



MARU 220 *DVOR*

TECHNICAL MANUAL

Volume II

Operations & Maintenance

MARU 220

Doppler VHF Omni-directional Radio Range

Technical Manual

Volume II

OPERATIONS AND MAINTENANCE INSTALLATION

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Table of Contents

CHAPTER 1. RMMS/LMMS.....	1-1
1.1. RMMS/LMMS overview	1-1
1.2. Software installation	1-2
1.3. Communication connection	1-5
1.4. Log-in.....	1-8
1.5. Main window.....	1-11
1.5.1. Main window description.....	1-11
1.5.2. Menu Bar	1-15
1.6. Transmitter window	1-16
1.6.1. Transmitter window description	1-16
1.6.2. Transmitter menu.....	1-29
1.7. Monitor window.....	1-30
1.7.1. Main monitor window description	1-30
1.7.2. Monitor Expansion Window Description	1-34
1.7.3. Monitor Menu.....	1-35
1.8. System window	1-36
1.8.1. System window Description.....	1-36
1.9. Log Data Management Window.....	1-41
1.9.1. Log Data Management Window Description	1-41
1.9.2. Log Data Format.....	1-43
1.9.3. Measure Item Record Data.....	1-52
1.10. Program Menu.....	1-54
1.10.1. File Menu	1-54
1.10.2. Window Menu	1-55
1.10.3. Calibration Menu.....	1-56
1.10.4. Tool Menu	1-58
CHAPTER 2. CSP.....	2-1
2.1. CSP Overview.....	2-1
2.2. CSP exterior configuration.....	2-1
2.2.1. Control & Silence	2-1
2.2.2. Transmitter Lamp.....	2-2
2.2.3. Monitor Lamp.....	2-2

2.3. Characteristics of CSP.....	2-3
2.3.1. Quick Menu.....	2-11
2.3.2. Alarm.....	2-12
2.3.3. Transmitter.....	2-20
2.3.4. Monitor.....	2-34
2.3.5. 2.3.5 System.....	2-49
2.3.6. Power Supply.....	2-68
2.3.7. Information.....	2-72
CHAPTER 3. OPERATION.....	3-1
3.1. Overview.....	3-1
3.2. Equipment Power On & Power Off.....	3-1
3.3. Bypassing Monitors.....	3-2
3.4. Using LMMS/RMMS.....	3-2
3.5. Using CSP/RCMU.....	3-2
CHAPTER 4. MAINTENANCE.....	4-1
4.1. Overview.....	4-1
4.2. Preventive Maintenance Schedule.....	4-1
4.3. Preventive Maintenance Procedure.....	4-2
4.3.1. Tools and Test Equipments Required.....	4-2
4.3.2. Checking System Status.....	4-2
4.3.3. Checking Carrier/Sideband RF Frequency.....	4-2
4.3.4. Checking Carrier Modulation Waveform.....	4-3
4.3.5. Checking Site Environment.....	4-3
4.3.6. Checking Carrier Output Power.....	4-3
4.3.7. Checking Sideband Output Power.....	4-3
4.3.8. Checking site IDENT.....	4-4
4.3.9. Checking Antenna VSWR.....	4-4
4.3.10. Checking Backup Battery.....	4-4
4.3.11. Checking Automatic Transmitter Changeover.....	4-5
4.3.12. Switching Main / Standby Transmitter.....	4-5
4.3.13. Checking Antenna Element and Radome.....	4-5
4.3.14. Checking Monitor Antenna.....	4-5
4.3.15. Checking Monitor Parameters.....	4-5
CHAPTER 5. INSTALLATION.....	5-1
5.1. SELECTING INSTALLATION SITE.....	5-1
5.2. FOUNDATIONS FOR DVOR COUNTERPOISE AND SHELTER.....	5-2
5.3. GROUNDING.....	5-3

5.3.1. General	5-3
5.3.2. Strip or mesh Ground Conductors	5-3
5.3.3. Ground Rods	5-4
5.3.4. Ground Plates	5-4
5.3.5. Estimating the Ground Resistance	5-5
5.3.6. Measuring the Ground Resistance	5-5
5.4. INSTALLING EQUIPMENT SHELTER.....	5-7
5.4.1. General	5-7
5.4.2. Installing Equipment Shelter	5-7
5.5. INSTALLING ANTENNAS	5-8
5.5.1. General	5-8
5.5.2. Antenna mounting.....	5-9
5.5.3. RF Cabling of Antennas.....	5-10
5.5.4. Aligning Sideband Antennas.....	5-11
5.5.5. Installing Field Monitor Antenna.....	5-12
5.6. INSTALLING DVOR EQUIPMENTS	5-13
5.6.1. General	5-13
5.6.2. Connecting Power Supply	5-13
5.6.3. Installing ASU.....	5-14
5.6.4. Connecting External Equipments	5-16

Contents of Figures

Figure 1-1 MARU 220 Software Installation Initiation Window	1-2
Figure 1-2 MARU 220 Software Installation Window	1-2
Figure 1-3 Program Installation Directory Selection Window	1-3
Figure 1-4 Program Menu Folder Selection Window	1-3
Figure 1-5 Program Installation Progress Window	1-4
Figure 1-6 Program Installation Finish Window	1-4
Figure 1-7 Communication Connection Window	1-5
Figure 1-8 Communication Setup Window	1-6
Figure 1-9 Communication Setup Add Window	1-7
Figure 1-10 Login Window	1-8
Figure 1-11 Main Window	1-11
Figure 1-12 Unit Status	1-13
Figure 1-13 Active/Standby Status of CMA and SMA	1-13
Figure 1-14 PDC Status Indication	1-13
Figure 1-15 Menu Bar	1-15
Figure 1-16 Transmitter Window	1-16
Figure 1-17 Transmitter Status Information	1-17
Figure 1-18 Frequency Status Display	1-18
Figure 1-19 Operation Frequency Setup	1-19
Figure 1-20 Modulation Depth Display	1-20
Figure 1-21 Modulation Depth Setup	1-20
Figure 1-22 Sideband RF Phase Display	1-21
Figure 1-23 Sideband RF Phase Setup	1-21
Figure 1-24 Azimuth Offset Display	1-22
Figure 1-25 Azimuth Offset Setup	1-22
Figure 1-26 Modulation Status Display	1-23
Figure 1-27 Modulation ON/OFF Setup	1-23
Figure 1-28 Output Power Display	1-24
Figure 1-29 Output Power Setup	1-24
Figure 1-30 IDENT Signal Display	1-25
Figure 1-31 IDENT Setup	1-25
Figure 1-32 Antenna Status Display	1-26
Figure 1-33 Antenna Status Setup	1-26
Figure 1-34 Modulation Amp Status Display	1-27
Figure 1-35 Modulation AMP On/Off Setup	1-27
Figure 1-36 Temperature Display	1-28
Figure 1-37 Main Monitor Window	1-30
Figure 1-38 General Status Information	1-30
Figure 1-39 Normal/Bypass Mode Setup	1-31
Figure 1-40 Changeover	1-31

Figure 1-41 Measured Value Display	1-32
Figure 1-42 Alarm Range Setup	1-32
Figure 1-43 Azimuth Alarm Range Setup Window	1-33
Figure 1-44 MON Configuration	1-33
Figure 1-45 Monitor Expansion Window.....	1-34
Figure 1-46 System Window	1-36
Figure 1-47 LCU General Information Display	1-36
Figure 1-48 Normal/Bypass Setup	1-37
Figure 1-49 Alarm Sound Setup Window	1-37
Figure 1-50 Alarm Sound Setup	1-38
Figure 1-51 Auto FAN Control	1-38
Figure 1-52 Manual FAN Control	1-39
Figure 1-53 Changeover	1-40
Figure 1-54 System Reset.....	1-40
Figure 1-55 History Log Window	1-41
Figure 1-56 Program Menu	1-54
Figure 1-57 File Menu.....	1-54
Figure 1-58 Window Menu.....	1-55
Figure 1-59 Calibration Menu	1-56
Figure 1-60 MON Calibration.....	1-56
Figure 1-61 TX Calibration.....	1-57
Figure 1-62 Tool Menu	1-58
Figure 1-63 Account Create.....	1-60
Figure 1-64 Account Delete	1-60
Figure 2-65 Front of CSP of MARU 220 System	2-1
Figure 2-66 Main Screen Composition	2-3
Figure 2-67 MSG1 Power Off Notice Message Screen	2-6
Figure 2-68 Alarm Silence Null Message Screen	2-7
Figure 2-69 Setup Application Complete Screen	2-7
Figure 2-70 Changeover Question Message Screen	2-8
Figure 2-71 Text Line Setup Message Screen	2-9
Figure 2-72 Non-Decimal Based Number Value Setup Message Screen	2-9
Figure 2-73 Decimal Based Number Value Setup Message	2-10
Figure 2-74 Setup Message Screen in Case that It is not Number or Text Line	2-10
Figure 2-75 Quick Menu Screen.....	2-11
Figure 2-76 Alarm Menu Screen.....	2-12
Figure 2-77 Alarm Menu Structure.....	2-13
Figure 2-78 Alarm > Transmitter 1 / 2 Menu Screen	2-14
Figure 2-79 Alarm > Monitor 1 / 2 Menu Screen	2-15
Figure 2-80 Alarm > Presence Detect Screen.....	2-16
Figure 2-81 Alarm > System Menu Screen	2-17
Figure 2-82 Alarm > Power Supply Menu Screen	2-18
Figure 2-83 Alarm > Environment Screen	2-19

Figure 2-84 Transmitter Menu Screen	2-20
Figure 2-85 Transmitter Menu Structure	2-21
Figure 2-86 Transmitter > TX1 / 2 Menu Screen	2-22
Figure 2-87 Transmitter > TX1 / 2 > Status Menu Screen	2-23
Figure 2-88 Transmitter > TX1 / 2 > Power AMP Control Screen	2-24
Figure 2-89 Transmitter > TX1 / 2 > Output Power Screen	2-25
Figure 2-90 Transmitter > TX1 / 2 > Modulation Depth Screen	2-26
Figure 2-91 Transmitter > TX1 / 2 > Modulation Control Screen	2-27
Figure 2-92 Transmitter > TX1 / 2 > Carrier Frequency Screen	2-28
Figure 2-93 Transmitter > TX1 / 2 > Azimuth Offset Screen	2-29
Figure 2-94 Transmitter > TX1 / 2 > SB RF Phase Offset Screen	2-30
Figure 2-95 Transmitter > CONFIG Menu Screen	2-31
Figure 2-96 Transmitter > IDENT Setting Screen	2-32
Figure 2-97 Transmitter > Antenna Control Screen	2-33
Figure 2-98 Monitor Menu Screen	2-34
Figure 2-99 Monitor Menu Structure	2-35
Figure 2-100 Monitor > MON1 / 2 Menu Screen	2-36
Figure 2-101 Monitor > MON1 / 2 > Status Menu Screen	2-37
Figure 2-102 Monitor > MON1 / 2 > Basic Parameters Menu Screen	2-39
Figure 2-103 Monitor > MON1 / 2 > Extended Parameters Menu Screen	2-40
Figure 2-104 Monitor > MON1 / 2 > Limits Menu Screen	2-41
Figure 2-105 Monitor > CONFIG Menu Screen	2-44
Figure 2-106 Monitor > CONFIG > TSG Control Screen	2-44
Figure 2-107 Monitor > CONFIG > Measure Mode Screen	2-46
Figure 2-108 Monitor > CONFIG > MON1 Bypass Screen	2-47
Figure 2-109 Monitor > CONFIG > MON2 Bypass Screen	2-48
Figure 2-110 System Menu Screen	2-49
Figure 2-111 System Menu Structure	2-50
Figure 2-112 System > Save & Restore Menu Screen	2-51
Figure 2-113 System > System Control Menu Screen	2-52
Figure 2-114 System > Changeover Menu Screen	2-53
Figure 2-115 System > Changeover > Auto CHOV Reason (MON1 / 2) Menu Screen ..	2-54
Figure 2-116 System > FAN Control Menu Screen	2-55
Figure 2-117 System > FAN Control > FAN Status Menu Screen	2-56
Figure 2-118 System > FAN Control > Config Manual Mode Menu Screen	2-57
Figure 2-119 System > FAN Control > Config Auto Mode Menu Screen	2-58
Figure 2-120 System > Presence Detect Menu Screen	2-59
Figure 2-121 System > Temperature Menu Screen	2-60
Figure 2-122 System > Environment Menu Screen	2-62
Figure 2-123 System > Environment > Config Environment Menu Screen	2-63
Figure 2-124 System > Audio Menu Screen	2-64
Figure 2-125 System > DME Interface Menu Screen	2-65
Figure 2-126 System > LCU Configuration Menu Screen	2-66

Figure 2-127 System > LCU Configuration > Config COMM Port Menu Screen	2-67
Figure 2-128 Power Supply Menu Screen.....	2-68
Figure 2-129 Power Supply Menu Structure	2-68
Figure 2-130 Power Supply > PSU Status Menu Screen	2-69
Figure 2-131 Power Supply > PSU Measurement Menu Screen	2-70
Figure 2-132 Information Menu Screen	2-72
Figure 2-133 Information Menu Structure	2-73
Figure 2-134 Information > Date & Time Menu Screen	2-74
Figure 2-135 Information > Date & Time > System Date Menu Screen	2-75
Figure 2-136 Information > Date & Time > System Time Menu Screen	2-76
Figure 2-137 Information > LCU Menu Screen	2-77
Figure 2-138 Information > MSG1 / 2 Menu Screen	2-78
Figure 2-139 Information > MON1 / 2 Menu Screen	2-79

Contents of Tables

Table 1-1 Rights by User Level.....	1-10
Table 1-2 Basic Status Information Display Content	1-17
Table 1-3 Frequency Display Content	1-18
Table 1-4 Frequency Setup Range.....	1-19
Table 1-5 Modulation Depth Setup Range.....	1-20
Table 1-6 Sideband RF Phase Setup Range	1-21
Table 1-7 Azimuth Offset Setup Range	1-22
Table 1-8 Modulation Control Display Content	1-23
Table 1-9 Output Setup Range	1-24
Table 1-10 IDENT Display Content.....	1-25
Table 1-11 Antenna Control Mode Display Content.....	1-26
Table 1-12 Modulation Amp Display Content.....	1-27
Table 1-13 Basic Status Information Display Content	1-30
Table 2-14 Alarm > Transmitter 1 / 2 Display Item.....	2-14
Table 2-15 Alarm > Monitor 1 / 2 Display Item.....	2-15
Table 2-16 Alarm > Presence Detect Display Item	2-16
Table 2-17 Alarm > System Display Item.....	2-17
Table 2-18 Alarm > Power Supply Display Item	2-18
Table 2-19 Alarm > Environment Display Item	2-19
Table 2-20 Transmitter Display Item	2-20
Table 2-21 Transmitter > TX1 / 2 Display Item	2-22
Table 2-22 Transmitter > TX1 / 2 > Status Display Item	2-23
Table 2-23 Transmitter > TX1 / 2 > Power AMP Control Setup Item	2-24
Table 2-24 Transmitter > TX1 / 2 > Output Power Setup Item	2-25
Table 2-25 Transmitter > TX1 / 2 > Modulation Depth Setup Item	2-26
Table 2-26 Transmitter > TX1 / 2 > Modulation Control Setup Item	2-27
Table 2-27 Transmitter > TX1 / 2 > Carrier Frequency Setup Item	2-28
Table 2-28 Transmitter > TX1 / 2 > Azimuth Offset Setup Item	2-29
Table 2-29 Transmitter > CONFIG Display Item.....	2-31
Table 2-30 Transmitter > IDENT Setting Setup Item	2-32
Table 2-31 Transmitter > Antenna Control Setup Item	2-33
Table 2-32 Monitor Sub Menu	2-34
Table 2-33 Monitor > MON1 / 2 Display Item	2-36
Table 2-34 Monitor > MON1 / 2 > Status Display Item	2-37
Table 2-35 Monitor > MON1 / 2 > Basic Parameters Display Item.....	2-39
Table 2-36 Monitor > MON1 / 2 > Extended Parameters Display Item	2-40
Table 2-37 Monitor > MON1 / 2 > Limits Display Item.....	2-41
Table 2-38 Monitor > CONFIG Display Item.....	2-44
Table 2-39 Monitor > CONFIG > TSG Control Setup Item	2-45
Table 2-40 TSG Signal Item.....	2-45

Table 2-41 Monitor > CONFIG > Measure Mode Setup Item	2-46
Table 2-42 Monitor > CONFIG > MON1 Bypass Setup Item	2-47
Table 2-43 Monitor > CONFIG > MON2 Bypass Setup Item	2-48
Table 2-44 System Display Item	2-49
Table 2-45 System > Save & Restore Display Item	2-51
Table 2-46 System > System Control Display Item	2-52
Table 2-47 System > Changeover Display Item	2-53
Table 2-48 System > Changeover > Auto CHOV Reason (MON1 / 2) Display Item	2-54
Table 2-49 System > FAN Control Display Item	2-55
Table 2-50 System > FAN Control > FAN Status Display Item	2-56
Table 2-51 System > FAN Control > Config Manual Mode Display Item	2-57
Table 2-52 System > FAN Control > Config Auto Mode Display Item	2-58
Table 2-53 System > Presence Detect Display Item	2-59
Table 2-54 System > Temperature Display Item	2-60
Table 2-55 System > Environment Display Item	2-62
Table 2-56 System > Environment > Config Environment Display Item	2-63
Table 2-57 System > Audio Display Item	2-64
Table 2-58 System > DME Interface Display Item	2-65
Table 2-59 System > LCU Configuration Display Item	2-66
Table 2-60 System > LCU Configuration > Config COMM Port Display Item	2-67
Table 2-61 Power Supply Display Item	2-68
Table 2-62 Power Supply > PSU Status Display Item	2-69
Table 2-63 Power Supply > PSU Measurement Display Item	2-70
Table 2-64 Information Display Item	2-72
Table 2-65 Information > Date & Time Display Item	2-74
Table 2-66 Information > Date & Time > System Date Setup Item	2-75
Table 2-67 Information > Date & Time > System Time Setup Item	2-76
Table 2-68 Information > LCU Display Item	2-77
Table 2-69 Information > MSG1 / 2 Display Item	2-78
Table 2-70 Information > MON1 / 2 Display Item	2-79

Abbreviations

ADC	Analog to Digital Converter
AES	Antenna Electronics Subsystem
AMP	Amplifier
ANT	Antenna
ASU	Antenna Switching Unit
BIT	Built In Test
BITE	Built In Test Equipment
BPF	Band Pass Filter
CMA	Carrier Modulation Amplifier
CMS	Control Monitor Subsystem
CPA	Carrier Power Amplifier
CPD	Carrier Power Detector
CSP	Control and Status Panel
CSU	Control Selection Unit
CVOR	Conventional VOR
DAC	Digital to Analog Converter
DET	Detector
DME	Distance Measuring Equipment
DPDT	Double-Pole Double-Throw
DVOR	Doppler VOR
ENV	Envelope
GUI	Graphic User Interface
LCU	Local Control Unit
LPF	Low Pass Filter
LSB	Lower Sideband
MAS	Modulation Amplifier Subsystem
MOD	Modulator
MISC	MISCellaneous
MMIC	Monolithic Microwave Integrated Circuit
MOD	Modulator
MON	Monitor
MSG	Modulation Signal Generator
PA	Power Amplifier
PDC	Power Detector &Changeover
PFC	Phase Frequency Comparator
PLD	Programmable Logic Device
PLL	Phase Locked Loop
PSS	Power Supply Subsystem
PSU	Power Supply Unit
PWM	Pulse-Width Modulation

RCMU	Remote Control and Monitor Unit
REF CLK	Reference Clock
RMU	Remote Monitor Unit
SBA	Sideband Amplifier Unit
SM	Selection Module
SMA	Sideband Modulation Amplifier
SPD	Sideband Power Detector
SPI	Serial Peripheral Interface
SYN	Synthesizer
TACAN	Tactical Air Navigation System
TCXO	Temperature Compensated Crystal Oscillator
TM	Toggling Module
UART	Universal Asynchronous Receiver/Transmitter
USART	Universal Synchronous/Asynchronous Receiver/Transmitter
USB	Upper Sideband
VOP	Voice Processor
VSWR	Voltage Standing Wave Ratio

Chapter 1. RMMS/LMMS

1.1. RMMS/LMMS overview

Remote Maintenance Monitoring System (RMMS) or Local Maintenance Monitoring System (LMMS) is a program that enables users to monitor or control MARU 220 system on PCs. The RMMS/LMMS can be directly connected through the use of Local Control Unit (LCU) and serial cables and remotely accessed through the use of modems.

The RMMS/LMMS controls the status of TX and reads the values measured on MON to display them on the monitor of a PC. The information is the same as what is displayed on the Control Status Panel (CSP) of the MARU 220 system.

Representative status information displayed on the PC monitor is as follows.

- Alarm measured in each unit
- Plug-in status of each unit
- Measured main parameters of DVOR signal
- Control of main parameters of DVOR signal
- History log

Main functions of each window are as follows.

- Log-in window: It is a user authentication window to control the MARU 220 System. Only authenticated users can control the system by entering a user account and a password. Only status reference is allowed in communication connection without log-in.
- Main window: It has been designed to view major parameters among values measured by the MARU 220 System and conveniently figure out fault status in the unit. The unit where alarm occurred is indicated as red, and if the unit is clicked, it switches to the window of the unit or displays information on the unit.
- TX window: It controls the signal of MARU 220 Transmitter. It can control general signals such as frequency setup and output power setup and provides functions for antenna tests.
- MON window: It displays parameters measured in MON unit and can set up the range of alarms with regard to measured items.
- History log window: LCU saves alarm occurrence status of the values measured in MON and information on the transmitter control item changed in MSG. The log data are save not only in LCU but also in a local folder of a RMMS/LMMS PC, and history log window displays log records saved in the LCU and the PC. Inquiry can be made by date or in order of the latest record.
- System window: It provides such general control items required to operate the system as Changeover, System reset, FAN control and System sound setup.

1.2. Software installation

A PC should have following specifications to install MARU 220 RMMS/LMMS software.

Distinction	Specifications
System	IBM Compatible PC : Desktop or Laptop
CPU	Intel Pentium 133MHz or Higher
Memory	Minimum 64MB RAM
HDD	Minimum 2GB (650MB or more)
Operating System	Microsoft Windows 2000/XP

RMMS/LMMS software is installed in accordance with following procedures.

If you insert a RMMS program CD into a PC, following installation initiation window appears. If the installation initiation window does not appear automatically, execute 'Setup.exe'.



Figure 1-1 MARU 220 Software Installation Initiation Window

If following installation window appears, click [Next>] button.

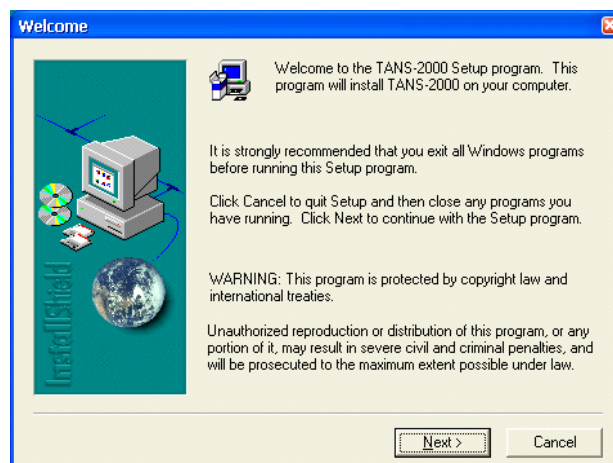


Figure 1-2 MARU 220 Software Installation Window

The following window is to select a program installation directory. Default installation directory is 'C:\Program Files\MOPIENS\MARU 220\'. If you want to change the installation directory, click [Browse...] button, and if you do not want to change the directory, move to the next step by clicking [Next>] button. Unless it is a special case, do not change the default installation directory.

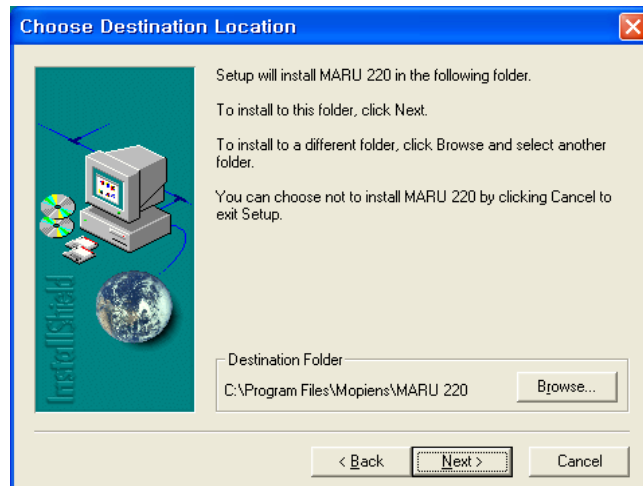


Figure 1-3 Program Installation Directory Selection Window

If the following window appears, enter the name of a program folder to be registered in the Windows start menu and then click [Next>] button. Unless it is a special case, do not change the name of the folder.



Figure 1-4 Program Menu Folder Selection Window

If the following program installation progress window appears, the program is installed

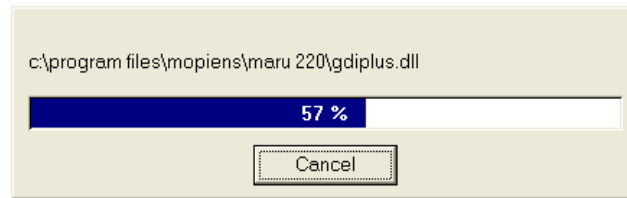


Figure 1-5 Program Installation Progress Window

If the installation of the program is completed, the following window appears. If you click [\[Finish\]](#) button, the installation of the program is finished.

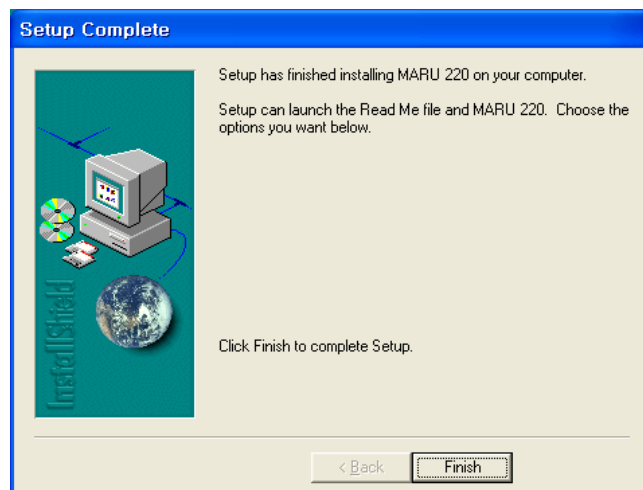


Figure 1-6 Program Installation Finish Window

If the installation of the program is completed, MARU 220 icon is made on the Windows start menu and the background window.

1.3. Communication connection

If the program is executed, it tries to access the MARU 220 System according to previous connection setup record. If the connection is successfully made, the right to use the program is Level 1 that only allows users to inquire values set and measured in the MARU 220 System. If the MARU 220 System needs to be controlled, click [LOGIN] button on the menu on the left to log in as a Level 2 user or higher. The following figure is the window where communication connections are being tried.



Figure 1-7 Communication Connection Window

Setup

If the program is used for the first time after installation or if you want to change existing setup, cancel connection by clicking [Cancel] button and then change the setup into a new one that fits installation environment.

Retry

[Retry] button is used to try connecting again in the same setup if connection has failed.

Cancel

[Cancel] button is used to stop connecting.

Exit

[Exit] button is used to cancel all activities and close the program.

The following figure is a window where communication is set up through the use of [\[Setup\]](#) button.

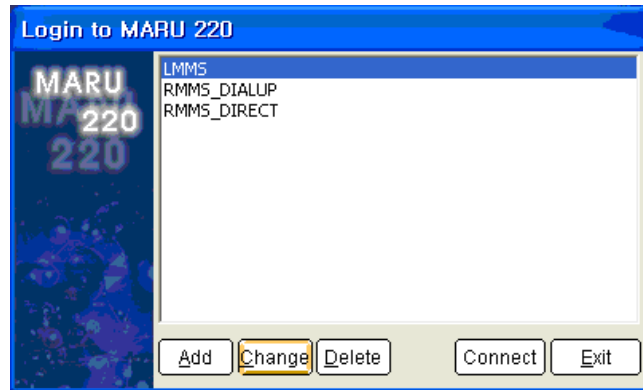


Figure 1-8 Communication Setup Window

Add

If you click [\[Add\]](#) button, a window to set up a new communication appears.

Change

If you select an item to be changed among communication setup items and then click [\[Change\]](#) button, a window to change communication setup appears.

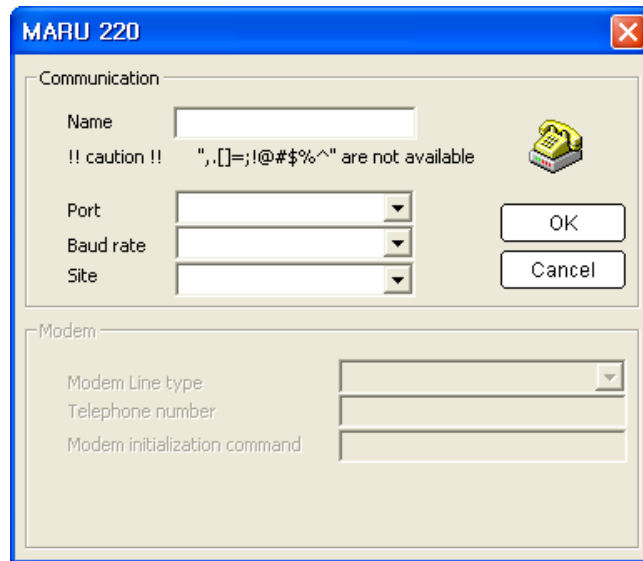
Delete

If you select an item to be deleted among communication setup items and then click [\[Delete\]](#) button, the pertinent item is deleted.

Connect

If you select an item to be used among communication setup items and click [\[Connect\]](#) button, connection is tried as set up.

If you click [\[Add\]](#) button, the following window appears. The [\[Change\]](#) window is the same as [\[Add\]](#) window, but the [\[Name\]](#) cannot be changed.

**Figure 1-9 Communication Setup Add Window****Name**

It is the name of an installation site that an operator arbitrarily sets up. It is used as the name of the folder to save MON measure values and history log stored in the RMMS/LMMS. If you did not change the installation folder at a time of program installation, MON measure values and history log data are saved in 'C:\Program Files\MOPIENS\MARU 220\<Name>' folder

Port

Select communication port.

Baud rate

Select communication speed.

Site

Select the location where the program is installed. Select either [Local] or [Remote]. If you selected [Remote], the following [Modem] is activated to enable modem setup.

Modem Line Type

Choose either [Leased Line] or [Dialup]. If you choose [Dialup], the following [Telephone number] is activated to enable entry of modem telephone

number for destination..

Telephone number

Enter modem telephone number to be connected.

Modem Initialization command

Enter model control command in the AT Command format. Since it aims to test a modem, leave it as a blank space.

1.4. Log-in

If the connection is successfully made, the program moves to the main window. At that time, it is a level 1 security status that only allows users to inquire the MARU 220 System. If you need to control the MARU 220 System, you must log in again as a level-2 user or higher. You can log in as a higher-level user by clicking [\[LOGIN\]](#) button on the menu on the left of the program.

Security levels range from level 1 through level 3, and the level 3 is the highest. The security level, ID, password are saved in the LCU unit of the MARU 220 System.



Figure 1-10 Login Window

Security level

It is divided into followings in accordance with the security level of RMMS/LMMS system operators, and functions are limited by level.

- Level 1: It is possible to inquire Main window, MON window, TX window and System.
- Level 2: It is possible to control Main window, MON window, TX window, TX control, MON control and Changeover.
- Level 3: It is possible to manage Main window, MON window, TX window, TX

control, MON control, Changeover, History Log data and create/delete user account.

The following indicates access rights by user level.

Table 1-1-1 Rights by User Level

Window	Item	Level 1	Level 2	Level 3
Main window	Main Status Inquire	○	○	○
MON window	MON Window Inquire	○	○	○
	MON operation mode setup	×	○	○
	MON alarm range setup	×	○	○
TX window	TX Window Inquire	○	○	○
	TX setup value change	×	○	○
System window	Window Inquire	○	○	○
	FAN Control	×	○	○
	System switching	×	○	○
	System Reset	×	○	○
Log window	History Log View	○	○	○
	History Log Delete, Backup	×	×	○
ETC	Account Create	×	×	○
	Account Delete	×	×	○

1.5. Main window

The main window is the first window to appear after connection to the system through normal communication connection. It displays a figure that is similar to actual system configuration that enables users to view the entire system at a glance

1.5.1. Main window description



Figure 1-11 Main Window

Antenna status information



Antenna status information indicates whether antenna is normal or not through the use of values measured in MON. If any abnormality is detected in the antenna, antenna image is indicated as red, and if you click the antenna image, a pop-up window appears to display information on the status of the antenna. The status of carrier antenna is indicated as 'Normal' or 'Fault', and Sideband antenna indicates faulty antenna number. If the sideband antenna is normal, it is indicated as 'Normal'.

ASU status information



The activity status of antenna is indicated as 'Normal Mode' or 'Maintenance Mode', and if it is 'Maintenance Mode', red color is indicated in the pertinent spot. If you click ASU image, the status of ASU is indicated in a pop-up window.

Battery status information



It indicates whether battery is normal or not. If any abnormality is detected in the battery, red color is indicated in the pertinent spot. If you click the battery image, the normality of the battery, voltage and electric current are indicated in a pop-up window.

Shelter status information



If the door of the shelter is open or a fire broke out, red color is indicated in the pertinent spot. If you click the shelter image, internal temperature and door status of the shelter and fire alarm status are indicated in a pop-up window.

Rack status information

Rack indicated in the Main Window looks similar to actual configuration of the MARU 220 System. If you click each unit, information on the unit is displayed, and in cases of MON and MSG, it moves to the pertinent information window. If any failure occurs, red color is indicated in the unit, and if the unit is deleted from the rack,

it is indicated as black.

The following shows unit status.

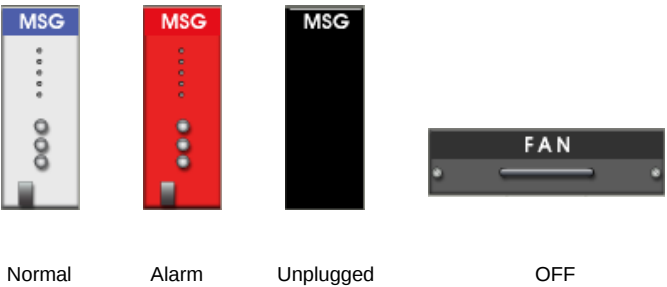


Figure 1-12 Unit Status

Indication method differs in CMA and SMA according to Active and Standby status, and in case of Active status, it is indicated in the four different ways as described above, and in case of Standby status, each status is indicated in gray-tinted colors as below.

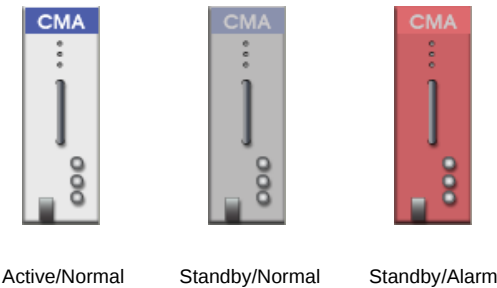


Figure 1-13 Active/Standby Status of CMA and SMA

The LED of the currently activated TX in the PDC in the upper part of the



rack are turned on.

Figure 1-14 PDC Status Indication

IDENT and operation frequency information



Operation frequency and IDENT that are set up in the MSG of the MARU 220 System are indicated.

Azimuth information



It indicates information on azimuth measured in the MON. If you click the pertinent area, a pop-up window appears and you can choose MON to be indicated between two MON values.

CARRIER Output Information



It indicates CARRIER output value measured in MON. If you click the pertinent area, a pop-up window appears, and you can choose MON to be indicated between two MON values.

1.5.2. Menu Bar



Figure 1-15 Menu Bar

The menu bar is located on the left of the program, and the function of each part is as follows.

Window switch button

The button is to switch windows, and if you click each button, it moves to the pertinent window.

Login status information display

The account and level of users who have logged in are indicated. If it is disconnected, it is indicated as 'Disconnected'.

Message transmission status LED

LED blinks at a time of data transmission to indicate that data is being transmitted.

1.6. Transmitter window

You can control the transmitter of the MARU 220 System or inquire the values set in the transmitter on the transmitter window. In case of controllable items, if you place the mouse on the pertinent item, the shape of the mouse changes to the shape of a hand from the shape of an arrow. Items where the shape of the mouse does not change are uncontrollable value items.

1.6.1. Transmitter window description

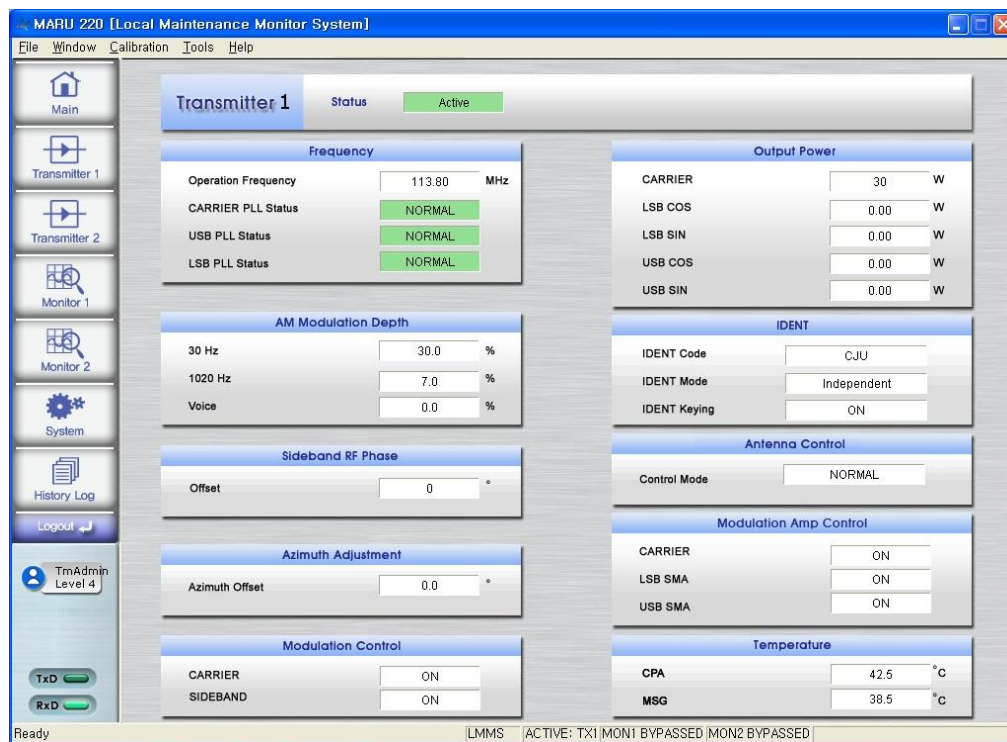


Figure 1-16 Transmitter Window

Transmitter status display**Figure 1-17 Transmitter Status Information**

[Status] item displays the current status of a selected transmitter. Indicated content is shown in the table as below.

Table 1-1-2 Basic Status Information Display Content

Item	Display content	Remarks
Status	Active	Green
	Standby	Yellow
	Unplugged	Black

Frequency

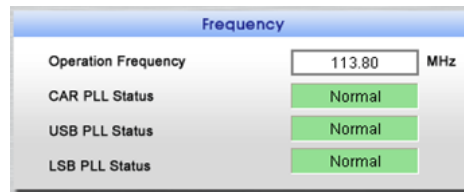


Figure 1-18 Frequency Status Display

The frequency item displays the status of the currently set operation frequency, carrier, USB and LSB PLL.

Table 1-1-3 Frequency Display Content

Item	Display content	Remarks
Operating Frequency	108.00 ~ 118.00	MHz
CAR PLL Status	Normal	Green
	FAIL	Red
USB PLL Status	Normal	Green
	FAIL	Red
LSB PLL Status	Normal	Green
	FAIL	Red

If you click frequency frame area, a window to enter the password of a user who has logged in appears, and if you accurately entered the password, a window where you can change frequency appears.

The following figure is a window to change operation frequency.

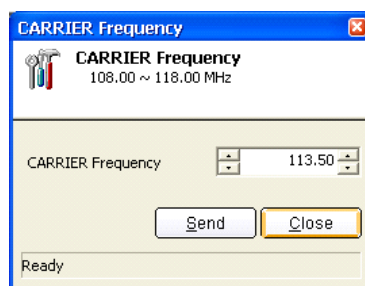


Figure 1-19 Operation Frequency Setup

If you click [Send] button after changing the value of frequency, the changed value is transmitted to MSG to be applied to the transmitter. The processing result of the transmitted values is indicated at the bottom of the window. If they are normally treated, it is indicated as 'Success'. Otherwise, it is indicated as 'Fail'.

Table 1-1-4 Frequency Setup Range

Item	Setup range	Step	Unit
Operating Frequency	108.00 ~ 118.00	0.05	MHz

AM Modulation depth

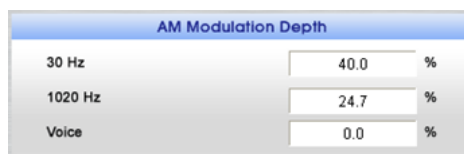


Figure 1-20 Modulation Depth Display

It indicates the status of modulation depth setup with regard to AM 30MHz, 1020Hz and voice signals. If you click AM Modulation Depth frame area, a window where you can change the modulation depth appears.

The following figure is a window to set up modulation depth.

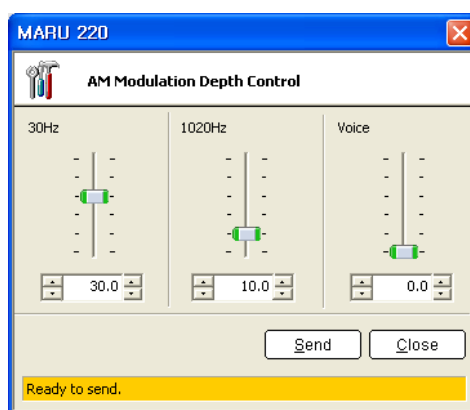


Figure 1-21 Modulation Depth Setup

If you click [Send] button after changing each modulation depth, changed value is transmitted to MSG to be applied to the transmitter. The processing result of the transmitted value is indicated at the bottom of the window. If it is normally processed, it is indicated as 'Success'. Otherwise, it is indicated as 'Fail'.

Table 1-1-5 Modulation Depth Setup Range

Item	Setup range	Step	Unit
30Hz	0.0 ~ 50.0	0.1	%
IDENT 1020Hz	0.0 ~ 40.0	0.1	%
Voice	0.0 ~ 50.0	0.1	%

Sideband RF Phase



Figure 1-22 Sideband RF Phase Display

It indicates the status of Sideband RF Phase Setup. If you click Sideband RF Phase frame area, a window to change the Sideband RF Phase appears.

The following figure is a window to set up the Sideband RF Phase.

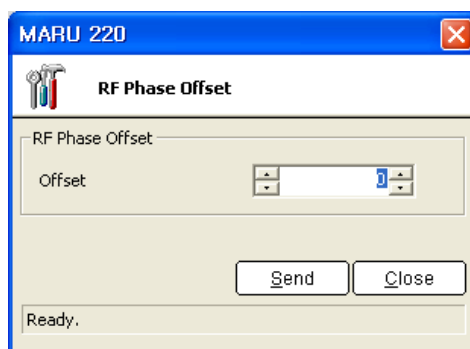


Figure 1-23 Sideband RF Phase Setup

If you click [Send] button after changing [Offset], the changed value is transmitted to MSG to be applied to the transmitter. The processing result of the transmitted value is indicated at the bottom of the window. If it is normally processed, it is indicated as 'Success'. Otherwise, it is indicated as 'Fail'.

Table 1-1-6 Sideband RF Phase Setup Range

Item	Setup range	Step	Unit
Offset	-179.9 ~ 180.0	0.1	Degree

Azimuth Adjustment

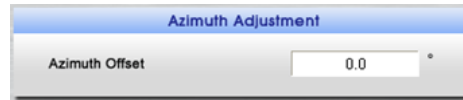


Figure 1-24 Azimuth Offset Display

It displays the status of Azimuth offset setup. If you click Azimuth offset frame area, a window to change Azimuth offset value appears.

The following figure is a window to set up the Azimuth Offset.

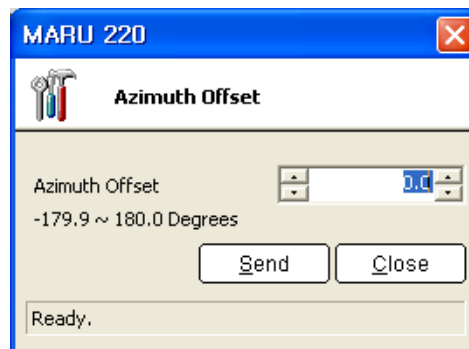


Figure 1-25 Azimuth Offset Setup

If you click [\[Send\]](#) button after changing the Azimuth Offset, the changed value is transmitted to MSG to be applied to the transmitter. The processing result of the transmitted value is indicated at the bottom of the window. If it is normally processed, it is indicated as '[Success](#)'. Otherwise, it is indicated as '[Fail](#)'.

Table 1-1-7 Azimuth Offset Setup Range

Item	Setup range	Step	Unit
Azimuth Offset	-179.9 ~ 180.0	0.1	Degree

Modulation Control



Figure 1-26 Modulation Status Display

It indicates Modulation On/Off status of CARRIER and Sideband.

Table 1-1-8 Modulation Control Display Content

Item	Display content	Remarks
Carrier	ON	White
	OFF	Black
Sideband	ON	White
	OFF	Black

If you click Modulation Control frame area, a window to change modulation status appears as follows. If you click the switch, you can change the ON/OFF status.



Figure 1-27 Modulation ON/OFF Setup

If you check [\[Simultaneously\]](#), the two switches of the CARRIER and the SIDEBAND are simultaneously turned on/off in the same way.

Output Power



Figure 1-28 Output Power Display

It indicates the status of output power setup for the CARRIER and the SIDEBAND. If you click Output Power frame area, a window to change the output value of the CARRIER and the SIDEBAND appears. The following figure is a window to set up the output power of the CARRIER and the SIDEBAND.

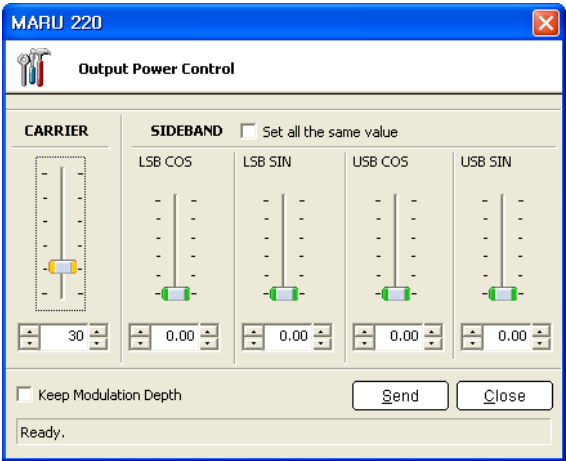


Figure 1-29 Output Power Setup

If you check [Set all the same value] and change the output of USB SIN, the output of remaining SIDEBAND also changes to the same value as that of the USB SIN.

If you check [Keep Modulation Depth] and change the CARRIER output, a certain ratio against the CARRIER output is maintained, and the SIDEBAND output changes as well.

Table 1-1-9 Output Setup Range

Item	Setup range	Step	Unit
Carrier	0.0 ~ 130.0	0.1	Watt
Sideband	0.00 ~ 12.00	0.01	Watt

IDENT



Figure 1-30 IDENT Signal Display

It indicates the status of IDENT Signal Setup.

Table 1-1-10 IDENT Display Content

Item	Display content	Remarks
IDENT Code	Identifier	2 to 4 characters
IDENT Mode	Independent	White
	Associated, Master	Green
	Associated, Slave	Yellow
	Test mode	Red (high tone, continuously)
IDENT Keying	ON	White
	OFF	Black

If you click IDENT frame area, a window to change IDENT Signal Setup appears. The following figure is a window to set up IDENT signal.

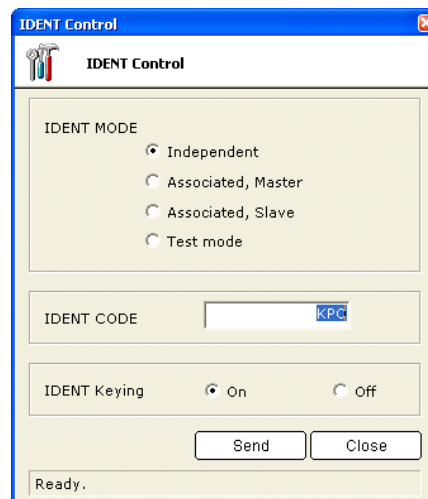


Figure 1-31 IDENT Setup

Antenna Control



Figure 1-32 Antenna Status Display

It indicates the setup status of antenna activity mode.

Table 1-1-11 Antenna Control Mode Display Content

Item	Display content	Remarks
Control Mode	Normal	White
	Maintenance	Yellow

If you click Antenna Control frame area, a window to change antenna activity mode appears.

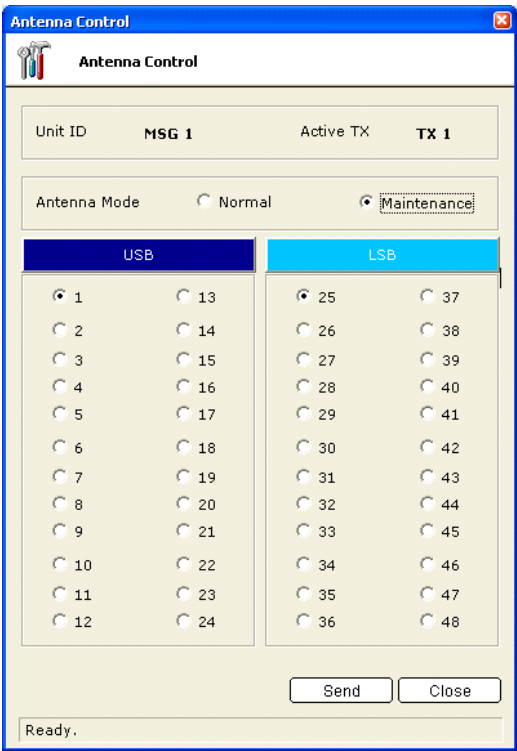


Figure 1-33 Antenna Status Setup

If you check Maintenance item and select antenna number before clicking [\[Send\]](#) button, setup status is sent to the transmitter. As for the antenna number, if you choose either USB or LSB, antenna number on the other side is changed as well.

Modulation Amp Control



Figure 1-34 Modulation Amp Status Display

It indicates the setup status of Modulation AMP.

Table 1-1-12 Modulation Amp Display Content

Item	Display content	Remarks
CPA	ON	White
	OFF	Red
USB SBA	ON	White
	OFF	Red
LSB SBA	ON	White
	OFF	Red

If you click Modulation AMP Control frame area, a window to change On/Off status of CPA, USB SBA and LSB SBA appears. The following figure is a window to set up the On/Off status of Modulation AMP.

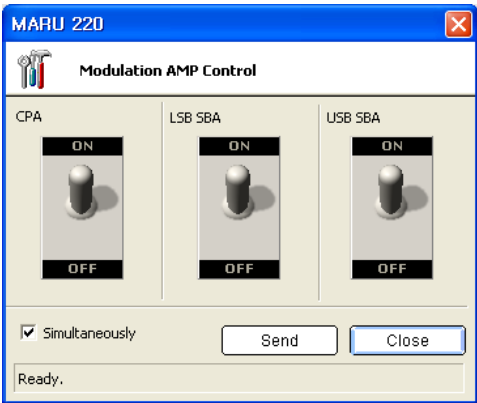


Figure 1-35 Modulation AMP On/Off Setup

If you check [Simultaneously], three switches of CPA, USB SBA and LSB SBA are simultaneously turned on/off in the same way.

Temperature

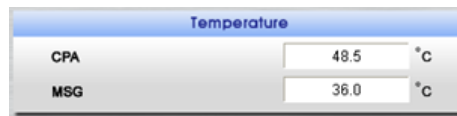


Figure 1-36 Temperature Display

It displays the temperature of CPA and the internal temperature of MSG Unit. The two values have been measured, and users cannot set them up.

1.6.2. Transmitter menu

If you click the right button of the mouse on the transmitter window, the following menu item appears.

Refresh

It transmits MSG status reference message to LCU and then renew the transmitter window.

Write to EEPROM

It saves the values currently set in the transmitter in the pertinent MSG EEPROM.

Print...

It prints the values currently set in the transmitter.

1.7. Monitor window

1.7.1. Main monitor window description

It displays the value and the status of each parameter of the system measured by the monitor



Figure 1-37 Main Monitor Window

Status Display



Figure 1-38 General Status Information

The status item indicates the current status of the monitor. It is indicated as Normal, Bypassed and Unplugged, and the Normal status is indicated as green, the Bypassed status yellow and the Unplugged status black. TX1 and TX2 items indicate the status of the current transmitter as Live/Standby.

Table 1-1-13 Basic Status Information Display Content

Item	Display content	Remarks
Status	Normal	Green
	Bypassed	Yellow
	Unplugged	Black
TX1, TX2	Live	Green
	Standby	Yellow

If you click [Status] area with the mouse, a window to change Normal/Bypass status appears. You can set up the activity status of MON by clicking the MON1 and MON2 status switch respectively.

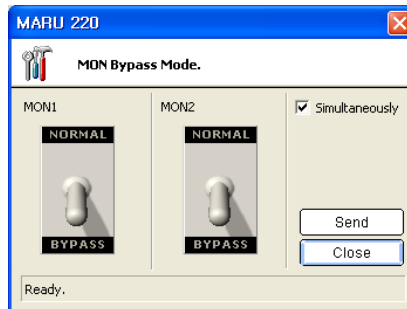


Figure 1-39 Normal/Bypass Mode Setup

If you click [TX1] or [TX2] area with the mouse, a Transmitter Changeover window appears. If you click [OK] button on the Changeover window, Changeover is done.

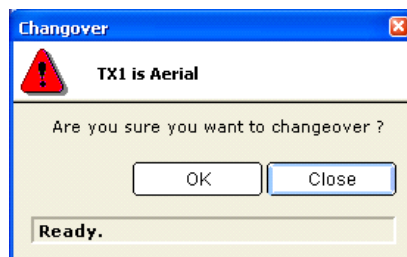


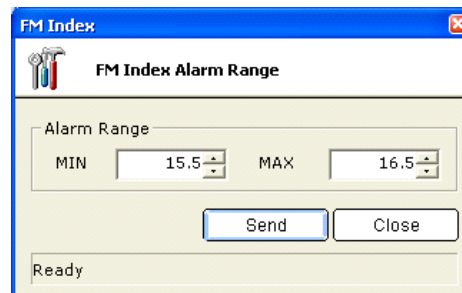
Figure 1-40 Changeover

Measured value display

Items measured in MON are indicated in the form of a horizontal bar as shown in the following figure. The white indicator in the horizontal bar moves right and left to visually display the currently measured values. The numbers in the horizontal bar indicate the currently measured values. If the indicator enters the red section at both ends, it is alarm status, and at that time, the entire horizontal bar blinks in red, issuing alarm.

**Figure 1-41 Measured Value Display**

An operator is able to set upper/lower limit of alarm with regard to all measured items. If you place the mouse in the horizontal bar, the shape of the mouse changes to the shape of a hand from the shape of an arrow. At that time, if you click the left-hand button of the mouse, a window to set up the range of alarm appears. Provided that IDENT item and Sideband Power item are excluded from alarm range setup item. The following figure is a window to set up the alarm range. As for all other items excluding Azimuth, one can set up the alarm range as follows.

**Figure 1-42 Alarm Range Setup**

Enter the lower limit of the alarm range to be set in [MIN] item and input the upper limit of the alarm range to be set in [MAX] item. If the entry is completed, click [Send] button to apply the setup values to MON. If the setup values were applied properly, 'Success' is indicated at the bottom of the window. Otherwise, 'Fail' is indicated.

In order to set up the alarm range with regard to Azimuth, standard Azimuth and its alarm range should be entered. If [Reference value] is set as 180° and [Alarm Limit] is set as 1, the alarm range of the Azimuth applied to MON is 179 to 181°.

The following figure is a window to set up the alarm range of Azimuth.

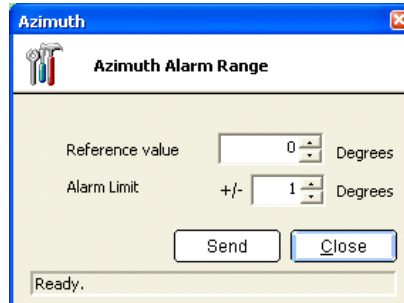


Figure 1-43 Azimuth Alarm Range Setup Window

Close

It closes MON window.

Configure...

If you click [\[Configure...\]](#) button, the following MON setup window appears.

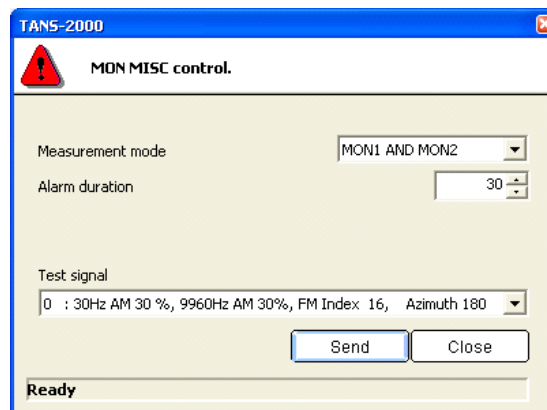


Figure 1-44 MON Configuration

It determines whether to operate AND mode or OR mode when the MON sensed alarm in [\[Measurement mode\]](#).

When an alarm is sensed, the [\[Alarm duration\]](#) item determines the duration before Changeover is implemented. The unit is 1 second, and up to 300 seconds can be set up.

The [\[Test signal\]](#) item is used for the test and the calibration of MON unit through the change of test signal saved in the CSU. 0 is selected while in normal operation.

Detail>>

If you click [Detail>>] button in the basic window of the monitor, the monitor window is expanded to display more detailed status in addition to the parameters indicated on the basic window. The [Detail>>] button changes into [Brief<<] in the expanded status, and if you click [Brief<<] button, it is reduced to the basic window.

1.7.2. Monitor Expansion Window Description

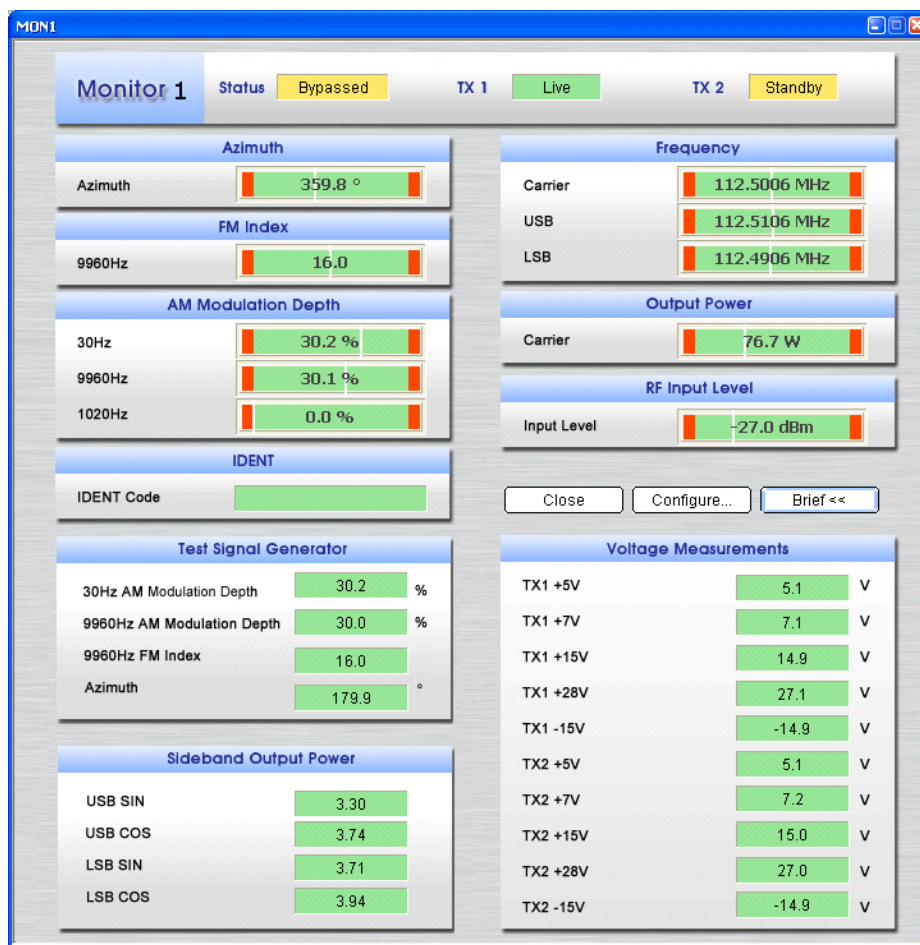


Figure 1-45 Monitor Expansion Window

1.7.3. Monitor Menu

If you click the right button of the mouse on the monitor window, the following menu item appears.

Refresh

It renews the monitor window after transmitting MON Status Reference Message to LCU.

Write to EEPROM

It saves the values currently set in the monitor in the pertinent MON EEPROM.

MON Configure...

It is the same as clicking [\[Configure...\]](#) button of the monitor window.

Bypass Mode...

A window to set up Normal/Bypass mode appears.

Print...

It prints out the values currently measured in the monitor..

Changeover

It switches transmitters.

1.8. System window

1.8.1. System window Description

The system window includes items controlled through LCU such as FAN Activity Setup, System Sound Setup and Reset. In addition, it includes version information on MSG and MON LCU units.

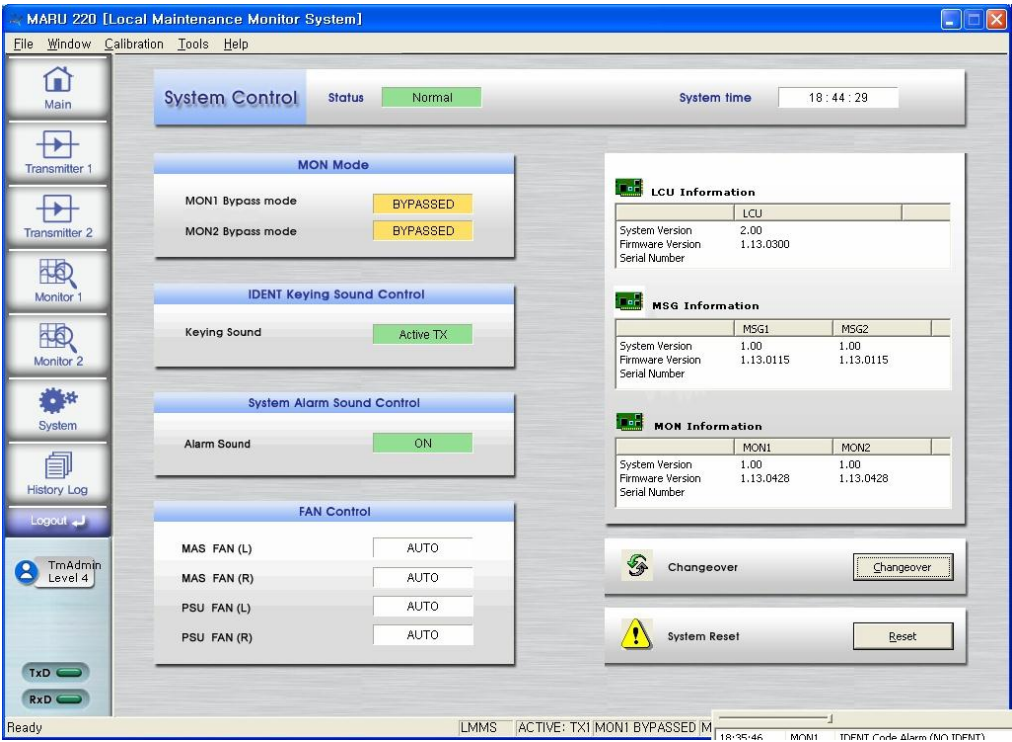


Figure 1-46 System Window

Status Display

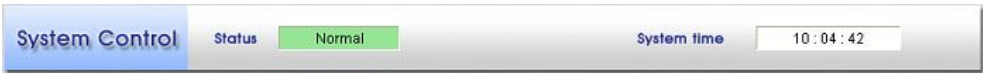


Figure 1-47 LCU General Information Display

The [Status] item indicates whether the LCU unit is normal or not as Normal and Alarm, and Normal is indicated as green and alarm red.

The [System time] item is the current time indicated in CSP installed in the MARU 220 System and has nothing to do with the time on the RMMS/LMMS PC.

MON Mode

It sets up Normal/Bypass status of MON1 and MON2.

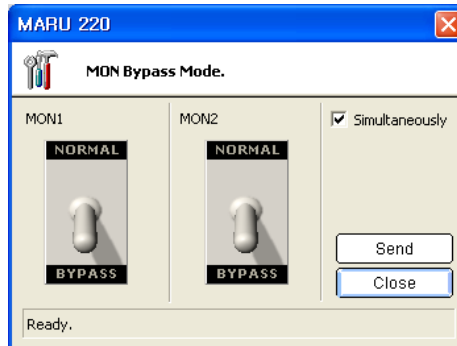


Figure 1-48 Normal/Bypass Setup

IDENT Keying Sound Control

IDENT Keying sound can be heard through a speaker installed in the MARU 220 System. If you click the pertinent area with the mouse, the following window to select IDENT Keying sound source appears.

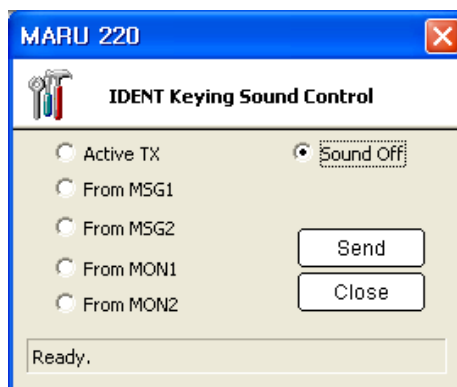


Figure 1-49 Alarm Sound Setup Window

Item	Description
Active TX	It outputs Keying sound in the currently Active MSG to a speaker.
From MSG1	It outputs IDENT Keying sound transmitted from MSG1 to a speaker.
From MSG2	It outputs IDENT Keying sound transmitted from MSG2 to a speaker.
From MON1	It outputs IDENT Keying transmitted from MON1 to a speaker.
From MON2	It outputs IDENT Keying sound transmitted from MON2 to a speaker.
Sound Off	It turns off IDENT Keying sound.

System Alarm Sound Control

If alarm is issued from the MARU 220 System, alarm sound goes off through a speaker installed in the system. If you click the pertinent area with the mouse, a window to initiate or end the alarm sound appears. You can initiate or end the alarm sound by clicking the On/Off switch.



Figure 1-50 Alarm Sound Setup

FAN Control

It sets up the activity method of four fans in MAS and PSU. The FAN Control mode is divided into Auto and Manual. The following figure is a FAN Control window set up as Auto mode.

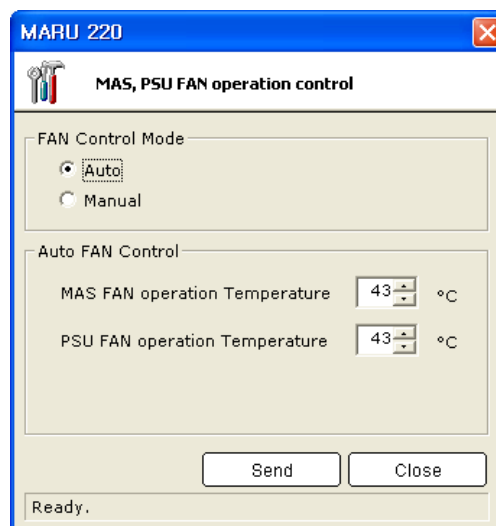


Figure 1-51 Auto FAN Control

If you set up [FAN Control Mode] as [Auto] and then enter temporary temperature in [FAN operation temperature], when the system temperature measured by LCU exceeds the entered temperature, the FAN automatically operates.

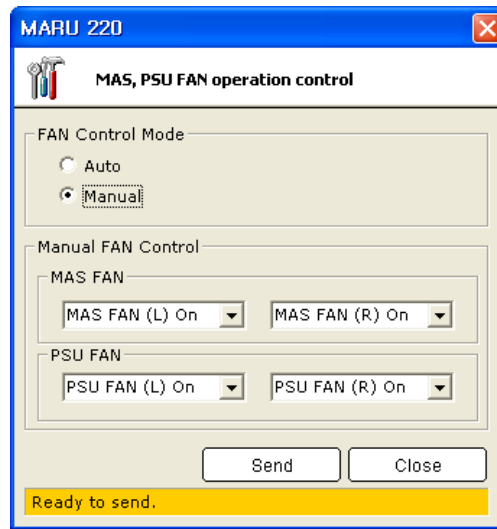


Figure 1-52 Manual FAN Control

If you check [FAN Control Mode] as [Manual], two FANs on MAS and two FANs on PSU can be turned on and off separately.

Version Information

System version information is the values entered when the MARU 220 System was taken out of a warehouse, and it indicates the version of the hardware and software of the current system.

Item	Description
System Version	It indicates the hardware version of the MARU 220 System.
Firmware Version	It indicates the firmware version of MSG, MON and LCU.
Serial Number	It indicates the serial numbers of MSG, MON and LCU units.

CHANGEOVER

If alarm goes off when the MON is in Normal mode, Changeover is implemented in the MON. In that case, if another operator wants Changeover regardless of the status of the MON, he or she uses [Changeover] button. The following is a confirmation message window that appears when the [Changeover] button is clicked. If you click the [OK] button, Changeover is implemented, and if you click the [Close] button, the window is closed without the implementation of Changeover.

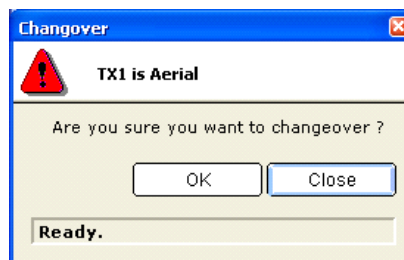


Figure 1-53 Changeover

System Reset

If you click the [Reset] button, the following confirmation window appears, and if you click the [OK] button, the system is reset. Since the system reset disconnects communication with LMMS/RMMS, reconnection to the program is required.

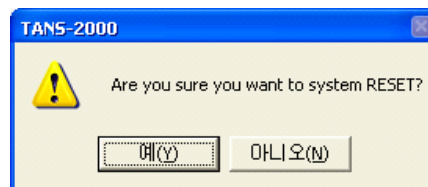


Figure 1-54 System Reset

1.9. History Log Window

LCU saves the data of various events that occur in the MARU 220 System in the flash memory inside. Not only the LCU but also the RMMS/LMMS saves the data of events that occurred in the program installation directory of the RMMS/LMMS PC while in connection to the MARU 220 System. The History Log Window inquires, prints and saves the log data stored in the way described above.

1.9.1. History Log Window Description

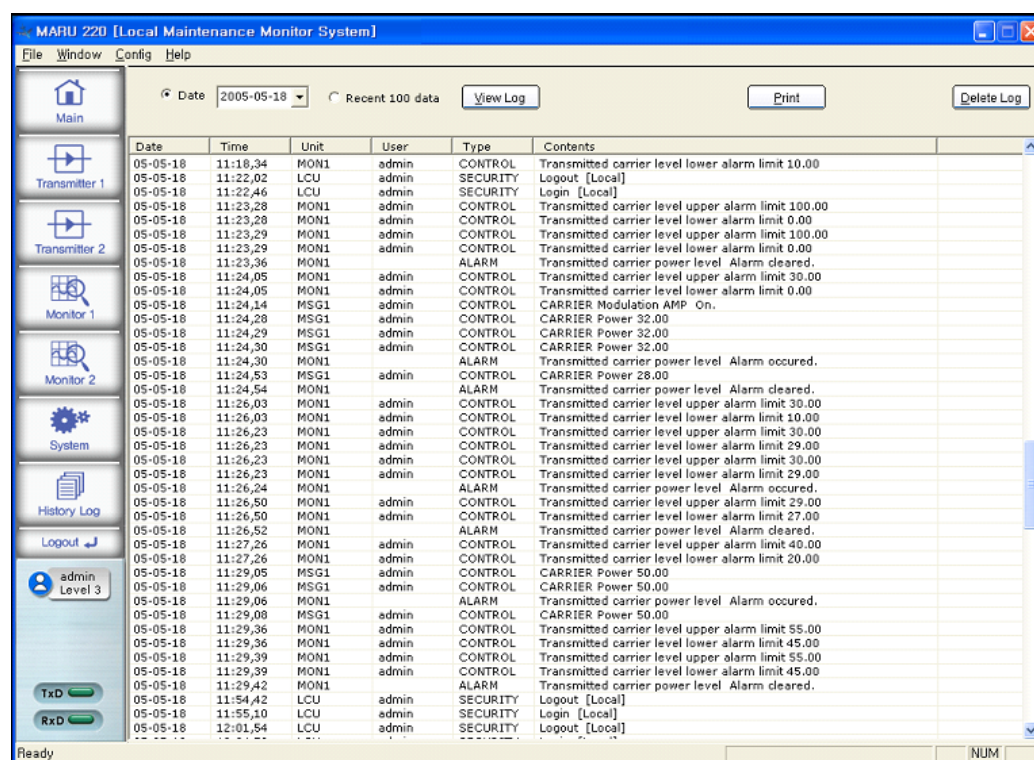


Figure 1-55 History Log Window

LCU Log Data Reference Condition Select

If you select [\[Date\]](#) item and the date to be inquired and then click [\[Get Log\]](#) button, the log data of the pertinent date is retrieved from LCU. If you click the [\[Cancel\]](#) button while the data is being retrieved, log reference is stopped.

If you select the [\[Recent records\]](#) item, enter the number of records to be inquired and click the [\[Get Log\]](#) button, the latest log data is retrieved by the same number as designated in the LCU. If you click the [\[Cancel\]](#) button while the data is being retrieved, log reference is stopped.

Save as...

It saves History Log Content indicated on the window in the RMMS/LMMS PC as a file. The saved file can be checked through the use of a compiler such as 'Notepad' and [Load...] button.

Load...

It indicates the content of the History Log file saved in the RMMS/LMMS PC on the window.

Print...

It prints the content of the History Log displayed on the window.

Information

It displays the status of progress when the log data is retrieved from LCU. [Total xx records] indicates the number of entire data and [Received xx records] indicates the number of data that have been read until now.

Log Data Indication

- No: It indicates the number of data.
- Date: The date when an event occurred is indicated.
- Time: The time when an event occurred is indicated.
- Unit: The name of the unit where an event occurred is indicated.
- User: In case of control record, a user who logged in the RMMS/LMMS is indicated. In case of alarm record, it is indicated as a blank space.
- Type: Alarm Occur/Release record is indicated as Alarm, and Control record is indicated as Control.
- Description: The content of an event that occurred is indicated.

1.9.2. Log Data Format

Log Data Save Format

History Log is saved in LCU and RMMS/LMMS in the following format. Provided that since the History Log saved in the RMMS/LMMS is saved in files by date, date item was omitted in the following format.

Date	Time	Unit	User	Format	Event information
2005-07-11	10:44:16	MON1	admin	ALARM	30Hz AM Alarm (28.3%)
2005-07-11	10:44:16	MON1		ALARM	9960Hz AM Alarm (28.2%)
2005-07-11	10:44:16	MON2		ALARM	IDENT code Alarm (NO IDENT)
2005-07-11	10:44:16	MON2		ALARM	30Hz AM Alarm (28.4%)
2005-07-11	10:44:16	MON2		ALARM	9960Hz AM Alarm (28.3%)
2005-07-11	10:44:25	MSG1		CONTROL	CARRIER, USB, LSB Power Amp ON
2005-07-11	10:44:28	MON1		ALARM	30Hz AM Alarm Cleared
2005-07-11	10:44:31	MON2		ALARM	30Hz AM Alarm Cleared

- Date: The date when an event occurred is indicated.
- Time: The time when an event occurred is indicated.
- Unit: The name of the unit where an event occurred is indicated.
- User: In case of control record, a user who logged in RMMS/LMMS is indicated.
- Type: Alarm Occur/Release record is indicated as '[ALARM](#)' and Control record is indicated as '[CONTROL](#)'.
- Event information: The content of events that occurred is recorded.
-

RMMS/LMMS Log Data Save Location

If the RMMS/LMMS is in operation, log data recorded in the RMMS/LMMS is saved in the in the following folder.

- Filename example: 20050710.log
- Save location: C:\Program Files\MOPIENS\MARU 220\<Site Name>\Log
- '[Site Name](#)' is the name of communication connection setup.

Log Record Event

The type of event saved in the log data is as follows.

- Login/Logout time and user
- Value controlled by an operator (Changed value)
- Alarm defined in the system
- Changeover

The following table shows the types of **alarm items** among History Log Records saved in LCU and RMMS/LMMS.

	Content of alarm event	Description
MSG	MSG Temperature Alarm	It occurs when the internal temperature measured in MSG is -10℃ or lower or 50℃ or higher
	CARRIER PLL Fail Alarm	It occurs when CARRIER PLL Lock has failed
	USB PLL Fail Alarm	It occurs when USB PLL Lock has failed
	LSB PLL Fail Alarm	It occurs when LSB PLL Lock has failed
	Internal EEPROM Access Failed	It occurs when the internal EEPROM of MSG cannot be read (Checksum or Access fail)
	External EEPROM Access Failed	It occurs when the external Backplane EEPROM of MSG cannot be read (Checksum or Access fail)
	Power Table Load Failed	It occurs when Power table for output setup in MSG cannot be read
MON	CARRIER Output Power Alarm	It occurs when CARRIER output power goes beyond alarm setup range.
	RF Input Level Alarm	It occurs when RF Level measured from a monitor antenna goes beyond alarm setup range.
	CARRIER Frequency Alarm	It occurs when Carrier frequency measurement value goes beyond alarm setup range.
	IDENT Code Alarm	It occurs when IDENT Code is not measured or when measured IDENT is different from set IDENT.
	Antenna Notch Alarm	It occurs when VSWR measurement value goes beyond standard value.
	Azimuth Alarm	It occurs when azimuth measured from a monitor antenna goes beyond alarm setup range.
	MON Self Test Alarm	It occurs when measured TSG signal goes beyond alarm setup range.
	30Hz AM Modulation Depth Alarm	It occurs when 30Hz AM modulation depth received from a monitor antenna goes beyond alarm setup range.
	9960Hz AM Modulation Depth Alarm	It occurs when 9960Hz AM modulation depth received from a monitor antenna goes beyond alarm setup range.
	9960Hz FM index Alarm	It occurs when 9960Hz FM Index received from a monitor antenna goes beyond alarm setup range.

	Content of alarm event	Description
	1020Hz AM Modulation Depth Alarm	It occurs when 1020Hz AM modulation depth received from a monitor antenna goes beyond alarm setup range.

	Content of alarm event	Description
M O N	Backplane Voltage Alarm	It occurs when each voltage measured in Backplane goes beyond alarm setup range.
	USB Frequency Alarm	It occurs when USB frequency measurement value goes beyond alarm setup range.
	LSB Frequency Alarm	It occurs when LSB frequency measurement value goes beyond alarm setup range.
	TSG 30Hz AM Modulation Depth Alarm	It occurs when measured TSG 30Hz AM modulation depth goes beyond alarm setup range.
	TSG 9960Hz AM Modulation Depth Alarm	It occurs when measured TSG 9960Hz AM modulation depth goes beyond alarm setup range.
	TSG 9960Hz FM Index Alarm	It occurs when measured TSG 9960Hz FM Index goes beyond alarm setup range.
	TSG Azimuth Alarm	It occurs when measured TSG Azimuth goes beyond alarm setup range.
L C U	MSG1 Communication Alarm	(Left) It occurs when there is a failure in communication with MSG1
	MSG2 Communication Alarm	(Right) It occurs when there is a failure in communication with MSG2
	MON1 Communication Alarm	(Left) It occurs when there is a failure in communication with Monitor 1
	MON2 Communication Alarm	(Right) It occurs when there is a failure in communication with Monitor 2
	BATTERY1 Alarm	(Left) It occurs when Battery Switch of DC/DC1 is turned off.
	BATTERY2 Alarm	(Right) It occurs when Battery Switch of DC/DC2 is turned off
	AC/DC1 Alarm	(Left) It occurs when AC/DC1 or unit input voltage fails or unit is unplugged
	AC/DC2 Alarm	(Right) It occurs when AC/DC2 or unit input voltage fails or unit is unplugged
	DC/DC1 Alarm	(Left) It occurs when DC/DC1 fails or unit is unplugged
	DC/DC2 Alarm	(Right) It occurs when DC/DC2 fails or unit is unplugged
	PSU Left FAN Alarm	(Lower left) It occurs when FAN temperature is measured higher than FAN activity setup temperature in Auto Mode
	PSU Right FAN Alarm	(Lower right) It occurs when FAN temperature is measured higher than FAN activity setup temperature in Auto Mode
	MAS Left FAN Alarm	(Upper left) It occurs when FAN temperature is measured higher than FAN activity setup temperature in Auto Mode

	Content of alarm event	Description
L C U	MAS Right FAN Alarm	(Upper right) It occurs when FAN temperature is measured higher than FAN activity setup temperature in Auto Mode
	Unit Unplugged Alarm	It occurs when one unit or more is unplugged within CMS/MAS Shelf
	System Overheat Shutdown	It occurs while system is being shutting down when one of two CMSs goes beyond setup temperature after measurement of CMA temperature.
	Log data is full	It occurs when LCU Log Data exceeds maximal storage number
	Shelter Door Open	It occurs when Shelter door is open
	Shelter Fire Alarm	It occurs when fire breaks out in Shelter

The following table shows the types of **control items** among History Log records saved in LCU and RMMS/LMMS

	Content of control event	Description
M S G	CARRIER Frequency 113.80MHz	Operation frequency is set as 113.8MHz
	30Hz AM Modulation Depth 30.0%	30Hz AM modulation depth is set as 30%
	1020Hz AM Modulation Depth 10.0%	1020Hz AM modulation depth is set as 10%
	Voice Modulation Depth 10.0%	Voice AM modulation depth is set as 10%
	Sideband RF Phase Offset 180.0 degrees	Sideband RF Phase offset is set as 180 degrees
	Azimuth Offset 0.0degrees	Azimuth Offset is set as 0 degree
	CARRIER Modulation ON	CARRIER modulation ON
	CARRIER Modulation OFF	CARRIER modulation OFF
	SIDEBAND Modulation ON	Sideband modulation ON
	SIDEBAND Modulation OFF	Sideband modulation OFF
	CARRIER Output Power 100.0W	CARRIER output power is set as 100W
	USB SIN Output Power 10.00W	USB SIN output power is set as 10W
	USB COS Output Power 10.00W	USB COS output power is set as 10W
	LSB SIN Output Power 10.00W	LSB SIN output power is set as 10W
	LSB COS Output Power 10.00W	LSB COS output power is set as 10W
	IDENT Code [TST]	IDENT Code is set as 'TST'

	Content of control event	Description
M S G	IDENT Mode – INDEPENDENT	IDENT mode is set as INDEPENDENT mode
	IDENT Mode – MASTER	IDENT mode is set as MASTER mode
	IDENT Mode – SLAVE	IDENT mode is set as SLAVE mode
	IDENT Mode – TEST	IDENT mode is set as test mode
	IDENT Keying Start	It is set to receive IDENT signal
	IDENT Keying Stop	It is set to stop transmitting IDENT signal
	Antenna MAINTENANCE Mode	It is set as antenna maintenance mode (Antenna Switching OFF)
	Antenna Normal Mode	It is set as antenna normal operation mode (Antenna Switching ON)
	[MAINTENANCE] USB Antenna Selected	USB antenna selection in MAINTENANCE mode
	[MAINTENANCE] LSB Antenna Selected	LSB antenna selection in MAINTENANCE mode
M O N	[MAINTENANCE] 1st Antenna Selected	1st Antenna selection in MAINTENANCE mode
	[MAINTENANCE] 15th Antenna Selected	15th Antenna selection in MAINTENANCE mode
	CARRIER Power AMP ON	CMA Amp is set as ON
	CARRIER Power AMP OFF	CMA Amp is set as OFF
	USB Power AMP ON	USB Amp is set as ON
	USB Power AMP OFF	USB Amp is set as OFF
	LSB Power AMP ON	LSB Amp is set as ON
	LSB Power AMP OFF	LSB Amp is set as OFF
	Write the MSG Settings to EEPROM	Save setup value in internal EEPROM and external EEPROM of MSG
	MON Active	Change into monitor Active mode
	MON Bypassed	Change into monitor Bypass mode
	MON OR Mode	Change into Monitor OR Mode
	MON AND Mode	Change into Monitor AND Mode
	Test Signal No.0	Select test Signal No. 0
	TSG Calibration Enable	Measure TSG signal and execute Self Test
	TSG Calibration Disable	It is set up not to measure TSG signal
	AGC Enable	Execute AGC
	AGC Disable	Manual Gain Control
	Alarm duration time 30sec	The period of time between alarm detection and Changeover is set as 30 seconds
	Calibrate TSG	TSG signal measurement value is automatically calibrated
	30Hz AM Calibration Factor 30.0%	Calibration is conducted to meet 30% of 30Hz AM modulation depth
	9960Hz FM Index Calibration Factor 16	Calibration is conducted to meet 9960Hz FM Index Factor 16

	Content of control event	Description
M O N	9960Hz AM Calibration Factor 10.0%	Calibration is conducted to meet 9960Hz AM Modulation Depth 10.0%
	1020Hz AM Calibration Factor 10.0%	Calibration is conducted to meet 1020Hz AM Modulation Depth 10.0%
	Azimuth Calibration Factor 0.0degrees	Calibration is conducted to calibrate Azimuth
	CARRIER Output Power Alarm Upper Limit 101.0W	Upper and lower limit Alarm value is set up
	CARRIER Output Power Alarm Lower Limit 99.0W	
	RF Input Level Alarm Upper Limit -1.0dBm	
	RF Input Level Alarm Lower Limit -45.0dBm	
	Azimuth Alarm Upper Limit 179.0degrees	
	Azimuth Alarm Lower Limit 181.0degrees	
	Carrier Frequency Alarm Upper Limit 118.3000MHz	
	Carrier Frequency Alarm Lower Limit 118.2000MHz	
	USB Frequency Alarm Upper Limit 118.3000MHz	
	USB Frequency Alarm Lower Limit 118.2000MHz	
	LSB Frequency Alarm Upper Limit 118.3000MHz	
	LSB Frequency Alarm Lower Limit 118.2000MHz	
	30Hz AM Modulation Depth Alarm Upper Limit 29.0%	
	30Hz AM Modulation Depth Alarm Lower Limit 31.0%	
	9960Hz AM Modulation Depth Alarm Upper Limit 10.0%	

	Content of control event	Description
M O N	9960Hz AM Modulation Depth Alarm Lower Limit 9.0%	
	1020Hz AM Modulation Depth Alarm Upper Limit 10.0%	
	1020Hz AM Modulation Depth Alarm Lower Limit 9.0%	
	9960Hz FM Index Alarm Upper Limit 16.0	
	9960Hz FM Index Alarm Lower Limit 15.0	
	TSG 30Hz AM Modulation Depth Alarm Upper Limit 30.0%	
	TSG 30Hz AM Modulation Depth Alarm Lower Limit 29.9%	
	TSG 9960Hz AM Modulation Depth Alarm Upper Limit 10.0%	
	TSG 9960Hz AM Modulation Depth Alarm Lower Limit 11.0%	
	TSG 9960Hz FM Index Alarm Upper Limit 11.0	
	TSG 9960Hz FM Index Alarm Lower Limit 10.0	
	TSG Azimuth Alarm Upper Limit 180.0degrees	
	TSG Azimuth Alarm Lower Limit 181.0degrees	
	TX +5V Alarm Upper Limit 4.5V	
	TX +5V Alarm Lower Limit 4.5V	
	TX +7V Alarm Upper Limit 7.5V	
	TX +7V Alarm Lower Limit 6.5V	
	TX +15V Alarm Upper Limit 15.5V	
	TX +15V Alarm Lower Limit 14.5V	
	TX +28V Alarm Upper Limit 28.5V	
	TX +28V Alarm Lower Limit 27.5V	
	TX -15V Alarm Upper Limit -14.5V	

	Content of control event	Description
M O N	TX -15V Alarm Lower Limit -16.5V	
	Write the MON Settings to EEPROM	Save the setup in internal and external EEPROM of MON
L C U	System Reset	MON, MSG, LCU software reset
	System Alarm Sound OFF	System alarm sound is temporarily turned off (Front CSP Silence button)
	Under Control of LOCAL SITE	System control passed on to Local Site
	Under Control of REMOTE SITE	System control passed on to Remote Site
	FAN Auto Control	Automatic FAN control mode is set
	FAN Manual Control	Manual FAN control mode is set
	PSU Left FAN ON	PSU Left FAN ON in manual FAN control mode
	PSU Left FAN OFF	PSU Left FAN OFF in manual FAN control mode
	PSU Right FAN ON	PSU Right FAN ON in manual FAN control mode
	PSU Right FAN OFF	PSU Right FAN OFF in manual FAN control mode
	MAS Left FAN ON	MAS Left FAN ON in manual FAN control mode
	MAS Left FAN OFF	MAS Left FAN OFF in manual FAN control mode
	MAS Right FAN ON	MAS Right FAN ON in manual FAN control mode
	MAS Right FAN OFF	MAS Right FAN OFF in manual FAN control mode
	Audio Input - MIC	Audio input is set as MIC
	Audio Input - LINE	Audio input is set as LINE
	System Sound ON	System alarm sound is turned on
	System Sound OFF	System alarm sound is turned off
	Date Adjustment(YYMMDD) - 051212	Setup of the date displayed on CSP LCD
	Time Adjustment(HHMMSS) - 112344	Setup of the time displayed on CSP LCD
	Shutdown Temperature : 50.5	System shutdown temperature setup
	FAN operation temperature : 40.5	FAN activity temperature setup in automatic FAN control mode
	IDENT Keying Sound From MSG1	IDENT sound transmitting from MSG1 is output to a speaker
	IDENT Keying Sound From MSG2	IDENT sound transmitting from MSG2 is output to a speaker
	IDENT Keying Sound From MON1	IDENT sound received from MON1 is output to a speaker
	IDENT Keying Sound From MON2	IDENT sound received from MON2 is output to a speaker
	IDENT Keying Sound OFF	IDENT Keying sound is set not to be output to a speaker
	IDENT Keying Sound From Active TX	IDENT sound receiving from Active TX is output to a speaker
	Write the LCU Settings to EEPROM	Save the current setup in internal EEPROM of LCU

	Content of control event	Description
SYSTEM	User Manual Changeover [TX1 --> TX2]	If user switched the transmitter (from TX1 to TX2)
	Changeover [TX1 Shutdown/TX2 Active] TX1 30Hz AM Modulation Depth Alarm	In case of system switching due to the occurrence of 30Hz alarm Switched from TX1 to TX2

1.9.3. Measure Item Record Data

RMMS/LMMS regularly saves both History Log and the items measured in MON in PC as text files. The content of the files can be checked through the use of a compiler or Microsoft Excel program.

File name <MON No.>_<Year, Month, Day > format. Extension is .csv.

- Filename example: MON1_20050710.csv
- Save location: C:\Program Files\MOPIENS\MARU 220\<Site name >\Monitor
- 'Site name' is communication connection setup name.

Items recorded in the file are as follows.

Item	Remarks
Time	Record time
CARRIER Output Power	
RF Input Level	
Azimuth	
CARRIER Frequency	
USB Frequency	
LSB Frequency	
30Hz AM Modulation Depth	
9960Hz AM Modulation Depth	
1020Hz AM Modulation Depth	
9960Hz FM Index	
IDENT Code	
TSG 30Hz AM Modulation Depth	
TSG 9960Hz AM Modulation Depth	
TSG 9960Hz FM Index	
TSG Azimuth	
Cause of Changeover	Reason for occurrence of Changeover
Active Transmitter	Active Transmitter Number
Backplane TX1 +5V	
Backplane TX1 +7V	
Backplane TX1 +15V	
Backplane TX1 +28V	
Backplane TX1 -15V	
Backplane TX2 +5V	
Backplane TX2 +7V	
Backplane TX2 +15V	
Backplane TX2 +28V	
Backplane TX2 -15V	
Fault Antenna Number	

1.10. Program Menu

If you use the menu item on the upper side, you can use additional functions required to operate the MARU 220 System. The menu item includes followings.

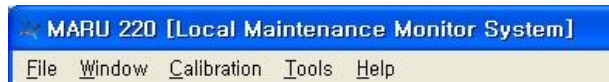


Figure 1-56 Program Menu

1.10.1. File Menu

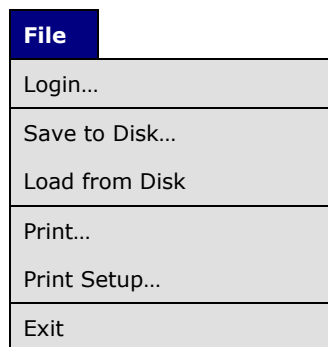


Figure 1-57 File Menu

Login

It makes a Login window appear.

Save to Disk...

It saves Setup Value for transmitter and monitor in the PC as a file.

Load from Disk...

It reads the Setup File saved as above and applies it to transmitter and monitor.

Print...

It prints transmitter setup value for and monitor receipt value.

Print Setup...

It sets up a printer for printing.

Exit

It closes the program.

1.10.2. Window Menu

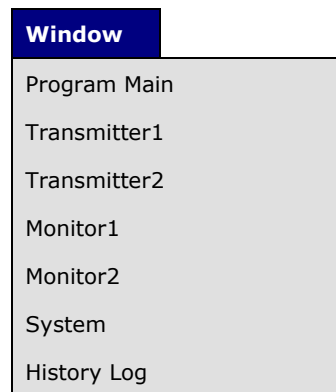


Figure 1-58 Window Menu

Move to a selected window in the menu item. It implements the same function as what the window switch button on the menu on the left does.

1.10.3. Calibration Menu

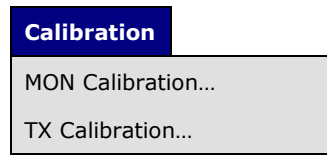


Figure 1-59 Calibration Menu

MON Calibration...

It calibrates measured values of MON unit through the use of the values measured by an accurate measuring instrument. Items subject to calibration are as follows.

- 30Hz, 9960Hz, 1020Hz modulation depth values
- Measured FM Index values
- Measured TSG values
- Measured output power values of CARRIER and SIDEBAND

If you select the menu, the following window appears.

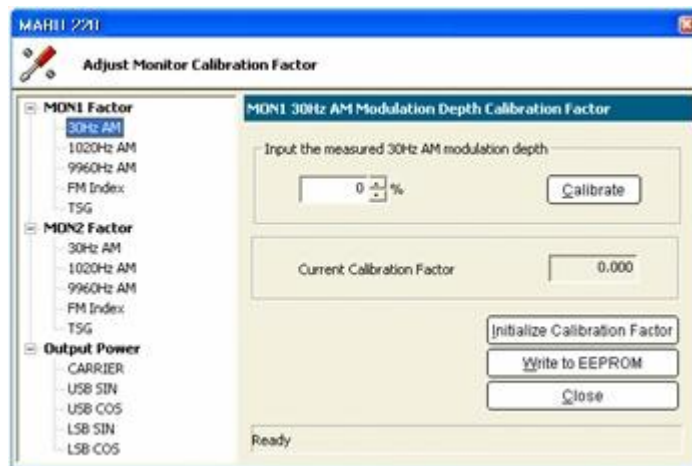


Figure 1-60 MON Calibration

Enter the value accurately measured by an accurate measuring instrument in the entering space for [Input the measured 30Hz AM modulation depth] instead of the value measured in the MON. If you click [Calibrate] button after entering the measured value, the measured value of MON unit is calibrated.

The entering space for [Current Calibration Factor] is calibration value currently applied to MON unit, and if the value is 1, the calibration value is not applied.

If you click [Initialize Calibration Factor] button, calibration value is set as 1, so it goes back to the initial status where the calibration is not applied.

If you have completed the calibration, click [\[Write to EEPROM\]](#) button to save the current status.

TX Calibration...

It calibrates setup value of transmitter. Items subject to calibration are as follows.

- Output power setup value of CARRIER and SIDEBAND
- 30Hz, 1020Hz, Voice modulation depth setup value

If you choose the menu, the following window appears.

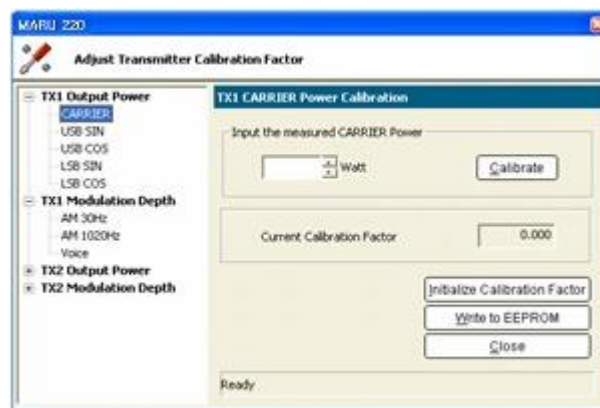


Figure 1-61 TX Calibration

If CARRIER output power is set as 100W, and the value measured in MON is 120W, enter 120 in the entering space for [\[Input the measured CARRIER power\]](#) and then click [\[Calibrate\]](#) button. If the calibration is normally completed, CARRIER output power setup value is changed into 120.

The space for [\[Current Calibration Factor\]](#) shows calibration value currently applied to MSG unit, and if the value is 1, the calibration value is not applied.

If you click [\[Initialize Calibration Factor\]](#) button, calibration value is set as 1, so it goes back to the initial status where the calibration value was not applied.

If the calibration is has been completed, click [\[Write to EEPROM\]](#) button to save the current status.

1.10.4. Tool Menu

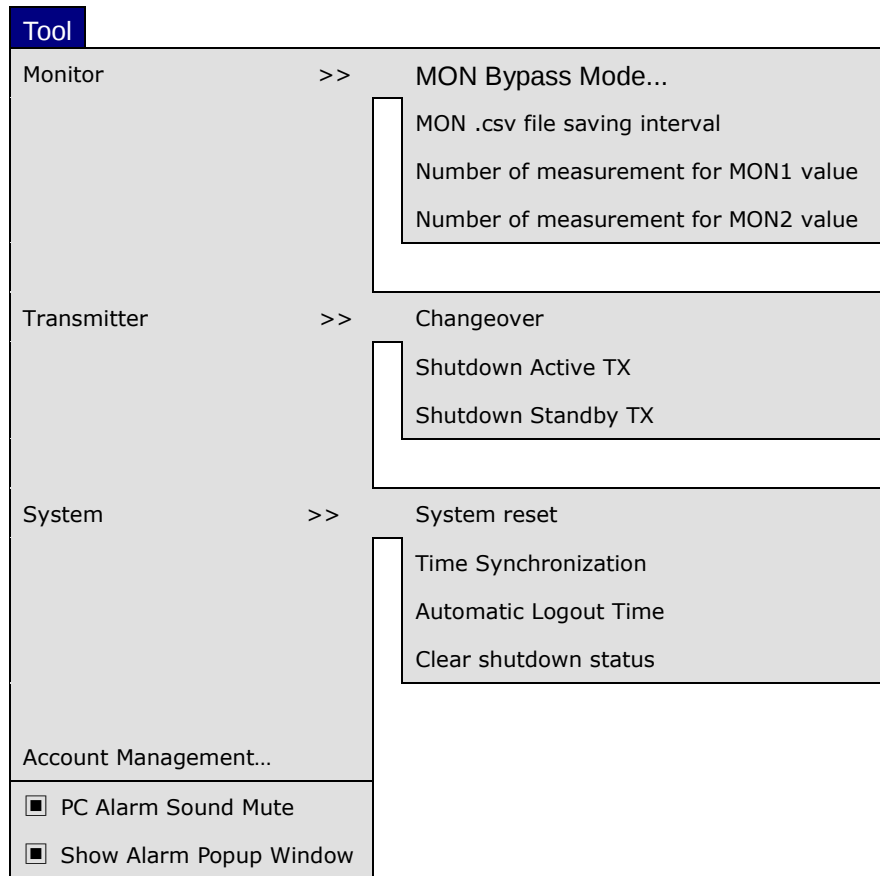


Figure 1-62 Tool Menu

Monitor Bypass Mode...

It changes Normal/Bypass status of MON unit.

MON .csv file saving interval

It sets up the interval of record time at a time of saving MON measurement value in the PC.

Number of measurement for MON1/2 value

It determines how many values are averaged to generate the MON measurement value.

Changeover

It executes Changeover.

Shutdown Active TX

It turns off CARRIER and SIDEBAND AMP of Active Transmitter.

Shutdown Standby TX

It turns off CARRIER and SIDEBAND AMP of Standby Transmitter.

System Reset

It resets the system.

Time Synchronization

It synchronizes time in three locations including LCU, RMMS PC and LMMS PC.

Automatic Logout Time

If a certain period of time passes without user's control activity in LMMS, automatic logout is implemented, and the right to control is passed on to RMMS. At that time, waiting time is set.

Clear Shutdown Status

It clears shutdown status. If MON Bypass is implemented and then it is returned to Normal status, the same effect can be generated.

Account Management

It is a window to manage RMMS/LMMS users. It creates new accounts and deletes and changes a password. Account information data is saved in LCU.

The following figure is a window to add a new account. If you enter user's level, account name and password to be used and then click [\[Create\]](#) button, a new account is created.



Figure 1-63 Account Create

The following figure is a window to delete an account. If you select an account to be deleted and then click [\[Delete\]](#) button, the account is deleted.

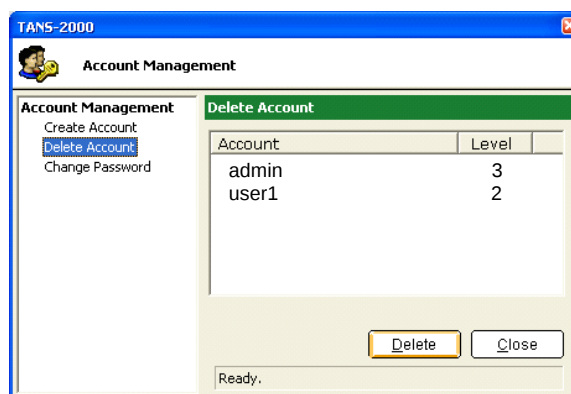


Figure 1-64 Account Delete

PC Alarm Sound Mute

If any trouble occurs in the MARU 220 System, alert sound goes off from the RMMS/LMMS PC. If the item is checked, the alert sound does not go off although a trouble occurs.

Show Alarm Popup Window

If any trouble occurs in the MARU 220 System, RMMS/LMMS displays an alert window indicating the content of the trouble. If the item is not checked, the alert

window is not displayed although a trouble occurs.

Chapter 2. CSP

2.1. CSP Overview

CSP plays an interface role helping a system operator control system without external devices including LMMS and RMMS and provide information on system status.

2.2. CSP exterior configuration

The following shows the exterior of CSP of the MARU 220 System

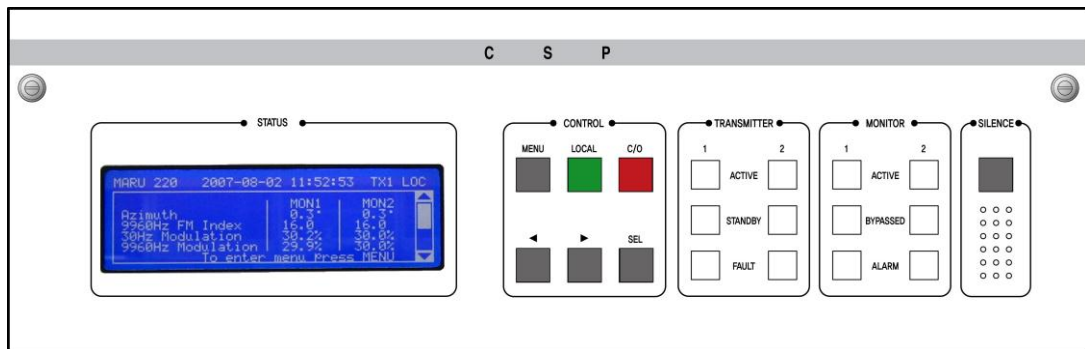


Figure 2-1 Front of CSP of MARU 220 System

2.2.1. Control & Silence

There are 7 buttons in CSP, and the system is controlled through the use of the pertinent buttons. The functions of each button are as follows.

Button	Function
MENU	Move to main menu screen from initial screen. Move to parent menu screen from sub menu screen.
LOCAL	It sets up system control right. Whenever you click [LOCAL] button, it changes into Local or Remote status, changed status is displayed on the upper right side of LCD.
C/O (Changeover)	It is used at a time of Transmitter Changeover.
◀, ▶	It is used to switch menus or change screen items.
SEL (Select)	It selects a menu or completes setup.
SILENCE	It reinforces alert sound at a time of occurrence of alarm sound.

2.2.2. Transmitter Lamp

There are three Transmitter Lamps each in TX1 and TX2.

Details of each lamp are as follows.

Distinction	Color	Description
ACTIVE	GREEN	It is turned on when Transmitter is Active (connected to antenna).
STANDBY	ORANGE	It is turned on when Transmitter is on Standby (connected to Dummy Load).
FAULT	RED	It is turned on when there is any test trouble in Transmitter or it was shut down or there are any communication errors. Issued alarm item can be checked in alarm menu.

2.2.3. Monitor Lamp

There are three Monitor LAMPs each in MON1 and MON2.

Details of each lamp are as follows.

Distinction	Color	Description
ACTIVE	GREEN	It is turned on when MON is Active.
Bypassed	ORANGE	It is turned on when MON is bypassed not being involved in Changeover.
ALARM	RED	It is turned on when it is not less than measurement value of MON or there are any test problems or there are communication errors. Issued alarm items can be checked in alarm menu.

2.3. Characteristics of CSP

CSP menu consists of main screen and 6 menus.

The main screen provides basic system information measured by MON. Azimuth, 9960Hz FM Index, 30Hz Modulation, 9960Hz Modulation, 1020Hz Modulation, CAR Output Power and RF Input Level are displayed.

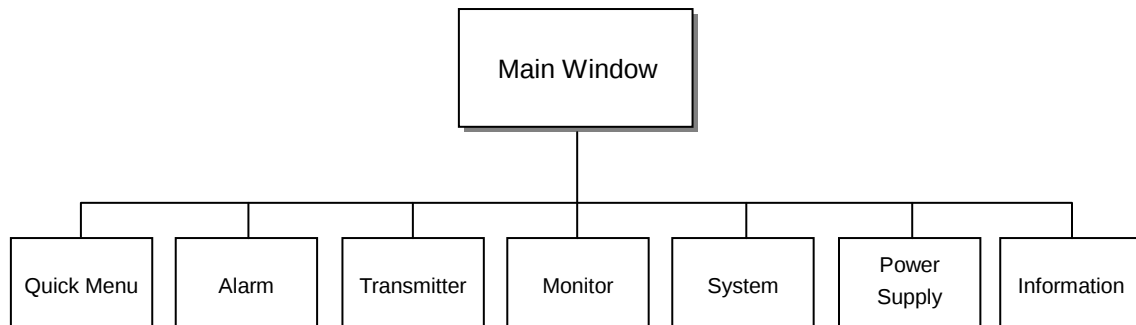


Figure 2-2 Main Screen Composition

Menu	Description
Quick Menu	It is Shortcut Menu that enables users to implement setup without going into sub menu several times at a time of operation of device through CSP. Menu item can be added or deleted through user setup. Basic menus include MON Bypass, Shutdown Main, Shutdown Standby, Add Menu and Delete Menu.
Alarm	It displays alarm status and BITE status of each unit. Alarm menu includes Transmitter1, Transmitter2, Monitor 1, Monitor 2, Presence Detect, System, Power Supply and Environment, and the alarm status and the BITE status can be checked respectively.
Transmitter	The frequency of the system and general signals can be set. Transmitter menu consists of TX1, TX2 and CONFIG.
Monitor	It displays results measured in MON1 and MON2. Monitor menu consists of MON1, MON2 and CONFIG.
System	It can save or restore system setup value and inquire or set up system status such as Changeover, antenna control, FAN control and system temperature. System menu consists of Save & Restore, System Control, Changeover, FAN Control, Presence Detect, Temperature, Environment, Audio, DME Interface and LCU Configuration.
Power Supply	It can inquire PSS status. Power Supply Menu consists of PSU Status and PSU Measurement.
Information	It displays status information of each unit. Sub menu consists of Date & Time, LCU, MSG1, MSG2, MON1 and MON2.

Main Display

Main Screen of LCD displays important parameters measured in MON1 and MON2. In addition, the current time and current control time (Local/Remote) are displayed on the upper side of the LCD.

Values measured in MON1 and MON2 is indicated on the Main Screen, and they are as follows.

- Azimuth
- 9960 Hz FM Index
- 30 Hz Modulation
- 9960 Hz Modulation
- 1020 Hz Modulation
- CAR Output Power
- RF Input Level

The initial screen of CSP LCD is as follows.

MARU 220 2005-00-00 00:00:00 TX1 LOC		
	MON1	MON2
Azimuth	000.0'	000.0'
9960Hz FM Index	00.0	00.0
30Hz Modulation	00.0%	00.0%
9960Hz Modulation	00.0%	00.0%
To enter menu press MENU		

If you click [MENU] button in the initial main screen, main menu is displayed. If you click [MENU] button repeatedly, the main menu and the initial main screen is toggled and operated.

MARU 220 2005-00-00 00:00:00 TX1 LOC		
Quick Menu	Alarm	Transmitter

Move to another menu by using direction (◀, ▶) button on the main screen and then select each menu by clicking [SEL] button. If you click [MENU] button in the sub menu, parent menu screen appears.

Notice message

If you choose control or status check menu through CSP, a notice message saying that menu setup is completed or that you cannot select pertinent menu is displayed to inform users of the current status.

Notice message is displayed in following cases.

Notice message	Description
MENU LEVEL Error!!	It displays erroneous access to menu
Parameter value was applied	It displays the completion of setup value application
Parameter value was save	It displays the completion of setup value save
Parameter value was reloaded	It displays the completion of setup value restoration
Click during x sec do changeover	It displays how long one should click CSP Changeover key to do Changeover.
Changeover command sending failed!	It displays cases when Changeover command cannot be executed.
ID code is null value!	It indicates that ID Code value has not been set up.
Alarm silence applied	It indicates the completion of application of Alarm Silence.
Alarm silence does not effect	It indicates that if re-setup is implemented at a time of operation of system alarm silence, the alarm silence is not applied.
Under control of REMOTE user	It is displayed when system control right belongs to REMOTE but control activity is executed in LOCAL.
Auto change to REMOTE control	It displays that control right has automatically changed to REMOTE when there has not been any control activity from LOCAL for a certain period of time.
Communication failure occurred!	It is displayed when errors occurred while in communication with MSG1, MSG2, MON1 and MON2 units.
MSG1 removed!	It indicates that MSG1 is not installed.
MSG2 removed!	It indicates that MSG2 is not installed.
MSG1,2 removed!	It indicates that MSG1 and MSG2 are not installed.
MSG1 communication error!	It indicates that an error occurred at a time of communication with MSG1.
MSG2 communication error!	It indicates that an error occurred at a time of communication with MSG2.

Notice message	Description
MSG1,2 communication error!	It indicates that errors occurred at a time of communication with MSG1 and MSG2.
MON1 removed!	It indicates that MON1 is not installed.
MON2 removed!	It indicates that MON2 is not installed.
MON1,2 removed!	It indicates that MON1 and MON2 are not installed.
MON1 communication error!	It indicates that an error occurred at a time of communication with MON1.
MON2 communication error!	It indicates that an error occurred at a time of communication with MON2.
MON1,2 communication error!	It indicates that there are communication errors in MON1 and MON2.
MON unit is activated!	It indicates that monitor executes control in Active Mode.
System is shutdown state!	It indicates that the system implements control in Shutdown status.
Can not know TX ACT state!	It indicates that Active Transmitter cannot be confirmed.
Sending log data to user (REM/LOC)	It indicates that system operation record is being transmitted.
User menu is full! Max user menu is 16	It indicates that up to 16 user menus can be added.
User menu is null!	It indicates that User Menu Delete is selected in absence of user menu.
Can't edit menu. Refer to manual!	It indicates that setup cannot be changed.
System is processing Ground Error Check!!	It indicates that GEC is activated.

The following figure shows the example screen of the notice message.

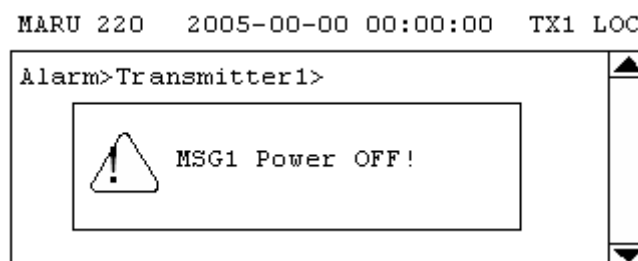


Figure 2-3 MSG1 Power Off Notice Message Screen

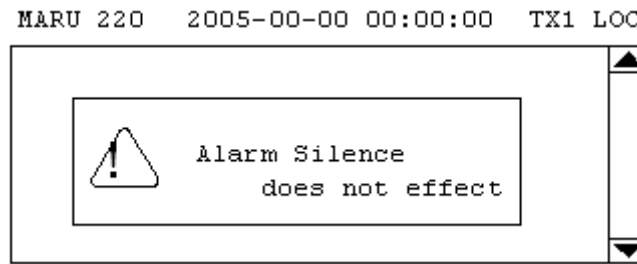


Figure 2-4 Alarm Silence Null Message Screen

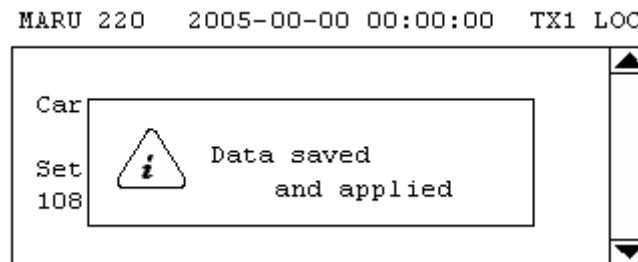


Figure 2-5 Setup Application Complete Screen

Question message

If the menu requests users to select YES or NO according to setup value at a time of control through CSP, the question message is displayed.

The question message is displayed when the following menu is selected.

- Quick Menu > User Menu Add
- Quick Menu > User Menu Delete
- Quick Menu > Monitor Bypass
- Quick Menu > Shutdown Main Transmitter
- Quick Menu > Shutdown Standby Transmitter
- Transmitter > Carrier Frequency
- System > System Control > System Reset
- System > System Control > Clear Shutdown State
- System > Changeover > Run Changeover
- System > LCU Configuration > Lamp Test
- Transmitter > CONFIG > IDENT Setting > IDENT Code

The following figure shows the example screen of the question message.

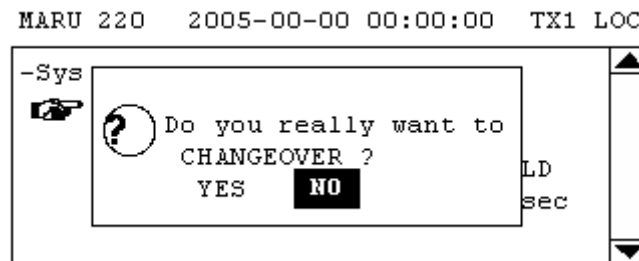


Figure 2-6 Changeover Question Message Screen

Setup message – Text line

Text line setup message is displayed at a time of change of text line through CSP.

•

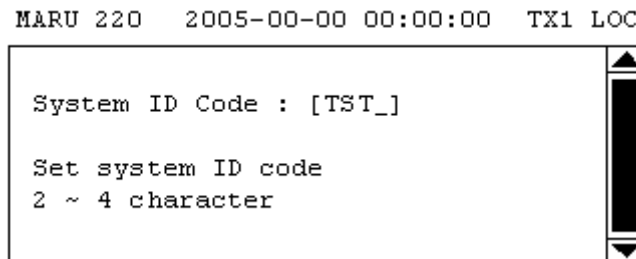


Figure 2-7 Text Line Setup Message Screen

- Activity according to CSP key is as follows.
-
- ◀, ▶ : Text change
- MENU : Move a cursor to the left side. If it is the end of the left-hand side, move to a previous menu.
- SEL : Move a cursor to the right side. If cursor text is ' '(Space), setup is completed.

•

Setup message – Non-decimal based number line

Number value setup message is displayed at a time of change of non-decimal based number value through CSP

•

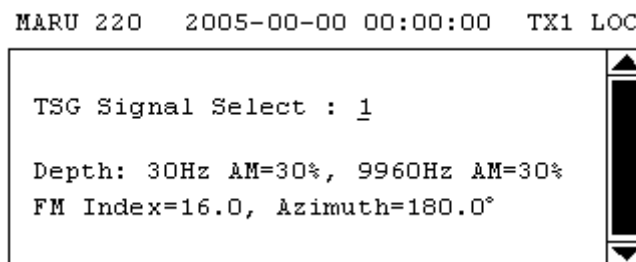


Figure 2-8 Non-Decimal Based Number Value Setup Message Screen

- Activity according to CSP key is as follows.
-
- ◀, ▶ : Number change
- MENU : Return to a previous menu
- SEL : Setup completed
-

Setup message – Non-decimal based number line

Number value setup message is displayed at a time of change of decimal based number value through CSP.

-

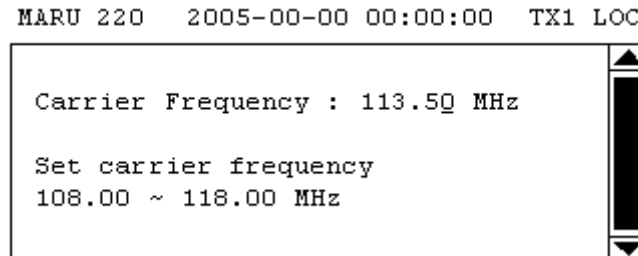


Figure 2-9 Decimal Based Number Value Setup Message

- Activity according to CSP key is as follows.
-
- ◀, ▶ : Number change
- MENU : Move to the left side. If the number value is the end of the left-hand side, return to the previous menu.
- SEL : Move to the right side. If the number value is the end of the right-hand side, setup is completed.

-

Setup message – Others

If it is not a number or a text line at a time of change of setup value through CSP, the following setup message is displayed.

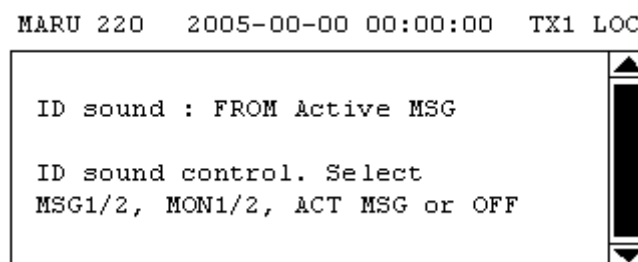


Figure 2-10 Setup Message Screen in Case that It is not Number or Text Line

- Activity according to CSP key is as follows.
-
- ◀, ▶ : Setup value change
- MENU : Return to the previous menu
- SEL : Setup completed

2.3.1. Quick Menu

Quick Menu includes Shortcut to help users conveniently operate a device. Menu item can be added or deleted in accordance with user setup.

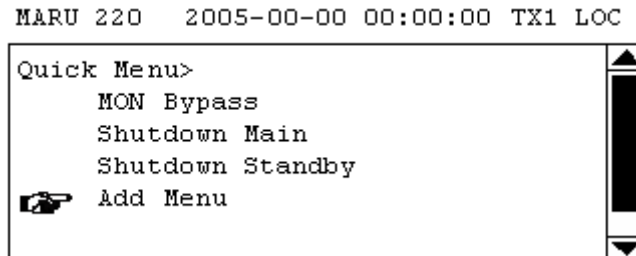


Figure 2-11 Quick Menu Screen

The sub menu of the Quick Menu is as follows.

Sub menu	Description
MON Bypass	It transforms MON 1 and MON 2 to Bypass mode. The menu is basic system menu and cannot be deleted through the use of 'Delete Menu'.
Shutdown Main	It turns off CMA/LSMA/USMA of Main Transmitter connected to antenna. The menu is basic system menu and cannot be deleted through the use of 'Delete Menu'.
Shutdown Standby	It turns off CMA/LSMA/USMA of Standby Transmitter connected to Dummy Load. The menu is basic system menu and cannot be deleted through the use of 'Delete Menu'.
Add Menu	It adds user menu below the Quick Menu.
Delete Menu	It deletes user menu below the Quick Menu.

2.3.2. Alarm

Alarm menu displays system alarm and BITE result of each unit.

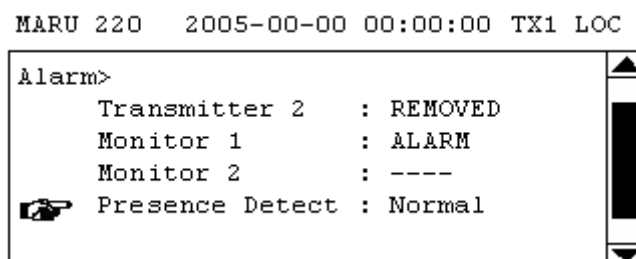


Figure 2-12 Alarm Menu Screen

The sub menu of the alarm menu is as follows.

Sub menu	Description
Transmitter1, 2	It displays normality of PLL of Carrier, LSB and USB, normality of power of Carrier/USB COS/LSB COS/USB SIN and LSB SIN, Internal/External EEPROM, Power Table Load status and installation of CMA/LSMA/USMA.
Monitor1, 2	It displays BIT measurement failure and normality of Carrier Output Power, RF Input Level, Carrier/LSB/USB Frequency, ID Code, Azimuth, 30Hz/9960/1020Hz Modulation, 9960Hz FM Index, Antenna Fault, TSG Azimuth, TSG 30Hz/9960Hz Modulation, TSG 9960Hz FM Index, and Backplane Voltage.
Presence Detect	It displays the status of packing and unpacking of units detected in LCU.
System	It displays Automatic Shutdown status, MSG1/MSG2/MON1/MON2 communication status, status of FAN and shortage of storage space for Log Data.
Power Supply	It displays power outage status, packing and unpacking status of AC/DC1 and 2 and DC/DC1 and 2 that constitute PSU, module failure and Battery Switch status.
Environment	If temperature/fire/invasion sensor is installed in an equipment room and connects to the system, it displays the status of the sensor.

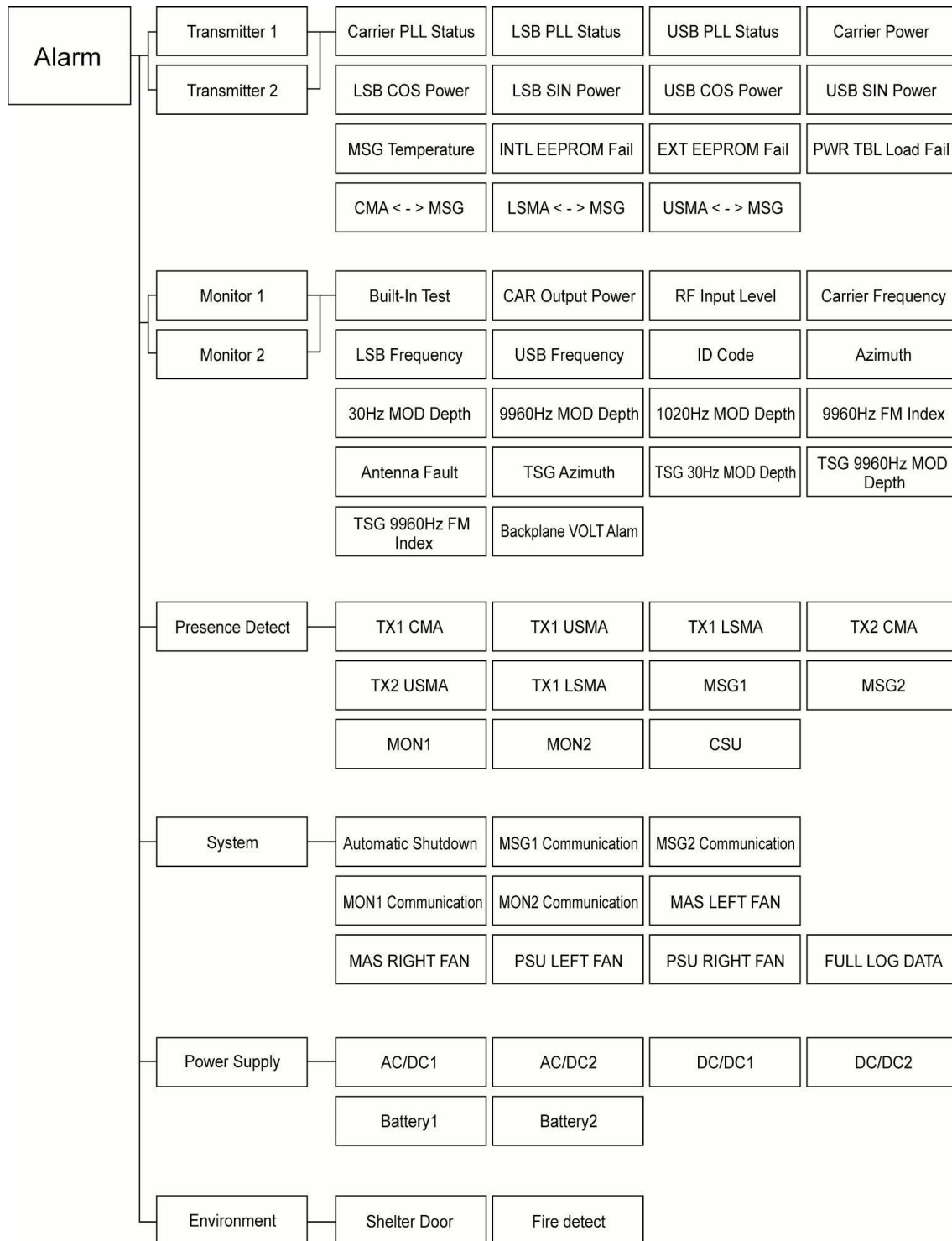


Figure 2-13 Alarm Menu Structure

Transmitter 1 and Transmitter 2

Transmitter 1 and Transmitter 2 menus display BITE result and alarm of each Transmitter.

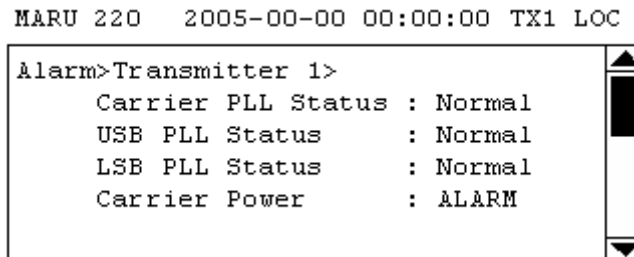


Figure 2-14 Alarm > Transmitter 1 / 2 Menu Screen

Items displayed in the Transmitter Menu screen are as follows.

Table 2-2-1 Alarm > Transmitter 1 / 2 Display Item

Item	Status display	Description
Carrier PLL Status	Normal or FAIL	Carrier PLL lock detect fail
USB PLL Status	Normal or FAIL	USB PLL lock detect fail
LSB PLL Status	Normal or FAIL	LSB PLL lock detect fail
Carrier Power	Normal or ALARM	Carrier Power fault
LSB COS Power	Normal or ALARM	LSB COS Power fault
LSB SIN Power	Normal or ALARM	LSB SIN Power fault
USB COS Power	Normal or ALARM	USB COS Power fault
USB SIN Power	Normal or ALARM	USB SIN Power fault
MSG Temperature	Normal or ALARM	Beyond MSG temperature range
CMA <-> MSG	Normal or ALARM	CMA connection status
LSMA <-> MSG	Normal or ALARM	LSMA connection status
USMA <-> MSG	Normal or ALARM	USMA connection status

Monitor 1 and Monitor 2

Monitor 1 and Monitor 2 menus display the status of alarm issued when the value measured in each MON exceeded setup value.

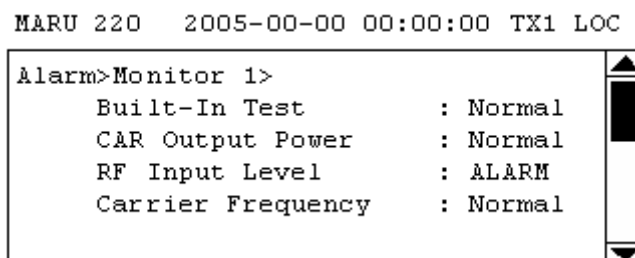


Figure 2-15 Alarm > Monitor 1 / 2 Menu Screen

Items displayed in Monitor Menu Screen are as follows.

Table 2-2-2 Alarm > Monitor 1 / 2 Display Item

Item	Status display	Description
Built-In Test	Normal or FAIL	TSG measurement error
TX Carrier Level	Normal or ALARM	Beyond Carrier Output Power range
RX Carrier Level	Normal or ALARM	Beyond RF Input Level range
Carrier Frequency	Normal or ALARM	Beyond Carrier Frequency range
ID Code	Normal or ALARM	ID Code error
Azimuth	Normal or ALARM	Beyond Azimuth range
30Hz Modulation	Normal or ALARM	Beyond 30Hz Modulation range
9960Hz Modulation	Normal or ALARM	Beyond 9960Hz Modulation range
1020Hz Modulation	Normal or ALARM	Beyond 1020Hz Modulation range
9960Hz FM Index	Normal or ALARM	Beyond FM Index range
Antenna Fault	Normal or ALARM	ANT Alarm detect
TSG Azimuth	Normal or ALARM	Beyond TSG Azimuth range
TSG 30Hz MOD Depth	Normal or ALARM	Beyond TSG 30Hz Modulation range
TSG 9960Hz MOD Depth	Normal or ALARM	Beyond TSG 9960Hz Modulation range
TSG 9960Hz FM Index	Normal or ALARM	Beyond TSG FM Index range
Backplane VOLT Alarm	Normal or ALARM	Beyond the range of TX voltage supplied to backplane

Presence Detector

Presence Detector Menu displays packing/unpacking status of units that constitute system.

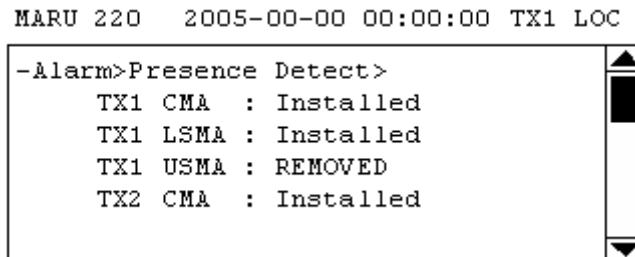


Figure 2-16 Alarm > Presence Detect Screen

Items displayed in the Presence Detector Menu Screen are as follows.

Table 2-2-3 Alarm > Presence Detect Display Item

Item	Status display
TX1 CMA	Installed or REMOVED
TX1 LSMA	Installed or REMOVED
TX1 USMA	Installed or REMOVED
TX2 CMA	Installed or REMOVED
TX2 LSMA	Installed or REMOVED
TX2 USMA	Installed or REMOVED
MSG1	Installed or REMOVED
MSG2	Installed or REMOVED
MON1	Installed or REMOVED
MON2	Installed or REMOVED
CSU	Installed or REMOVED

System

System Menu displays the content of alarm issued from the entire system.

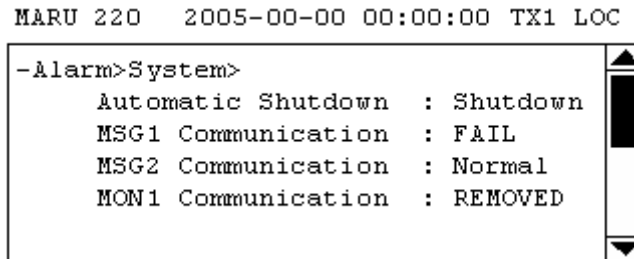


Figure 2-17 Alarm > System Menu Screen

Items displayed in the system menu screen are as follows.

Table 2-2-4 Alarm > System Display Item

Item	Status display	Description
Automatic Shutdown	Normal or SHUTDOWN	Automatic shutdown
MSG1 Communication	Normal/FAIL/REMOVED	Communication error between LCU and MSG1
MSG2 Communication	Normal/FAIL/REMOVED	Communication error between LCU and MSG2
MON1 Communication	Normal/FAIL/REMOVED	Communication error between LCU and MON1
MON2 Communication	Normal/FAIL/REMOVED	Communication error between LCU and MON2
MAS Left FAN	Normal or FAULT	MAS LEFT FAN status
MAS Right FAN	Normal or FAULT	MAS RIGHT FAN status
PSU Left Fan	Normal or FAULT	PSU LEFT FAN status
PSU Right Fan	Normal or FAULT	PSU RIGHT FAN status
Full Log Data	Normal or ALARM	Shortage of storage space for log data

Power Supply

Power Supply Menu displays the content of alarm issued from PSU. If the power of the pertinent AC is cut, AC/DC1 and AC/DC2 are indicated as '----'.

```

MARU 220  2005-00-00 00:00:00 TX1 LOC
-Alarm>Power Supply>
  AC2 ELEC Fail : FAILURE
  AC/DC1       : Normal
  AC/DC2       : ----
  DC/DC1       : FAULT
  
```

Figure 2-18 Alarm > Power Supply Menu Screen

Items displayed in the Power Supply Menu Screen are as follows.

Table 2-2-5 Alarm > Power Supply Display Item

Item	Status display	Description
AC1 ELEC Fail	Normal or FAILURE	AC1 outage
AC2 ELEC Fail	Normal or FAILURE	AC2 outage
AC/DC1	Normal/FAULT/----	AC/DC1 status
AC/DC2	Normal/FAULT/----	AC/DC2 status
DC/DC1	Normal/FAULT	DC/DC1 status
DC/DC2	Normal/FAULT	DC/DC2 status
Battery1	ON or OFF	Battery1 switch status
Battery2	ON or OFF	Battery2 switch status

Environment

Environment Menu displays pertinent content if alarm is sensed within shelter.

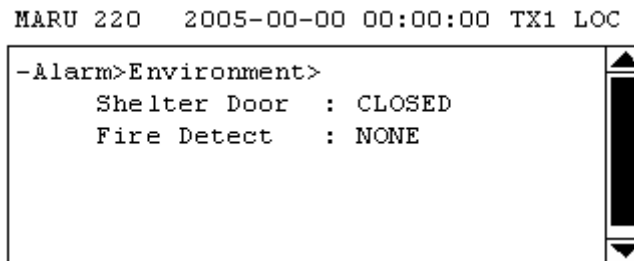


Figure 2-19 Alarm > Environment Screen

Items displayed in the Environment Menu Screen are as follows.

Table 2-2-6 Alarm > Environment Display Item

Item	Status display	Description
Shelter Door	OPENED or CLOSED	Shelter Door status
Fire Detect	FIRE DETECTED! or NONE	Fire detection sensor status

2.3.3. Transmitter

Transmitter Menu implements general setup for transmitter such as transmission output power, frequency and modulation depth of the MARU 220 System.

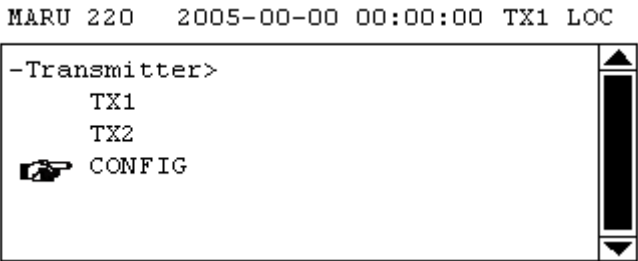


Figure 2-20 Transmitter Menu Screen

The sub menu of the Transmitter menu is as follows.

Table 2-2-7 Transmitter Display Item

Sub menu	Description
TX1	Transmitter 1 setup and status reference menu
TX2	Transmitter 2 setup and status reference menu
CONFIG	IDENT and antenna related setup

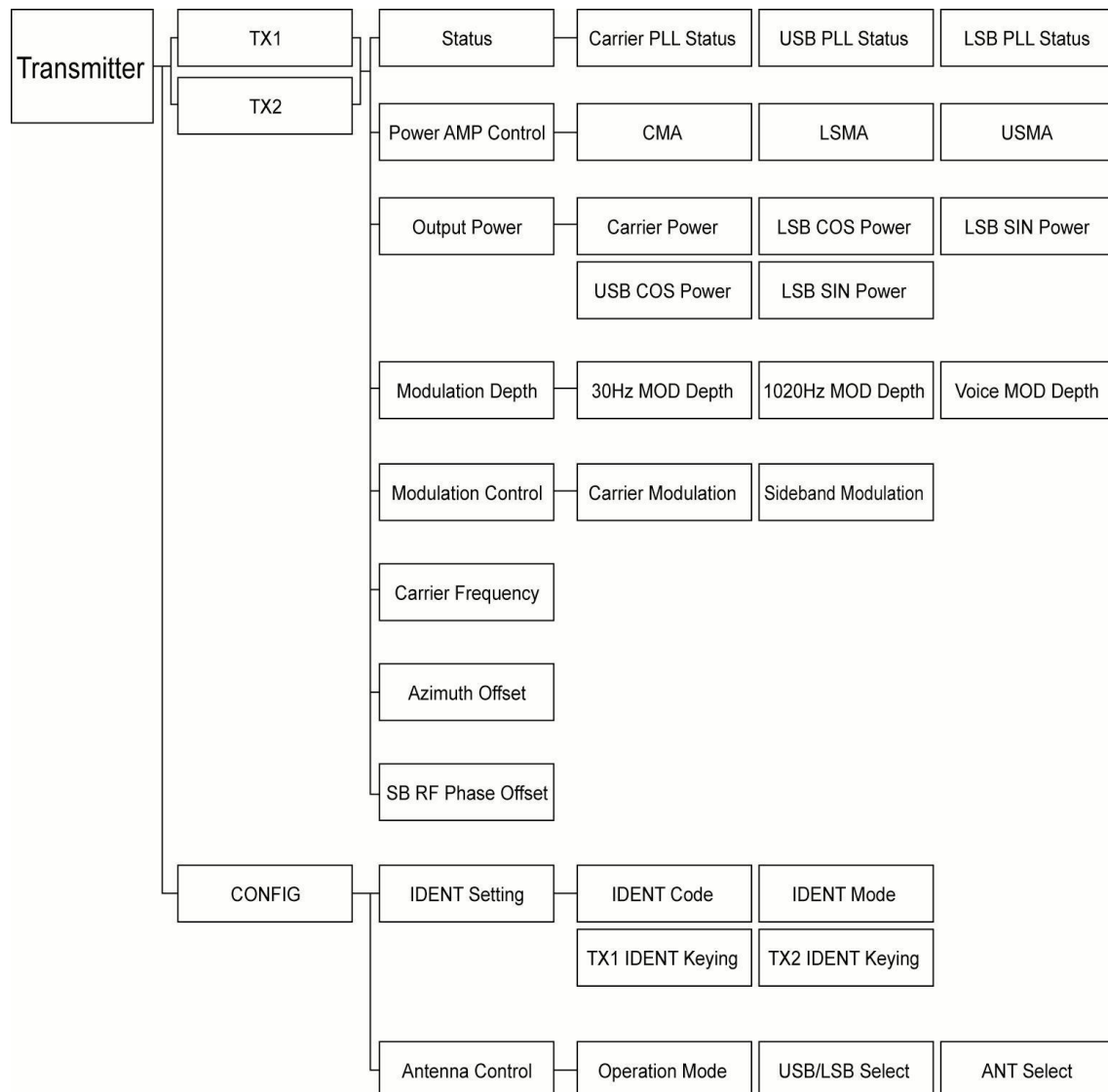


Figure 2-21 Transmitter Menu Structure

TX1 and TX2

TX1 and TX2 menu sets up transmitter status, Power AMP control, output power, modulation depth, modulation activation, operating frequency, azimuth offset and Sideband RF Phase offset. Provided that pertinent MSG is not packed, sub menu cannot be accessed.

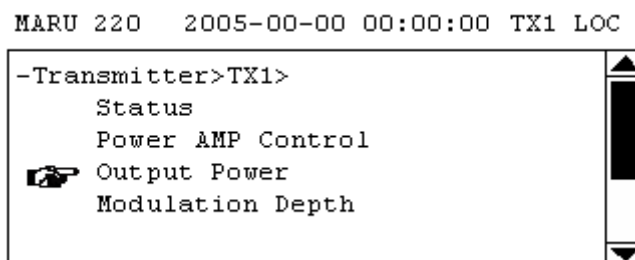


Figure 2-22 Transmitter > TX1 / 2 Menu Screen

The sub menu of TX1 and TX2 Menu is as follows.

Table 2-2-8 Transmitter > TX1 / 2 Display Item

Sub menu	Description
Status	Carrier/LSB/USB PLL status
Power AMP Control	CMA/LSMA/USMA On/Off setup
Output Power	Carrier/LSB COS/LSB SIN/USB COS/USB SIN output power setup
Modulation Depth	30Hz/1020Hz/Voice modulation depth setup
Modulation Control	Carrier/Sideband modulation activation
Carrier Frequency	Carrier frequency setup
Azimuth Offset	Azimuth offset setup
SB RF Phase Offset	Sideband RF phase offset setup

TX1 / 2 > Status

Status Menu indicates the status of PLL in the Transmitter. Provided that if communication error occurs in the pertinent MSG, it is indicated as ‘----’.

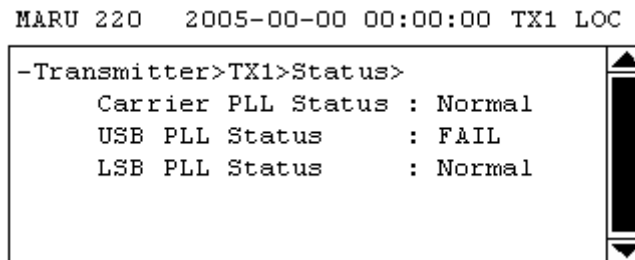


Figure 2-23 Transmitter > TX1 / 2 > Status Menu Screen

The sub item of the Status Menu is as follows.

Table 2-2-9 Transmitter > TX1 / 2 > Status Display Item

Item	Status display	Description
Carrier PLL Status	Normal/FAIL/----	Carrier PLL status
USB PLL Status	Normal/FAIL/----	USB PLL status
LSB PLL Status	Normal/FAIL/----	LSB PLL status

TX1 / 2 > Power AMP Control

Power AMP Control Menu enables and disables output of CMA, LSMA and USMA. Provided that if communication errors occur in the pertinent MSG, it is indicated as ‘---’, and if AMP is not packed, it is indicated as ‘REMOVED’.

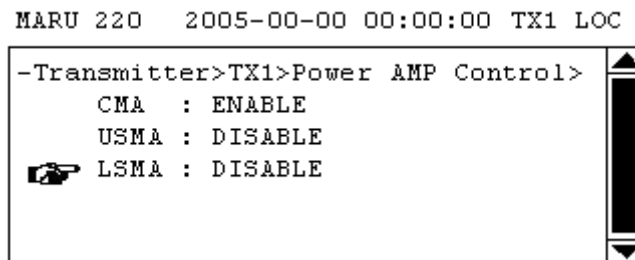


Figure 2-24 Transmitter > TX1 / 2 > Power AMP Control Screen

Items that can be set in the Power AMP Control Screen are as follows.

Table 2-2-10 Transmitter > TX1 / 2 > Power AMP Control Setup Item

Item	Display and setup range	Description
CMA	Enable or Disable	CMA Enable/ Disable Control
USMA	Enable or Disable	USMA Enable/ Disable Control
LSMA	Enable or Disable	LSMA Enable/ Disable Control

TX1 / 2 > Output Power

Output Power Menu sets up power of Carrier and Sideband. Provided that if communication error occurs in the pertinent MSG, it is indicated as '----', and if MSG is not packed, status display value on the right is not indicated.

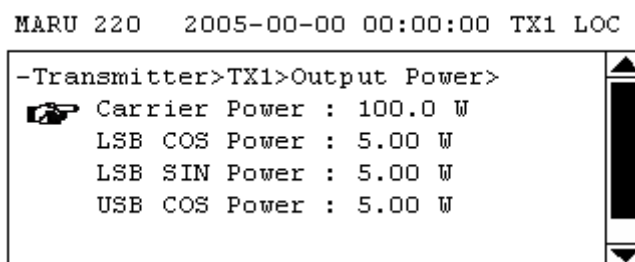


Figure 2-25 Transmitter > TX1 / 2 > Output Power Screen

Items that can be set in the Output Power Menu are as follows.

Table 2-2-11 Transmitter > TX1 / 2 > Output Power Setup Item

Item	Display and setup range	Description
Carrier Power	00.0 ~ 130.0 W	Carrier Power setup
LSB COS Power	0.00 ~ 13.00 W	LSB COS Power setup
LSB SIN Power	0.00 ~ 13.00 W	LSB SIN Power setup
USB COS Power	0.00 ~ 13.00 W	USB COS Power setup
USB SIN Power	0.00 ~ 13.00 W	USB SIN Power setup

TX1 / 2 > Modulation Depth

Modulation Depth Menu sets up 30Hz Modulation Depth, 1020Hz Modulation Depth and Voice Modulation Depth. Provided that if communication error occurs in the pertinent MSG, it is indicated as '----', and if MSG is not packed, status display value on the right is not indicated.

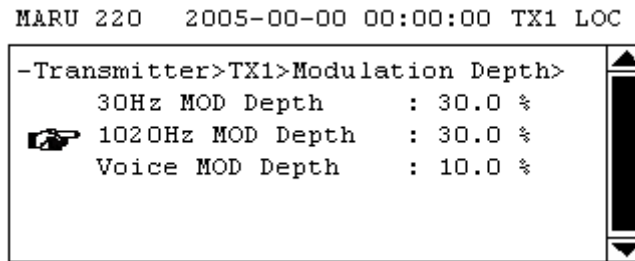


Figure 2-26 Transmitter > TX1 / 2 > Modulation Depth Screen

Items that can be set in the Modulation Depth Menu Screen are as follows.

Table 2-2-12 Transmitter > TX1 / 2 > Modulation Depth Setup Item

Item	Display and setup range	Description
30Hz MOD Depth	0.0 ~ 40.0 %	30Hz Modulation Depth
1020Hz MOD Depth	0.0 ~ 20.0 %	1020Hz Modulation Depth
Voice MOD Depth	0.0 ~ 40.0 %	Voice Modulation Depth

TX1 / 2 > Modulation Control

Modulation Control Menu sets up Carrier and Sideband Modulation On/Off. Provided that if communication error occurs in the pertinent MSG, it is indicated as ‘----’, and if MSG is not packed, status display value on the right is not indicated.

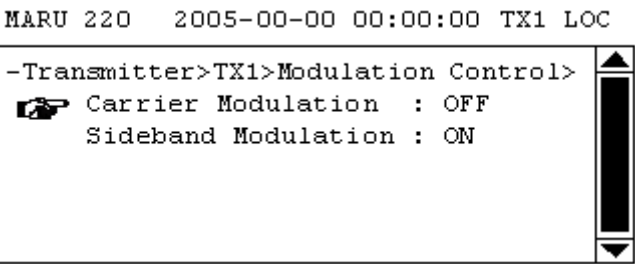


Figure 2-27 Transmitter > TX1 / 2 > Modulation Control Screen

Items that can be set up in the Modulation Control Menu Screen are as follows.

Table 2-2-13 Transmitter > TX1 / 2 > Modulation Control Setup Item

Item	Display and setup range	Description
Carrier Modulation	On or Off	Carrier Modulation On/Off Control
Sideband Modulation	On or Off	Sideband Modulation On/Off Control

TX1 / 2 > Carrier Frequency

Carrier Frequency Menu sets up the frequency of Carrier. Provided that if communication error occurs in the pertinent MSG, or if the MSG is not packed, one cannot choose the Carrier Frequency Menu.

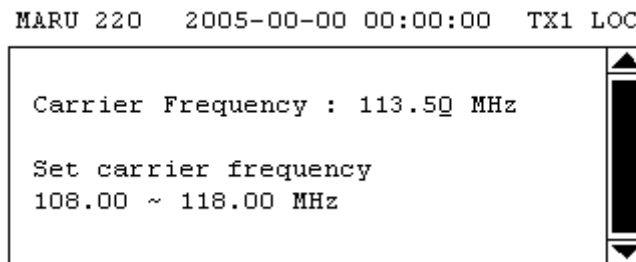


Figure 2-28 Transmitter > TX1 / 2 > Carrier Frequency Screen

Items that can be set in the Carrier Frequency Menu are as follows.

Table 2-2-14 Transmitter > TX1 / 2 > Carrier Frequency Setup Item

Item	Display and setup range	Description
Carrier Frequency	108.0 ~ 118.0 MHz	Carrier frequency setup

TX1 / 2 > Azimuth Offset

Azimuth Offset Menu sets up the Azimuth Offset of Transmitter. Provided that if communication error occurs in the pertinent MSG, or if the MSG is not packed, one cannot choose the Azimuth Offset Menu.

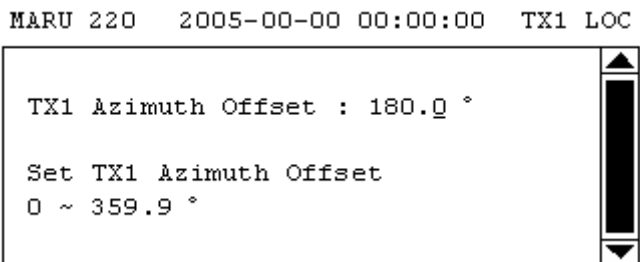


Figure 2-29 Transmitter > TX1 / 2 > Azimuth Offset Screen

Items that can be set in the Azimuth Offset Menu Screen are as follows.

Table 2-2-15 Transmitter > TX1 / 2 > Azimuth Offset Setup Item

Item	Display and setup range	Description
Azimuth Offset	0 ~ 359.9 °	Azimuth Offset setup

TX1 / 2 > SB RF Phase Offset

SB RF Phase Offset Menu displays the Sideband RF Phase Offset of Transmitter. The menu cannot change setup value, and setup can be implemented only in RMMS/LMMS. If communication error occurs in the pertinent MSG, it is indicated as '---', and if the MSG is not packed, status display value on the right is not indicated.

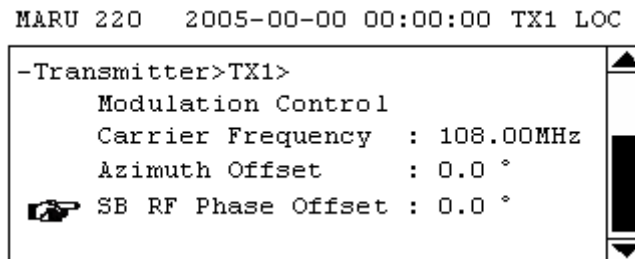


Figure 2-30 Transmitter > TX1 / 2 > SB RF Phase Offset Screen

CONFIG

CONFIG Menu implements setup related to IDENT and antenna of the MARU 220.

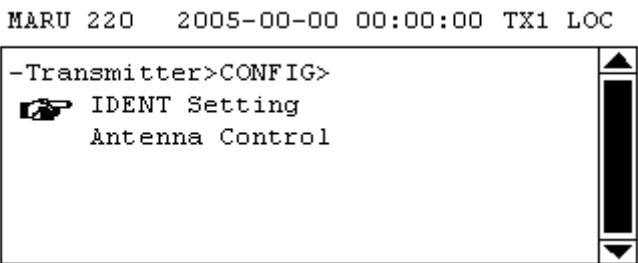


Figure 2-31 Transmitter > CONFIG Menu Screen

The sub menu of CONFIG menu is as follows.

Table 2-2-16 Transmitter > CONFIG Display Item

Sub menu	Description
IDENT Setting	IDENT Code, IDENT Mode, Keying setup
Antenna Control	Antenna Operation Mode setup, Separate selection of antenna

CONFIG > IDENT Setting

IDENT Setting Menu can set up ID Code and can control IDENT Mode and Keying On/Off. Provided that if communication error occurs in the pertinent MSG, IDENT Keying item is indicated as '---', and if the MSG is not packed, status display value on the right is not displayed.

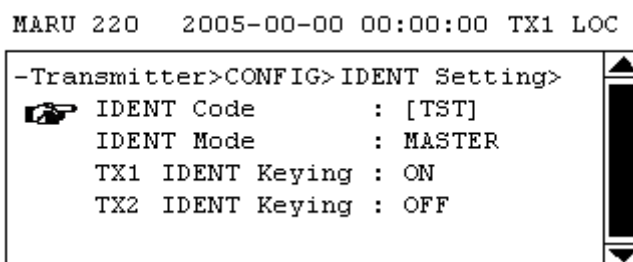


Figure 2-32 Transmitter > IDENT Setting Screen

Items that can be set in the IDENT Setting Menu Screen are as follows.

Table 2-2-17 Transmitter > IDENT Setting Setup Item

Item	Display and setup range	Description
IDENT Code	XXX	3 to 4 characters setup
IDENT Mode	Independent, Master, Slave	Selection of one among 3 modes
TX1 IDENT Keying	ON or OFF	TX1 Keying On/Off control
TX2 IDENT Keying	ON or OFF	TX2 Keying On/Off control

CONFIG > Antenna Control

Antenna Menu sets up or inquires antenna related information. USB/LSB Select item and ANT Select item are indicated only when the operation mode is maintenance, and if an error occurs in communication with the MSG of Active TX, it is indicated as ‘---’.

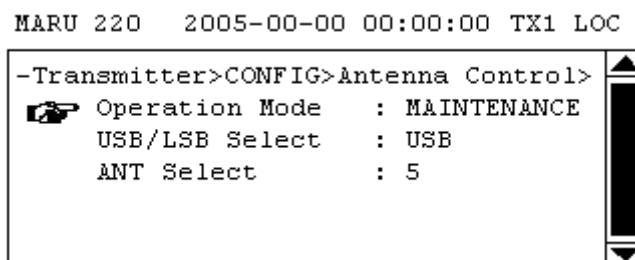


Figure 2-33 Transmitter > Antenna Control Screen

Items that can be set in the Antenna Control Menu Screen are as follows.

Table 2-2-18 Transmitter > Antenna Control Setup Item

Item	Display and setup range	Description
Operation Mode	Normal or MAINTENANCE	ASU activity mode select
USB/LSB Select	USB or LSB	USB/LSB select
ANT Select	1 ~ 48	Separate antenna select

2.3.4. Monitor

Monitor Menu inquires values measured in MON1 and MON2 and sets up the range of alarm.

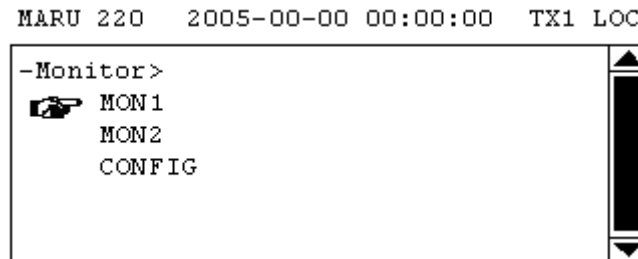


Figure 2-34 Monitor Menu Screen

The sub menu of monitor menu is as follows.

Table 2-2-19 Monitor Sub Menu

Sub menu	Description
MON1	Monitor 1 setup and status reference menu
MON2	Monitor 2 setup and status reference menu
CONFIG	TSG setup, monitor measurement mode and Bypass setup

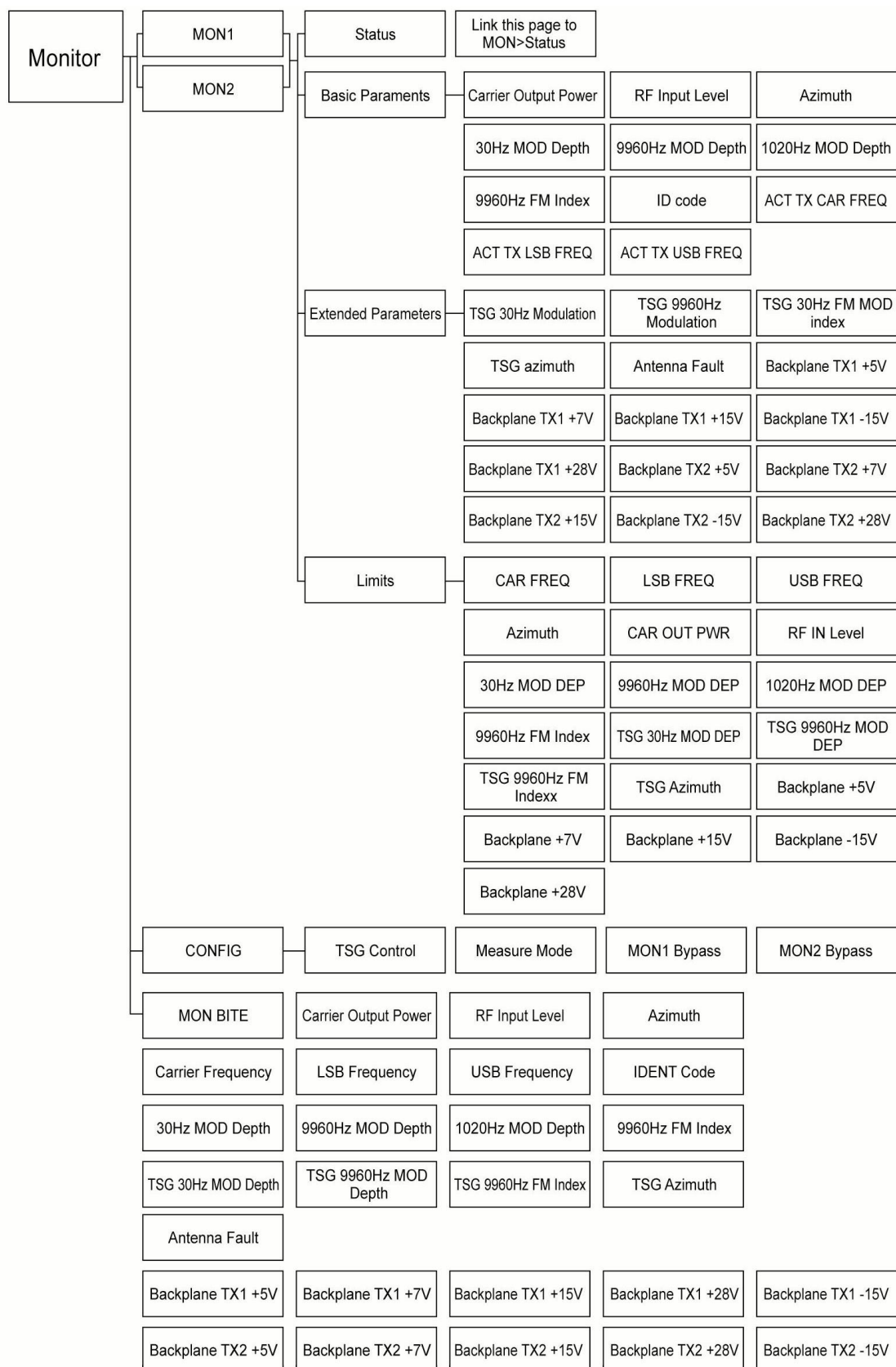


Figure 2-35 Monitor Menu Structure

MON1 and MON2

MON1 and MON2 Menus inquire value measured in each monitor and status and set up the range of alarm. Provided that if the pertinent MON is not packed, it is not possible to access sub menu.

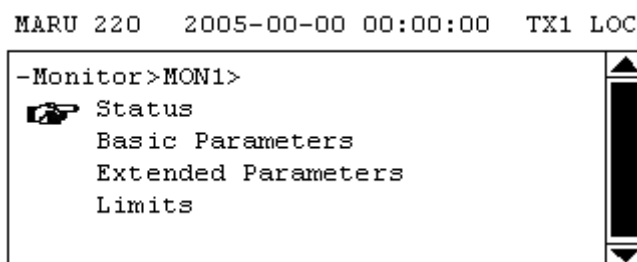


Figure 2-36 Monitor > MON1 / 2 Menu Screen

The sub menu of MON1 and MON2 Menus is as follows.

Table 2-2-20 Monitor > MON1 / 2 Display Item

Sub menu	Description
Status	Measurement value and monitor self-test alarm reference
Basic Parameters	Reference of basic measurement value including Input & output power, azimuth and modulation degree
Extended Parameters	Reference of power measurement value of TSG, Antenna and Backplane
Limits	Setup and reference of alarm range value

MON1 / 2 > Status

Status Menu displays measurement value alarm of monitor and self-diagnosis alarm status. Provided that if communication errors occur in the pertinent MON, it is indicated as '----'.

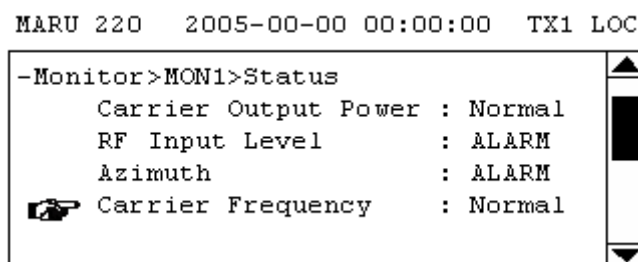


Figure 2-37 Monitor > MON1 / 2 > Status Menu Screen

The sub item of the Status Menu is as follows.

Table 2-2-21 Monitor > MON1 / 2 > Status Display Item

Item	Status display	Description
MON BITE	Normal/ALARM/----	Monitor self-diagnosis status
Carrier Output Power	Normal/ALARM/----	Carrier Output Power status
RF Input Level	Normal/ALARM/----	RF Input Level status
Azimuth	Normal/ALARM/----	Azimuth status
Carrier Frequency	Normal/ALARM/----	Carrier frequency status
LSB Frequency	Normal/ALARM/----	LSB frequency status
USB Frequency	Normal/ALARM/----	USB frequency status
IDENT Code	Normal/ALARM/----	IDENT Code status
30Hz MOD Depth	Normal/ALARM/----	30Hz Modulation Depth status
9960Hz MOD Depth	Normal/ALARM/----	9960Hz Modulation Depth status
1020Hz MOD Depth	Normal/ALARM/----	1020Hz Modulation Depth status
9960Hz FM Index	Normal/ALARM/----	9960Hz FM Index status
TSG 30Hz MOD Depth	Normal/ALARM/----	TSG 30Hz Modulation Depth status
TSG 9960Hz MOD Depth	Normal/ALARM/----	TSG 9960Hz Modulation Depth status
TSG 9960Hz FM Index	Normal/ALARM/----	TSG 9960Hz FM Index status
TSG Azimuth	Normal/ALARM/----	TSG Azimuth status
Antenna Fault	Normal/ALARM/----	Antenna Status
Backplane TX1 +5V	Normal/ALARM/----	Backplane TX1 +5V status

Item	Status display	Description
Backplane TX1 +7V	Normal/ALARM/----	Backplane TX1 +7V status
Backplane TX1 +15V	Normal/ALARM/----	Backplane TX1 +15V status
Backplane TX1 +28V	Normal/ALARM/----	Backplane TX1 +28V status
Backplane TX1 -15V	Normal/ALARM/----	Backplane TX1 -15V status
Backplane TX2 +5V	Normal/ALARM/----	Backplane TX2 +5V status
Backplane TX2 +7V	Normal/ALARM/----	Backplane TX2 +7V status
Backplane TX2 +15V	Normal/ALARM/----	Backplane TX2 +15V status
Backplane TX2 +28V		Backplane TX2 +28V status
Backplane TX2 -15V		Backplane TX2 -15V status

MON1 / 2 > Basic Parameters

Basic Parameters Menu displays basic measurement values including input/output power, modulation degree, azimuth, frequency and IDENT Code. Provided that if communication errors occur in the pertinent MON, or if measurement signal level is low or none, it is indicated as '----'.

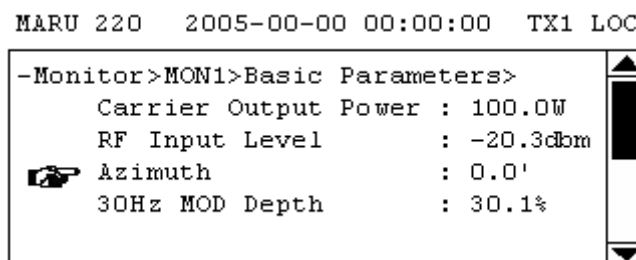


Figure 2-38 Monitor > MON1 / 2 > Basic Parameters Menu Screen

The sub item of the Basic Parameters Menu is as follows.

Table 2-2-22 Monitor > MON1 / 2 > Basic Parameters Display Item

Item	Display range	Description
Carrier Output Power	0.0 ~ 200.0 W	Carrier Output Power measurement value
RF Input Level	-50.0 ~ 10.0 dBm	RF Input Level measurement value
Azimuth	0.0 ~ 359.9 °	Azimuth measurement value
30Hz MOD Depth	0.0 ~ 100.0 %	30Hz Modulation Depth measurement value
9960Hz MOD Depth	0.0 ~ 100.0 %	9960Hz Modulation Depth measurement value
1020Hz MOD Depth	0.0 ~ 100.0 %	1020Hz Modulation Depth measurement value
9960Hz FM Index	0.0 ~ 30.0	9960Hz FM Index measurement value
IDENT Code	XXXX	IDENT Code measurement value, 3 to 4 characters.
ACT TX CAR FREQ	0.0 ~ 200.0000 MHz	Active TX Carrier frequency measurement value
ACT TX LSB FREQ	0.0 ~ 200.0000 MHz	Active TX LSB frequency measurement value
ACT TX USB FREQ	0.0 ~ 200.0000 MHz	Active TX USB frequency measurement value

MON1 / 2 > Extended Parameters

Extended Parameters Menu displays measurement value related to TSG, antenna status and backplane voltage. Provided that if communication errors occur in the pertinent MON or measurement signal level is low or none, it is indicated as '----'.

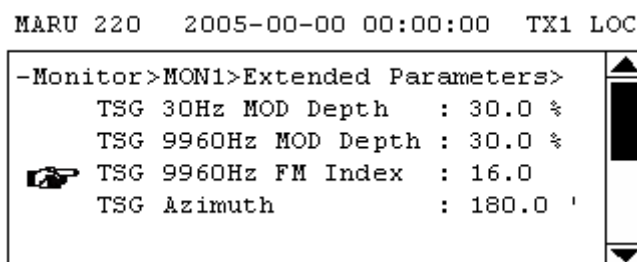


Figure 2-39 Monitor > MON1 / 2 > Extended Parameters Menu Screen

The sub item of the Extended Parameters Menu is as follows.

Table 2-2-23 Monitor > MON1 / 2 > Extended Parameters Display Item

Item	Display range	Description
TSG 30Hz MOD Depth	0.0 ~ 100.0 %	TSG 30Hz Modulation Depth measurement value
TSG 9960Hz MOD Depth	0.0 ~ 100.0 %	TSG 9960Hz Modulation Depth measurement value
TSG 9960Hz FM Index	0.0 ~ 30.0	TSG 9960Hz FM Index measurement value
TSG Azimuth	0.0 ~ 359.9 °	TSG Azimuth measurement value
Antenna Fault	Normal or FAULT	Test result of the normality of antenna (Display by ANT)
Backplane TX1 +5V	0.0 ~ 10.0 V	Backplane TX1 +5V measurement value
Backplane TX1 +7V	0.0 ~ 15.0 V	Backplane TX1 +7V measurement value
Backplane TX1 +15V	0.0 ~ 25.0 V	Backplane TX1 +15V measurement value
Backplane TX1 +28V	0.0 ~ 50.0 V	Backplane TX1 +28V measurement value
Backplane TX1 -15V	-25.0 ~ 0.0 V	Backplane TX1 -15V measurement value
Backplane TX2 +5V	0.0 ~ 10.0 V	Backplane TX2 +5V measurement value
Backplane TX2 +7V	0.0 ~ 15.0 V	Backplane TX2 +7V measurement value
Backplane TX2 +15V	0.0 ~ 25.0 V	Backplane TX2 +15V measurement value
Backplane TX2 +28V	0.0 ~ 50.0 V	Backplane TX2 +28V measurement value
Backplane TX2 -15V	-25.0 ~ 0.0 V	Backplane TX2 -15V measurement value

MON1 / 2 > Limits

Limits Menu sets up or displays upper limit and lower limit of alarm value measured in monitor. Since the menu does not display setup value on the right-hand side of the item, one should select sub menu to check setup value or reset.

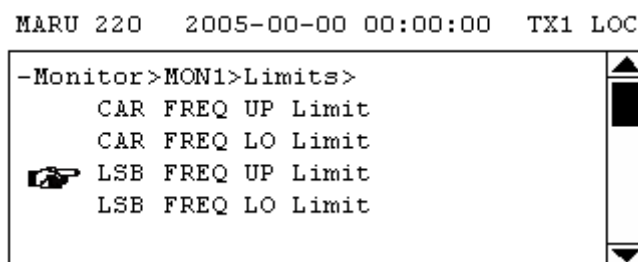


Figure 2-40 Monitor > MON1 / 2 > Limits Menu Screen

The Sub item of the Limits Menu is as follows.

Table 2-2-24 Monitor > MON1 / 2 > Limits Display Item

Item	Display and setup range	Description
CAR FREQ UP Limit	103.0000 ~ 123.0000 MHz	Carrier Frequency Alarm upper limit value setup
CAR FREQ LO Limit	103.0000 ~ 123.0000 MHz	Carrier Frequency Alarm lower limit value setup
LSB FREQ UP Limit	102.9900 ~ 122.9900 MHz	LSB Frequency Alarm upper limit value setup
LSB FREQ LO Limit	102.9900 ~ 122.9900 MHz	LSB Frequency Alarm lower limit value setup
USB FREQ UP Limit	103.0100 ~ 123.0100 MHz	USB Frequency Alarm upper limit value setup
USB FREQ LO Limit	103.0100 ~ 123.0100 MHz	USB Frequency Alarm lower limit value setup
Azimuth UP Limit	0.0 ~ 359.9 °	Azimuth Alarm upper limit value setup
Azimuth LO Limit	0.0 ~ 359.9 °	Azimuth Alarm lower limit value setup
CAR OUT PWR UP Limit	0.0 ~ 120.0 W	Carrier Output Power Alarm upper limit value setup
CAR OUT PWR LO Limit	0.0 ~ 120.0 W	Carrier Output Power Alarm lower limit value setup

Item	Display and setup range	Description
RF IN Level UP Limit	-45.0 ~ 5.0 dBm	RF Input Level Alarm upper limit value setup
RF IN Level LO Limit	-45.0 ~ 5.0 dBm	RF Input Level Alarm lower limit value setup
30Hz MOD DEP UP Limit	0.0 ~ 55.0 %	30Hz Modulation Depth Alarm upper limit value setup
30Hz MOD DEP LO Limit	0.0 ~ 55.0 %	30Hz Modulation Depth Alarm lower limit value setup
9960Hz MOD DEP UP Limit	0.0 ~ 55.0 %	9960Hz Modulation Depth Alarm upper limit value setup
9960Hz MOD DEP LO Limit	0.0 ~ 55.0 %	9960Hz Modulation Depth Alarm lower limit value setup
1020Hz MOD DEP UP Limit	0.0 ~ 35.0 %	1020Hz Modulation Depth Alarm upper limit value setup
1020Hz MOD DEP LO Limit	0.0 ~ 35.0 %	1020Hz Modulation Depth Alarm lower limit value setup
9960Hz FM Index UP Limit	0.0 ~ 30.0	9960Hz FM Index Alarm upper limit value setup
9960Hz FM Index LO Limit	0.0 ~ 30.0	9960Hz FM Index Alarm lower limit value setup
TSG 30Hz MOD DEP UP Limit	0.0 ~ 40.0 %	TSG 30Hz Modulation Depth Alarm upper limit value setup
TSG 30Hz MOD DEP LO Limit	0.0 ~ 40.0 %	TSG 30Hz Modulation Depth Alarm lower limit value setup
TSG 9960Hz MOD DEP UP Limit	0.0 ~ 40.0 %	TSG 9960Hz Modulation Depth Alarm upper limit value setup
TSG 9960Hz MOD DEP LO Limit	0.0 ~ 40.0 %	TSG 9960Hz Modulation Depth Alarm lower limit value setup
TSG 9960Hz FM Index UP Limit	0.0 ~ 30.0	TSG 9960Hz FM Index Alarm upper limit value setup
TSG 9960Hz FM Index LO Limit	0.0 ~ 30.0	TSG 9960Hz FM Index Alarm lower limit value setup
TSG Azimuth UP Limit	0.0 ~ 359.9 °	TSG Azimuth Alarm upper limit value setup
TSG Azimuth LO Limit	0.0 ~ 359.9 °	TSG Azimuth Alarm lower limit value setup
Backplane +5V UP Limit	0.0 ~ 7.0 V	Backplane TX1 +5V Alarm upper limit value setup

Item	Display and setup range	Description
Backplane +5V LO Limit	0.0 ~ 7.0 V	Backplane TX1 +5V Alarm lower limit value setup
Backplane +7V UP Limit	0.0 ~ 9.0 V	Backplane TX1 +7V Alarm upper limit value setup
Backplane +7V LO Limit	0.0 ~ 9.0 V	Backplane TX1 +7V Alarm lower limit value setup
Backplane +15V UP Limit	0.0 ~ 17.0 V	Backplane TX1 +15V Alarm upper limit value setup
Backplane +15V LO Limit	0.0 ~ 17.0 V	Backplane TX1 +15V Alarm lower limit value setup
Backplane -15V UP Limit	-17.0 ~ 0.0 V	Backplane TX1 -15V Alarm upper limit value setup
Backplane -15V LO Limit	-17.0 ~ 0.0 V	Backplane TX1 -15V Alarm lower limit value setup
Backplane +28V UP Limit	0.0 ~ 30.0 V	Backplane TX1 +28V Alarm upper limit value setup
Backplane +28V LO Limit	0.0 ~ 30.0 V	Backplane TX1 +28V Alarm lower limit value setup

CONFIG

CONFIG Menu sets up TSG, monitor measurement mode and monitor Bypass function.

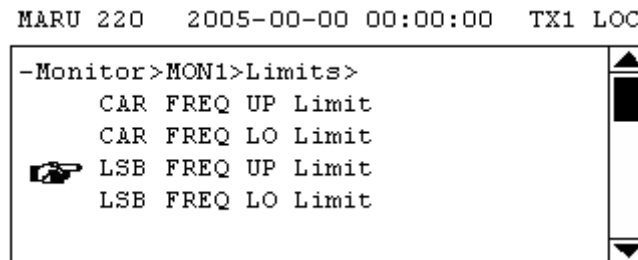


Figure 2-41 Monitor > CONFIG Menu Screen

The sub menu of the CONFIG Menu is as follows.

Table 2-2-25 Monitor > CONFIG Display Item

Sub menu	Description
TSG Control	TSG Signal setup
Measure Mode	Monitor mode setup
MON1 Bypass	Monitor 1 Bypass setup
MON2 Bypass	Monitor 2 Bypass setup

CONFIG > TSG Control

TSG Control Menu selects TSG signal used as self-diagnosis signal.

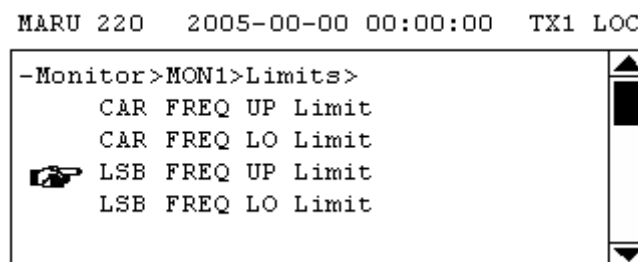


Figure 2-42 Monitor > CONFIG > TSG Control Screen

Items that can be set in the TSG Control Menu Screen are as follows.

Table 2-2-26 Monitor > CONFIG > TSG Control Setup Item

Item	Display and setup range	Description
TSG Control	0 ~ 15	TSG signal setup

Table 2-2-27 TSG Signal Item

Signal No.	30Hz Depth	9960Hz Depth	FM Index	Azimuth	Description
0	30%	30%	16	180°	REF
1	30%	30%	16	178.5°	Azimuth -1.5° alarm
2	30%	30%	16	181.5°	Azimuth +1.5° alarm
3	20%	30%	16	180°	30Hz AM modulation depth reduction alarm
4	40%	30%	16	180°	30Hz AM modulation depth excess alarm
5	30%	20%	16	180°	9960Hz AM modulation depth reduction alarm
6	30%	40%	16	180°	9960Hz AM modulation depth excess alarm
7	30%	30%	14.5	180°	30Hz FM Index reduction alarm
8	30%	30%	17.5	180°	30Hz FM Index excess alarm
9	30%	0%	0	0°	30Hz Only
10	0%	30%	16	0°	9960Hz Only
11	30%	30%	16	0°	Calibration
12	30%	30%	16	45°	Calibration
13	30%	30%	16	270°	Calibration
14	30%	30%	15	0°	Calibration
15	30%	30%	17	0°	Calibration

CONFIG > Measure Mode

Measure Mode Menu sets up measurement mode.

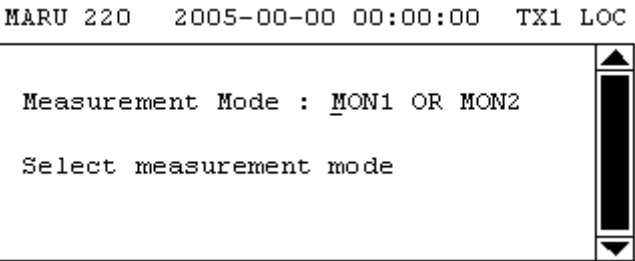


Figure 2-43 Monitor > CONFIG > Measure Mode Screen

Items that can be set in the Measure Mode Menu Screen are as follows.

Table 2-2-28 Monitor > CONFIG > Measure Mode Setup Item

Item	Display and setup range	Description
Measure Mode	AND or OR	Measure mode setup

CONFIG > MON1 Bypass

MON1 Bypass Menu sets up Active/Bypass of Monitor 1.

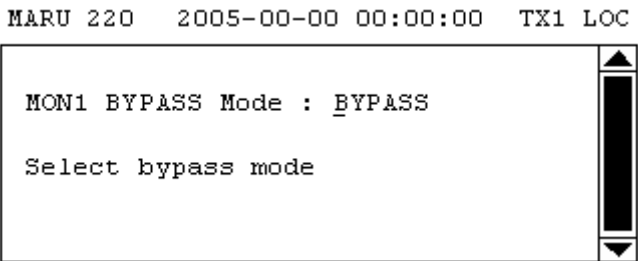


Figure 2-44 Monitor > CONFIG > MON1 Bypass Screen

Items that can be set in the MON1 Bypass Menu Screen are as follows.

Table 2-2-29 Monitor > CONFIG > MON1 Bypass Setup Item

Item	Display and setup range	Description
MON1 Bypass	ACTIVE or BYPASS	MON1 Bypass setup

CONFIG > MON2 Bypass

MON2 Bypass Menu sets up Active/Bypass of Monitor 2.

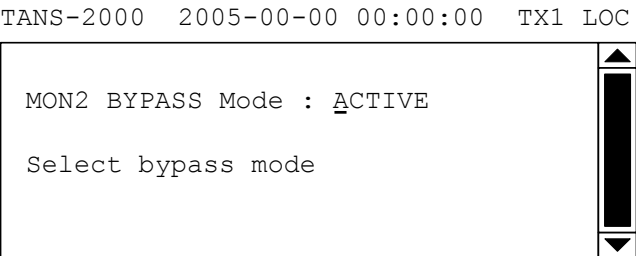


Figure 2-45 Monitor > CONFIG > MON2 Bypass Screen

Items that can be set in the MON2 Bypass Menu Screen are as follows.

Table 2-2-30 Monitor > CONFIG > MON2 Bypass Setup Item

Item	Display and setup range	Description
MON2 Bypass	ACTIVE or BYPASS	MON2 Bypass setup

2.3.5. 2.3.5 System

System Menu saves/restores setup values, changes system control right, resets the system, does Changeover, controls Fan, checks unit installation status, confirms device temperature, monitors environment and sets audio, interface and LCU operation item.

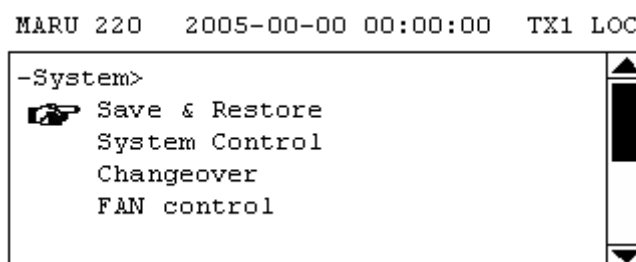


Figure 2-46 System Menu Screen

The sub menu of the system menu is as follows.

Table 2-2-31 System Display Item

Sub menu	Description
Save & Restore	Saves and restores setup value by unit
System Control	Control right change, reset, shutdown initiation, automatic logout setup
Changeover	Changeover related setup
FAN Control	FAN related setup
Presence Detect	Unit fitting status display
Temperature	System temperature display
Environment	Environment monitoring status display
Audio	Audio related setup
DME Interface	DME interface setup
LCU Configuration	LCU operation item setup

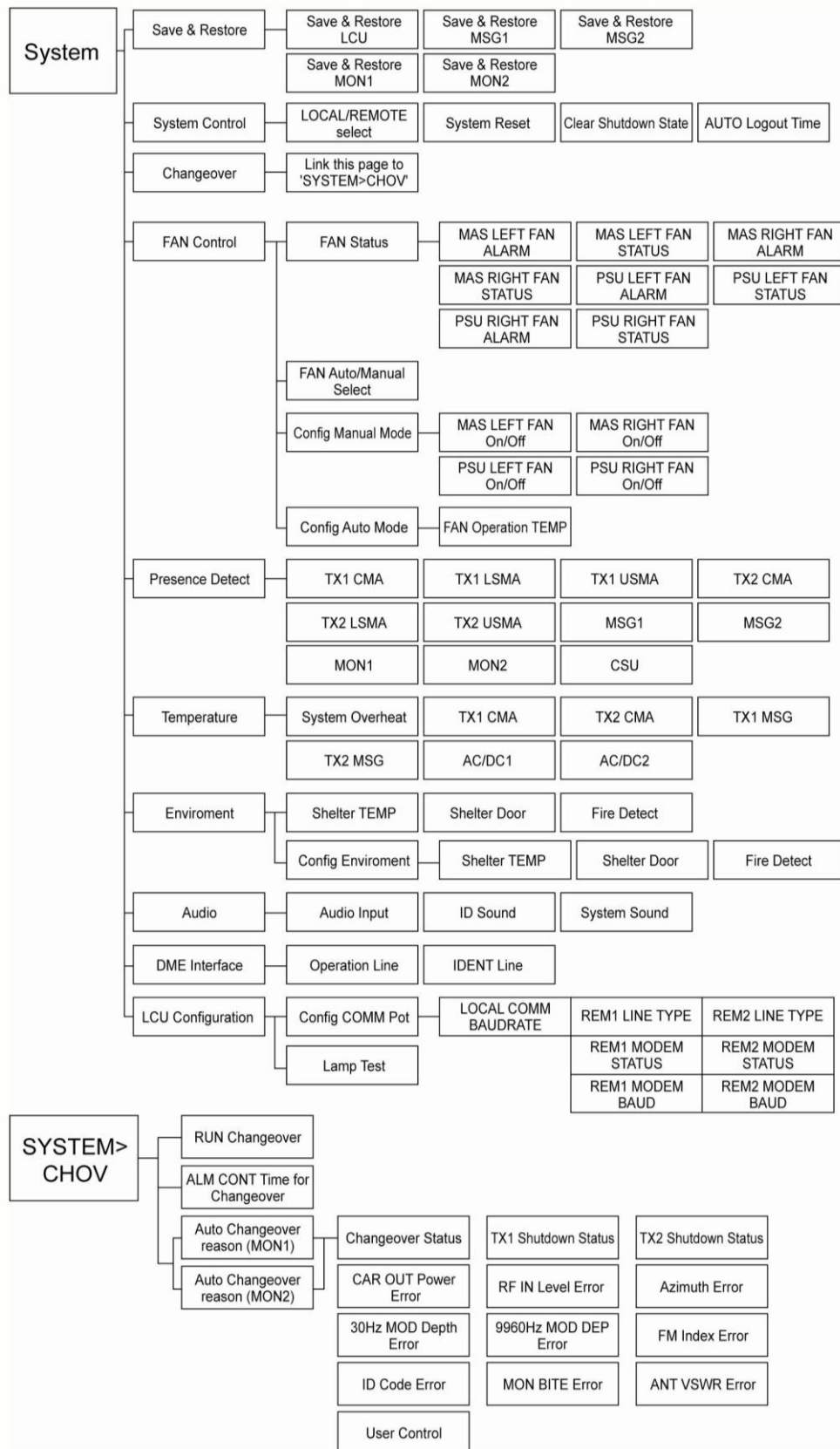


Figure 2-47 System Menu Structure

Save & Restore

System & Restore Menu saves or restores setup value of each unit. Provided that if the pertinent unit is not packed, it is not possible to access the sub menu.

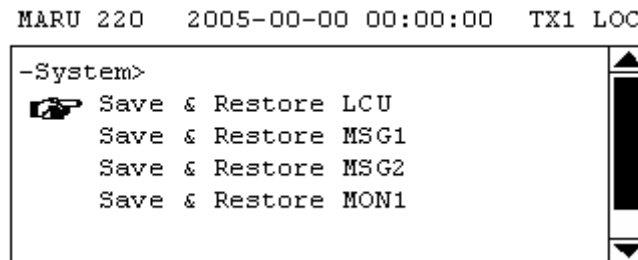


Figure 2-48 System > Save & Restore Menu Screen

The sub menu of Save & Restore Menu is as follows.

Table 2-2-32 System > Save & Restore Display Item

Item	Display and setup range	Description
Save & Restore LCU	NO OPERATION	LCU setup value or restore
Save & Restore MSG1	SAVE PARAMETER	MSG1 setup value or restore
Save & Restore MSG2	RELOAD PARAMETER	MSG2 setup value or restore
Save & Restore MON1		MON1 setup value or restore
Save & Restore MON2		MON2 setup value or restore

System Control

System Control Menu sets up system control, system reset, shutdown status initiation and RMMS/LMMS automatic access release time.

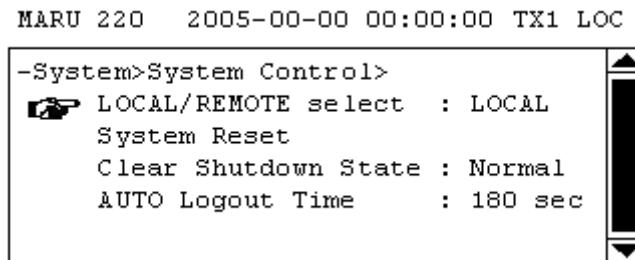


Figure 2-49 System > System Control Menu Screen

The sub menu of the System Control Menu is as follows.

Table 2-2-33 System >System Control Display Item

Item	Display and setup range	Description
LOCAL/REMOTE Select	LOCAL / REMOTE	System control right setup
System Reset	YES / NO	System reset
Clear Shutdown State	YES / NO	Shutdown status initiation
AUTO Logout Time	0 ~ 600 second	RMMS/LMMS automatic logout time setup

Changeover

Changeover Menu checks manual Changeover, alarm maintenance time required to do Changeover and cause of automatic Changeover occurrence.

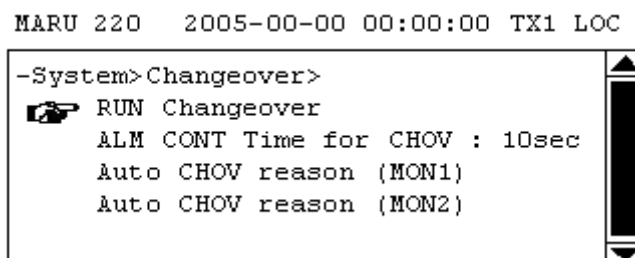


Figure 2-50 System > Changeover Menu Screen

The sub menu of the Changeover Menu is as follows.

Table 2-2-34 System > Changeover Display Item

Item	Display and setup range	Description
RUN Changeover	YES NO	Manual Changeover Implement
ALM CONT Time for CHOV	0 ~ 180 seconds	Alarm maintenance time setup for automatic Changeover
Auto CHOV Reason (MON1)	Refer to Table 2-2-35	Display of cause of automatic Changeover in Monitor 1
Auto CHOV Reason (MON2)	Refer to Table 2-2-35	Display of cause of automatic Changeover in Monitor 2

Changeover > Auto CHOV Reason (MON1 / 2)

Auto CHOV Reason (MON1 / 2) Menu indicates cause of occurrence of Changeover. Provided that if the Changeover was not done, or if communication errors occur in the pertinent monitor, it is indicated as '----'.

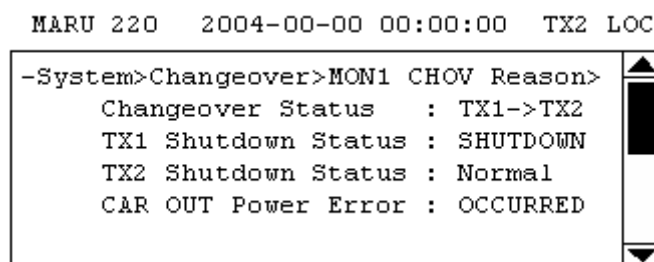


Figure 2-51 System > Changeover > Auto CHOV Reason (MON1 / 2) Menu Screen

The sub item of Auto CHOV Reason (MON1 / 2) Menu is as follows.

Table 2-2-35 System > Changeover > Auto CHOV Reason (MON1 / 2) Display Item

Item	Display and setup range	Description
Changeover Status	TX1->TX2 TX2->TX1	Changeover status
TX1 Shutdown Status	Normal/SHUTDOWN	TX1 Shutdown status
TX2 Shutdown Status	Normal/SHUTDOWN	TX2 Shutdown status
CAR OUT Power Error	None/OCCURRED	Changeover caused by Carrier Output Power alarm
RF IN Level Error	None/OCCURRED	Changeover caused by RF Input Level alarm
30Hz MOD Depth Error	None/OCCURRED	Changeover caused by 30Hz Modulation Depth alarm
9960Hz MOD Depth Error	None/OCCURRED	Changeover caused by 9960Hz Modulation Depth alarm
FM Index Error	None/OCCURRED	Changeover caused by FM Index alarm
ID Code Error	None/OCCURRED	Changeover caused by ID Code alarm
MON BITE Error	None/OCCURRED	Changeover caused by MON BITE alarm
ANT VSWR Error	None/OCCURRED	Changeover caused by ANT VSWR alarm
User Control	None/OCCURRED	Changeover caused by user control

FAN Control

FAN Control Menu controls FAN installed in the system or checks activity status of the FAN.

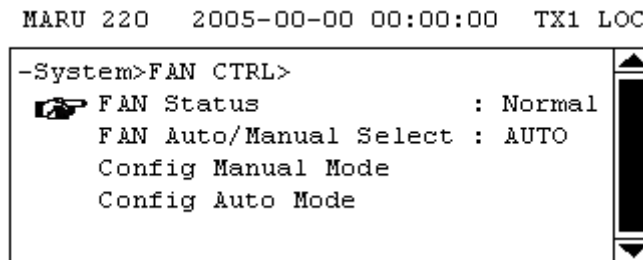


Figure 2-52 System > FAN Control Menu Screen

The sub item of the FAN Control Menu is as follows.

Table 2-2-36 System > FAN Control Display Item

Item	Display and setup range	Description
FAN Status	Normal/ALARM	FAN activity status
FAN Auto/Manual Select	AUTO/MANUAL	FAN activity mode selection
Config Manual Mode		Manual mode related setup
Config Auto Mode		Auto mode related setup

FAN Control > FAN Status

FAN Status Menu checks the activity status and the alarm status of the FAN installed in the system.

```

MARU 220   2005-00-00 00:00:00   TX1 LOC

-System>FAN CTRL>FAN Status>
  MAS Left Fan Alarm   : Normal
  MAS Left Fan Status  : ON
  MAS Right Fan Alarm  : FAIL
  MAS Right Fan Status : ON
  
```

Figure 2-53 System > FAN Control > FAN Status Menu Screen

The sub item of FAN Status Menu is as follows.

Table 2-2-37 System > FAN Control > FAN Status Display Item

Item	Display and setup range	Description
MAS Left Fan Alarm	Normal / FAIL	MAS Left Fan alarm status
MAS Left Fan Status	ON / OFF	MAS Left Fan activity status
MAS Right Fan Alarm	Normal / FAIL	MAS Right Fan alarm status
MAS Right Fan Status	ON / OFF	MAS Right Fan activity status
PSU Left Fan Alarm	Normal / FAIL	PSU Left Fan alarm status
PSU Left Fan Status	ON / OFF	PSU Left Fan activity status
PSU Right Fan Alarm	Normal / FAIL	PSU Right Fan alarm status
PSU Right Fan Status	ON / OFF	PSU Right Fan activity status

FAN Control > Config Manual Mode

Config Manual Mode Menu changes or checks setup used to operate the Fan of the system in manual mode.

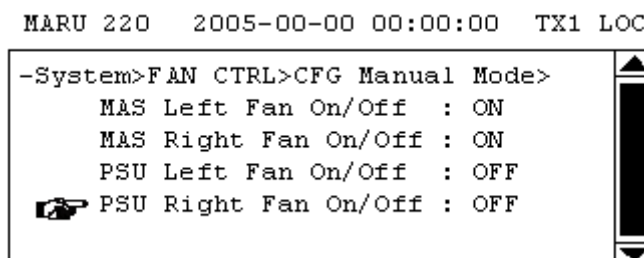


Figure 2-54 System > FAN Control > Config Manual Mode Menu Screen

The Sub Item of the Config Manual Mode is as follows.

Table 2-2-38 System > FAN Control > Config Manual Mode Display Item

Item	Display and setup range	Description
MAS Left Fan On/Off	ON / OFF	MAS Left Fan activity setup
MAS Right Fan On/Off	ON / OFF	MAS Right Fan activity setup
PSU Left Fan On/Off	ON / OFF	PSU Left Fan activity setup
PSU Right Fan On/Off	ON / OFF	PSU Right Fan activity setup

FAN Control > Config Auto Mode

Config Auto Mode Menu changes or confirms setup used to operate the FAN of the System in Auto mode.

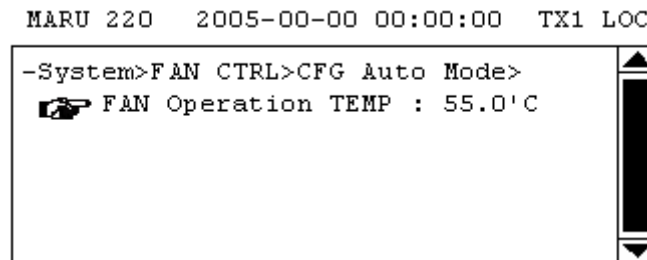


Figure 2-55 System > FAN Control > Config Auto Mode Menu Screen

The sub item of the Config Auto Mode Menu is as follows.

Table 2-2-39 System > FAN Control > Config Auto Mode Display Item

Item	Display and setup range	Description
Fan Operation TEMP	-55.0 ~ 125.0 °C	Fan activity temperature setup

Presence Detect

Presence Detect Menu displays packing/unpacking status of units that constitute the system.

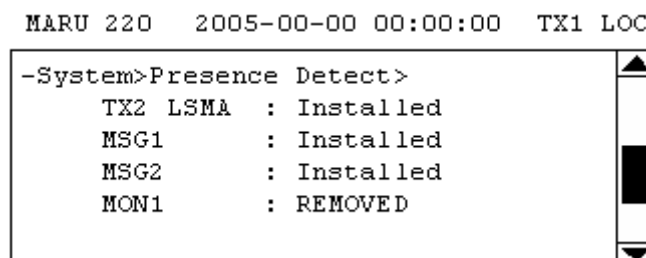


Figure 2-56 System > Presence Detect Menu Screen

The sub item of the Presence Detect Menu is as follows.

Table 2-2-40 System > Presence Detect Display Item

Item	Display and setup range	Description
TX1 CMA	Installed/REMOVED	TX1 CMA fitting status
TX1 LSMA	Installed/REMOVED	TX1 LSMA fitting status
TX1 USMA	Installed/REMOVED	TX1 USMA fitting status
TX2 CMA	Installed/REMOVED	TX2 CMA fitting status
TX2 LSMA	Installed/REMOVED	TX2 LSMA fitting status
TX2 USMA	Installed/REMOVED	TX2 USMA fitting status
MSG1	Installed/REMOVED	MSG1 fitting status
MSG2	Installed/REMOVED	MSG2 fitting status
MON1	Installed/REMOVED	MON1 fitting status
MON2	Installed/REMOVED	MON2 fitting status
CSU	Installed/REMOVED	CSU fitting status

Temperature

Temperature Menu sets up the temperature of shutdown caused by overheating or indicates temperature of each part of the system

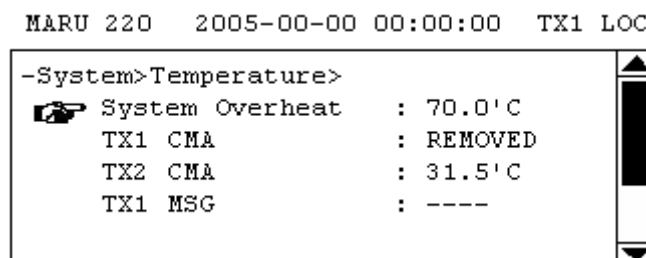


Figure 2-57 System > Temperature Menu Screen

The sub item of the Temperature Menu is as follows.

Table 2-2-41 System > Temperature Display Item

Item	Display and setup range	Description
System Overheat	-55.0 ~ 125.0 °C	Setup of temperature of shutdown caused by overheating
TX1 CMA	-55.0 ~ 125.0 °C / REMOVED	TX1 CMA temperature display Indicated as REMOVED at a time of CMA plug-in
TX2 CMA	-55.0 ~ 125.0 °C / REMOVED	TX2 CMA temperature display Indicated as REMOVED at a time of CMA plug-in
TX1 MSG	-55.0 ~ 125.0 °C / REMOVED / ----	MSG1 temperature display Indicated as REMOVED at a time of MSG plug-in Indicated as ---- at a time of communication error
TX1 MSG	-55.0 ~ 125.0 °C / REMOVED / ----	MSG2 temperature display Indicated as REMOVED at a time of MSG plug-in Indicated as ---- at a time of occurrence of communication error

Item	Display and setup range	Description
AC/DC1	-55.0 ~ 125.0 °C / REMOVED / ----	AC/DC1 temperature display Indicated as REMOVED at a time of AC/DC plug-in Indicated as ---- at a time of occurrence of AC/DC error
AC/DC2	-55.0 ~ 125.0 °C / REMOVED / ----	AC/DC2 temperature display Indicated as REMOVED at a time of AC/DC plug-in Indicated as ---- at a time of occurrence of AC/DC error

Environment

Environment Menu sets up the installation of fire, temperature and door sensors in Shelter or indicates the status of the sensors.

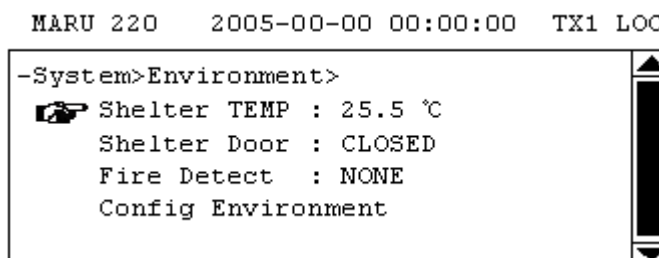


Figure 2-58 System > Environment Menu Screen

The sub item of the Environment Menu is as follows.

Table 2-2-42 System > Environment Display Item

Item	Display and setup range	Description
Shelter TEMP	-55.0 ~ 125.0 °C / ----	Display of internal temperature of Shelter It is indicated as ---- if a sensor is not installed
Shelter Door	OPENED/CLOSED/ ----	Shelter Door Open/Close Display It is indicated as ---- if a sensor is not installed
Fire Detect	NONE/FIRE/----	Shelter fire detection display It is indicated as ---- if a sensor is not installed
Config Environment		It sets up the installation of environment detection sensor in Shelter

Environment > Config Environment

Config Environment Menu sets up the installation of fire, temperature, door sensors in Shelter

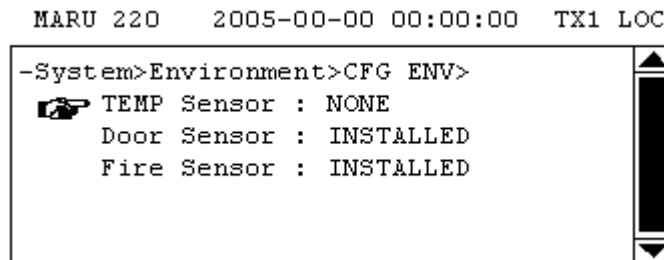


Figure 2-59 System > Environment > Config Environment Menu Screen

The sub item of the Config Environment Menu is as follows.

Table 2-2-43 System > Environment > Config Environment Display Item

Item	Display and setup range	Description
TEMP Sensor	NONE/INSTALLED	It sets up the installation of temperature sensor inside Shelter
Door Sensor	NONE/INSTALLED	It sets up the installation of Shelter Door sensor
Fire Sensor	NONE/INSTALLED	It sets up the installation of fire monitoring sensor of Shelter

Audio

Audio Menu executes or displays audio-related setup for the system.

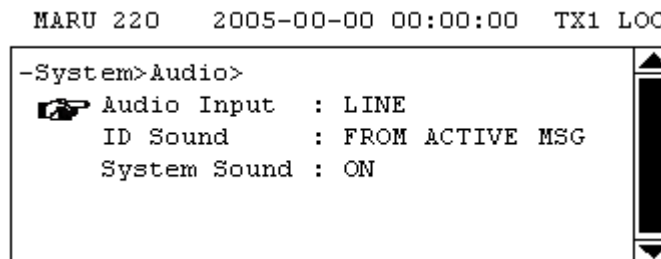


Figure 2-60 System > Audio Menu Screen

The sub item of the Audio Menu is as follows.

Table 2-2-44 System > Audio Display Item

Item	Display and setup range	Description
Audio Input	MIC/LINE	Audio input setup
ID Sound	FROM MSG1 FROM MSG2 FROM MON1 FROM MON2 FROM ACTIVE MSG OFF	ID sound setup
System Sound	ON/OFF	System sound On/Off setup

DME Interface

DME Interface Menu sets up or displays interface used when it operates in connection with the DME system.

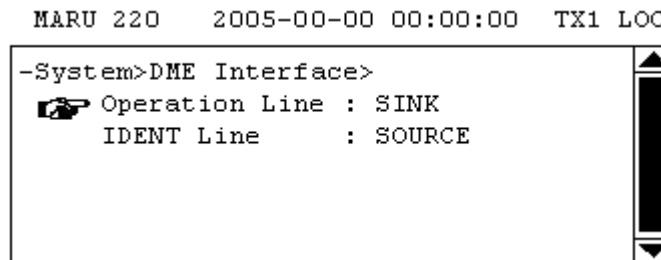


Figure 2-61 System > DME Interface Menu Screen

The sub item of the DME Interface Menu is as follows.

Table 2-2-45 System > DME Interface Display Item

Item	Display and setup range	Description
Operation Line	SOURCE/SINK	Operation Line setup
IDENT Line	SOURCE/SINK	IDENT Line setup

LCU Configuration

LCU Configuration Menu conducts communication-related setup for LCU or tests CSP lamps

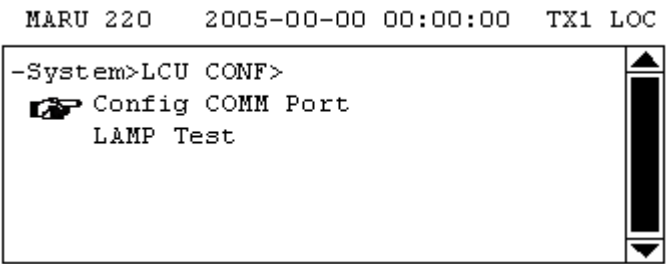


Figure 2-62 System > LCU Configuration Menu Screen

The sub item of the LCU Configuration Menu is as follows.

Table 2-2-46 System > LCU Configuration Display Item

Item	Display and setup range	Description
Config COMM Port		LCU communication-related setup
Lamp Test	YES/NO	Lamp test execution

LCU Configuration > Config COMM Port

Config COMM Port Menu checks or sets up the speed of local communication port of LCU, Remote line and modem status.

```

MARU 220  2005-00-00 00:00:00  TX1 LOC
-System>LCU CONF>Config COMM Port>
LOCAL COMM BAUD   : 57600 bps
REM1 Line Type    : DIAL-UP
REM2 Line Type    : RS-232
REM1 MODEM Status : CONNECTED
  
```

Figure 2-63 System > LCU Configuration > Config COMM Port Menu Screen

The sub item of the Config COMM Port Menu is as follows.

Table 2-2-47 System > LCU Configuration > Config COMM Port Display Item

Item	Display and setup range	Description
LOCAL COMM BAUD	300 ~ 115200 bps	LCU Local communication port speed setup
REM1 Line Type	RS-232 LEASED LINE DIAL-UP	Remote 1 Line Type setup
REM2 Line Type	RS-232 LEASED LINE DIAL-UP	Remote 2 Line Type setup
REM1 MODEM Status	CONNECTED DISCONNECTED N/A	Modem connection status (If Line Type is RS-232, it is indicated as N/A)
REM2 MODEM Status	CONNECTED DISCONNECTED N/A	Modem connection status (If Line Type is RS-232, it is indicated as N/A)
REM1 MODEM BAUD	300 ~ 115200 bps	Modem connection speed
REM2 MODEM BAUD	300 ~ 115200 bps	Modem connection speed

2.3.6. Power Supply

Power Supply Menu displays the status of each PSU unit and output voltage/ current.

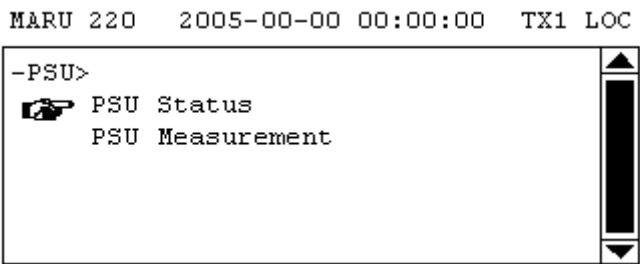


Figure 2-64 Power Supply Menu Screen

The sub menu of the Power Supply Menu is as follows.

Table 2-2-48 Power Supply Display Item

Sub menu	Description
PSU Status	AC/DC, DC/DC, battery status display, outage status display
PSU Measurement	AC/DC, DC/DC, battery voltage/current measurement value display

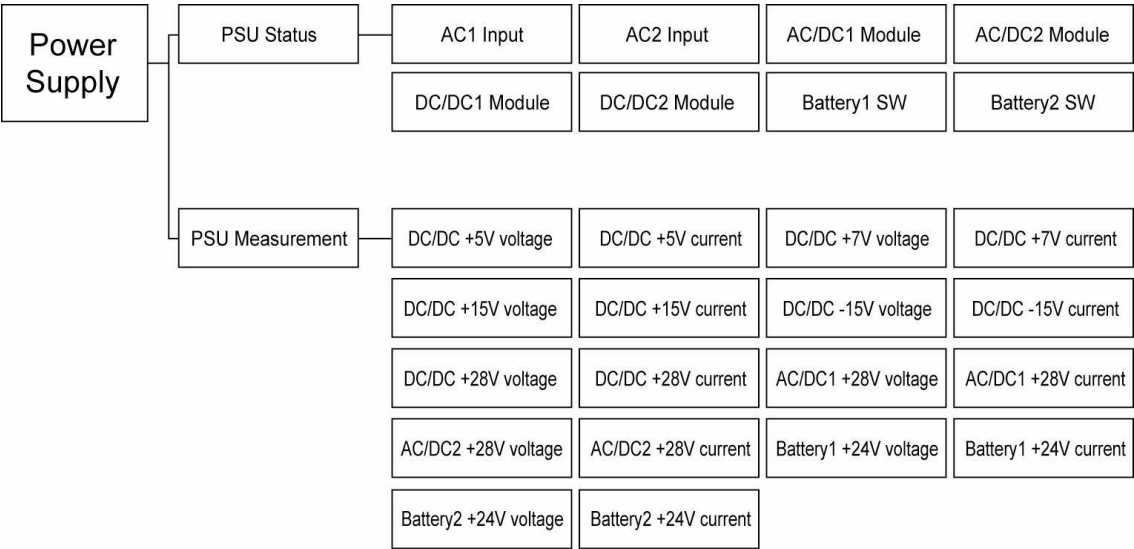


Figure 2-65 Power Supply Menu Structure

PSU Status

PSU Status Menu displays AC/DC, DC/DC, battery status or outage status.

```

MARU 220   2005-00-00 00:00:00   TX1 LOC
-PSU>PSU Status>
  AC2 Input      : OUTAGE
  AC/DC1 Module  : Normal
  AC/DC2 Module  : ----
  DC/DC1 Module  : FAIL
  
```

Figure 2-66 Power Supply > PSU Status Menu Screen

The sub menu of the PSU Status Menu is as follows.

Table 2-2-49 Power Supply > PSU Status Display Item

Item	Display and setup range	Description
AC1 Input	Normal / ---- / OUTAGE	AC1 outage status
AC2 Input	Normal / ---- / OUTAGE	AC2 outage status
AC/DC1 Module	Normal / UNPLUGGED / ---- / MODULE FAIL / INPUT FAIL	AC/DC1 module status If it is outage, AC1 input is indicated as ----.
AC/DC2 Module	Normal / UNPLUGGED / ---- / MODULE FAIL / INPUT FAIL	AC/DC2 module status If it is outage, AC2 input is indicated as ----.
DC/DC1 Module	Normal / UNPLUGGED / FAIL	DC/DC1 status
DC/DC2 Module	Normal / UNPLUGGED / FAIL	DC/DC2 status
Battery1 SW	ON / OFF	Battery1 Switch On/Off status
Battery2 SW	ON / OFF	Battery2 Switch On/Off status

PSU Measurement

PSU Measurement Menu displays AC/DC, DC/DC and measurement values of battery voltage and electric current.

```

MARU 220   2005-00-00 00:00:00   TX1 LOC
-PSU>PSU Measurement>
  DC/DC +5V Voltage : 5.01 V
  DC/DC +5V Current : 2.32 A
  DC/DC +7V Voltage : 7.00 V
  DC/DC +7V Current : 1.57 A
  
```

Figure 2-67 Power Supply > PSU Measurement Menu Screen

The sub menu of the PSU Measurement Menu is as follows.

Table 2-2-50 Power Supply > PSU Measurement Display Item

Item	Display and setup range	Description
DC/DC +5V Voltage	0.00 V ~	DC/DC +5V Voltage measurement value
DC/DC +5V Current	0.00 A ~	DC/DC +5V Current measurement value
DC/DC +7V Voltage	0.00 V ~	DC/DC +7V Voltage measurement value
DC/DC +7V Current	0.00 A ~	DC/DC +7V Current measurement value
DC/DC +15V Voltage	0.00 V ~	DC/DC +15V Voltage measurement value
DC/DC +15V Current	0.00 A ~	DC/DC +15V Current measurement value
DC/DC -15V Voltage	0.00 V ~	DC/DC -15V Voltage measurement value
DC/DC -15V Current	0.00 A ~	DC/DC -15V Current measurement value
DC/DC +28V Voltage	0.00 V ~	DC/DC +28V Voltage measurement value
DC/DC +28V Current	0.00 A ~	DC/DC +28V Current measurement value

Item	Display and setup range	Description
AC/DC1 +28V Voltage	0.00 V ~	AC/DC1 +28V Voltage measurement value
AC/DC1 +28V Current	0.00 A ~	AC/DC1 +28V Current measurement value
AC/DC2 +28V Voltage	0.00 V ~	AC/DC2 +28V Voltage measurement value
AC/DC2 +28V Current	0.00 A ~	AC/DC2 +28V Current measurement value
Battery1 +24V Voltage	0.00 V ~	Battery1 +24V Voltage measurement value
Battery1 +24V Current	0.00 A ~	Battery1 +24V Current measurement value
Battery2 +24V Voltage	0.00 V ~	Battery2 +24V Voltage measurement value
Battery2 +24V Current	0.00 A ~	Battery2 +24V Current measurement value

2.3.7. Information

Information Menu displays the date and time of the system and information of each unit.

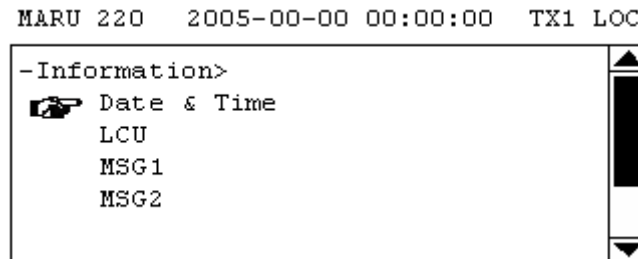


Figure 2-68 Information Menu Screen

The sub menu of the Information Menu is as follows.

Table 2-2-51 Information Display Item

Sub menu	Description
DATE & TIME	It sets up and displays the date and the time of the system
LCU	LCU unit information display
MSG1	MSG1 unit information display
MSG2	MSG2 unit information display
MON1	MON1 unit information display
MON2	MON2 unit information display

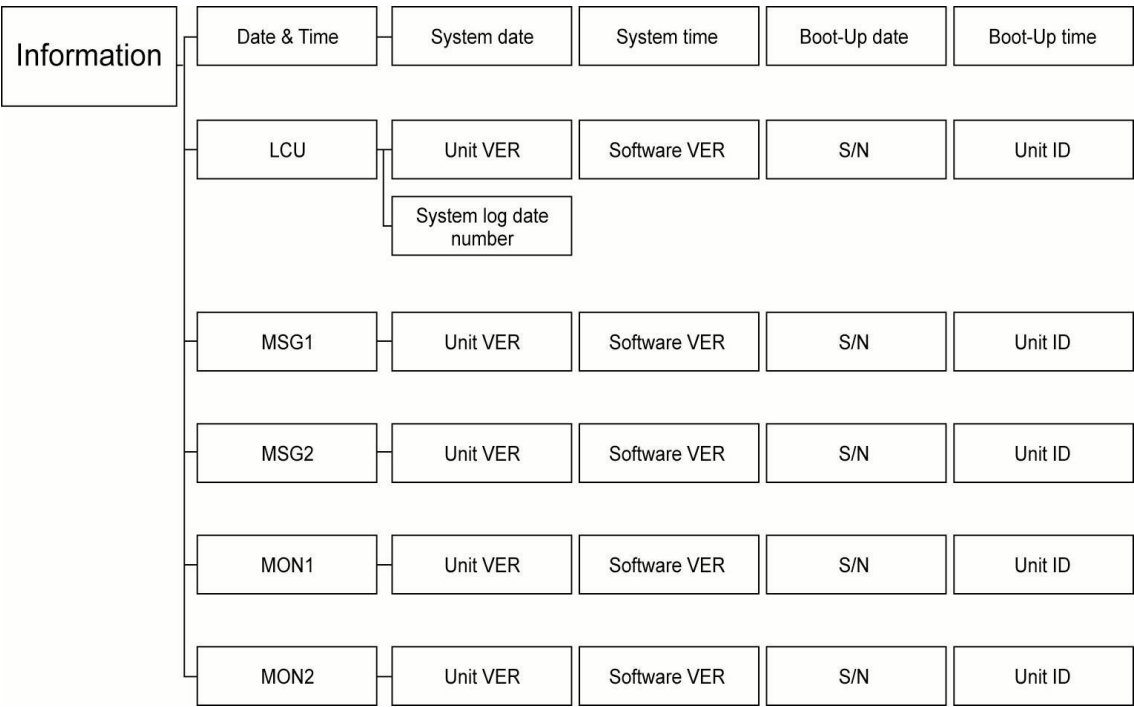


Figure 2-69 Information Menu Structure

DATE & TIME

Date & Time Menu sets up or displays the date and the time of the system and displays the time and the date of the initiation of system operation.

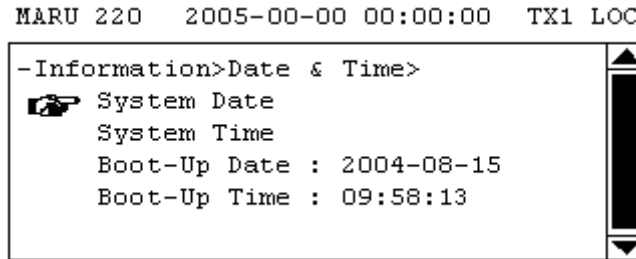


Figure 2-70 Information > Date & Time Menu Screen

The sub menu of the Date & Time Menu is as follows.

Table 2-2-52 Information > Date & Time Display Item

Item	Display and setup range	Description
System Date		System date setup
System Time		System time setup
Boot-up Date	yyyy-mm-dd	Display of initiation date of system operation
Boot-up Time	hh:mm:ss	Display of initiation time of system operation

DATE & TIME > System Date

System Date Menu sets up the date of the system.

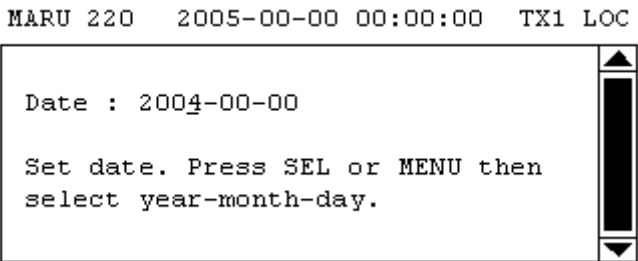


Figure 2-71 Information > Date & Time > System Date Menu Screen

Items that can be set in the System Date Menu are as follows.

Table 2-2-53 Information > Date & Time > System Date Setup Item

Item	Display and setup range	Description
System Date	20yy-mm-dd	System date setup

DATE & TIME > System Time

System Date Menu sets up the time of the system.

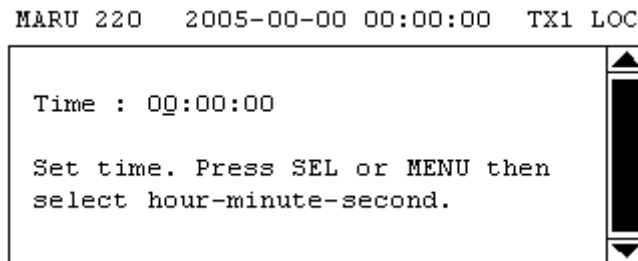


Figure 2-72 Information > Date & Time > System Time Menu Screen

Items that can be set in the System Time Menu are as follows.

Table 2-2-54 Information > Date & Time > System Time Setup Item

Item	Display and setup range	Description
System Time	hh:mm:ss	System time setup

LCU

LCU Menu displays information on LCU unit.

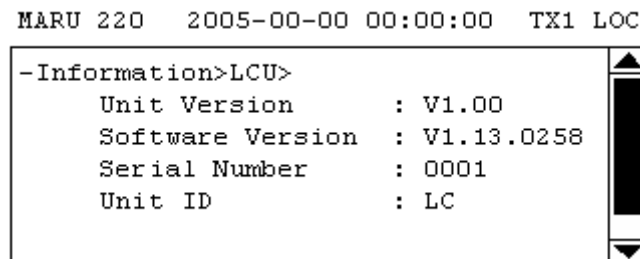


Figure 2-73 Information > LCU Menu Screen

The sub menu of the LCU Menu is as follows.

Table 2-2-55 Information > LCU Display Item

Item	Display and setup range	Description
Unit VER	Vxx.xx	LCU hardware version
S/W VER	Vxx.xx.xxxx	LCU software version
S/N	xxxx	Serial number
Unit ID	LC	Unit division signal
System Log Data Number	xxxxx	The number of system operation record data

MSG1, MSG2

MSG1 and MSG2 Menus display information on each MSG unit.

```

MARU 220   2005-00-00 00:00:00   TX1 LOC
-Information>MSG1>
  Unit Version      : V1.00
  Software Version  : V1.13.0260
  Serial Number     : 0001
  Unit ID           : G1
  
```

Figure 2-74 Information > MSG1 / 2 Menu Screen

The sub menu of the MSG1 / 2 Menu is as follows.

Table 2-2-56 Information > MSG1 / 2 Display Item

Item	Display and setup range	Description
Unit VER	Vxx.xx	MSG hardware version
S/W VER	Vxx.xx.xxxx	MSG software version
S/N	xxxx	Serial number
Unit ID	G1 / G2	Unit division signal

MON1, MON2

MON1 and MON2 Menus display information on each MON unit.

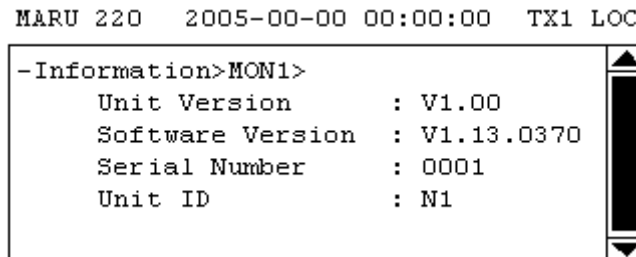


Figure 2-75 Information > MON1 / 2 Menu Screen

The sub menu of the MON 1/ 2 Menu is as follows.

Table 2-2-57 Information > MON1 / 2 Display Item

Item	Display and setup range	Description
Unit VER	Vxx.xx	MON hardware version
S/W VER	Vxx.xx.xxxx	MON software version
S/N	xxxx	Serial number
Unit ID	N1 / N2	Unit division signal

Chapter 3. OPERATION

3.1. Overview

Standard operation is normally carried out via a remote control interface with the user program LMMS or RMMS installed on a PC. Also almost all the same functions can be carried out with the control status panel (CSP). It is interfaced with the local control unit (LCU) for main status indication, equipment status and measurement data and manual controls (switch commands) for basic control functions. Normally the alignment procedure and the maintenance are performed with a locally connected PC using the LMMS.

3.2. Equipment Power On & Power Off

Before Power on the equipment, make sure the followings:

- All the transmitter antenna cables are connected properly.
- All the monitor antenna cables are connected properly.
- The standby transmitter output is connected to the dummy load.
- The mains power is connected to a proper AC source and the input voltage is within the tolerance range.
- Backup batteries are connected to the equipment properly.
- An RS-232C direct cable (9-pin DSUB male to female) is connected to LMMS PC's serial port.
- All remote links are connected to the equipment properly.

To turn on the equipment:

- Turn on the AC/DC1' INPUT circuit breaker switch
- Turn on the AC/DC2's INPUT circuit breaker switch
- Turn on the DC/DC1's INPUT circuit breaker switch
- Turn on the DC/DC2's INPUT circuit breaker switch
- Turn on the DC/DC1's BATTERY circuit breaker switch
- Turn on the DC/DC2's BATTERY circuit breaker switch

To turn off the equipment:

- Turn on the DC/DC2's BATTERY circuit breaker switch
- Turn on the DC/DC1's BATTERY circuit breaker switch

- Turn on the DC/DC2's INPUT circuit breaker switch
- Turn on the DC/DC1's INPUT circuit breaker switch
- Turn on the AC/DC2's INPUT circuit breaker switch
- Turn on the AC/DC1' INPUT circuit breaker switch

3.3. Bypassing Monitors

During normal operation, the monitors need to be in ACTIVE state, so that any anomaly in the radiated signal quality can be result in either transfer to standby transmitter or shutting down the VOR completely.

Also, all of the commands that change system parameters are inhibited when the monitors are in ACTIVE state. Therefore it is necessary to BYPASS the monitors before making any change in system configuration.

Bypassing monitors can be done using LMMS or RMMS, in which case a proper level of security login should be done first. Alternatively bypassing monitors can be done using CSP or RCMU, in which case no need to log on.

During the monitor bypass operation, it is highly advised that the IDENT is disabled unless the radiated signal quality is in absolute normal.

Also it should be kept in mind that after finishing any maintenance works, the monitors should return to ACTIVE state.

3.4. Using LMMS/RMMS

The LMMS and RMMS is a MS Windows based program running on an IBM PC compatible computer. In fact, they are not two different programs, but a single the same program with different configurations. The LMMS is normally installed at close vicinity of the main cabinet and connected via a direct RS-232C link. The RMMS is normally installed at distant place using a leased-line modem or dialup modem. The switching over between LMMS and RMMS can be done by changing the program configuration file.

For details on using the LMMS or RMMS, refer to chapter 1.

3.5. Using CSP/RCMU

For using the CSP or RCMU, refer to chapter 2.

Chapter 4. MAINTENANCE

4.1. Overview

This section contains instructions for system level performance testing and maintenance of the MARU 220 Doppler VOR. The DVOR is capable of continuous, unattended operation. Maintainability is based on a schedule consisting of a monthly, quarterly, semi-annual and annual performance checks. The performance checks are described in the following paragraphs. If maintenance action has potentially degraded system performance to such a degree that its published aircraft approach procedures may not be achieved, system performance is to be verified by a flight inspection aircraft prior to returning the facility to normal service.

4.2. Preventive Maintenance Schedule

Table 4-1 Monthly Preventive Maintenance

No.	Performance Check	Maintenance Procedure
1	Check System Status	
2	Check Carrier/Sideband RF Frequency	
3	Check Carrier Modulation Waveform	
4	Check Sideband Blending Waveform	
5		

Table 4-2 Quaterly Preventive Maintenance

No.	Performance Check	Maintenance Procedure
1	Check site environment	
2	Check and clean cooling fan (blowers)	
3	Check Carrier Output Power	
4	Check Sideband Output Power	
5	Check site IDENT	
6	Check Antenna VSWR	
7	Check Backup battery	
8	Check Automatic Transmitter Changeover	
9	Switch Main/Standby Transmitter	
10		

Table 4-3 Yearly Preventive Maintenance

No.	Performance Check	Maintenance Procedure
1	Check Antenna element and radome	
2	Check Monitor Antenna	
3	Check Monitor Parameters	
4		

4.3. Preventive Maintenance Procedure

4.3.1. Tools and Test Equipments Required

The performance checks are designed to make optimum use of the Built-in Equipment (BITE) by personnel responsible for the maintenance of the DVOR facility. The test equipment (or equivalent) listed in are required to perform DVOR maintenance procedures.

No.	Test Equipment	Type
1	Oscilloscope	Tektronix TDS 1012B or equivalent
2	Digital Multimeter	Fluke Model 114 or equivalent
3	Frequency Counter	Goodwill GFC-8270H or equivalent
4	Power Meter	Bird Model 4314B or equivalent
5	Power Meter Elements	250C, 25C
6	Dummy Load	VHF 50Ω 250W
7	ILS/VOR Analyzer	Rhode & Schwarz EVS300
8	Network Analyzer	Anritsu MS2024A
9	Test Cables	BNC(M)-to-BNC(M)

4.3.2. Checking System Status

- a. Check the status LEDs on the CSP on the system cabinet or RCMU. If there is a red LED on.
- b. Also carry out LAMP TEST to see if there is any faulty LEDs.

4.3.3. Checking Carrier/Sideband RF Frequency

- a. Connect a VHF frequency counter to the BNC jack labeled “FREQ” on the CMA

and SMA using a BNC(M) to BNC(M) test cable.

- b. Verify that the measured is in the frequency tolerance range.

4.3.4. Checking Carrier Modulation Waveform

- a. Connect an oscilloscope to the BNC jack labeled “CAR MOD” on the front panel of MSG using a BNC(M)-to-BNC(M) test cable.
- b. Go to the TRANSMITTER tab on the LMMS/RMMS to disable IDENT keying and voice modulation.
- c. Verify that a clean 30Hz sine wave signal is observed on the oscilloscope screen.

4.3.5. Checking Site Environment

- a. Check that the site is clear of any new obstructions or materials which could affect the normal operation of the DVOR system.
- b. Check the shelter, inside and out, for any sign of water filtration, damage, or other deterioration.
- c. Check the condition of the air conditioner, shelter lighting, obstruction lights, baseboard heaters, electrical outlets, lightening arrestors, etc.
- d. Check for and remove any accumulation of snow, ice, or debris on the field monitor antennas.
- e. Check for and remove any accumulation of snow, ice or debris on the counterpoise surface.

4.3.6. Checking Carrier Output Power

- a. Verify that transmitter 1 is operating.
- b. Select Transmitter 1 tab in the LMMS/RMMS screen. Typically Carrier Power is set for 100 watts (en route) or 50 watts (terminal).
- c. Verify the carrier power output is within $\pm 10\%$ of the setting.
- d. Go to System tab and manually changeover to transmitter 2.
- e. Verify the carrier power output is within $\pm 10\%$ of the setting.

4.3.7. Checking Sideband Output Power

- a. Verify that transmitter 1 is operating.
- b. Select Transmitter 1 tab in the LMMS/RMMS screen. Typically Sideband Power

is set for 2.5 watts depending on the 9960 Hz subcarrier Modulation depth.

- c. Verify each sideband power output is within $\pm 10\%$ of the setting.
- d. Go to System tab and manually changeover to transmitter 2.
- e. Verify each sideband power output is within $\pm 10\%$ of the setting.

4.3.8. Checking site IDENT

- a. Go to monitor tab.
- b. Check for IDENT code and modulation depth.
- c. Go to system tab.
- d. Open IDENT sound control dialog box.
- e. Choose “Sound from MON1” or “Sound from MON2”.
- f. Verify the site IDENT Morse code is heard.

4.3.9. Checking Antenna VSWR

Checking Carrier Antenna VSWR:

- a. Disable Carrier Amplifier
- b. Disconnect the coaxial cable from the carrier antenna.
- c. Get a vector network analyzer and carry out one port calibration.
- d. Connect the network analyzer port 1 to the carrier antenna.
- e. Set the analyzer in VSWR display format and measure S11 parameter.

Checking Sideband Antenna VSWR:

- a. Disable Sideband Amplifiers
- b. Disconnect the coaxial cable from the ASU inputs.
- c. Get a vector network analyzer and carry out one port calibration.
- d. Set the analyzer in VSWR display format for S11 parameter measurement.
- e. Connect the network analyzer port 1 to the ASU input.
- f. Go to TRANSMITTER tab in the LMMS/RMMS and set Antenna Test Mode.
- g. Choose a sideband antenna and measure VSWR.
- h. Change to next antenna and repeat the measurement for all 48 sideband antennas.

4.3.10. Checking Backup Battery

- a. Turn off the INPUT circuit breaker switch on the AC/DC1.
- b. Turn off the INPUT circuit breaker switch on the AC/DC2.
- c. Verify that the system still up and running.

4.3.11. Checking Automatic Transmitter Changeover

- a. Bypass both monitors.
- b. Go to MONITOR tab on the LMMS/RMMS screen.
- c. Click on the Azimuth box.
- d. Change the azimuth reference value by 1.5 degrees.
- e. As soon as the change comes into effect, clear the monitor bypass mode.
- f. Wait and verify that the system is transferred to the standby transmitter.
- g. Wait again and verify the system is shutdown completely.
- h. Bypass both monitors and return the azimuth reference value.

4.3.12. Switching Main / Standby Transmitter

- a. Go to SYSTEM tab on the LMMS/RMMS screen.
- b. Click on the CHANGEOVER box.
- c. Click on YES on changeover confirmation message.

4.3.13. Checking Antenna Element and Radome

- a. Go to TRANSMITTER 1 tab and disable CPA, LSB SMA and USB SMA.
- b. Go to TRANSMITTER 2 tab and disable CPA, LSB SMA and USB SMA.
- c. Go up to the counterpoise and visually inspect each antenna cover radome.
- d. Open each antenna cover and visually inspect each antenna element.

4.3.14. Checking Monitor Antenna

- a. Approach the monitor antenna tower
- b. Visually inspect the monitor antenna tower for any mechanical and/or environmental damages such as corrosion.
- c. Visually inspect the monitor antenna and the feeder cable.

4.3.15. Checking Monitor Parameters

- a. Go to MONITOR tab on the LMMS/RMMS screen.
- b. Verify all the monitor parameters are in normal color and within the tolerance limits.

Chapter 5. INSTALLATION

5.1. SELECTING INSTALLATION SITE

The area in which a DVOR is to be installed is determined by the responsible Civil Aviation Authority according to the international air traffic regulations. This area is generally sufficiently large to allow a point with the optimum topography and thus the optimum propagation conditions to be chosen. This point is determined by means of a site survey at which a surveyor must always be present. When the installation site has been determined, precise bearings must be taken, either with reference to trigonometric points or, if available, via a DGPS for increased precision.

5.2. FOUNDATIONS FOR DVOR COUNTERPOISE AND SHELTER

The following drawings show the foundations for counterpoises with heights of 4 m and the corresponding shelter foundations. These drawings are for information only. The drawings used for the installation site are provided by the engineering plan.

Shelter plate foundation drawing details (for shelter foundation plate see Fig. 3)

5.3. GROUNDING

5.3.1. General

The type of grounding implemented is dependent on the local terrain. Consequently it is only possible to provide general guidelines here. Grounding conductors or rods are metallic elements of a particular form which are either driven into the ground or laid in the ground so as to cover a relatively large area. All connections in the ground must be welded and protected against corrosion. The ground resistance required for a DVOR (or other navigation installations) can be given as $\leq 5 \Omega$. This resistance can only be measured precisely with the aid of special ground resistance measuring equipment. The exact measuring procedure is described in the operating instructions for these devices. Universally valid instructions are given in Para 5.3.6. Sufficient grounding can generally be obtained if the installation suggestions described below and the terrain conditions are paid attention to. When estimating the ground resistance the length and extent of the network laid are the crucial points, not the cross-sectional area of the conductors. Favorable resistance conditions are provided by arable land and loamy ground (ground resistivity 100Ω per meter). The data specified below applies to these conditions. With other types of terrain the factors below must be taken into consideration (increase in the resistance with respect to the basic values stated).

- Moist sandy soil 2x
- Dry sandy soil 5 to 10x
- Gravel or stones up to 30x

If the ground is not chemically neutral, e.g. if it is salty, it may be necessary to coat all metal parts laid in the ground with lead or to use a sufficiently non-corrosive steel (e.g. V2A). The different types are as follows:

Radial Ground rod or plate Interlinked ground

Fig. 36 Different types of ground conductor configuration

5.3.2. Strip or mesh Ground Conductors

Strip ground conductors take the form of a strip, round material or cable laid in the ground at a depth of 0.5 to 1 m so as to cover a relatively large area.

Materials:

- Steel strip (hot galvanized) 100 mm^2 , min. thickness 3 mm
- Copper strip 50 mm^2 , min. thickness 2 mm

- Copper cable (not finely stranded) 135 mm²

The network should be laid as symmetrical to the DVOR station as possible. The necessary length and extension when laid in a straight line, should be estimated from the basic data below.

- Strip length Ground resistance 25 m 10 Ω
50 m 5 Ω
100 m 3 Ω

5.3.3. Ground Rods

Ground rods are either pipes or U, L or T-shaped profiles driven vertically into the ground and 1 to 2 m in length. It is necessary to connect several ground rods together in order to reduce the grounding resistance. The minimum spacing is twice the length of each ground rod.

- Material: Steel (hot galvanized) Pipe 30 x 3 mm
Bracket L 65 x 65 x 7 mm
U-profile U 65 DIN 1026
T-profile T 60 DIN 1024
- Probable grounding resistance of a rod: Length 1 m approx. 70 Ω
Length 2 m approx. 40 Ω

The material, cross sectional areas and grounding resistance of the connecting leads to the shelter should be as for strip ground conductors, (see Para 5.3.2). When pipe-type grounding rods are fastened with clamps, screws at least M10 in size should be used.

5.3.4. Ground Plates

Ground plates are solid perforated sheet metal plates with dimensions of approx. 0.5 x 1 m or 1 x 1 m, which are embedded vertically in the ground. The top edge of the plates should always be at least 1 m below the surface. Several ground plates must be connected in parallel in order to reduce the grounding resistance. The minimum spacing should be 3 m. Material:

- Sheet steel (hot galvanized) min. thickness 3 mm

- Sheet copper min. thickness 2 mm

The ground resistance of a plate 1 m² is approx. 30 Ω. The data for the connecting conductors is specified in the tables in Para 5.3.2.

5.3.5. Estimating the Ground Resistance

The resistance of each rod, each plate and each supply line used should be determined on the basis of Para 5.3.2 to 5.3.4. They should be considered as parallel resistances. The resulting grounding resistance should then be calculated as follows: $1/R_{res} = 1/R_1 + 1/R_2 + 1/R_3 + \dots + 1/R_n$. Taking into account the nature of the terrain (for factors see Para 5.3.1) satisfactory grounding conditions can be assumed if the ground resistance calculated from the base data is < 5 Ω. If the value calculated is 5 Ω or more, measuring the ground resistance is recommended.

5.3.6. Measuring the Ground Resistance

Three measurements must be performed over a large area in order to determine the ground resistance precisely. The distance between two auxiliary grounds required must be large in relation to the complete ground network of the navigation installation. Two steel rods approx. 1 m long should be used as auxiliary grounds (reinforcing bars); these should be driven into the ground with only a few centimeters remaining at the designated points. It is essential that the rods are of equal length and are driven in to the same depth.

Example of a DVOR plate ground with 5 x 2 plates, each 1 m². The drawing is not to scale. A theoretical round resistance of approx. 2 Ω (good) would be obtained on the basis of the 10 plates, connecting conductors and assumed terrain conditions (e.g. arable land) in accordance with the formula in Para 5.3.5

Measurements are performed as shown in the diagram below:

E = Installation ground

H₁ = Auxiliary ground 1

H₂ = Auxiliary ground 2

M₁ = Measured value 1

M₂ = Measured value 2

M₃ = Measured value 3

Measured value 1: Resistance between installation ground and auxiliary ground 1

Measured value 2: Resistance between auxiliary ground 1 and auxiliary ground 2

Measured value 3: Resistance between installation ground and auxiliary ground 2

When the three measurements have been performed the ground resistance is calculated as follows:

$$\text{Ground resistance} = (\text{corr. meas. 1} + \text{corr. meas. 3} - \text{corr. meas. 2}) / 2$$

The measurement is falsified by the resistance of the two test leads. The cross-sectional area of the test leads should not be less than 1.5 mm^2 in order to ensure an adequate breaking strength. With this cross-sectional area and an assumed length of $2 \times 25 \text{ m} = 50 \text{ m}$, the falsifying resistance would be 0.58Ω . This resistance should therefore be measured and deducted from measured values 1, 2 and 3. The measured values corrected in this manner are entered into the above formula.

5.4. INSTALLING EQUIPMENT SHELTER

5.4.1. General

The Navais equipment can be installed in a 3m x 5m Standard Shelter which is offered by MOPIENS, Inc. To cover the requirements, the shelter is based on the definition on transport containers ISO/KS standards. The shelter consists of a self-supporting, distortion resistant steel frame construction with eight ISO corners and walls made of fiber-reinforced plastic (FRP) in standardized container dimensions.

During installation, the shelter should be placed on the foundations such that the door is oriented according to the site survey and project drawings. The shelter is anchored to the four foundation blocks using the ISO corners and twist locks. The power supply (mains) and signal (remote control, field monitor) feeder cables enter from below through openings in the shelter floor.

5.4.2. Installing Equipment Shelter

When transporting by crane or helicopter, care should be taken to ensure that the angle between the lifting harness and the crate is at least 60° .

5.5. INSTALLING ANTENNAS

5.5.1. General

This chapter describes the installation and adjustment of the DVOR antennas. The installation of the counterpoise with associated supports and framework, and the framework decking are normally part of the civil works section and not included in this description. The counterpoise foundation drawing in section 5.2 is shown for information only. It depends on actual siting conditions.

WARNING

Sturdy shoes, safety gloves and safety helmets must be worn during installation. Safety belts with rescue line and swivel snaphook should be used when working on the counterpoise platform.

5.5.1.1. Prerequisites

Counterpoise

The counterpoise for the DVOR antenna has been completely assembled according to the drawings set included with the counterpoise material.

NOTE: *Building up the counterpoise and the antenna mounting devices it is to ensure that the counterpoise surface constitutes a homogeneous RF plane. The metallic parts (e.g. mesh web, antenna ring etc.) of the surface should be conductive interconnected so that the antennas will find adequate RF radiation conditions.*

Support for Carrier Antenna (Counterpoise Center)

The support for mounting the middle antenna has been installed in the center of the counterpoise. Permissible deviation from the center: ± 150 mm.

Antenna Ring

(Fig. 7)

The antenna ring has been installed on the counterpoise. The radius measured at the inner ring is 6623 mm.

Cable Run

(optional, Fig. 8)

As default the RF cables are fed through the mesh clamps or using steel hooks below the counterpoise. Alternatively 16 plastic or steel pipes may be optionally installed on the lower side of the counterpoise for the cable runs from the sideband antennas to the center of the counterpoise. A further pipe may be used in addition if the antenna of a collocated DME is to be installed.

5.5.2. Antenna mounting

5.5.2.1. Placing the Antennas onto the Counterpoise

The DVOR antennas comprising antenna dome, matching stub, balun and pedestal are lifted with their packaging over the outer edge and onto the counterpoise. To do this, the use of a lifting crane, a trestle with swiveling arm or, e.g. for the 4 m-high counterpoise, a guyed auxiliary mast is recommended (Fig. 9).

5.5.2.2. Installing the Carrier Antenna

Determine the center of the counterpoise with respect to the antenna ring of the sideband antennas. Install the pedestal of the carrier antenna at this point, then align it using a spirit level (compensate if necessary by means of washers, etc.) and secure. Mount the carrier antenna with cover on the pedestal and secure with the appropriate screws.

CAUTION

When removing the cover, always make sure that no rain can penetrate the lower section of the antenna or come into contact with the antenna elements.

5.5.2.3. Installation of the Sideband Antennas

First install the sideband antenna A1. The installation point of this antenna should be selected with the aid of a compass such that it is aligned approximately with North with respect to the middle antenna. Mark the installation point on the antenna ring. Install pedestal #1 here, and align it perpendicularly with the aid of a spirit level (if necessary compensate by means of washers or similar). Secure the pedestal to the antenna ring by means of a clamping plate and four screws. Secure all pedestal fastenings to the outer ring.

Install the sideband antenna A2 in the same way as A1 and to the left of it (as seen

from the carrier antenna), such that with a pedestal diameter of 127 mm the distance between the outer edge of pedestal #1 and the outer edge of pedestal #2 is 750 mm. This distance can be set anticlockwise from antenna to antenna using improved means (e.g. a wooden rod cut to size).

NOTE: *750 mm is a standard dimension, which may vary somewhat in practice on account of tolerance chains within the antenna ring and the pedestals. In such cases a positive or negative deviation from the standard dimension of 750 mm will be measured between A48 and A1. This dimension (deviation from 750 mm) should be divided by 48, in order to calculate a new clearance. The pedestals are then readjusted with a new wooden rod in a second procedure. Each pedestal adjusted must also be aligned precisely using a spirit level.*

The hooks on both sides of the antenna ring holding a layer of structural steel matting should be adjusted as necessary in order to ensure that they are firmly secured. The hooks ensure adequate electrical connection.

Careful, precise mechanical alignment of the antenna will considerably simplify the work of the commissioning engineer. A maximum deviation of 3 mm between A48 and A1 with respect to the corrected standard dimension can be tolerated. A sideband antenna (with cover) should now be mounted on each pedestal.

5.5.3. RF Cabling of Antennas

5.5.3.1. General

The RF cables between the sideband antennas and the ASU connectors below the counterpoise are marked from A1 to A48 at both ends by means of cable markers, as well as the RF cable from the lead through in the shelter wall to the carrier antenna with A0. The other 4 RF cables from the lead through in the shelter wall to the ASU housing are also marked with LSB COS, LSB SIN, USB COS and USB SIN at both ends. The SB antenna RF cables A1 to A48 are fed to the lead through in the shelter wall and from there to the antennas. Due to the different counterpoise height options there are sets with individual cable length for each.

CAUTION

Make sure that no bend in an RF-cable is made with a radius of less than 50 mm. The supply cables at the ASU should be laid such that they form a sufficiently large loop to prevent any rainwater running down the cables and coming into contact with the coaxial connections of the ASU.

5.5.3.2. Sideband Antennas

Slide the individual RF cables A1 to A48 and A0 each through the pedestal of the corresponding sideband antenna from below, connect the coaxial connector to the antenna connection socket and secure with the union nut. Feed the other end of the cable, except that for the carrier antenna A0 through corresponding mesh clamps used as cable duct to the U-girder and from there to the lead through (48x SB ANT, 1x CAR ANT, 1x MON ANT) of the shelter via the cable box.

Provide strain relief for the cable underneath the pedestal by means of UV-resistant cable ties. Excessive lengths of cable are cleared in a cable box at the lower end of the U-girder. The RF cabling of the individual sideband antennas to the shelter should be installed such that, for example, the cable from the central connection of the antenna of antenna A2 is fed to terminal A2 of the coaxial connector at the lead through of the shelter.

The supply cables at the shelter should be laid such that they form a sufficiently large loop to prevent any rainwater running down the cables and coming into contact with the coaxial screw connections in the wall entrance. The cable loops should be protected by means of a suitable cover.

5.5.4. Aligning Sideband Antennas

CAUTION

Care should be taken when removing the covers from the carrier and sideband antennas to ensure that no rain can penetrate into the lower section of the antenna or come into contact with the antenna elements.

Remove the cover from the carrier antenna, secured by with of 8 self-tapping, stainless steel round-head screws 5 x 30 mm. Take the rectangular tube and pin from the installation accessories for the DVOR system, and install them at the center of the

carrier antenna. The pin can be used to take bearings when aligning the 48 sideband antennas.

Remove the cover from one of the sideband antennas (e.g. A1). Preset the two calibration capacitors of each antenna, each with two plates adjustable by means of a threaded shaft and fastened by means of a lock nut. The plates should be roughly symmetrical between the antenna elements and spaced properly (6.7 mm for 113 MHz). This spacing is easy to set if a suitable twist drill shaft is used as a gauge. The lock nuts should be tightened following the setting.

Loosen the three mounting bolts for the antenna lower section/pedestal, and move the lower section of the antenna slightly to the left and right on the pedestal in accordance with the oblong holes in the pedestal. Using the rectangular tube, align the various sideband antennas from the outside of the installation ring via the pointer sights (press-fitted at the top of the antenna lower section) to the pin (bearing marker), which is mounted on the center of the middle antenna. The three screws (for securing the antenna lower section to the pedestal) should be tightened following the setting. Bearings should be taken with respect to the middle antenna several times if necessary, and the adjustment repeated. When the lower section of the antenna has been secured to the pedestal the cover should be installed. The 8 self-tapping screws for securing the cover should only be screwed in roughly half way, since further calibrations are likely to be necessary during commissioning.

Following these operations, or in the event that they are not necessary, secure the cover by means of the 8 screws. If damage is determined in the coated polystyrene body of the lower section of the antenna, it should be repaired immediately using the repair kit.

5.5.5. Installing Field Monitor Antenna

The monitor dipole is mounted on a mast at a height of 1.3 m above the antenna counterpoise. It should be installed at a distance of 100 m or farther from the center of the counterpoise. It is generally installed at the radial of major use. The supply cable is fed via a cable trench to the DVOR housing.

5.6. INSTALLING DVOR EQUIPMENTS

5.6.1. General

This chapter describes the connections at the transmitter: power supply, RF connections, interface connections and connections for remote control equipments.

NOTE: *If the shelter is provided by the customer, the customer will be responsible for the installation including a mains fuse box with arrester and a battery fuse box.*

5.6.2. Connecting Power Supply

5.6.2.1. Power Connections

A type MS-3057-12A circular male connector (Jack) with three prongs for main AC power supply is located on the top of the main equipment cabinet.

The connection must be done in the following sequence:

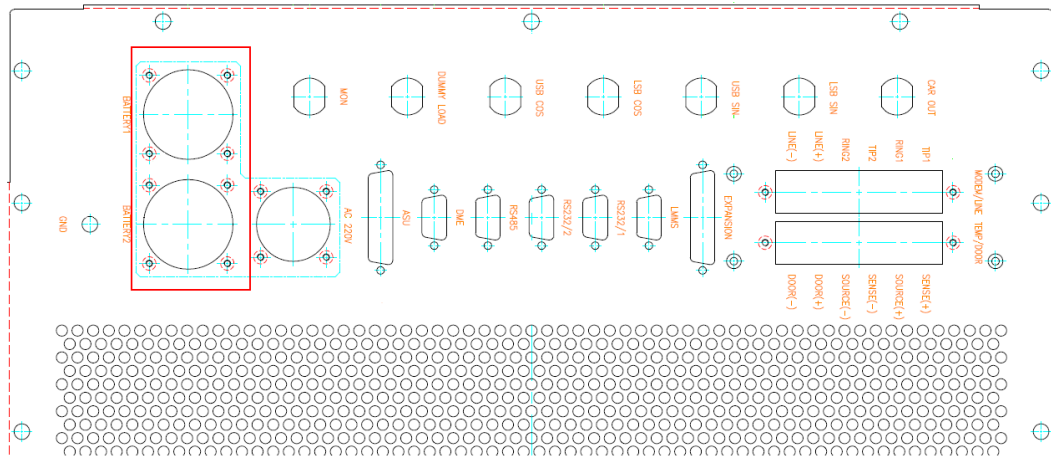
WARNING

Before connecting the cables check that the mains lead is not hot and that the battery is not connected.

- a) Set the POWER ON/OFF switches of the AC/DC units to OFF. Remove the units.
- b) Prepare three wires for power connection in suitable length.
- c) Solder the wires to the MIL-type circular plug included in the accessories kit supplied with MARU 220 DVOR. Be sure to identify correct pin for L (Live), N (Neutral), G (Ground)
- d) Connect the circular plug to the circular jack labeled as AC MAINS IN on the top plate of the equipment cabinet.
- d) Connect the other end of the fabricated power cable to a main power source (nominally AC 110 to 220 V 50/60 Hz, single phase) via power distribution panel of the equipment shelter.

5.6.2.2. Connecting Backup Battery

Two MIL-type circular male connectors (Jacks) with two prongs for backup battery are located on the top of the main equipment cabinet.



CAUTION

When connecting the DC supply observe the correct polarity (+ and -).

The battery set is connected via two PVC-insulated copper cables with a cross-sectional area of 22 mm². The length of this connection is restricted to a maximum of 15 m.

- Prepare two pairs of 22 mm² PVC-insulated copper cables with a cross-sectional area of 22 mm².
- Solder the leads to the prongs of the accessory plugs supplied with the MARU 220 DVOR.
- Connect the circular plug to the circular jack labeled BATTERY1 and BATTERY2 on the top plate of the equipment cabinet.
- Connect the other ends of the fabricated battery cables to the backup batteries which are installed in the backup battery cabinet supplied with MARU 220 DVOR.

5.6.3. Installing ASU

5.6.3.1. RF Connections

Prepare the following cable connections to connect ASU.

Four type RG-214 50Ω Coaxial Cable which are labeled as:

LSB COS

LSB SIN

USB COS

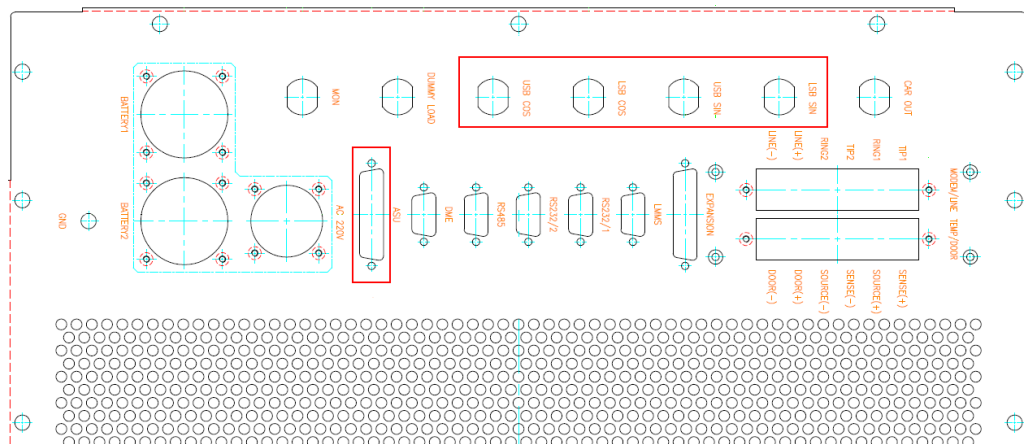
USB SIN

Note: Those ASU connection cables all must have the same electrical length which should be equivalent to integer multiples of half wavelength.

One ASU control cable type UL 2464 AWG24*25C with 25-pin D-SUB connectors on both ends

5.6.3.2. Connecting ASU to Sideband Antennas

The four type N male connectors for sideband output are located on the top of the equipment cabinet, which are labeled as LSB-COS, LSB-SIN, USB-COS and USB-SIN.

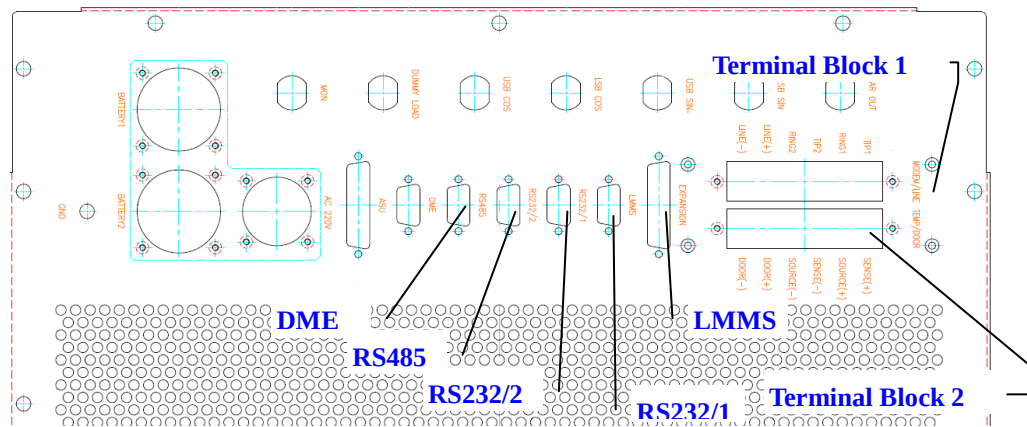


Likewise the four type N male connectors for sideband inputs are located on the front panel of the ASU with the same labels.

Connect one ends of the pre-fabricated ASU cables to the sideband output connectors on the main equipment cabinet. Connect the other ends of the cables to the sideband input connectors on the ASU front panel.

The 25-pin D-SBU connector for ASU control is located on the top of the equipment cabinet. Connect the ASU control cable supplied with the MARU 220 DME to the equipment cabinet and to the ASU.

5.6.4. Connecting External Equipments



5.6.4.1. Connecting LMMS

- For LMMS connection, prepare a RS-232C direct cable with proper length and with 9pin D-SUB male to female connectors attached at each end. Only pin #2, #3 and #5 are required for LMMS connection.
- Connect the female end to a serial com port of the LMMS PC's. If the serial com port is not available on the LMMS PC, use a suitable USB-to-RS-232C adaptor.
- Connect the male end of the RS-232C cable to the LMMS connector on the top plate of the equipment cabinet.

5.6.4.2. Connecting RMMS

To connect RMMS via the built-in two-wire modem (leased or dialup line):

- Prepare a pair of twisted cable with suitable length and with spade terminals at both ends.
- Connect the spade terminals to the Tip1 and Ring1 terminal on the terminal block 1.
- Connect the other end of the cable to the remote site via suitable distribution panel such as IDF.

To connect RMMS via other data link

- Remove the socket modem #1 and set the DIP switch for RS-232C in the LCU.
- Connect the external data link with RS-232C interface to the RS-232/1 connector.
- Refer to the instruction manual of the data link for further details.

5.6.4.3. Connecting RCMU

To connect RCMU via the built-in two-wire modem (leased or dialup line):

- Prepare a pair of twisted cable with suitable length and with spade terminals at both

ends.

- b) Connect the spade terminals to the Tip2 and Ring2 terminal on the terminal block 1.
- c) Connect the other end of the cable to the remote site via suitable distribution panel such as IDF.

To connect RCMU via other data link

- a) Remove the socket modem #2 and set the DIP switch for RS-232C in the LCU.
- b) Connect the external data link with RS-232C interface to the RS-232/2 connector.
- c) Refer to the instruction manual of the data link for further details.

5.6.4.4. Connection of Optional Voice Channel Signal

Connect a two wire line from incoming voice service (e.g. from Tower) to LINE(+) and LINE(-) terminals on the terminal block 1 on top plate of the equipment cabinet.

5.6.4.5. Connection of auxiliary Inputs/Outputs (Expansion)

The Nav aids installation contains an auxiliary interface (on LCU board) with 8 digital inputs and 8 digital outputs for additional signals which is at the user' s disposal. The external wiring is available on the 25-pin D-SUB connector labeled as EXPANSION on the top plate of the equipment cabinet.

5.6.4.6. Connection of Environmental Sensors

Connect a PT-100 temperature sensor for ambient temperature measurement to the SENS(+), SENS(-), SOURCE(+) and SOURCE(-) terminals of the terminal block 2 on the top plate of the equipment cabinet.

MARU 220

Doppler VHF Omni-directional Radio Range

Technical Manual

Volume II

OPERATIONS AND MAINTENANCE INSTALLATION

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