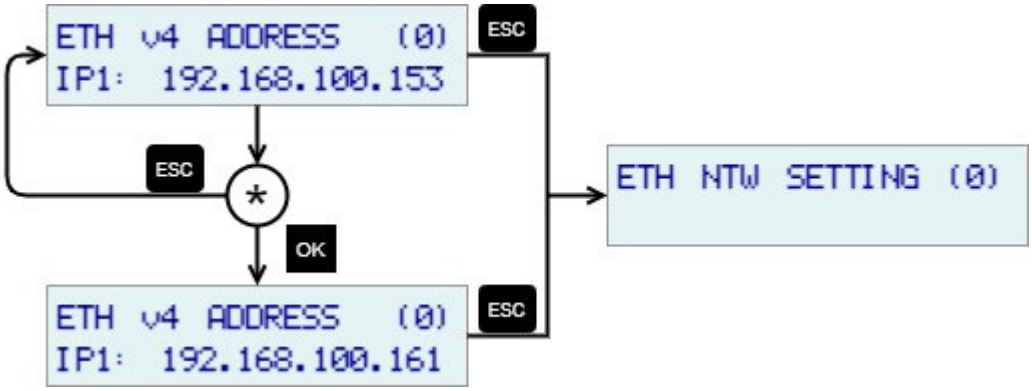


Network setting for port 2 (eth1):



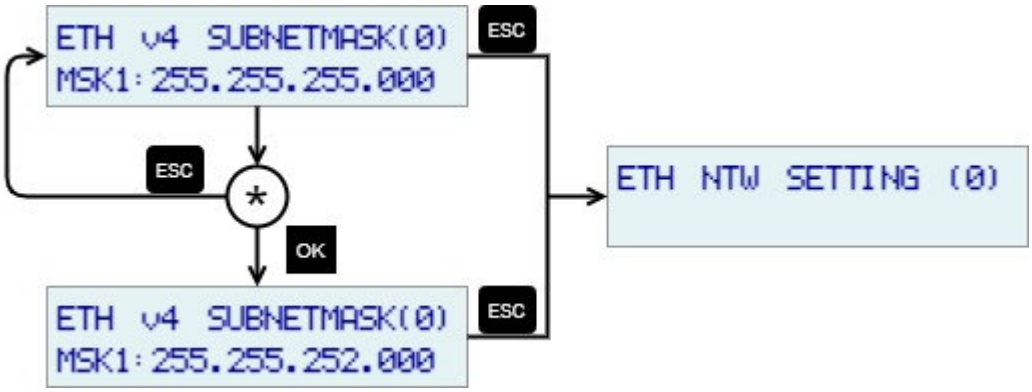
Configuration of Eth(x) Parameters

1. ETH v4 ADDRESS
Here, user can configure IPv4 address for a specific port(here eth0) as shown in the figure.



*: Cursor will start blinking once the user enters this mode by pressing the “OK” key, user can see the blinking cursor on the 1st position of the 2nd line. To change a specific digit, use the “UP” / “DOWN” arrow keys and to change the position of the blinking cursor use the “LEFT” / ”RIGHT” arrow keys. UP/DOWN arrow keys will update the digit on which the cursor is blinking.
After the value is edited, press “OK” again to save the parameter or "ESC" to restore the parameter value.
After the user presses the “OK” key, the user can view the changed IPv4 address.

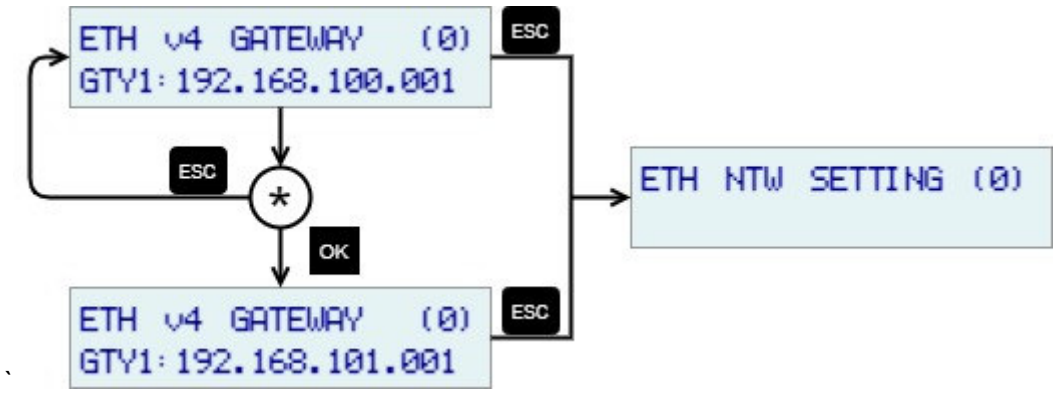
2. ETH v4 SUBNETMASK
Here, user can configure IPv4 subnet mask for a specific port (here eth0) as shown in the figure.



*: Cursor will start blinking once the user enters this mode by pressing the “OK” key, user can see the blinking cursor on the 1st position of the 2nd line. To change a specific digit, use the “UP” / “DOWN” arrow keys and to change the position of the blinking cursor use the “LEFT” / ”RIGHT” arrow keys. UP/DOWN arrow keys will update the digit on which the cursor is blinking.
After the value is edited, press “OK” again to save the parameter or "ESC" to restore the parameter value.
After the user presses the “OK” key, the user can view the changed IPv4 subnet mask.

3. ETH v4 GATEWAY

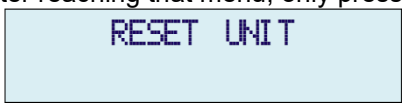
Here, user can configure IPv4 gateway for a specific port as shown in the figure.



*: Cursor will start blinking once the user enters this mode by pressing the “OK” key, user can see the blinking cursor on the 1st position of the 2nd line. To change a specific digit, use the “UP” / “DOWN” arrow keys and to change the position of the blinking cursor use the “LEFT” / ”RIGHT” arrow keys. UP/DOWN arrow keys will update the digit on which the cursor is blinking.
After the value is edited, press “OK” again to save the parameter or "ESC" to restore the parameter value. After the user presses the “OK” key, the user can view the changed IPv4 gateway.

RESET UNIT:

This mode will do a software reboot of the MTS200L device. For that just go to the RESET UNIT menu using the UP/DOWN arrow keys. After reaching that menu, only press the OK key.



The device will be restart. Wait till the time and date are there on Display.

CHANGE PASSWORD:

Users can change passwords. Users can set the password in the range from 0000 to 9999.

To change a specific digit, use the “UP” / “DOWN” arrow keys and to change the position of the blinking cursor use the “LEFT” / ”RIGHT” arrow keys. UP/DOWN arrow keys will update the digit on which the cursor is blinking.

9. Serial Communication and Configuration

*mas*TER T-Sync MTS200L device has a terminal at the front panel of the instrument which is a female DB-9 connector operating on RS-232 electrical standards. This terminal can be used to configure *mas*TER T-Sync MTS200L device parameters only when the terminal of *mas*TER T-Sync MTS200L device is connected to the RS-232 terminal of a computer using 9 pin CROSS Cable (refer below section for cable connections). The terminal also transmits serial-based time signal (T-Format or NGTS depending on device configuration) only when the Model device is not in configuration mode.
NOTE: 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 *mas*TER T-Sync MTS200L configuration is shown in figure 8. Connect one end of the cross cable to the Terminal of *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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.

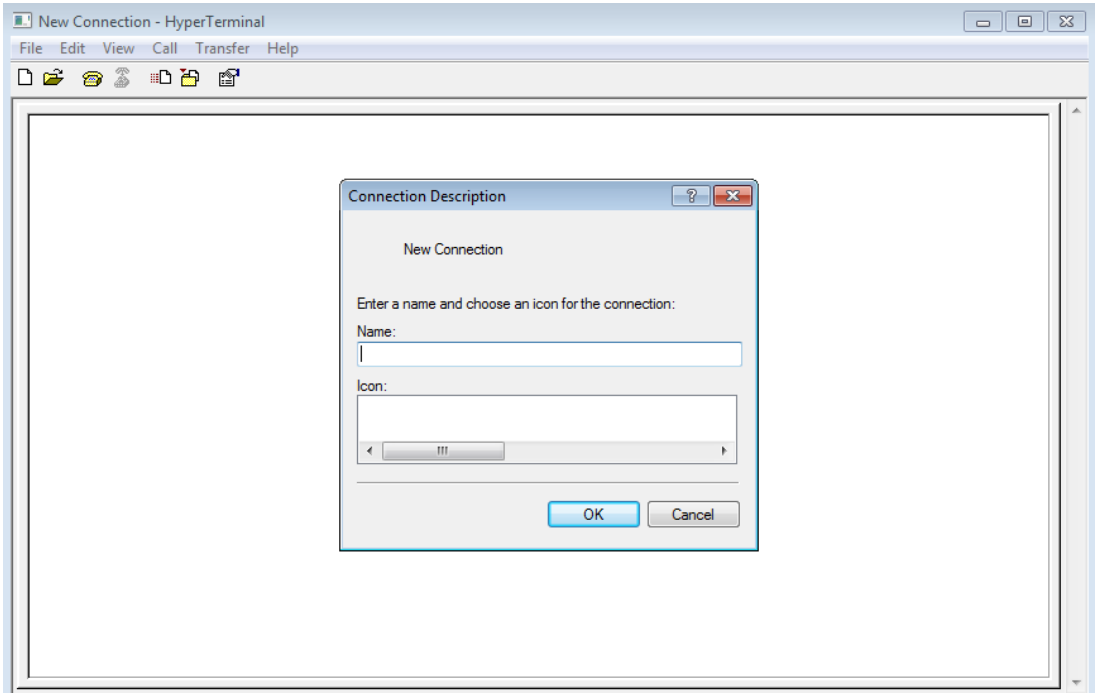


Figure 9-2 HyperTerminal View

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.

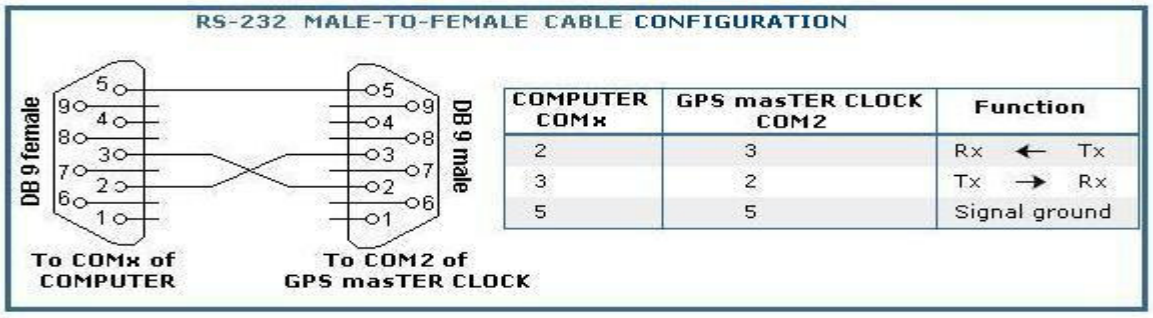


Figure 9-3 Terminal Cable Connections

⚠	• Cross cable connection as mentioned in the above figure is necessary to communicate with the serial Terminal. • Ensure Terminal serial communication setting done in *mas*TER T-Sync MTS200L unit and end device should be same for proper communication.

The port settings in **HyperTerminal** and the Terminal port of *mas*TER T-Sync MTS200L must match each other for fruitful communication. The factory set settings of Terminal port of *mas*TER **T-Sync MTS200L** 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's necessary to select the "NONE" option in the "Hardware Flow Control" option while doing

communication parameters settings in HyperTerminal. Users can check *mas*TER T-Sync MTS200L Terminal communication settings from the keypad menu available on the front panel of *mas*TER T-Sync MTS200L. Refer “USER CONFIGURATIONS” section in the manual for a 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**.

Figure 9-4 LCD Display – Terminal port Settings of *mas*TER T-Sync MTS200L

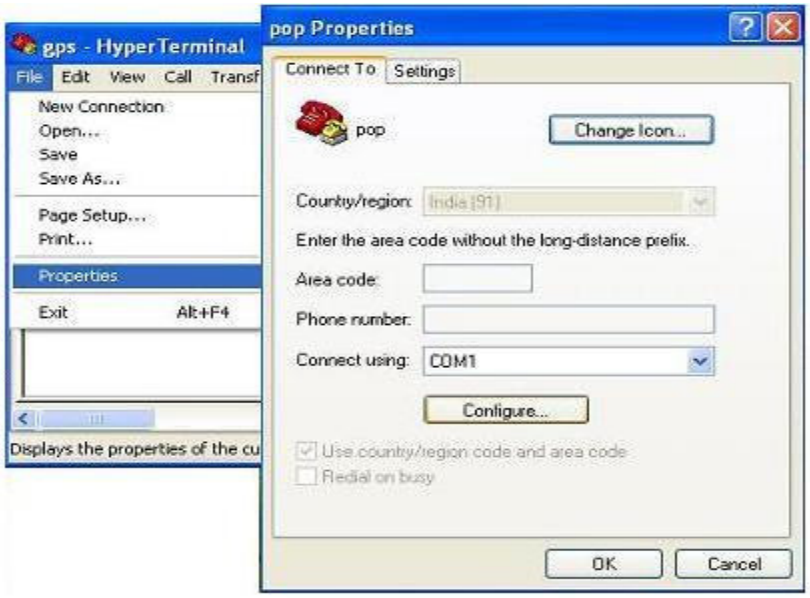


Figure 9-5 HyperTerminal Configuration

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, *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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

*mas*TER T-Sync MTS200L front Terminal can be used for configuring communication parameters of serial port settings for Terminal, output time string format (T-format / NGTS) on Front panel terminal, time display format, general parameters settings, time zone offset, password and additional event time outputs, antenna cable propagation delay, defaulting Ethernet port addresses.

All commands types are mentioned as subtitle names 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 the 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 *mas*TER **T-Sync MTS200L**. 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 visualize 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: 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 *mas*TER **T-Sync MTS200L** 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	2	24 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	1	NGTS 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

ENTER COMMAND TO CONFIGURE PARAMETER
OR PRESS ENTER TO CONTINUE.

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

Description: The 'H' command is a general HELP menu and will list all the commands to configure *mas*TER **T-Sync MTS200L**. 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
MASTER TIME SYNC 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 Front panel TERM2 transmit mode.
1 : NGTS mode
2 : T-format 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 Eth0/Eth1.
MASKx: Set Subnet mask of Eth0/Eth1.
GTYx: Set Gateway of Eth0/Eth11
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.

9.2.2 Communication 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 *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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)

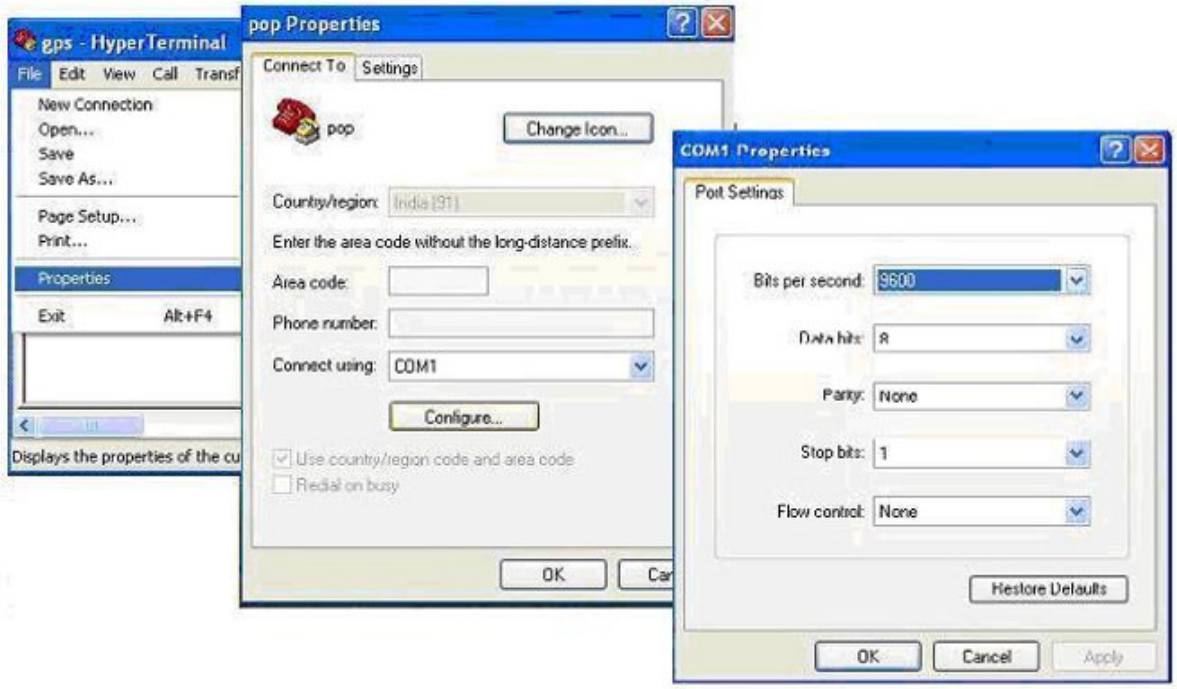
1. Suppose that the desired baud rate is 4800, the command should be **SB48** (See H: HELP). This will display the following on the **HyperTerminal**:

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 *mas*TER T-Sync MTS200L.

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 *mas*TER T-Sync MTS200L 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 *mas*TER **T-Sync MTS200L** 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.

Time Zone Offset Command:

- **Command: Z**

This command is to enter the time offset of any particular region/country concerning the UTC. Every country 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.

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

9.2.3 LCD Display Parameters Commands:

The 2x20 LCD on the front panel of *mas*TER T-Sync MTS200L displays the time as either UTC or LOCAL and 12 Hour/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-ho**ur** 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**.

- **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 Serial Terminal Time Frame Command:

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

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

The front panel terminal of *mas*TER **T-Sync MTS200L** 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.

9.2.5 Additional Event's Command (Optional Output):

The additional four-event signals(optional) are available at the terminal strip on the rear panel of *mas*TER T-Sync MTS200L**.** Users can configure these opto-relays through Serial terminal on front 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 Ethernet Default Command:

- **Command: ETH0**

	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 *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L.
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 *mas*TER T-Sync MTS200L Refer document **Appendix E** for configuring *mas*TER T-Sync MTS200L as Telnet Server.

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 Eth0 and IP2 for Eth1. 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 neither is 0 nor 255. The last byte of the IP address can not be 255.
  IP1: Set IP Address of Eth0
  IP2: Set IP Address of Eth1

- **Command: MASKx**
  This command is used to change the Subnet mask. MASK1 for Eth0 and MASK2 for Eth1.Default Subnet mask for both Ethernet port s 255.255.255.000. All bytes should be in the range from 0 to 255. The first byte neither is 0, and the last byte of the Subnet mask can not be 255.
  MASK1: Set Subnet mask of Eth0
  MASK2: Set Subnet mask of Eth1

- **Command: GTYx**
  This command is used to change Gateway. GTY1 for Eth0 and GTY2 for Eth1. Default Gateway for both Ethernet port s 192.168.100.001 all bytes should be in the range from 0 to 255. The first byte neither is 0 nor 255. The last byte of the Gateway can not be 255
  GTY1: Set Gateway of Eth0
  GTY2: Set Gateway of Eth1

- **Command: TLx**
  This command is used to enable or disable telnet services as required.
  TL0: Telnet Services Disable
  TL1: Telnet Services Enable

9.2.8 Password Change Command:

The user is allowed to change one 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.

	• 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.

9.2.9 Miscellaneous Command:

Other available commands are as follows:

- **Command: D**

Description: This command sets the following parameters of *mas*TER T-Sync MTS200L 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
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
Telnet Services	TLx	1	Telnet Services Enable/Disable

Table 9.2 Default Command parameters

If the user enters the default command in *mas*TER T-Sync MTS200L, 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 front panel terminal.

	• The above settings default with the DEFAULT menu in the keypad menu section. If the user defaults *mas*TER T-Sync MTS200L settings using the keypad menu, the 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 serial terminal of *mas*TER T-Sync MTS200L device. • This default command does not affect the NTP Ports IP address configuration, SPD value, Manual time.

- **Command: R**

This command will reset *mas*TER T-Sync MTS200L**.**

	This command will reset *mas*TER T-Sync MTS200L unit. As a result of which, all the outputs will be stopped or there will be a change in relay and pulse output till the unit boots up again.

9.2.10 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: 0to 99999 ns
Default value: 0 ns
Resolution: 1 ns

The user is allowed to change propagation delay. The command for changing propagation delay is: "**SPD**xxxxx"
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 6.1 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.

9.2.11 Manual Time Setting command:

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.

9.2.12 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 *mas*TER T-Sync MTS200L 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
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

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
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	2	24 Hour Mode
SBx	Baud Rate	96	9600 Baud Rate
SPx	Parity	0	Parity None
SSx	Stop Bit	1	1 Stop Bit
SUx	Time Format	2	LOCAL time
TC2x	Transmit Mode	1	NGTS Mode
ET1	Addi. Event1	00000002	Second Mode
ET2	Addi. Event2	00000001	Second Mode
ET3	Addi. Event3	00000001	Second Mode
ET4	Addi. Event4	00000001	Second Mode
EW1	Event1 ON Time	00001000	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

ENTER COMMAND TO CONFIGURE PARAMETER
OR PRESS ENTER TO CONTINUE.

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

10.1 Timing Output – Serial

10.1.1 NMEA-0183 RMC Time frame output

*mas*TER T-Sync MTS200L 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:

*mas*TER T-Sync MTS200L transmits T-format time frame from Terminal at the front 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 9 or the serial configuration method on the front panel Terminal as explained in section 9.2.4.

NOTE: *mas*TER T-Sync MTS200L can be configured to transmit T-format or NGTS time frame through its Terminal at the front 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 section9 or serial configuration command "**TC22**" as per section10.2.5.

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:

*mas*TER T-Sync MTS200L transmits NGTS time frame from Terminal at the front 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 section9 or the serial configuration method on the Terminal as explained in section 9.2.4.

NOTE: *mas*TER T-Sync MTS200L can be configured to transmit T-format or NGTS time frame through its Terminal at the front 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 section9 or serial configuration command "**TC21**" as per section9.2.4.
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 – IRIG-B / IEEE 1344 C37.118-2005

10.2.1 Introduction:

This section should help you with understanding, choosing, and connecting the correct output from the *mas*TER T-Sync MTS200L 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 MTS200L 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 MTS200L 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 MTS200L configuration for the same. *mas*TER T-Sync MTS200L can generate different no of digital as well as analogue signals as described in this section. Model MTS200L 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 *mas*TER T-Sync MTS200L 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 MTS200L 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.

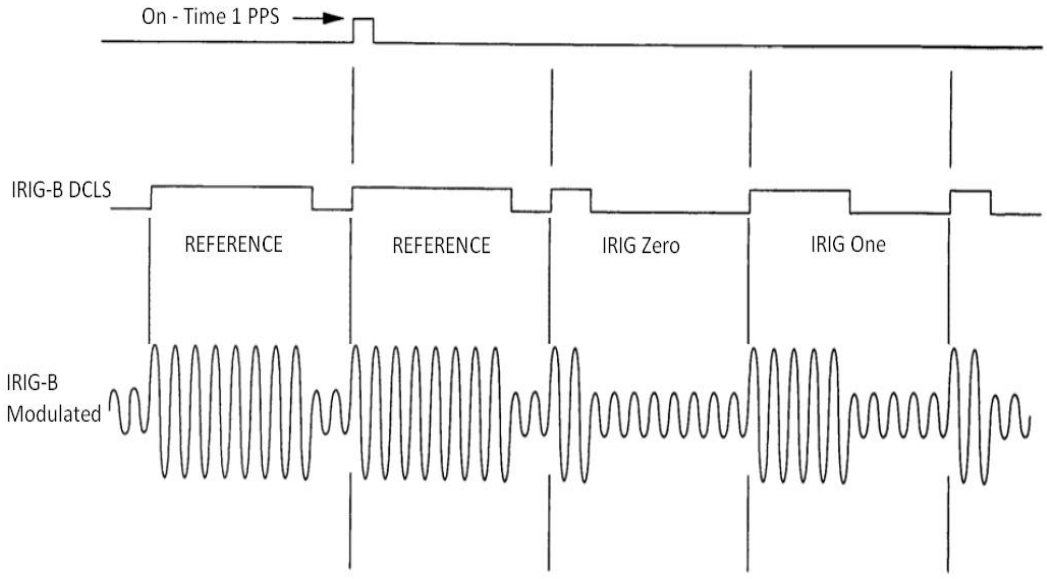


Figure 10-1 IRIG-B waveforms

10.2.3.3 IRIG-B IEEE 1344 Extension:

IEEE 1344 protocol has two versions available of which model MTS200L 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 in-serted
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 =MTS200L Locked, maximum accuracy 1111 =MTS200L 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:

*mas*TER T-Sync MTS200L 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
BCDTOY, BCDYR, SBS (Time of Day)

c) IEEE 1344 (C37.118-2005) : 100 pps, AM Signal, with 1 KHz Carrier frequency
BCDTOY, BCDYR, SBS, IEEE1344 assignment of CF bits (Refer Section 11.2.2.4)
: 100 pps, DCLS Signal, No Carrier Frequency
BCDTOY, BCDYR, SBS, IEEE1344 assignment of CF bits (Refer Section 11.2.2.4)

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 MTS200L Ethernet port ETH0 (NTP).
IRIG-B time code for model MTS200L 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 ETH0 (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 ETH0(NTP).

10.2.3.6 Connecting IRIG-B Time Code:

*mas*TER T-Sync MTS200L 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 MTS200L to the end device. To adapt twisted pair cabling with model MTS200L use BNC Breakout or other similar adapters.
NOTE: In case of shielded twisted pair cabling does not connect shielding of cable to model MTS200L, 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 *mas*TER T-Sync MTS200L results in the decrease of drive voltage due to an increase in load current. In many cases, model MTS200L 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 (Rdev)
- Calculate load current of each device (Idev = 5V ÷ Rdev)
- Sum all the load device current and compare with model MTS200L load capacity current

*mas*TER T-Sync MTS200L 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 MTS200L IRIG-B AM output causes an increase in current flow which affects the Pick-Pick output voltage to decrease. *mas*TER T-Sync MTS200L 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 hierarchal 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 *mas*TER T-Sync MTS200L NTP Output:

*mas*TER T-Sync MTS200L 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. *mas*TER T-Sync MTS200L 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. *mas*TER T-Sync MTS200L 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 15) can synchronize their time from *mas*TER T-Sync MTS200L NTP output.

*mas*TER T-Sync MTS200L 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 15) of NTP output only for holdover conditions which are applicable when the *mas*TER T-Sync MTS200L device is in Unlock condition. This feature indicates NTP client devices whenever *mas*TER T-Sync MTS200L device enters holdover mode during ideal run conditions. Under Lock conditions, *mas*TER T-Sync MTS200L NTP output will always operate at stratum level 1 which cannot be changed.

Users should change the stratum level of the *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L device is configured at 15 under Unlock conditions, no NTP client will synchronize its time with NTP server output as level 15 is the last limit of a stratum as per NTP standard.

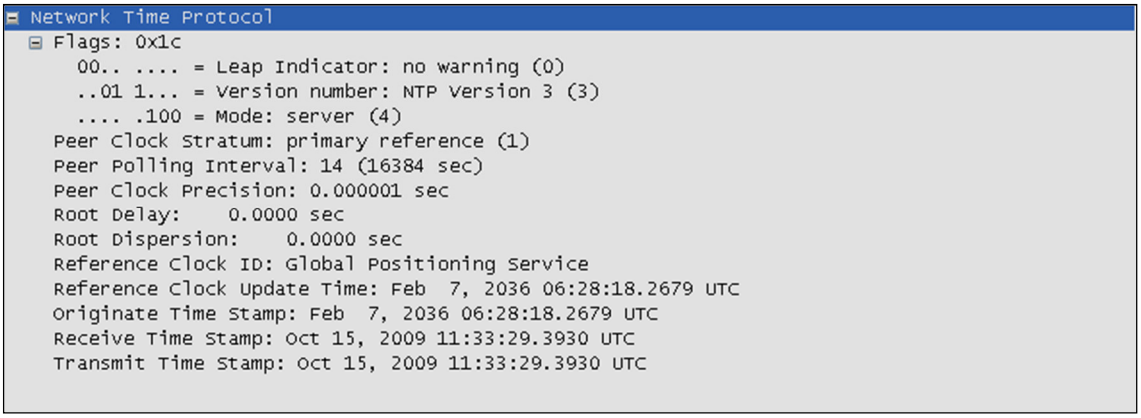


Figure 10-2 NTP frame format

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 *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L acts as the primary reference source. Stratum value will be fixed at 1 during *mas*TER T-Sync MTS200L Lock conditions. However, it can be configured between 2 to 15 (via telnet) which will only be applicable during *mas*TER T-Sync MTS200L 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. *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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. *mas*TER T-Sync MTS200L provides time format in seconds and fractional timestamp with a millisecond resolution.

	If the stratum level of *mas*TER T-Sync MTS200L device is configured at 15 under Unlock conditions, no NTP client will synchronize its time with NTP server output as level 15 is the last limit of a stratum as per NTP standard

10.3.3 NTP Client Synchronization:

*mas*TER T-Sync MTS200L NTP output port can be used to synchronize Windows PC or Unix/Linux based PC in networks. Please refer to **Appendix C** for procedure/settings for making PC operate as an NTP client.

It is recommended to visit the website www.ntp.org for installing and configuring Unix/Linux-based PC as an NTP client.
*mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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 fro 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 hierarchal 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.

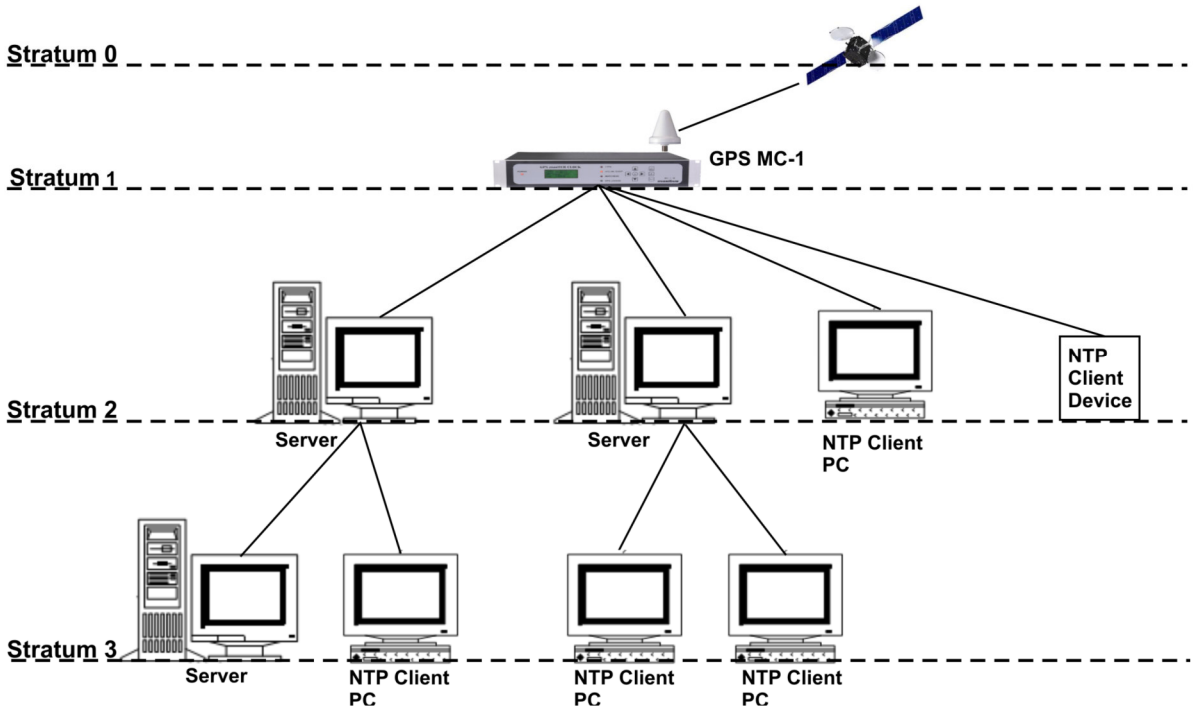


Figure 10-3 NTP Time distributions in Hierarchical Arrangement

As shown in figure 11.3, *mas*TER T-Sync MTS200L 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. *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L device is configured at 15 under Unlock conditions, no NTP client will synchronize its time with NTP server output as level 15 is the last limit of a stratum as per NTP standard. • The stratum of *mas*TER T-Sync MTS200L under Unlock conditions should be such that the last NTP client in the hierarchical arrangement should be at stratum level 15 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 *mas*TER T-Sync MTS200L is Lock after being power UP. If the *mas*TER T-Sync MTS200L 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(ETH0)**&**192.168.100.154(if ETH1 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 *mas*TER T-Sync MTS200L Unlock condition only. If *mas*TER T-Sync MTS200L NTP output stratum value is configured as 15, all NTP clients in the network will continue to ignore *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L is Lock after being power UP. If the *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L was Lock for once after being Power UP, *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L NTP Clock output accuracy during holdover conditions (when the device is Unlock as per ppm of internal clock crystal), etc.
- *mas*TER T-Sync MTS200L 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)

*mas*TER T-Sync MTS200L device is equipped with 2 Relay contact outputs for indication of POWER failure alarm,WATCHDOG alarm and and GPS LOCK status alarm on the back panel of the unit. Factory set configuration for relay contacts for all 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). The below table represents the relay contact status in various modes.

MODE	Contact on Terminal	POWER RELAY STATUS	CRARELAY STATUS	WATCHDOG RELAY STATUS	GPS LOCK RELAY STATUS
Unit Power OFF	**C-NO**	Contact Open	Contact Open	Contact Open	Contact Open
At Power ON	**C-NO**	Contact Close for individual Power Supply card.	Contact Close(If redundancy for clock card is available)	Contact Close only after 6 seconds once the time is displayed on unit Screen	Contact Close (if GPS is LOCK) **or** Contact Open (if GPS is UNLOCK)
Unit Healthy	**C-NO**	Contact Close for individual Power Supply card.	--	Contact Close	Contact Close (if GPS is LOCK)
GPS LOCK	**C-NO**		--	--	Contact Close Individual GPS LOCK relay output is also available with their respective clock card. C-NO-NC three relay terminal is available on an individual clock card
Clock Redundancy *	**C-NO**		Contact Close if Clock redundancy is available	--	--
Power Fail	**C-NO**		-		

Table 11.1 Relay Contact Status Chart during Operation

*Available in MTS200R and MTS300R

11.2 Pulse Outputs

11.2.1 1PPS Output

*mas*TER T-Sync MTS200L 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 Additional Event Outputs (Programmable Pulse Outputs)

*mas*TER T-Sync MTS200L 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 front panel. Please refer to section 9.2.5 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 *mas*TER T-Sync MTS200L can be configured remotely from a work station using the command-line interface (Telnet). Telnet configuration *mas*TER T-Sync MTS200L is password protected. *mas*TER T-Sync MTS200L model several parameters can configure using Telnet are shown in Table. To set up a Telnet connection please refers to Appendix. Model MTS200L 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.

Com-mand	Description	Reference
H	Command list supported by model MTS200L Model	Appendix E
CC	To view the Current Configuration of model MTS200L model.	
IP	Sets the network IP address, Ethernet port, of model MTS200L. 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 MTS200L. Factory set Value is: 255.255.255.0	
GTY	Sets the Network IP Gateway (factory set route address), Ethernet port, of model MTS200L. Factory set Value is: 192.168.100.254	
SIP1	Sets the IP address of SNMP manager which should receive any Trap messages generated by model MTS200L 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 MTS200L 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, factory set value is masibus. The input could be any ASCII string with 1-20 characters. For detail of Write Community refer to section 12.2.2	
STRT	Used to modify stratum of model MTS200L when it is not synchronized. The factory-set value is 1. For detail about stratum refer to section 11.3.2.	
U	Sets the User name Telnet session, current Ethernet port, of model MTS200L. Factory set Value is masibus (case sensitive).	Appendix E
P	Sets the Password Telnet session, current Ethernet port, of model MTS200L. 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 10.2.2.4	
Q	Quit the telnet configuration	

Table 12.1 Configurable Parameters through Telnet

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

	• NTP output stops during the Telnet session in progress. • Refer to Manual Appendix E for Procedure to Connect and Configure MTS200L 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, SNMPv2c, and SNMPv3 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.
*mas*TER T-Sync MTS200L device supports and operates as SNMPv1 / SNMPv2c agent, designed especially to handle SNMP requests for model MTS200L specific status information. *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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:

i) **GET-Request:** This PDU is used to get the values of a list of variables from a particular host.
ii) **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.
iii) **Set-Request:** This PDU is used to set the values of a list of variables for a particular host.
iv) **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:

*mas*TER T-Sync MTS200L model can work as SNMPv1 and SNMPv2c agent. SNMP Read and Write community used to monitor as well as configure SNMP parameters of model MTS200L model from some remote location. Read and Write community of model MTS200L agent is same for both SNMPv1 and SNMPv2c. model MTS200L model supports max 2 SNMP managers.

- **Read Community:** SNMP manager must know Read Community of model MTS200L agent to monitor model MTS200L from a remote location. MTS200L 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 MTS200L agent to configure SNMP parameters. MTS200L 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 MTS200L 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. •

*mas*TER T-Sync MTS200L 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:

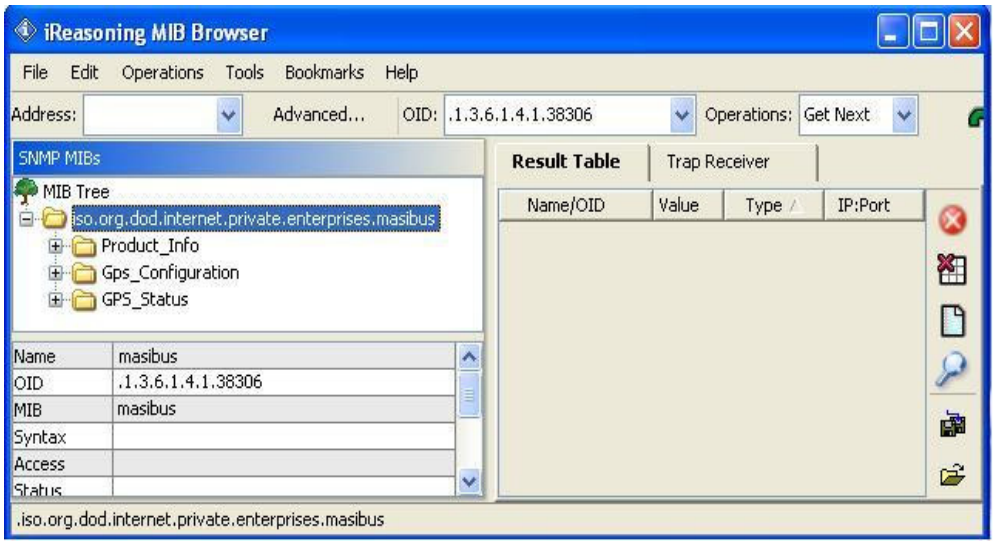
i) *mas*TER T-Sync MTS200L model MIB file must be present as well as included on the client software.

ii) Write community of the client software and *mas*TER T-Sync MTS200L model must be the same.

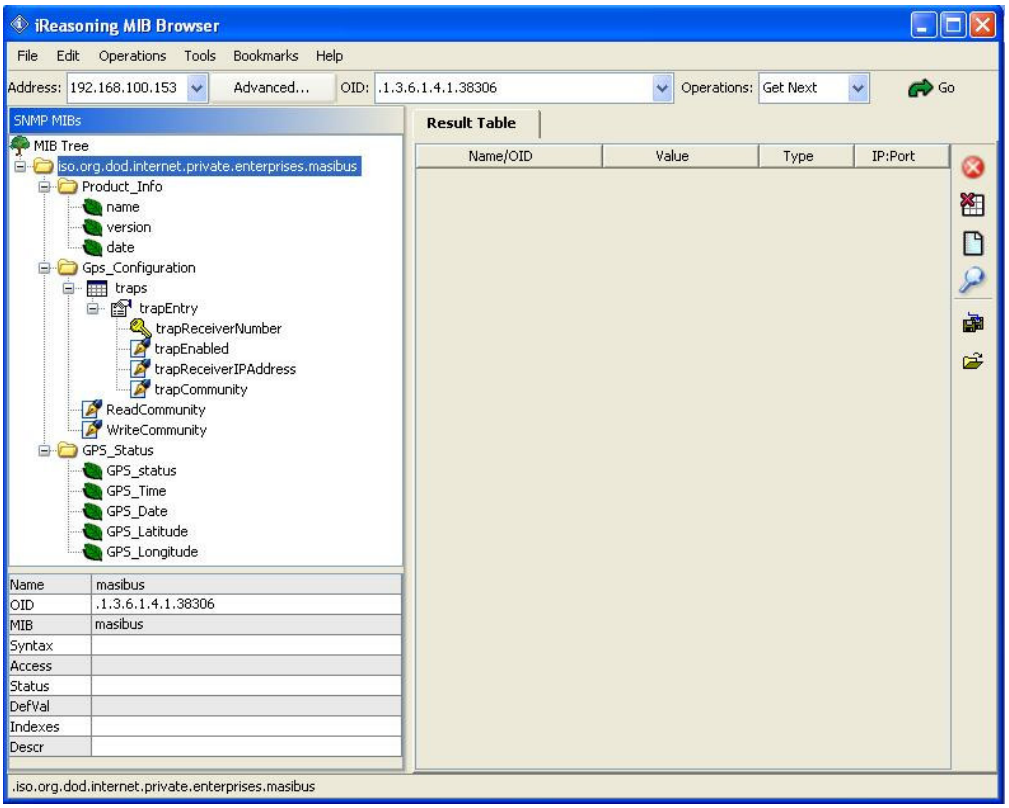
The mentioned MIB file can be found from the CD enclosed with the model MTS200L model or you can contact the masibus support team at support@masibus.com. For reference here, we have used the Ireasoning MIB browser. Below are the steps to configure model MTS200L using SNMP.

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.

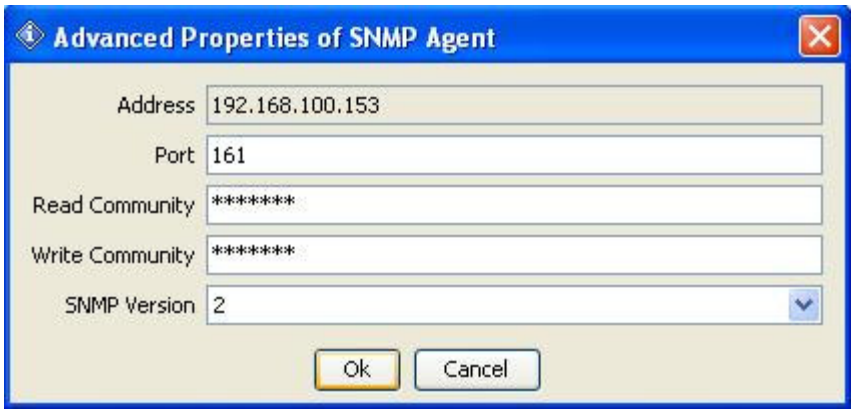


ii) Enter IP address of model MTS200L in address Tab:



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 & Write, 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 MTS200L 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 MTS200L Product information
masibus.2	GPS_Configuration 1.3.6.1.4.1.38306.2	String	Masibus model MTS200L SNMP configuration variable
masibus.3	GPS_Status 1.3.6.1.4.1.38306.3	String	Masibus model MTS200L 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

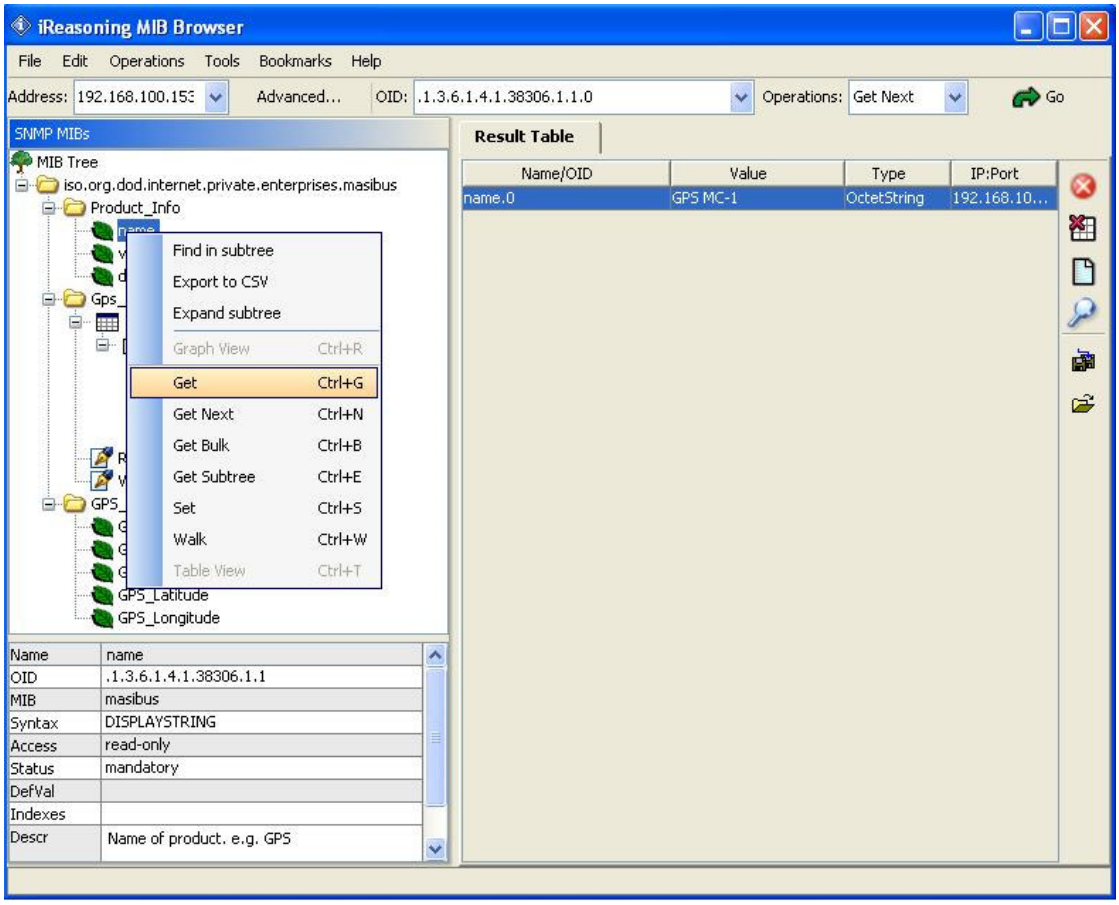
SNMP Object GPS_Configuration variables:

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 MTS200L 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 used to monitor status variables and configuration values.
GPS_Configuration	WriteCommunity 1.3.6.1.4.1.38306.2.3.0	String(R/W) (1 – 20 Characters)	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 MTS200L 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 MTS200L 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 MTS200L 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 MTS200L 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 MTS200L position longitude in xxxDyy.yyyyE/W format

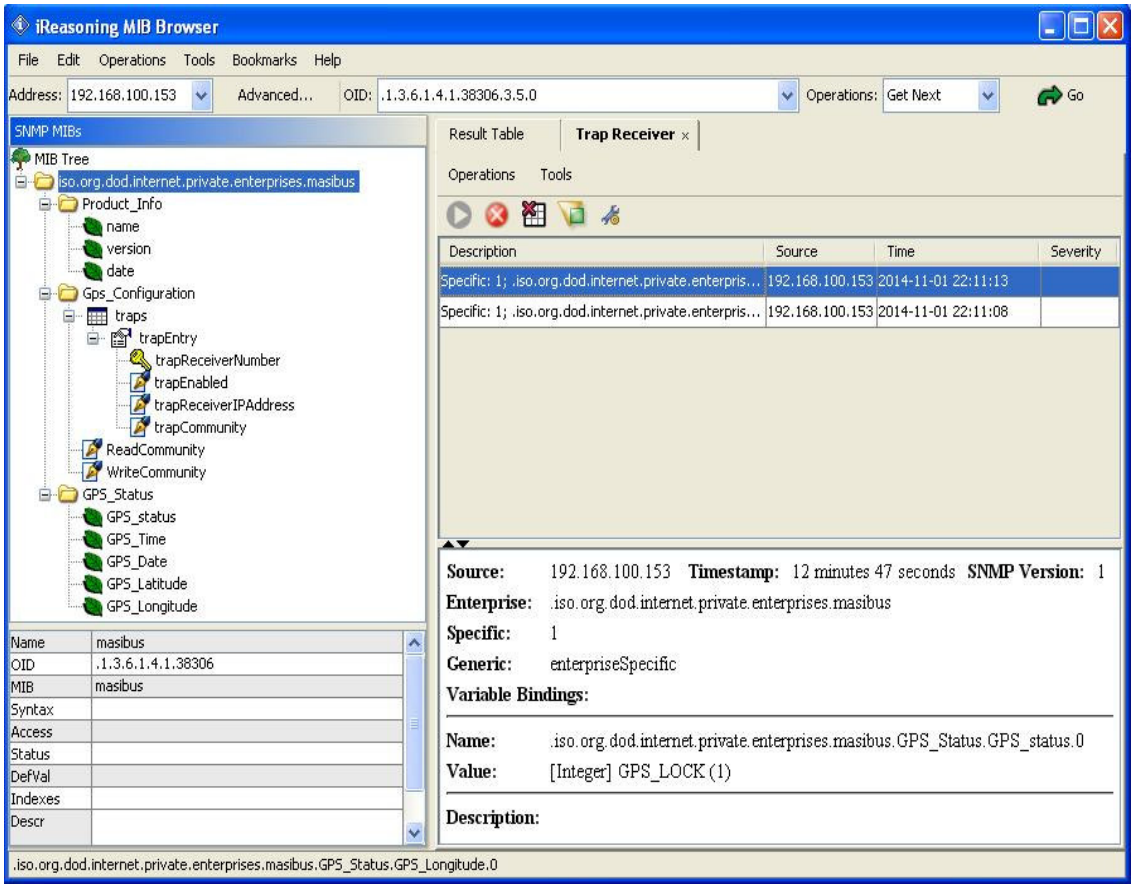
v) Get / Get Next / Get Bulk / Set / Walk Command:



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:

MTS200L can send SNMP traps a maximum of up to two SNMP managers if configured. Available traps in model MTS200L 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 MTS200L agent enabled to generate traps for SNMP Managers.
GPS Status: When the MTS200L model gets synchronized or unsynchronized SNMP trap receiver will receive the trap, where value 1 indicates model MTS200L synchronized and 0 indicates not synchronized.



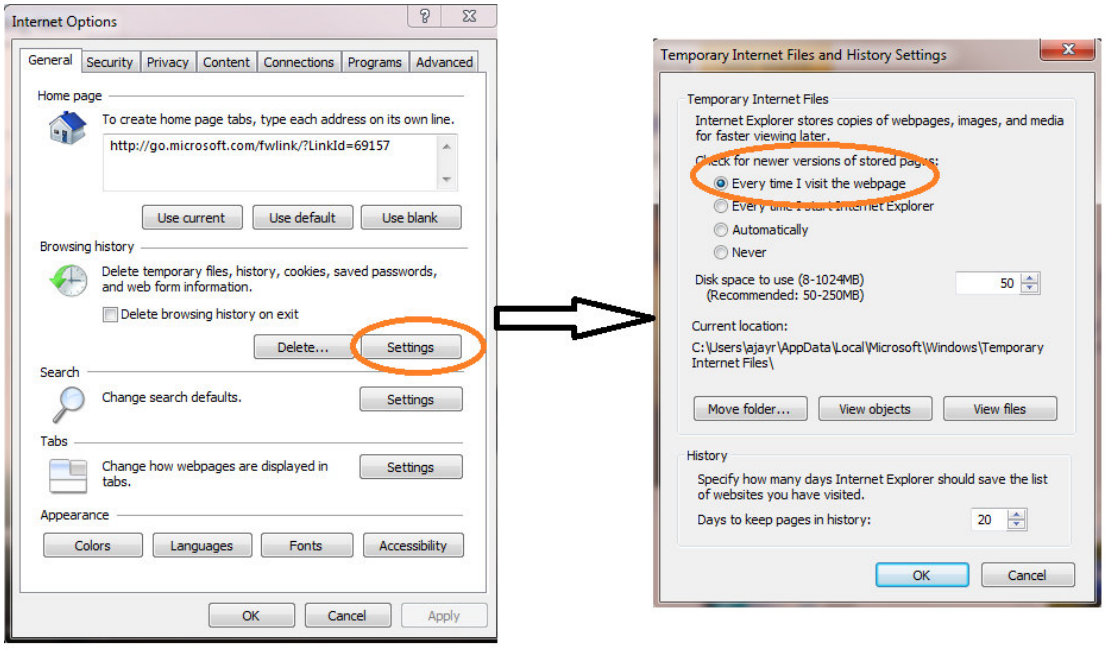
	• SNMP manager's IP address must be configured to receive asynchronous traps. • Please note that a particular trap will only be sent if that parameter is configured for the trap by Trap enabled option through SNMP.

12.3 Webserver

User/Operator need to carefully read and apply applicable notes before using the MTS200L webserver.

Note:
1. MTS200L 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 MTS200L web-server. Use shortcut “Ctrl + F5” instead of other ways to refresh the webpage.

3. It is recommended to clear cache and cookies before starting the MTS200L webserver.
4. It is recommended to clear cookies and cache files from the web browser after power-on of the MTS200L unit. This will avoid any user conflict with old caches files of the MTS200L device in web-browser with currentMTS200L 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 MTS200L 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
MTS200L: http://192.168.100.153 on IPv4

Once, the user gives the above address in web browser software, the login page of the MTS200L page will open as shown below.

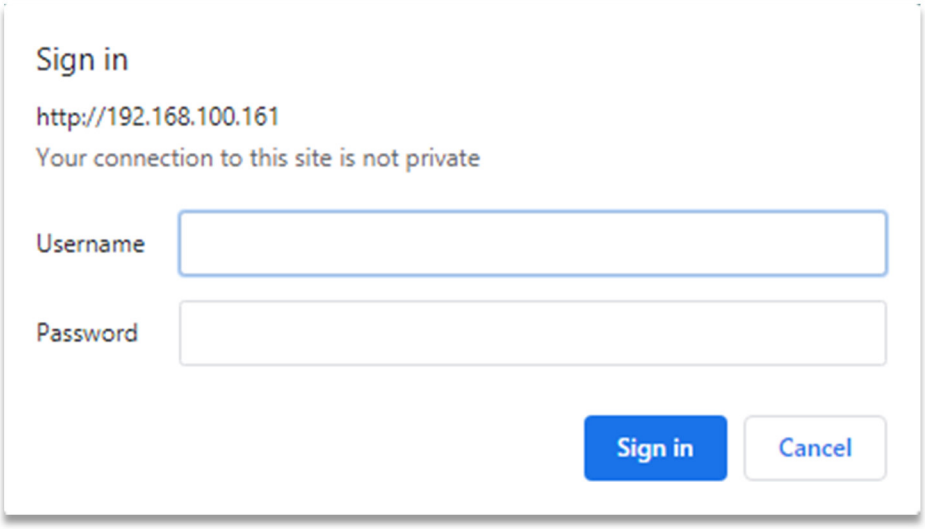


Figure 12-1 MTS200L Web server login

Users need to enter the username and password on the login page to gain access to other web pages of MTS200L.

➢ "Home" Webpage:

Once the user login in webserver, the MTS200L home web page will be displayed as below:

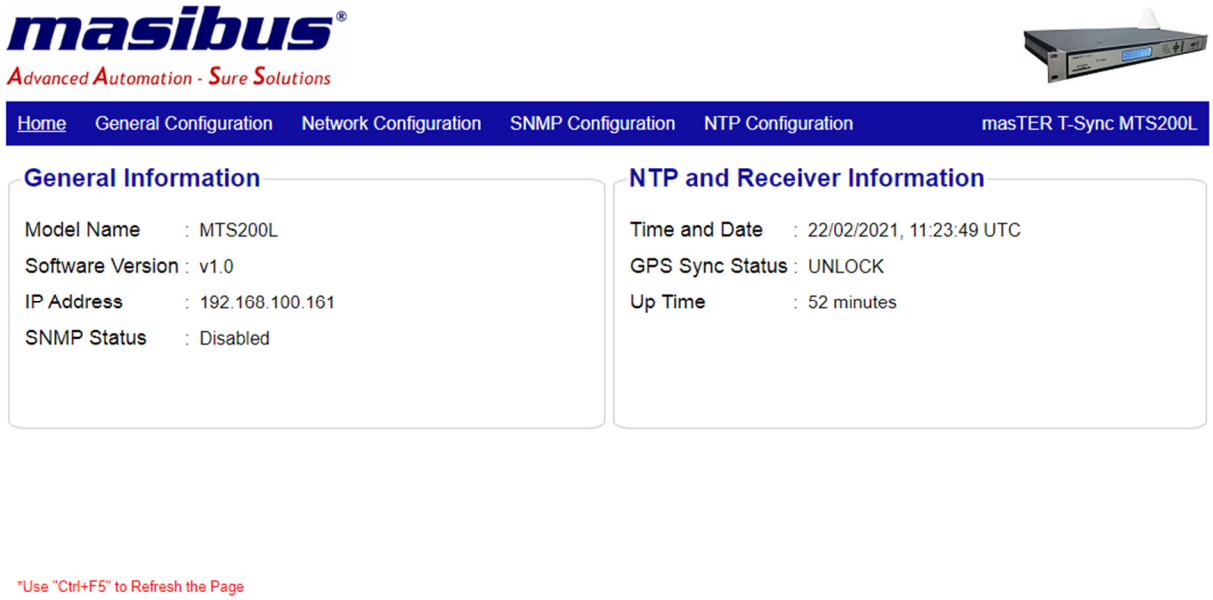


Figure 12-2 MTS200L Web server home page

Tabs shown in the menu bar have a link to the Home page, General Configuration, Network Configurations, SNMP configurations, and NTP 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

MTS200L 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 MTS200L.
Uptime – This represents the duration since the device is powered up.

➢ “General Configuration” Webpage:

For MTS200L General Settings, the user needs to navigate and select the “General Configurations” option in the menu bar. After, selecting the below webpage will be displayed.

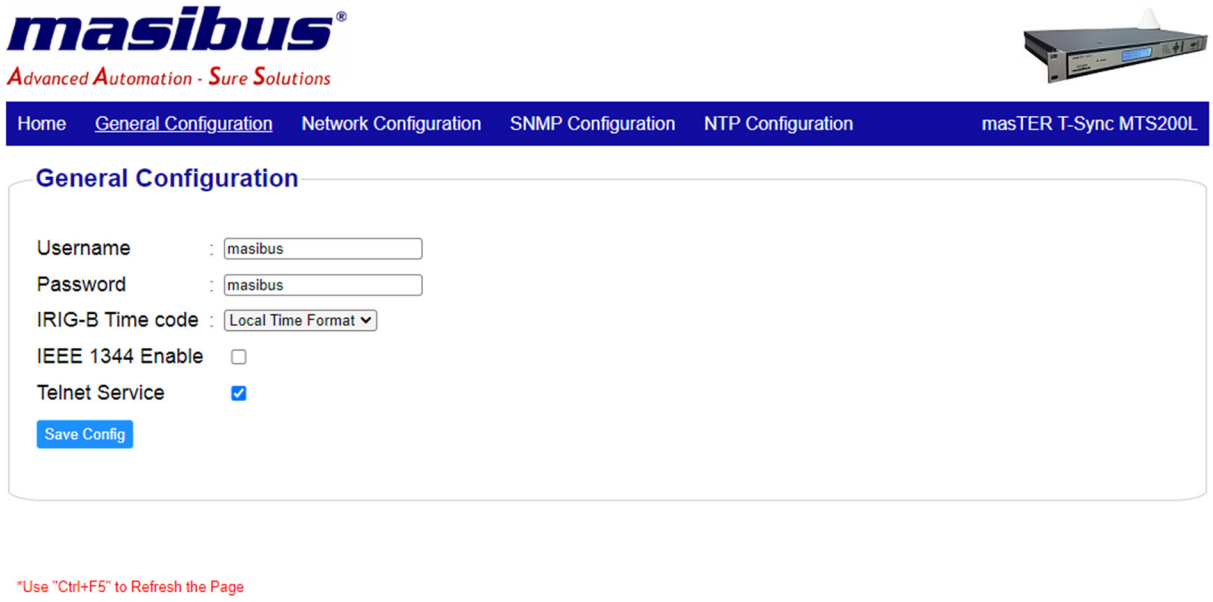


Figure 12-3 MTS200L Web server general configuration page

For web application and telnet session, Username, Password, IRIG-B Time code, IEEE 1344 Standard Enable, Start/Stop telnet services.
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 *mas*TER T-Sync MTS200L.

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

➢ “Network Configuration” Webpage:

For MTS200L 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.

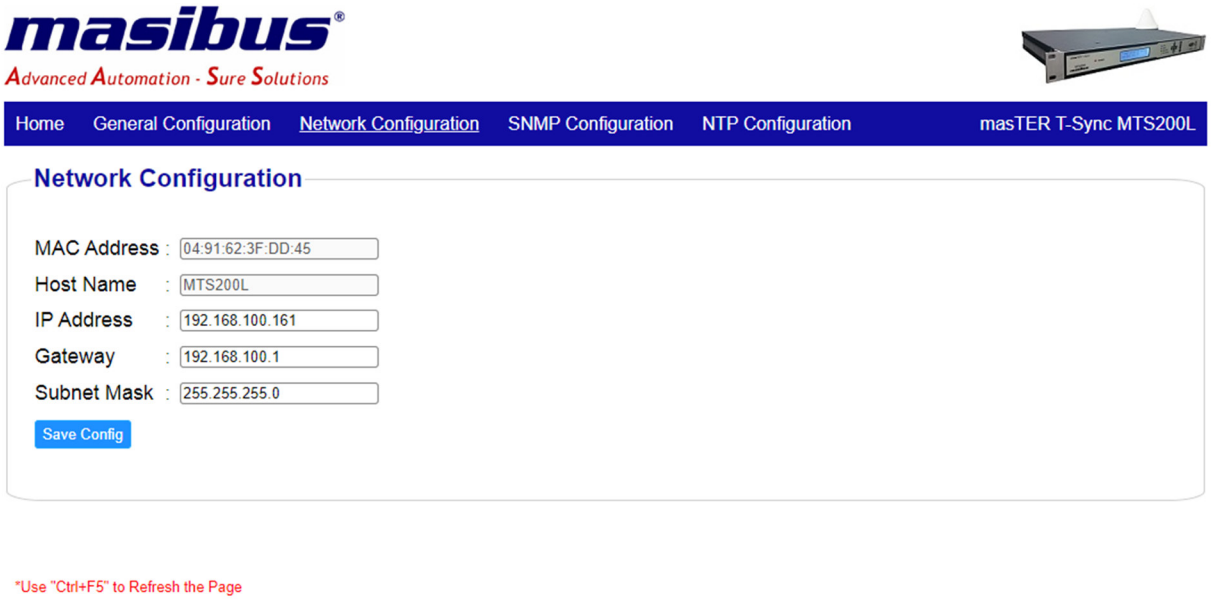


Figure 12-4 MTS200L Web server network configuration page

For the Ethernet interface, IP address, Subnet Mask, the gateway can be configured in IPv4 format.

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 *mas*TER T-Sync MTS200L.

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 MTS200L 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.

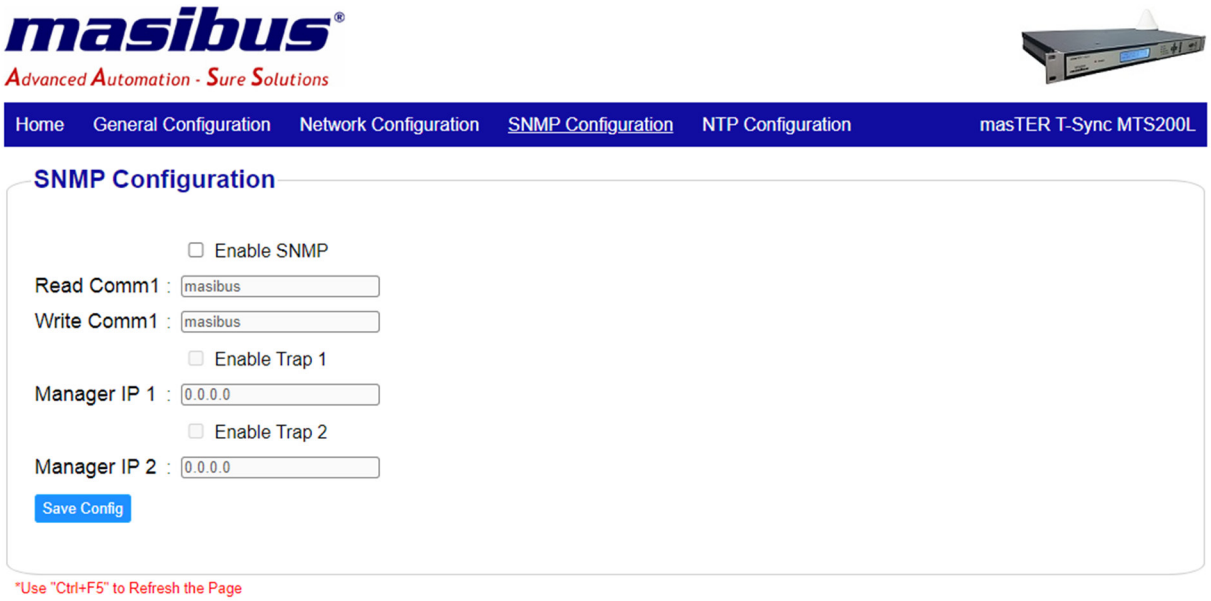


Figure 12-5 MTS200L Web server SNMP configuration page

SNMP service, Read community, write community, Manager IP 1 and Manager IP 2 can be configured using a Web application.

MTS200L 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 *mas*TER T-Sync MTS200L.

For a detailed understanding of each parameter refer to section 13.2.

➢ “NTP Configuration” Webpage:

For MTS200L 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 MTS200L NTP Service, local clock stratum, symmetric authentication key ID and Key string can be configured in the webserver.

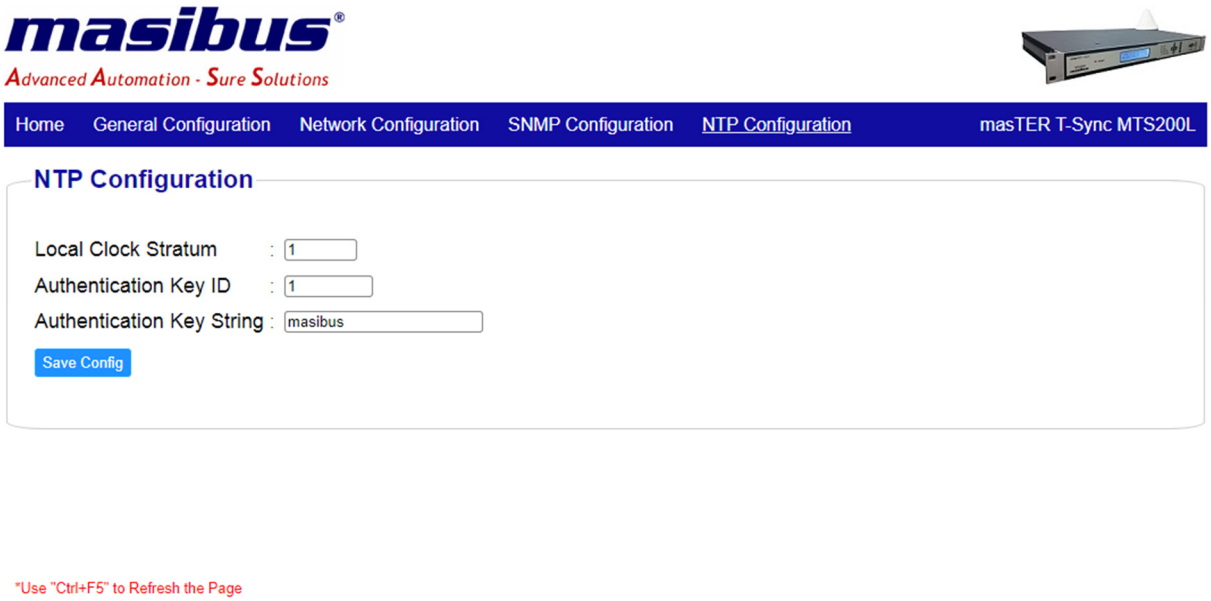


Figure 12-6 MTS200L Web server NTP configuration page

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 *mas*TER T-Sync MTS200L.

Detailed explanation mention in section 11.3. Refer to it for more understanding of all parameters.

13. Holdover Mode

If *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L, at Power ON conditions in unlocking conditions; all outputs of *mas*TER T-Sync MTS200L device will have factory-set time value and not the correct time. Once the *mas*TER T-Sync MTS200L device gets locked, all outputs will get proper time data.

*mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L unit gets a power reboot while the unit was in Unlock condition. *mas*TER T-Sync MTS200L outputs will regain their accuracy only when the unit gets in lock condition once after Power ON.

14. Options

*mas*TER T-Sync MTS200L model can be configured for Optional Power Supply.

14.1 Optional Input Power Supply

*mas*TER T-Sync MTS200L 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 – 36 V_{DC}
		36 – 72 V_{DC}
Power Consumption	:	< 15 W (Typical)

Fuse

Current Rating	:	1 Ampere
Voltage Rating	:	250 Volt

NOTE: This power consumption is for MTS200L without optional output.

15. Appendix List

Below is the list of *mas*TER T-Sync MTS200L supported manuals.
Appendix C – Procedure to configure Windows / Linux PC as NTP Client
Appendix D – Procedure to configure Unix PC as NTP Client
Appendix E – Procedure to configure PC as Telnet Client for GPS Telnet communication
Appendix F – Masibus NTP Utility 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 Wrong time at Unit Power ON

If the unit was kept in Power OFF conditions for more than 15 days, as mentioned in section 8.2, 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 8.2, for full charging of the internal battery. Full charging is necessary to avoid the possibility of wrong time output at unit Power ON.

16.3 *mas*TER T-Sync MTS200L display time not as per Local time

If *mas*TER T-Sync MTS200L 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 10.2.3 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 9) or serial communication (parameter: SU2 as per section 10.2.3).

16.4 Cannot establish Serial communication with rear RS232/RS485 Terminal

RS-232 cable used for serial communication with front 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 *mas*TER T-Sync MTS200L unit should comply with serial frame format as per table11.1.

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

Refer to troubleshoot index 16.4.

16.6 Cannot establish Serial communication with front Terminal

RS-232 cable used for serial communication with front terminal should be cross cable as per section 10.1.
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 9). It is necessary to match the end device serial communication parameters as configured in *mas*TER T-Sync MTS200L unit.

16.7 Not able to do the configuration through front terminal

Refer to troubleshoot index 16.6.

To configure *mas*TER T-Sync MTS200L unit through the serial configuration Terminal, it is necessary to enter the correct password (when asked for, refer to section 10.2.1.) 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.

16.8 Problem with getting unit LOCK to GPS satellites

1) It is always recommended to use factory provided antenna cable shipped with *mas*TER T-Sync MTS200L unit. If the antenna cable used for installation is other than provided with *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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.

16.9 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 *mas*TER T-Sync MTS200L should be determined considering the maximum electrical load capacity as specified in *mas*TER T-Sync MTS200L specification. Refer to product specifications and section 11.2.3.7 for further details.

16.10 No response to Ping Command

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

1) *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L Ethernet port to end device and configuration of intermediate Ethernet switches and gateways. *mas*TER T-Sync MTS200L 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 *mas*TER T-Sync MTS200L 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.

16.11 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 *mas*TER T-Sync MTS200L device is allowed.
4) It is necessary to exit the telnet communication after doing necessary Ethernet settings failing of which, *mas*TER T-Sync MTS200L will not allow reconnecting with telnet session on same IP address. Please refer to section 13.1 &manual Appendix E for telnet session and configuration.

16.12 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 or Unix based or Linux based, please refer to manual Appendix C for proper configuration and time synchronization method of the client device.
6) Please refer to section 11.3.3. and manual Appendix C for understanding the NTP client time synchronization method.

16.13 Loss of time synchronization by NTP Client during GPS Unlock

If the NTP client loses time synchronization when *mas*TER T-Sync MTS200L is in Unlock condition and resume when *mas*TER T-Sync MTS200L comes in LOCK condition, check the configured NTP stratum value in the *mas*TER T-Sync MTS200L device. It should be less than 15 or an applicable value depending on NTP hierarchical architecture arrangement as explained in section 11.3.3 and section 11.3.4.

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

When *mas*TER T-Sync MTS200L comes in UNLOCK condition from LOCK condition during normal operation, the unit enters in holdover mode. Refer to section 14 for a technical explanation of the holdover mode.

16.15 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 to manual Appendix E for the procedure for telnet connection with GPS Ethernet port.

16.16 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 MTS200L agent should be the same provided at the time of commissioning.
5) Read or Write Community of SNMP manager and model MTS200L agent should be same.

16.17 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 MTS200L agent.
5) Trap enable variable should be enabled.

16.18 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 MTS200L agent should be the same provided at the time of commissioning.
5) Write Community of SNMP manager and model MTS200L agent should be same.

- In a web application of MTS200L, 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. 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
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