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User's Manual

MC-2
Wireless GPS Master Clock

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1. INTRODUCTION

Foreword

Thank you for purchasing Wireless master clock.
MC-2 (Wireless master clock, 0.56" [14 mm], 6 Digit LED Display)

This manual describes the basic functions and operation methods. Please read through this user's manual carefully before using the product.

Notice

The contents of this manual are subject to change without notice as a result of continuous improvements to the instrument's performance and functions.

Every effort has been made to ensure accuracy in the preparation of this manual. Should any errors or omissions come to your attention, however, please inform MASIBUS Sales office or sales representative. Under no circumstances may the contents of this manual, in part or in whole, be transcribed or copied without our permission.

RF and Serial Communication related information will be applicable as per ordering code.
If RF based unit is selected then ignore Serial communication information and if Serial communication based unit is selected then ignore RF related information.

Trademarks

Our product names or brand names mentioned in this manual are the trademarks or registered trademarks of Masibus Automation and Instrumentation (P) Ltd. (herein after referred to as **masibus**).

Adobe, Acrobat, and Postscript are either registered trademarks or trademarks of Adobe Systems Incorporated. All other product names mentioned in this user's manual are trademarks or registered trademarks of their respective companies.

Checking the Contents of the Package

Unpack the box and check the contents before using the product. If the product is different from which you have ordered, if any parts or accessories are missing, or if the product appears to be damaged, contact your sales representative.

List of Accessories

The product is provided with the following accessories according to the model and suffix codes (see the table below). Check that none of them are missing or damaged.

Table 1 List of Accessories

No	Item name	Part number	Qty	Remarks
1	Operational Manual	M05aom101	1	
2	RF-Antenna		1	
3	GPS-Receiver Antenna with 5 meter long RG 174 Cable		1	
4	Wall mounting clamps		2	For Wall mounting option

Accessories (For Wall mount unit)
Wall mount clamp
mLP/mech/501

Product Ordering Code

Table 2Product Ordering Code

Ordering Code MC-2						
Model	**Mounting**		**Output Type 1**		**Output Type 2**	
MC-2	**X**		**X**		**X**	
	W	Wall (IP 20)	N	None	N	None
	T	Table Top	1	Wireless(RF)	1	RS 232
					2	RS 485

Note: For FLP Enclosure in MC-2 contact factory.

Safety Precautions

The product and the instruction manual describe important information to prevent possible harm to users and damage to the property and to use the product safely.

Understand the following description (signs and symbols), read the text and observe descriptions.

DESCRIPTION OF SIGNS

⚠ WARNING	***This indicates a danger that may result in death or serious injury if not avoided.***
⚠ CAUTION	***This indicates a danger that may result in minor or moderate injury or only a physical damage if not avoided.***

2. SPECIFICATIONS

2.1 Technical Specification Sheet

Specifications	Time/Date Display
Display	
No of Digit	Six
Digit Height	**0.56"(14mm)**
Type of display	LED Type
Display Colors	**Red**
Display Format	**Time: HH:MM:SS Date: DD.MM.YY/ MM.DD.YY/ YY.MM.DD**
12/24 Hour Mode	✓
AM/PM Indication	✓
International Time Zone	✓
User Interface	
Push Button Switch (For Configuration)	✓
Password Protected	✓
Serial Communication	**RS232/RS485**
Protocols	NMEA-0183[RMC] / NGTS/ T – Format
Baud Rate	4800/9600/19200/38400
Terminal	4 pin, Plug-in type Connector, **Wire**: 2.5mm2
RF Wireless Communication	
Wireless frequency	866 MHz
Antenna	3 dbi Rubber-duck External Antenna
Receiver Sensitivity	-120 dBm
Transmitter Power	+30 dBm
Distance Range(Approx.)	600m Line of site; 100m with obstacles

Specifications	Time/Date Display
Mechanical	
Enclosure Protection	IP20
Size [W x H x D]	160 x 80 x 55
Weight(approx.)	0.4Kg
Material	ABS
Mounting	Wall Mount/ Table Top
Power Supply	
Power	AC: 85-265 V, 50/60 Hz, 1Ph & DC: 100-300 V
Power Consumption	<2W
Terminals	3 Pin plug-in type Connector[Cable Size:2.5 sq.mm]
Environmental	
Operating temperature	0 °C to +55 °C
Storage temperature	-20 °C to +80 °C
Humidity	20-90 % RH (Non-condensing)
GPS Receiver [MC-2]	
Timing Accuracy	< 15 ns with GPS Receiver (Receiver is locked on fixed position)
Positioning Accuracy	< 10m
Input Frequency	1575.42 MHz L1 C/A code
Tracking	12 parallel channels
Acquisition Time	Hot Start < 5 sec Warm Start < 38 sec Cold Start < 45 sec
GPS Antenna [MC-2]	
Type	Active L1. GPS, 28 dB gain
Antenna Cable	RG174
Operating Temperature	-40 to +85 °C
Coverage	360°COmni-directional
Ingress Protection	IP67
Weight	<60 g

Isolation (Withstanding 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

** Primary terminals indicate power terminals*

*** Secondary terminals indicate RS232/485.*

Insulation resistance: 20MΩ or more @ 500 V DC between power terminals and grounding terminal

3. FRONT PICTURE

3.1 MC-2 IP20 Front views:

Figure 1 Front View

4. INSTALLATION& MOUNTING DETAIL

4.1 Safety Precautions in Installation

WARNING

1. To minimize the possibility of fire or shock hazards, do not expose this instrument to rain or excessive moisture.
2. 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

Ground the device. Otherwise, it may cause an electric shock or fire.
The protective conductor terminal is marked with a label on the product terminals with the following symbol:

Also insure that Earth Ground of the premises has been done properly.

CAUTION

Be sure all personnel involved in installation, servicing, and programming are qualified and familiar with electrical equipment and their ratings
Do not install, store, or use it in the place with a lot of dust, corrosive and flammable gases, vibrations and shocks exceeding the allowed values, place low or high temperature outside of the installation condition, direct sunlight and near equipment generating strong radio waves or magnetic fields, It may cause accidents.

3. This equipment can be damaged if incorrect power source voltage is applied. This equipment can be damaged if power source is applied with incorrect polarity on its respective terminal. Never plug unit power supply connector or power supply cables in terminal while main power source is ON.

WARNING

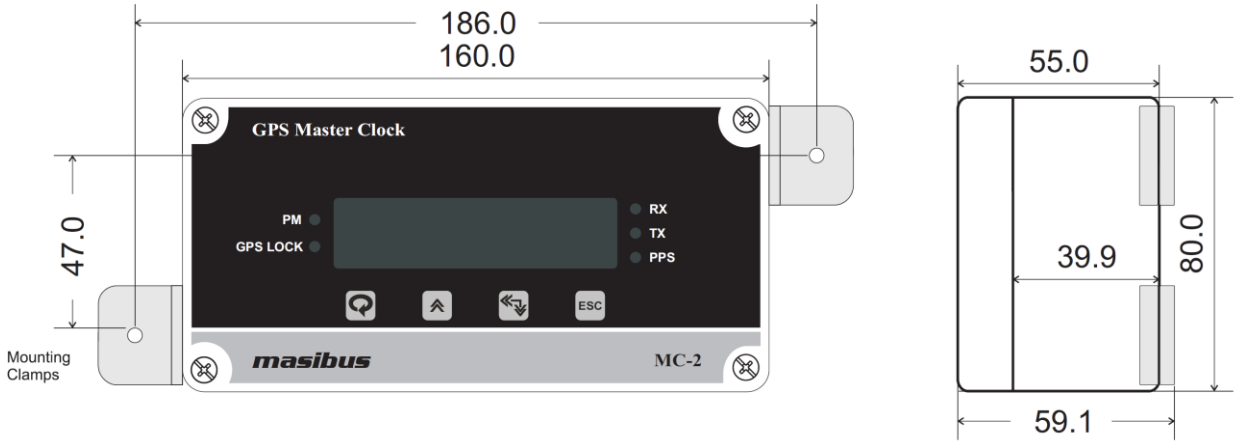
4.2 MC-2 and Receiver Antenna mounting

- As Shown in image of GPS-MC-2 will dispatched with magnetic antenna with 5 meter long RG 174 cable.
- Mount antenna away from RF-reflective surfaces that cause multipath interference.
- User must mount the antenna at least 1 meter away from and above the reflecting surface and from where less antenna access less obstacles in path with sky.
- Same way mount MC-2 unit with at enough height so long range can be achieved between master and slave.

4.3 Wall Mount

- For Wall mounting, there are two clamps as shown in below drawing in Back side of Main Box.

Figure 2 Wall Mounting detail for [160mm x 80mm x 55mm] Enclosure

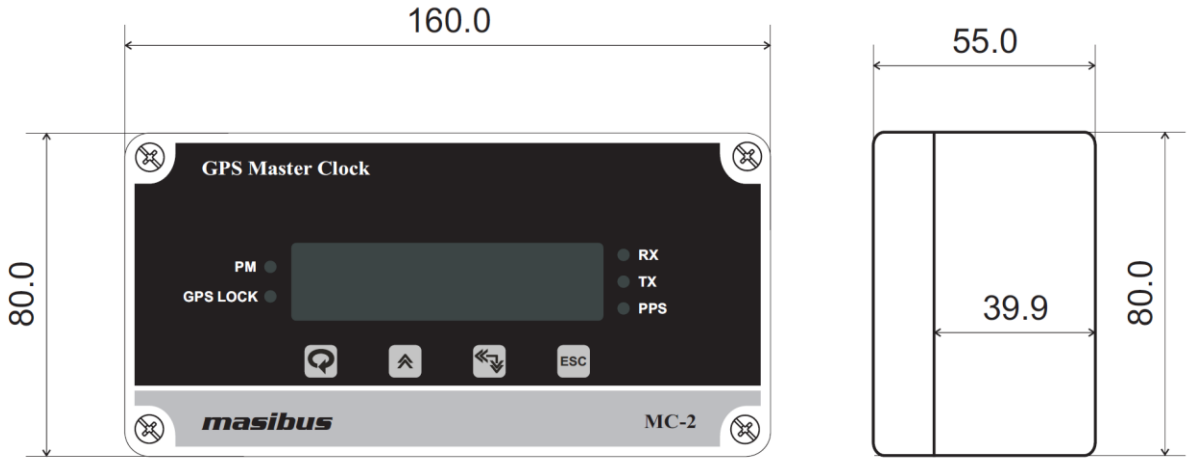


Note: - Wall Mounting drills are 5mm Dia.

4.4 Table Top

- As Shown in below figure is table top unit, there are two terminal connector one for power and one for serial communication is on back side of enclosure.
- Table top unit, bottom surface dimension is 160 X 55 mm. There are no other external accessories required for table top unit.

Figure 3 Table Top Mounting detail for [160mm x 80mm x 55mm] Enclosure



5. TERMINAL CONNECTIONS

5.1 Terminal connections on MC-2 Enclosures

5.1.1 Terminal connection for Wall Mount

Figure 4 Connection on Terminal plate of MC-2 Wall Mount

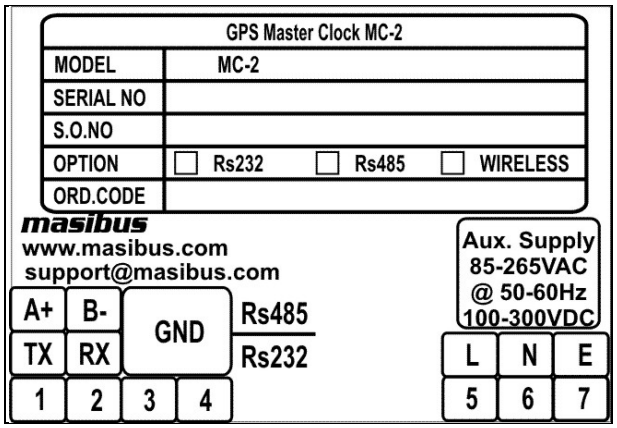


Table 3 Terminal Connection Detail of Wall Mount Unit

No.	Terminal Type		Description	
1	**MSTB Conn. 4 pin for RS232 or RS485**		RS232 or RS485 serial data input	
			For RS232 (1) - TX (2) - RX (3) - GND (4) - GND	For RS485 (1) - A+ (2) - B- (3) - GND (4) - GND
2	**MSTB Conn. 3 pin for Aux. PWR.**		(5) - L (6) - N (7) - Earth	

5.1.2 Terminal connection for Table Top

Figure 5 Connection on Terminal plate of MC-2 Table Top

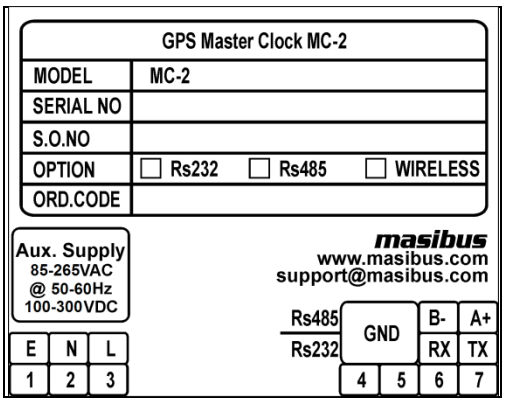


Table 4 Terminal Connection Detail of Table Top Unit

No.	Terminal Type		Description	
1	**MSTB Conn. 4 pin for RS232 or RS485**		RS232 or RS485 serial data input	
			For RS232 (7) - TX (6) - RX (5) - GND (4) - GND	For RS485 (7) - A+ (6) - B- (5) - GND (4) - GND
2	**MSTB Conn. 3 pin for Aux. PWR.**		(3) - L (2) - N (1) - Earth	

5.2 How to connect wires

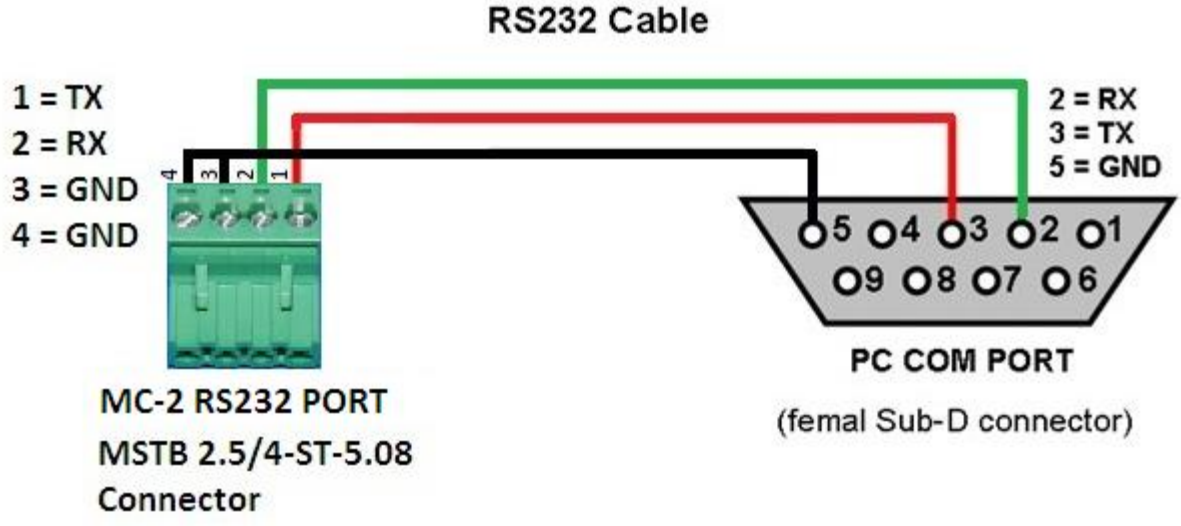
Before carrying out wiring, turn off the power and check that the cables to be connected are not alive because there is a possibility of electric shock.

WARNING

NOTE:

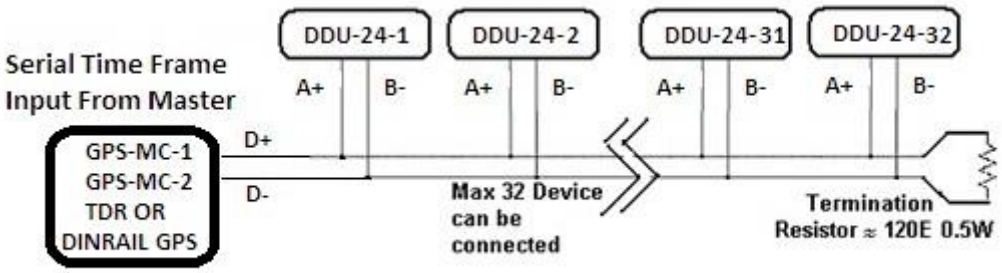
- ✓ All wiring must confirm to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for Voltage, Current and temperature rating of the system.
- ✓ Provide power from a single-phase instrument power supply. If there is a lot of noise in the power line, insert an insulating transformer into the primary side of the line and use a line filter on the secondary side. Do not place the primary and secondary power cables close to each other.
- ✓ Use repeater after each set of 32 instruments connected in RS-485 Communication.
- ✓ Unused terminals should not be used as jumper points as they may be internally connected, which may cause damage to the unit.
- ✓ Use >250V-1Amp Cable for Power Supply.
- ✓ Supply voltage must be below maximum voltage rating specified on the label.

Figure 6 MC-2 Connection Details



Note: Terminal connection for RS232 will change in case of table top and in wall mount unit, for connection follow terminal connection.

Figure 7 RS485 Connection Details



- ✓ In case of RS-232 Output base master unit, external RS-232 to RS-485 Connector required, and it will be connected direct in case of RS-485 output from Master.

6. CONFIGURATION GUIDELINES

6.1 Default Configuration

- A MC-2 ships from the factory with following configuration.
  - Display Type : Time Display
  - Time Format : Hour Time Format 24
  - Date Format : DD.MM.YY
  - E-OFFSET : YES
  - Time Zone Offset : 05:30

  Applicable for Serial Input Model:
    - Baud Rate : 9600
    - Stop Bit : 1
    - Parity Bit : None
    - Frame : NMEA
  - Password : 0001
  - GPS Unlock Time Out : YES
  - Unlock Blink : BL.COLON[unlock Blink Colon and DP]

  Applicable for Wireless Input Model:
    - RFM Transmit Channel : 0

Note:

1. Fundamental operation mode (Display Settings) will come in affect immediately of SW change. Action of CONFIG can be switched during clock operation. No power on/off cycle is required to change these modes.
2. GPS Unlock Time Out value when set YES it's by default value is 60.
3. You can set blink option such as colon and DP or Whole display in unlock Blink configuration for status shows in case of Loss of Synchronization. By default it is colon and DP blink in Time and Date

6.2 Key Configuration:

MC-2 offers facility to the users for configuring communication parameters of serial port, Display Format Selection, Time Zone Selection, Manual Time Set, Set Default Parameter and View Current Settings by Key Configuration.

- The communication parameters include baud rate, number of stop bits and parity.
- User Can Set Manual Time in unlock condition.
- The user is free to choose Time Display, Date Display and Both in Alternate Time/Date Display.
- User can set 12 hour or 24 hour format using key configuration.
- User can set any Standard Time Zone Offset.
- The user can enter the time offset of the time zone, where the unit is to be installed.
- Users can set Default all Configuration Parameter and View Current Configuration Parameter using Key Configuration.
- User can set propagation delay using key configuration.
- User can set transmit channel using key configuration.
- User can set GPS Unlock Time out using key configuration
- User can set Unlock Blink option for Blinking Colon or Whole display in case of Loss of Synchronization
- The Parameter of Master or Slave Can be updated by sending Configuration Frame on serial port using mTime sync Utility. This software can be downloaded from our website.

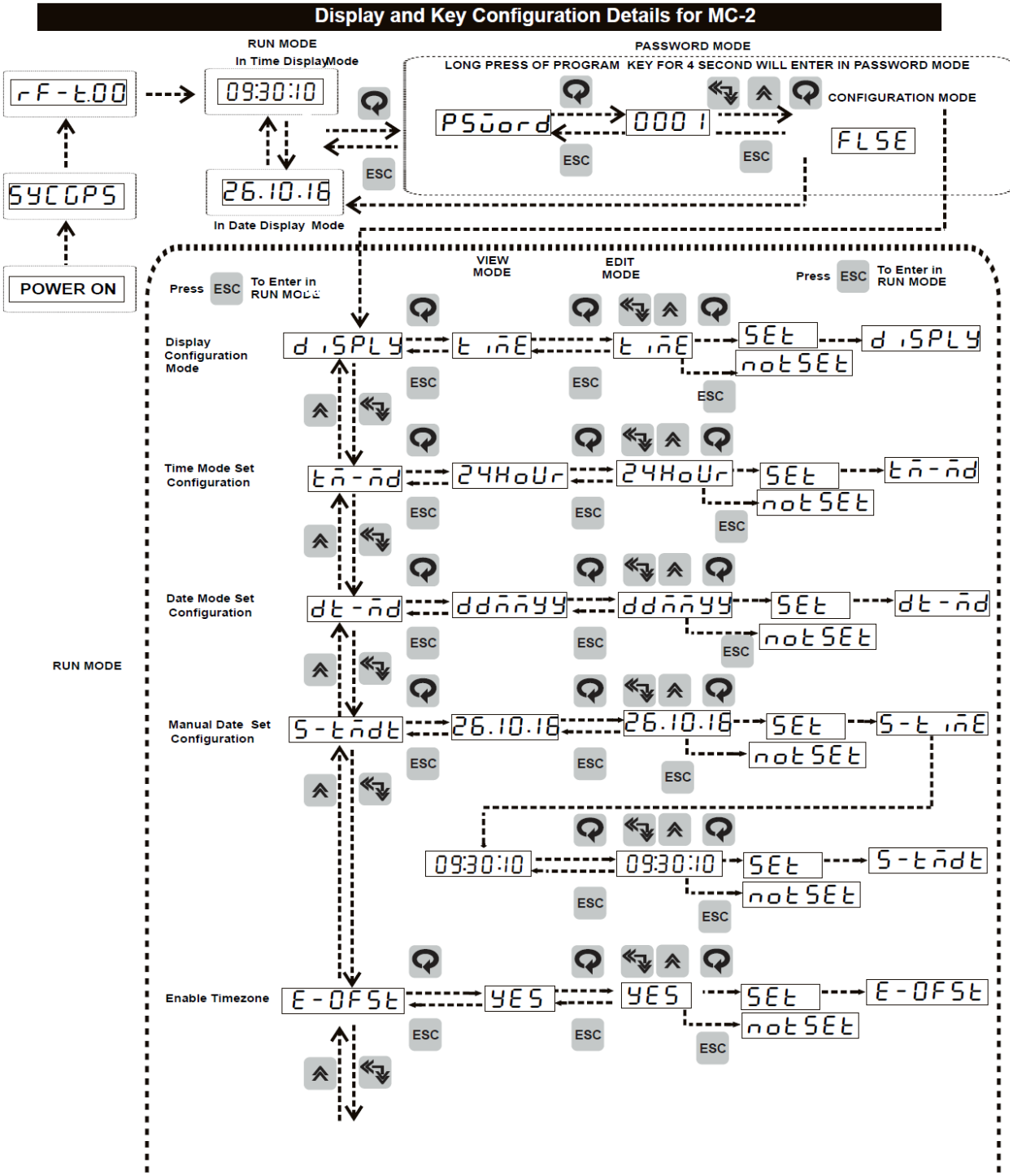
6.2.1 Run Mode

- In run mode MC-2 will display Time or Date as per set parameter in Run mode.

6.2.2 Password Mode (PSWoRD):

- To enter in Password mode long press Enter key for 4 Seconds, it will show **PSWorD** in Display. Enter Password using UP, Shift and Enter Keys, MC-2 will enter in Configuration mode and Display **DISPly** on Display.
- RF transmits channel show in display at power on then after it started in run mode.

Figure 8 Display and Key Configuration Details



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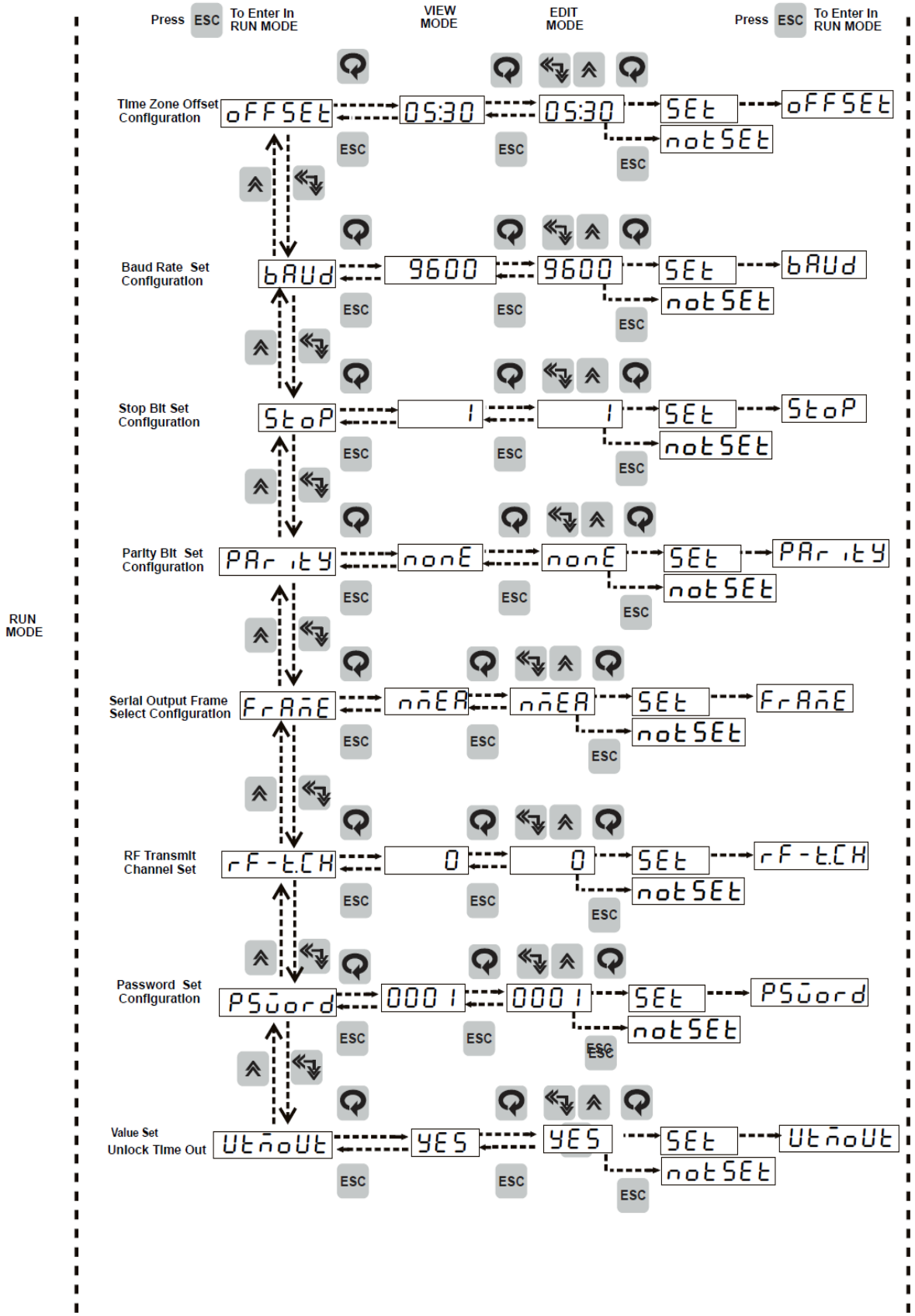


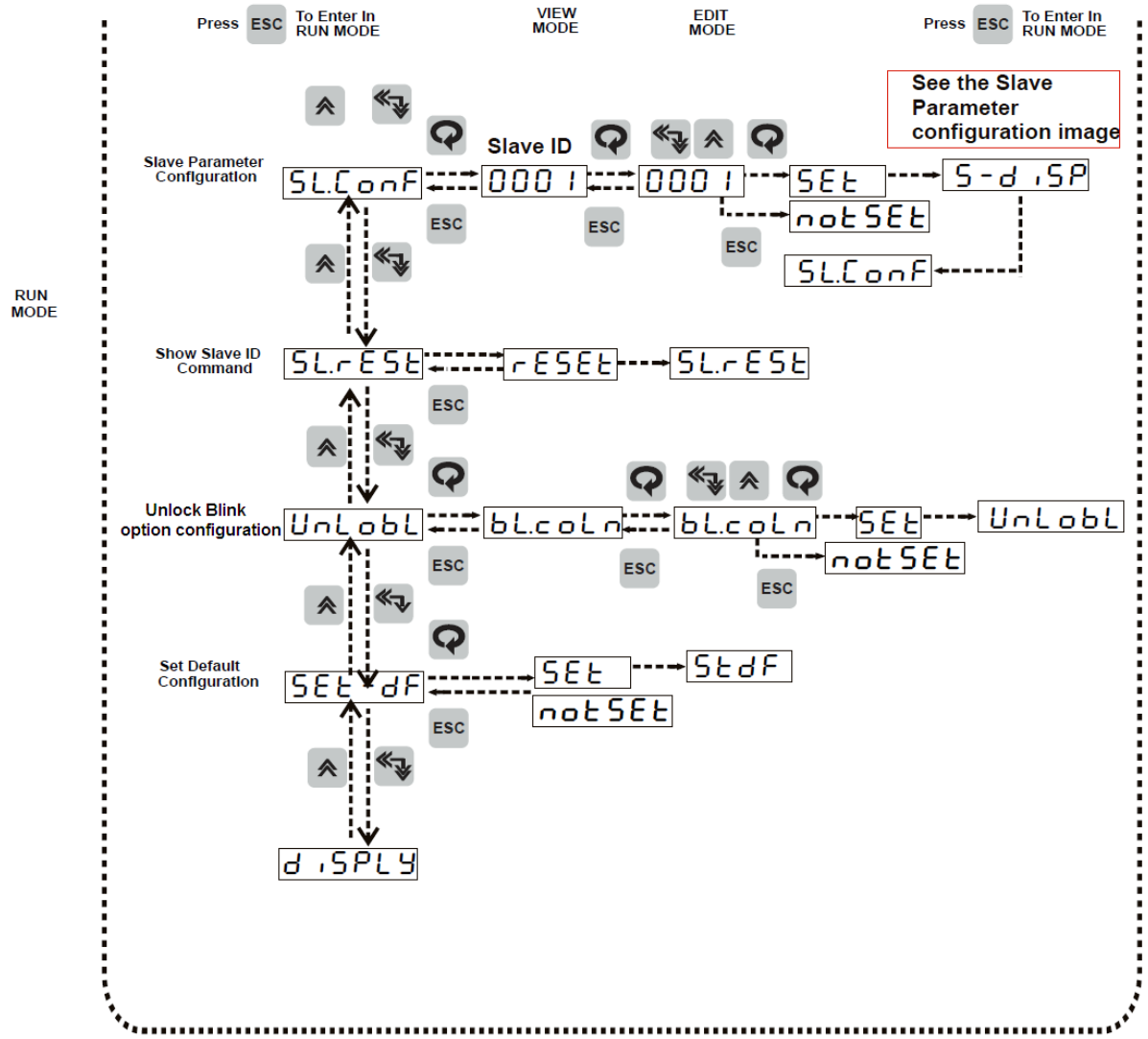
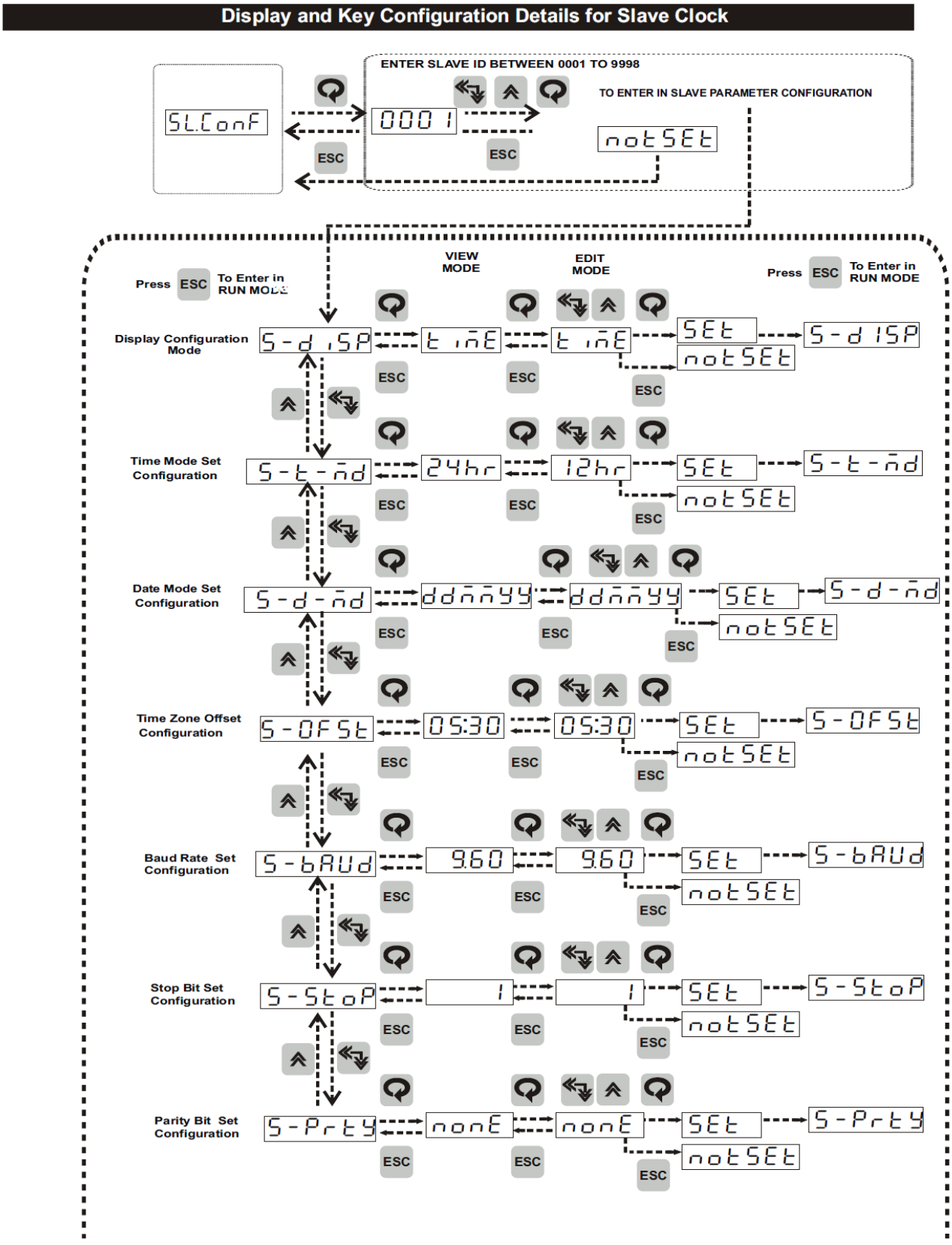
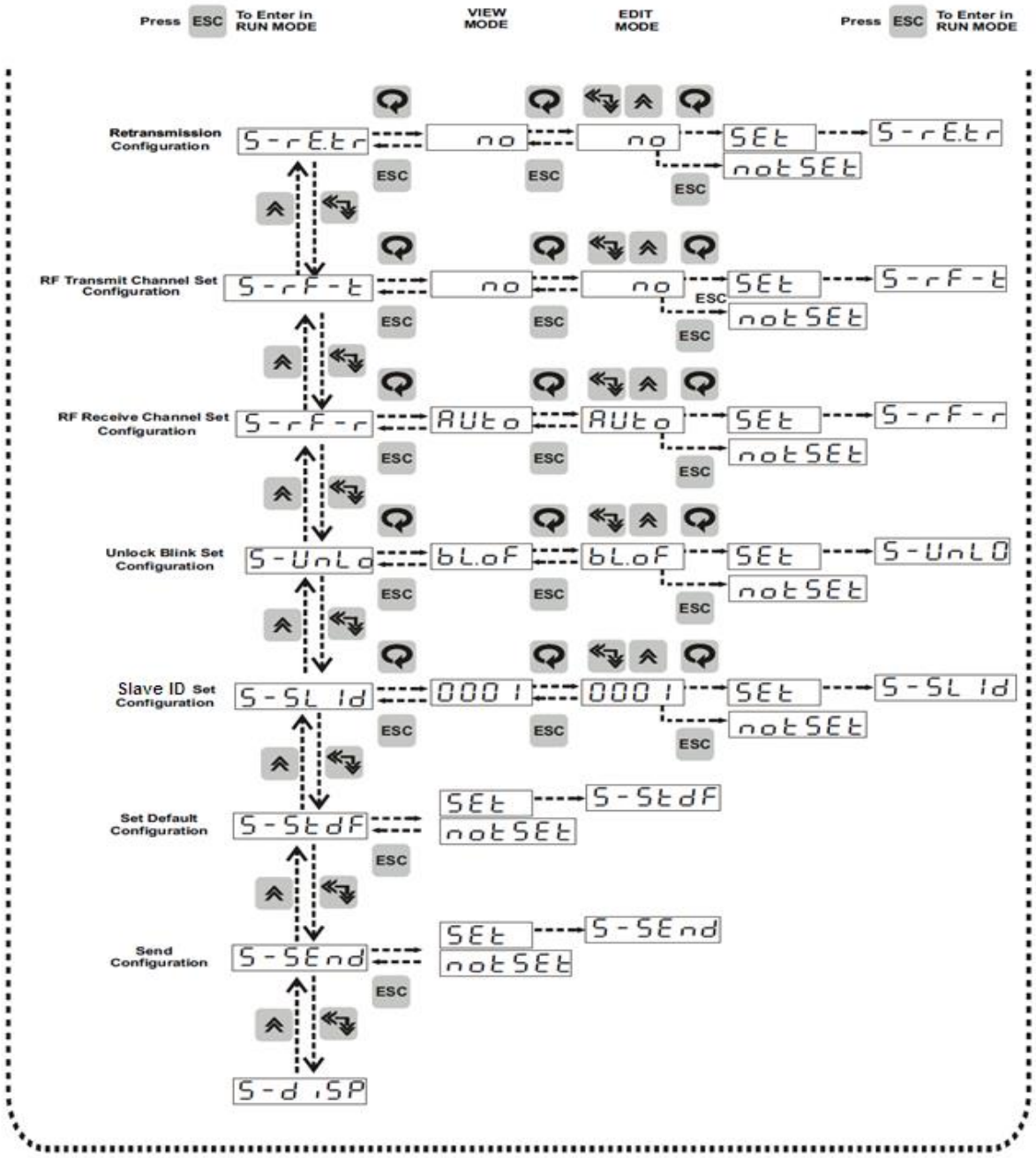

Press ESC To Enter In RUN MODE
VIEW MODE
EDIT MODE
Press ESC To Enter In RUN MODE
See the Slave Parameter configuration image
RUN MODE
Slave Parameter Configuration
SL.ConF
Slave ID
0001
0001
SEt
notSEt
S-diSP
SL.ConF
ESC
Show Slave ID Command
SL.rESt
rESEt
SL.rESt
Unlock Blink option configuration
UnLobL
bL.coLn
bL.coLn
SEt
notSEt
UnLobL
Set Default Configuration
SEt dF
SEt
notSEt
StdF
diSPLy

Figure 9 Display and Key Configuration Details of Slave Clock





6.2.3 Configuration Mode of Master

6.2.3.1 Display Configuration Mode (DISPLY):

- Press Enter Key to Enter in Display mode, it will enter in View mode and shows Current Display Mode.
- Press Enter in View mode to enter in Edit mode , in Edit mode it will shows **Time** , **Date** and **Both** mode , Press Enter key to set the any Display mode.
- Time mode will display time in Run mode, Date mode will display Date in Run mode and both option will Display Time and Date Both, Date will be displayed at seconds 18-20, 38-40, and 57-60 of minute.

6.2.3.2 Time Mode Set Configuration (TM-MD):

- Press Enter Key to Enter in Time mode, it will enter in View mode and shows Current Time Mode.

- Press Enter in View mode to enter in Edit mode, in Edit mode it will shows **12HoUR** for 12 hour time format and **24HoUR**for 24 hour time format, Press Enter key to set the any One Time mode.

6.2.3.3 Date Mode Set Configuration (DT-MD):

- Press Enter Key to Enter in Date mode, it will enter in View mode and shows Current Date Mode.
- Press Enter in View mode to enter in Edit mode, in Edit mode it will shows **DDMMYY**, **MMDDYY** and **YYMMDD** Date format, Press Enter key to set the any One Date mode.

6.2.3.4 Manual Time Set Configuration (S-TMDT):

- Press Enter Key to Enter in Manual date Set mode, it will enter in View mode and shows Current DATE on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode set date using INC and SHIFT Keys, Press Enter key to set the date it will show **S-TiME**.
- Press Enter Key to Enter in Manual time Set mode, it will enter in View mode and shows Current time on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode set time using INC and SHIFT Keys, Press Enter key to set the time.

6.2.3.5 Enable Time Zone offset Configuration (E-OFST):

- Press Enter Key to Enter in Enable Time zone offset mode, it will enter in View mode and shows Current mode on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode set YES or NO using INC and SHIFT Keys, Press Enter key to set the time zone offset mode.

6.2.3.6 Time Zone Configuration (OFFSET):

- Press Enter Key to Enter in Time Zone offset mode, it will enter in View mode and shows Current Time Zone offset on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode set time Zone offset using INC and SHIFT Keys, Press Enter key to set the Time Zone offset.
- Please enter time zone between +12:00 to -12:00 International standard.

6.2.3.7 Baud Rate Set Configuration (BAUD):

- Press Enter Key to Enter in Baud rate Set mode, it will enter in View mode and shows Current Baud rate on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode Set Baud rate using INC and SHIFT Keys, Press Enter key to set the Baud Rate.
- In Edit mode it will show **4800**, **9600**, **19200and**, **38400**baud Rate.
- This Option only available in RS232 or RS485 Input Model.

6.2.3.7 Stop Bit Set Configuration (StoP):

- Press Enter Key to Enter in Stop Bit Set mode, it will enter in View mode and shows Current Stop Bit on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode Set Stop Bit using INC and SHIFT Keys, Press Enter key to set the Stop Bit.
- In Edit mode it will show two options **1** for 1 Stop Bit and **2** for 2 Stop Bit.
- This Option only available in RS232 or RS485 Input Model.

6.2.3.8 Parity Bit Set Configuration (PARITY):

- Press Enter Key to Enter in Parity Bit Set mode, it will enter in View mode and shows Current Parity Bit on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode Set Parity Bit using INC and SHIFT Keys, Press Enter key to set the Parity Bit.
- In Edit mode it will show three options **Odd** Parity, **Even** Parity and **none** Parity.
- This Option only available in RS232 or RS485 Input Model.

6.2.3.9 Frame output selection serial (FRAME):

- Press Enter Key to Enter in Frame select mode, it will enter in View mode and shows Current frame on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode set frame using INC and SHIFT Keys, Press Enter key to set Frame for serial frame output.
- This Option only available in RS232 or RS485 Input Model.

6.2.3.10 RF Transmit Channel Set Configuration (RF-T.CH):

- This Option only available in Wireless Input Model and for Retransmission of Received Signals for increasing the Range.
- Press Enter Key to Enter in RF Transmit Channel Set mode, it will enter in View mode and shows Current RF Transmit Channel on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode Set RF Transmit Channel using INC Key, Press Enter key to set the RF Transmit Channel.
- In Edit mode it will show 0-9 options.
- You can show RF transmit channel on segment at power on condition.

6.2.3.11 Password Set Configuration (PSWoRD):

- Press Enter Key to Enter in Password mode, it will enter in View mode and shows Current Password on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode set password using INC and SHIFT Keys, Press Enter key to set Password.

6.2.3.12 GPS Unlock Time Out (UTMoUT)

- Press Enter Key to Enter in Unlock Time Out mode, it will enter in View mode and shows current mode on display.
- Press Enter in View mode to enter in Edit mode, in Edit mode set **YES** or **nO** using INC and SHIFT Keys, Press Enter key to set the Unlock Time Out.
- If you are selecting **YES** then you will set timeout value between 5 to 1440.The Unit is Minute.MC-2 retains its lock status Depending on minutes that you are set.

6.2.3.13 Slave Parameter Configuration (SL.ConF)

- Press Enter Key to Enter in Slave Configuration mode, it will enter in View mode and shows Slave ID on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode set Slave ID using INC and SHIFT Keys, Press Enter key to Enter in Slave Parameter Configuration Mode.
- Enter Slave ID Between 1 To 9999.

6.2.3.14 Show Slave ID Command (SL.RESt)

- Press Enter Key to send Show Slave ID Command.

6.2.3.15 Unlock Blink Option configuration (unlobl)

- Press Enter Key to Enter in Unlock Blink Configuration mode, it will enter in View mode and shows Blink option.
- Press Enter Key to Enter in Unlock Blink Configuration mode, it will enter in View mode and shows Current Unlock Blink option.
- In Edit mode it will show two options **BL.COLN** or **BL.DISP** option.
- User can set Blinking colon or Whole display in case of Loss of Synchronization.

6.2.3.16 Set Default Configuration (SET-DF):

- Press Enter Key to set the default parameters and Default parameter as per below.
  - Display Type : Time Display
  - Time Format : Hour Time Format 24
  - Date Format : DD.MM.YY
  - E-OFFSET : YES

- Time Zone Offset : 05:30

Applicable for Serial Input Model:

- Baud Rate : 9600
- Stop Bit : 1
- Parity Bit : None
- Frame : NMEA

- Password : 0001
- GPS Unlock Time Out :YES
- Unlock Blink : BL.COLN[Blinking Colon and DP]

Applicable for Wireless Input Model:

- RFM Transmit Channel : 0

Note:-

1. GPS Unlock Time Out value when set YES it's by default value is 60. MC-2 retains its lock status Depending on minutes that you are set.
2. User can set Unlock status by Blinking colon or Whole display in case of loss of Synchronization.

6.2.4 Configuration Mode of Slave

MC-2 offers facility to the users for configuring communication parameters of Slave Clock such as serial port, Display Format Selection, Time Zone Selection, Set Default Parameter by sending configuration Frame over wireless. See the image of Figure 9 for Slave Clock Parameters configuration.

6.2.4.1 Display Configuration Mode (S-DISP):

- Press Enter Key to Enter in Display mode, it will enter in View mode and shows Current Display Mode.
- Press Enter in View mode to enter in Edit mode , in Edit mode it will shows **Time** , **Date** and **Both** mode , Press Enter key to set the any Display mode.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.2 Time Mode Set Configuration (S-T-MD):

- Press Enter Key to Enter in Time mode, it will enter in View mode and shows Current Time Mode.
- Press Enter in View mode to enter in Edit mode , in Edit mode it will shows **12HR** for 12 hour time format and **24HR** for 24 hour time format , Press Enter key to set the any One Time mode.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.3 Date Mode Set Configuration (S-D-MD):

- Press Enter Key to Enter in Date mode, it will enter in View mode and shows Current Date Mode.
- Press Enter in View mode to enter in Edit mode, in Edit mode it will shows **DDMMyy**, **mmddyy** and **ddmmyy** Date format, Press Enter key to set the any One Date mode.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.4 Time Zone Configuration (S-OFST):

- Press Enter Key to Enter in Time Zone offset mode, it will enter in View mode and shows Current Time Zone offset on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode set time Zone offset using INC and SHIFT Keys, Press Enter key to set the Time Zone offset.
- Please enter time zone between +12:00 to -12:00 International standard.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.5 Baud Rate Set Configuration (S-BAUD):

- Press Enter Key to Enter in Baud rate Set mode, it will enter in View mode and shows Current Baud rate on Display.

- Press Enter in View mode to enter in Edit mode, in Edit mode Set Baud rate using INC and SHIFT Keys, Press Enter key to set the Baud Rate.
- In Edit mode it will show two options **9.60** for 9600 and **1.920** for 19200 baud Rate.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.6 Stop Bit Set Configuration (S-STOP):

- Press Enter Key to Enter in Stop Bit Set mode, it will enter in View mode and shows Current Stop Bit on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode Set Stop Bit using INC and SHIFT Keys, Press Enter key to set the Stop Bit.
- In Edit mode it will show two options **1** for 1 Stop Bit and **2** for 2 Stop Bit.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.7 Parity Bit Set Configuration (S-PRTY):

- Press Enter Key to Enter in Parity Bit Set mode, it will enter in View mode and shows Current Parity Bit on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode Set Parity Bit using INC and SHIFT Keys, Press Enter key to set the Parity Bit.
- In Edit mode it will show three options **odd** Parity, **Even** Parity and **none** Parity.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.8 Retransmission configuration (S-RE.TR):

- Press Enter Key to Enter in Retransmission, it will enter in View mode and shows Current configuration of Retransmission.
- Press Enter in View mode to enter in Edit mode, in Edit mode set configuration of Retransmission using INC and SHIFT Keys, Press Enter key to set the Retransmission.
- In Edit mode it will show four options **no**, **rf**, **ser** and **both**. If unit is serial and wireless input model.
- Press Enter key to set retransmission.
- In Pϕ–τ configuration No option selected by default if receive channel in ρϕ–ρ configuration and transmit channel in ρϕ–τ configuration are same and If you are In Retransmission configuration for selecting Σερ or βοτη option.
- If you are select Auto mode in RF receive channel configuration then **no** and **ser** option is available in retransmission mode for wireless and serial input model.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.9 RF Transmit Channel Set Configuration (S-RF-T):

- when in Retransmission configuration (ρε.τρ) you are selecting ρϕ or βοτη for Retransmission of Received Signals for increasing the Range and also selecting receive channel between 0 to 9 except Auto mode in **Rf-r** for RF receive channel set configuration.
- Press Enter Key to Enter in RF Transmit Channel Set mode, it will enter in View mode and shows Current RF Transmit Channel on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode Set RF Transmit Channel using INC Key, Press Enter key to set the RF Transmit Channel.
- In Edit mode it will show **0-9** and no options, **no** option for no re-transmission, It will stop re-transmission.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.10 RF Receive Channel Set Configuration (S-RF-R):

- Press Enter Key to Enter in RF Receive Channel Set mode, it will enter in View mode and shows Current RF Receive Channel on Display.
- Press Enter in View mode to enter in Edit mode, in Edit mode Set RF Transmit Channel using INC Key, Press Enter key to set the RF Receive Channel.
- In Edit mode it will show **0-9** and **Auto** options.

- Auto mode is disabled when you are selecting **RF** and **BOTH** option in retransmission configuration.
- Auto mode is enabled when you are selecting **no** and **ser** in retransmission configuration.
- If you are not set RF-R channel as same as Master then after sending command it will not Sync with Master
- Press Esc Key to enter in master mode configuration menu.

6.2.4.11 Unlock Blink Set Configuration (S-UnLo):

- This option will used in unlock condition, if you want stop blinking of Colon in Time Display and DP in Date Display.
- Press Enter Key to Enter in Unlock Blink mode, it will enter in View mode and shows Current Unlock Blink Mode.
- Press Enter in View mode to enter in Edit mode , in Edit mode it will shows **BLOf** to stop blinking and **BLO2**,**BL05** **BL10** and **BL.DI** to blink colon and DP in unlock condition after, Press Enter key to set the any One Blinking option.
- User can set configurable time 2 second, 5 second or 10 second by setting option **BΛ02**, **BΛ05** and **βΛ10** respectively.
- By default unlock blinking time is 10 minute.
- BL.DI Option use for blinking Whole display in case of loss of synchronization. The unlock blinking time is 2 minute.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.12 Slave ID configuration(S-SLID):

- Press Enter Key to Enter in Slave ID configuration, it will enter in View mode and shows Current Slave ID of Unit is same as configure Slave unit ID entered.
- Press Enter in View mode to enter in Edit mode, in Edit mode set Slave ID using INC and SHIFT Keys, Press Enter key to set Slave ID.
- If you are changing the Slave ID of Unit then the slave ID of slave clock changed. Make sure that Entered Slave ID does not match with any other Existence Slave ID.
- Press Esc Key to enter in master mode configuration menu.

6.2.4.13 Set Default Configuration (S-STDF):

- Press Enter Key to set the default parameters and Default parameter of Slave as per below.
  - Display Type : Time Display
  - Time Format : Hour Time Format 24
  - Date Format : DD.MM
  - Time Zone Offset : 05:30

  Applicable for Serial Input Model:
  - Baud Rate : 9600
  - Stop Bit : 1
  - Parity Bit : None

  Applicable for Wireless Input Model:
- RFM Receive Channel : 0
  - Display Unlock Blink : BL.10
  - Password : 0001
  - Retransmission : No
  - Press Esc Key to enter in master mode configuration menu.

6.2.4.14 Send Command (S-Send):

- Press Enter Key to send configure parameter that you are set.
- Press Esc Key to enter in master mode configuration menu.

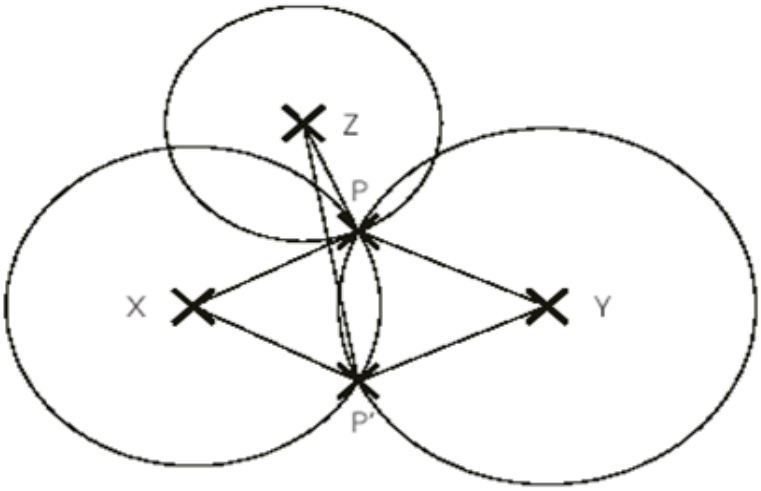
7. OPERATION INFORMATION

7.1 GPS Fundamentals [MC-2]

GPS Master Clock Model MC-2 device is a GPS/GNSS based receiver clock device which provides accurate SERIAL and Wireless time output. 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 include satellite navigation systems of SBAS, QZSS, Galileo systems etc.

GPS satellite navigation system is maintained by 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 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 a number of satellites.

Figure 10 The Basis 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. Actually 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 to 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. As for the flat plane case a measurement from an extra fixed point is required to absolutely 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 accurate measurement of distance from the unknown location of the receiver to 4 known points.

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 for continuous and global navigation for users world-wide.

A characteristic of the GLONASS constellation is that any given satellite only passes over the exact 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. So opposed to 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 GPS navigation system, all satellites operates at 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 navigation satellite system of GPS, GLONASS and other available systems in space, GNSS receivers can easily observer 10 to 12 satellites at a time. As more number of satellites are visible, more accuracy in receivers output signals are 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 own Ephemeris data. The ephemeris is updated every 2 hours and is usually valid for 4 hours.

7.2 Receiver Boot-up mode

When GPS Master Clock Model MC-2 unit is power up, the time of unit depends on the GPS receiver RTC data. At every Power ON, unit is in UNLOCK mode initially. If 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 unit, the time taken by unit to get LOCK after antenna is connected depends on the duration for which unit was in UNLOCK condition.

Refer below explanation for time taken by 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 previous visible satellites, last position of 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 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. In order to get current almanac data, GPS receiver should receive at least one satellite frame. Typically, TTFF (Time to First Fix) for 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 time to get initialized on boot up and as each satellite frame takes 30 seconds to transmit single frame.

Since each satellite transmits total 25 frames as satellite complete broadcast message, complete almanac data is transmitted by satellite in 12.5 minutes. So, in order 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, it is necessary that antenna should be located in open environment having no immediate obstacles.

If the device is moved to very far location in hundreds of kilometers from its last operation position and system is made ON, then receiver will try to identify visible satellites data and compare it with previously stored almanac data. If this does not match, 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 kms but do not have ephemeris information or ephemeris information may be invalid, the receiver enters Warm start mode. Typically, 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 at 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, current time is stored and are valid, receiver enter hot start mode and provides accurate time within few tens of seconds.

7.3 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 previous stored almanac information and then proceeds to develop 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 GPS Master Clock Model MC-2 unit was in Power off condition for the duration more than specified Memory retention time, 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 its all configuration parameters internally in non-volatile memory, even when the power is off.

7.4 Display Parameters of Master

7.4.1 Lock/Unlock Indication for Time/Date Display

- The colons or Whole Display of the MC-2 will flash if the time displayed is not lock and also GPS Lock led will remain off.
- This GPS Lock LED illuminates GREEN color if the GPS satellites signal are available and GPS is LOCKED and remain in OFF condition if no GPS satellites are available.
  - In case of Date Display in place of colons “dp” after 3rdand 5thdigit will provide lock/unlock information.
  -The GPS Lock Led and colon status also depending on timeout value that you are set on GPS unlock timeout configuration. MC-2 retains its lock status based on timeout value that is not elapsed. If no GPS satellite is available within timeout value elapsed The GPS Lock Led and colon or Whole Display of Mc-2 will off and flash respectively.

7.4.2 AM/PM Indication for Time Display

- If the MC-2 is configured for a 12-hour time display mode an AM/PM indicator will appear in the top left corner of the display during the PM hours. You will find PM Red LED **ON** when clock will be in PM hours in 12-hour mode.

7.4.3 Display Format

- In MC-2 , have 3 option configurable
  1. Time Display
  2. Date Display

3. Alternate Date & Time Display, which Display Both Time and Date Display. Date will be displayed at 18-20 seconds, 38-40 seconds and 58-60 seconds. These Display settings can be done by Key Configuration.

- There are two Time Format selectable
    1. 12 hour format
    2. 24 hour format
- There are 3 Date format given for Display
    1. DD/MM/YY
    2. MM/DD/YY
    3. YY/MM/DD
- In MC-2, there is one option of enable or disable the blinking of Colon and DP in unlocking condition.

7.5 GPS-MC-2 Other Parameters

7.5.1 Serial Port Settings

- In MC-2, for serial port, there are 4 Baud rate given configurable.
    1. 4800
    2. 9600
    3. 19200
    4. 38400
- Parity Bit can be configurable as Even ,Odd or None
- Stop Bit can be configurable as 1 Stop bit or 2 Stop bit
- All settings can be set by Key Configuration as shown in section 6.2

7.5.2 Time Zone Offset Settings

- In MC-2, Configurable Time Zone option is given.
- User can enable or disable offset using `E-OFST` option in key configuration.
- User Can Set Standard Time zone offset between +12:00 to -12:00 using `OFFSET` option in key configuration.
- All settings can be set by Key Configuration as shown in section 6.2
- If user enables the time zone offset, effect of time zone offset will be only shown on Display time and T-Format/NGTS Serial frame output and there will be no effect of time zone in NMEA and Wireless frame output.

7.5.3 Manual Time Settings

- In MC-2, if there is no Time frame input available, at that time user can enter Manually Time and Date, Manual Time set can be done by using Key configuration as shown in section 6.2.
- This only available in Unlock condition and in lock condition, it will display LOCK, on display and did not allow entering in this mode.

7.5.4 Wireless Transmit Channel Set

- In MC-2, User can configure Wireless GPS master's Transmit channel using Key configuration as shown in section 6.2.

7.5.5 GPS Unlock Time Out

- In MC-2, Configurable Unlock Time option is given.
- User can enable or disable time using **`Utmout`** option in key configuration.
- User Can Set values from 5 to 1440 minutes using key configuration.
- All settings can be set by Key Configuration as shown in section 6.2

7.5.6 Slave Clock Parameter configuration

- All Slave Clock Parameter can be set by Key configuration as shown section 6.2.4

7.5.7 Show Slave ID Command

- Using this command you can see the slave ID of Slave clock on display of slave clock in run Mode for 2 Second.

8. COMMUNICATION GUIDELINES

8.1 Serial Time Frame Output

MC-2 can be configured to transmit the NMEA Frame, NGTS Frame and T-FORMAT and can be configured by key configuration.
NMEA Frame's time will be only UTC time and it is independent with respect to set time zone offset of UNIT.
NGTS and T-Format frame's time will be change as according to the set time zone offset.

- The System Time can be synchronized using NEMA Frame with help of mTime Sync Utility.

8.1.1 NMEA-0183[RMC] Format

The $GPRMC sentence contains time and date of position fix, speed and course information. The following examples show the contents of a typical RMC sentence:

The settings for this serial format is 9600, 8, N, 1. It can be configurable.

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

Table 5 NMEA-0183[RMC] Format

Field	Example	Comments
Sentence 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-printing characters

8.1.2 NGTS Format

The settings for this format are programmable. The full data message of NGTS format shall consist of 14 printable characters and a concluding CRLF as follows:

Table 6 NGTS Format

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
CRLF	2	15,16	Non-printing character

The transmission sequence shall be from the Code Identification character through to the CRLF with the most significant digits being transmitted first.
The message shall become automatically available at one second prior to the clock minute epoch.

8.1.3 T-Format

The settings for this format are programmable. The full data message of T-format shall consist of 21 printable characters with a concluding CRLF as follows:

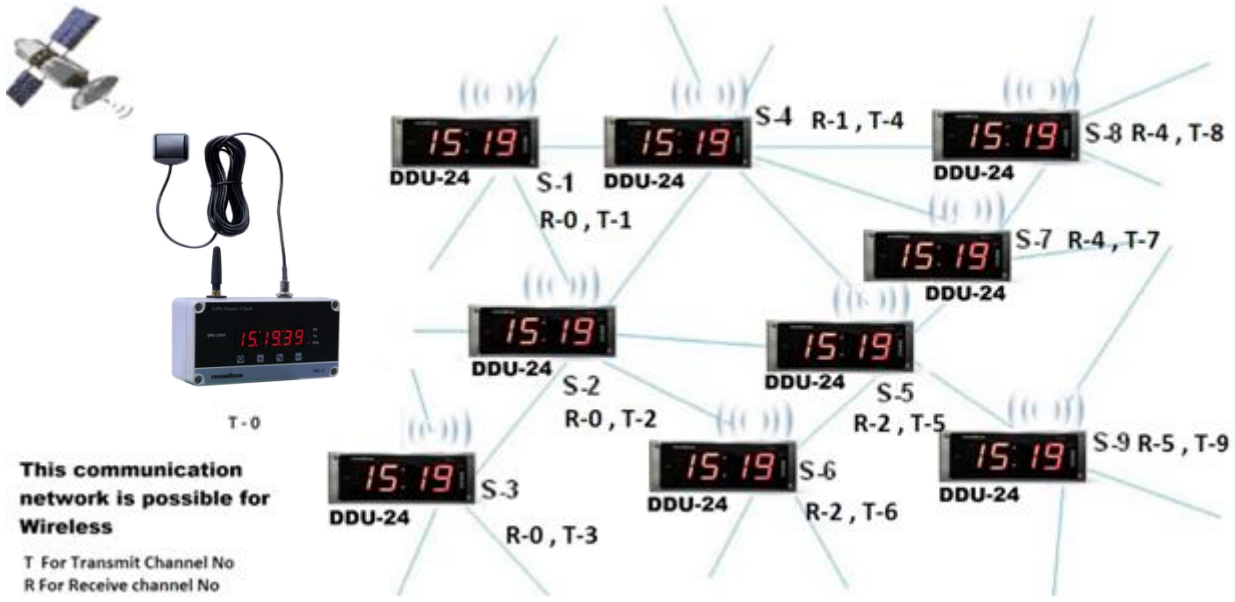
Table 7 T-Format

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
CRLF	2	25,26	Non printing character

8.2 Wireless Time Frame Output

- MC-2 designed to transmit time code frame using wireless media, wireless network as shown in fig 11.
- MC-2 unit transmit the UTC time and it is independent of set time zone offset.
- As shown in fig 9, there is Wireless master connected with GPS, which transmit the GPS time code in 866 MHz frequency. Wireless master will transmit data on 0 to 9 RF channels, so set RF receive channel between 0-9on DDU-24, all slave DDU-24will get lock which are in range of Wireless Master. As shown in figure S1, S2 and S3 are all in range of master so it will be directly connect with master.

Figure 11 Wireless Network



8.3 Wireless Configuration Frame Output

MC-2 offers facility to the users for configuring communication parameters of Slave Clock Such as serial port, Display Format Selection, Time Zone Selection, Set Default Parameter by sending configuration Frame over Wireless.

- The communication parameters include baud rate, number of stop bits and parity.
- The user is free to choose Time Display, Date Display and Both in Alternate Time/Date Display.
- User can set 12 hour or 24 hour format.
- User can set any Standard Time Zone Offset.
- Users can set Default all Configuration Parameter.
- User can set Slave ID.
- User can set transmit channel and Receive channel.
- User can set Retransmission Mode.

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9. TROUBLESHOOTING TIPS

Problem: Unit not getting Power ON
Possible reasons/solutions:
1. Check Power input cable connected properly
2. Check Power input cable connected to respective terminal as described in section 5.1
3. Check Input power is available.
4. All points are ok, then please contact Masibus support department.

Problem: Wrong time at Unit Power ON
Possible reasons/solutions:

If the unit was kept in Power OFF conditions for the duration more than 15 days, as per mentioned in section 7.3, the battery back of internal RTC will get discharged completely. As a result, at unit Power ON, time displayed on 7-segment display and time provided in all time outputs will be according to default internal time till the unit gets LOCKED after GPS antenna is connected to unit.

If the battery is discharged as per mentioned above, it is necessary to keep unit in Power ON condition for duration mentioned in section 7.3, for full charging of internal battery. Full charging is necessary to avoid possibility of wrong time output at unit Power ON.

Problem: GPS Master Clock Model MC-2 display time not as per Local time
Possible reasons/solutions:

If GPS Master Clock Model MC-2 time on display, NGTS & T-format time output is not showing local time then check set time zone offset , it depends on set time zone offset , please verify that set time zone offset is as per your country/Time zone region.

Problem: Cannot establish Serial communication with COM1
Possible reasons/solutions:

RS-232/RS485 cable used for serial communication with Serial port terminal should be as per section 5.1 and 5.2.Verify communication cable.Check the serial port settings in MC-2 using key configuration and set same parameters in slave devices to establish serial communication.

Problem: Problem with getting unit LOCK to GPS satellites.
Possible reasons/solutions:
1) It is always recommended to use factory provided antenna cable shipped with GPS Master Clock Model MC-2 unit. If antenna used for installation is other than provided with GPS Master Clock Model MC-2 unit, please contact Masibus Service department for assistance.
2) GPS Antenna must be installed properly as per suggested in section 4.1.
3) GPS Antenna cable must be connected at the antenna connection on Top side connector of GPS Master Clock Model MC-2 device.
4) If GPS Master Clock Model MC-2 device is able to capture very less number of satellites even if the weather and sky is clear, try to re-orient the GPS antenna or relocate the GPS antenna so that maximum number of GPS satellites isvisible.

Problem: Wireless clock showing wrong time.
Possible reasons/solutions:

1. MC-2 unit is transmitting the UTC Time, so set in slave clock local time zone for local time.

PROBLEM: Cannot establish Wireless communication with MC-2.
Possible reasons/solutions:
- Set RF Transmit channel between 0-8 and same channel in receive channel in slave device.
- Master clock and slave device must be in range of master's range of 100 meters with obstacles and 600 meter in line of site.
- Check in both device RF antennas is correctly fitted with unit.

If these troubleshooting tips do not solve your problem then, please contact Customer support at either nearest area office or Main Head Office as given on the first page.

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REVISION HISTORY

Following Changes added in m05Aom101_04 compared to m05Aom101_03.

1. Unlock Blink option configuration Features added for Blinking of Colon or Whole Display in case of loss of Synchronization.

Following Changes added in m05Aom101_05 compared to m05Aom101_04.

1. Masibus old logo is replaced with a new one.

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