TRAINMASTER XD – Clean Cab Railroad Radio

Railcom

User Manual
Software Release ver.2.2, July 2015

TRAINMASTER XD – Clean Cab Railroad Radio

Table of contents

1 Introduction

This document is representing the standard feature user manual of the Clean Cab Railroad Radio system. The system is designed for a high level of customization related to voice and data operation.

Specific modifications of functions, menu interactions, data interface operation, etc. come along with specific implementation projects and related specifications that cannot be reflected within this document.

Such matters will be treated at project management level and will generate a project specific user manual.

The Clean Cab Railroad Radio is a rolling stock system component of either analog FM or digital railroad 2-way VHF radio networks for 12.5 kHz channels.

It is fully compliant to the AAR frequency plan either in analog or digital operation.

2   Prerequisites

2.1   FCC and IC Requirements

The FCC and IC (Industry Canada) require you to obtain a station license for your radio equipment before you transmit on it, but do not require an operating license or permit. The station licensee is responsible for ensuring that the transmitter power, frequency and deviation are within maximum limits allowed by the station license.

The licensee of the station is at all times responsible for the proper operation of the equipment. No FCC or IC license is required for personally maintaining the equipment. However, the licensee is cautioned that any changes or modifications to the equipment not expressly approved by Railcom could void the user's authority to operate the equipment. You must check the frequency and deviation of the transmitter on installation and at least once yearly.

2.2   General Safety Information

Proper use of the radio requires that the following precautions be taken:

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within 0.6 meters (two feet) of the antenna.

DO NOT operate the transmitter of a fixed radio (base station, microwave and rural telephone RF-equipment) or marine radio when someone is within 0.6 m (two feet) of the antenna.

DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are electrically properly terminated.

In addition,

DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded according to Railcom installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

<u>WARNING</u>

Because of the hazardous voltages involved in the 72 volt power supply, the power supply compartment cover must be kept in place at all times, except when specifically troubleshooting and servicing the power supply circuitry. Before opening the power supply compartment, disconnect the power from the radio set.

3   Overview of the Clean Cab Radio

3.1   General Description

The Clean Cab Radio is a synthesized railroad radio for 12.5 kHz analogue and digital Mototrbo compliant operation at 12.5 kHz channel grid in 2 timeslot TDMA mode.

The Clean Cab Radio works in 3 different operational modes:

a) AAR mode:

It operates on all carrier frequencies as specified by the American Association of Railroads (AAR), and supports existing analogue Tone and DTMF signaling systems. The radio can be pre-programmed for all AAR frequencies and channel numbers as well as for 12 DTMF tones and 10 dispatch single tones.

→The fleet administrator of the railroad is able to block specific channels from user access.

b) HOME analog mode / c) HOME digital mode:

The fleet administrator is able to pre-program channels for HOME mode operation. Those channels can be programmed for analog, digital or mixed within the whole VHF frequency range of 136 … 174 MHz. Channel names can be alphanumeric.

If channels are set in digital mode, the Mototrbo^{TM} digital signaling system and data transmission and Short Data Service (SDS) mode of Motorola Solutions is applicable.

In HOME digital mode GPS location tracking is possible.

3.2   Construction

The Clean Cab Radio has been subjected to stringent mechanical and environmental testing to ensure that it meets the requirements of the harsh railroad environment.

The front panel incorporates pushbutton controls and built-in microphone and loudspeaker to make operation easier and more reliable. The bright indicators and alphanumeric display provide for a wide angle of visibility, allowing for several different mounting configurations.

The radio can be field-programmed at fleet administrator access level without disassembly of the unit, for unique frequencies and operating characteristics as system requirements are modified, making it a convenient and cost-effective unit.

Within the metal enclosure is a transceiver module, a DC/DC power converter, the central processing circuit board, the audio switching board, the rear connector board,

the front panel printed circuit board with TFT screen and keypad matrix, internal loud-speaker, ambient light sensor and microphone.

The modular design permits easy servicing by providing quick access to the major radio elements.

Security is provided by a lock located at the rear side of the radio which secures the radio to the mounting tray.

All connectors have been mounted on the rear side of the device and are recessed to protect them from being damaged during installation, removal or transport of the radio.
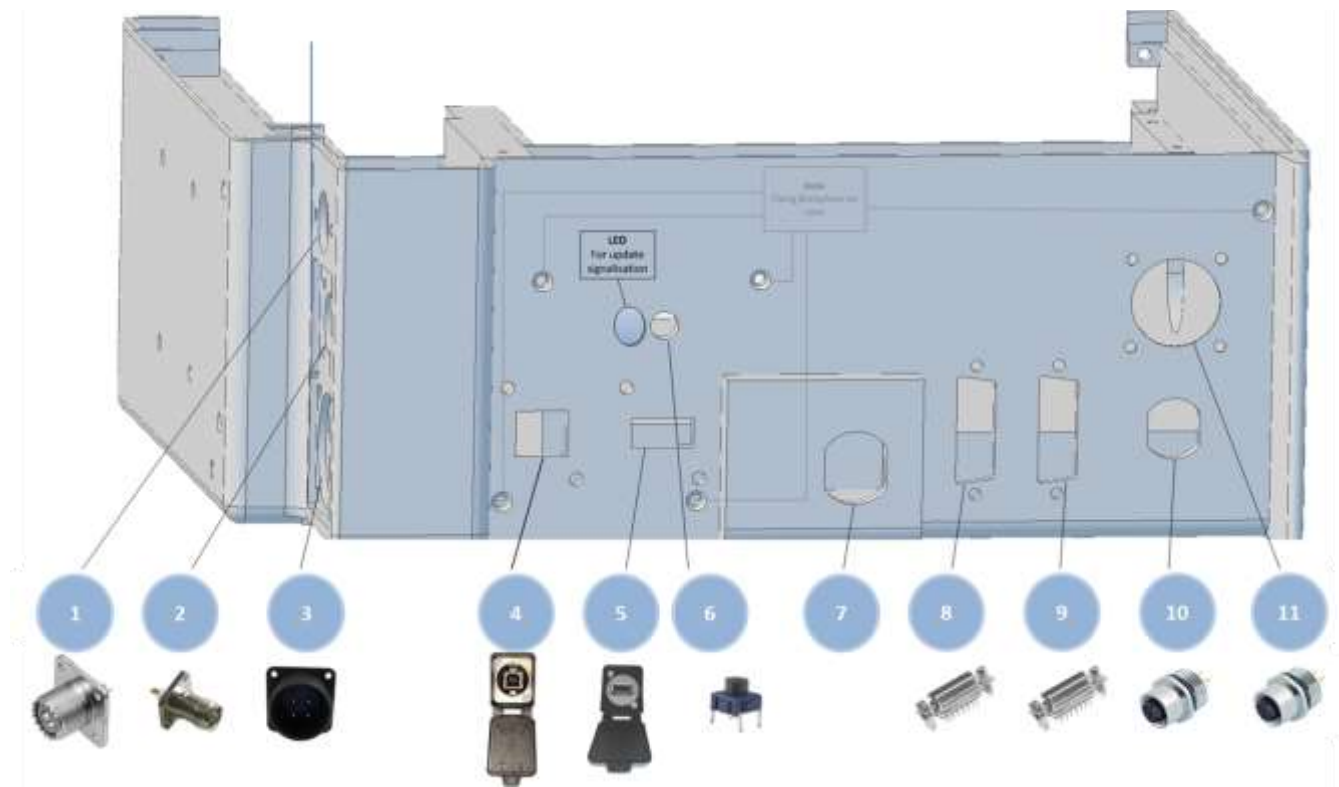
3.3 Front Layout
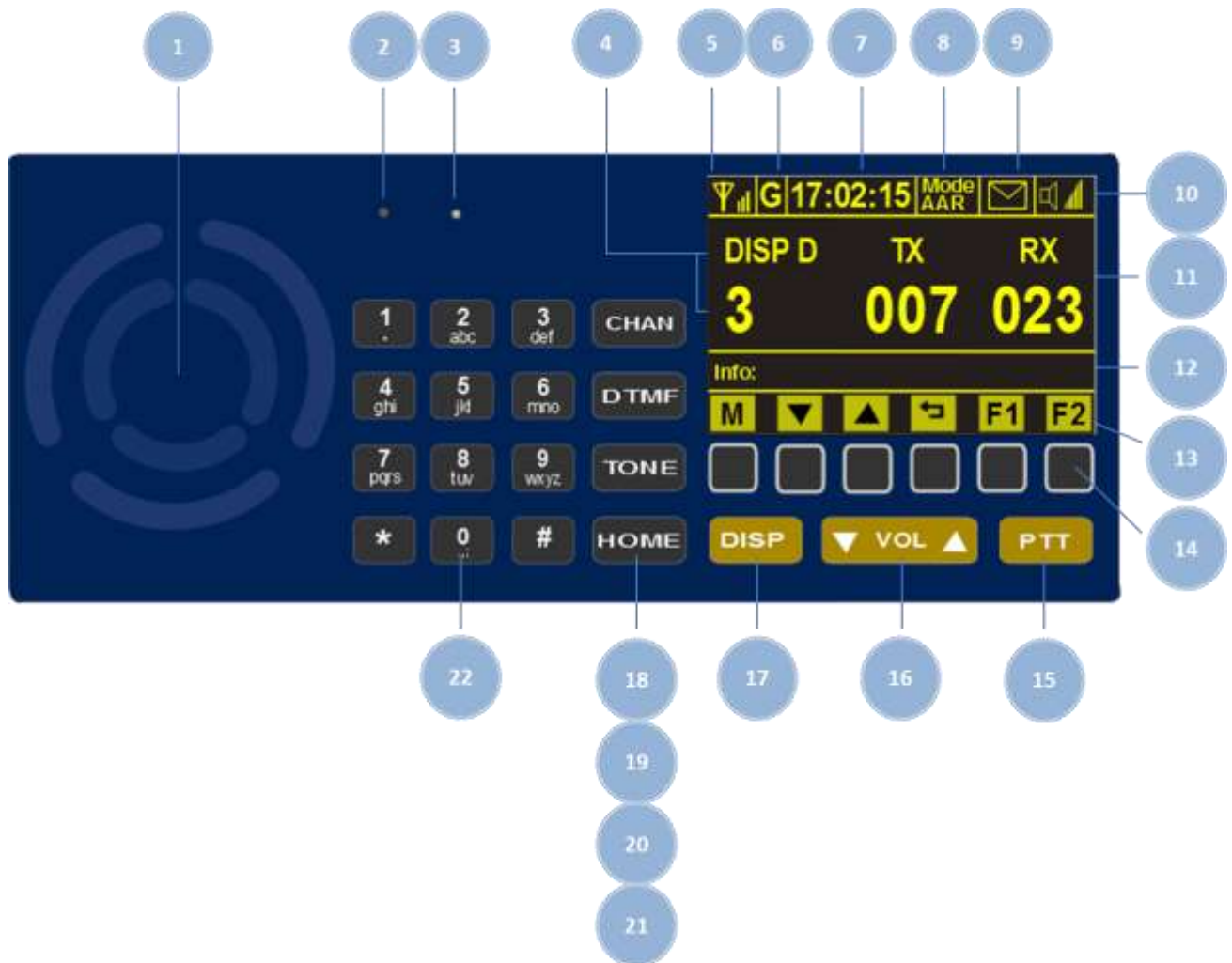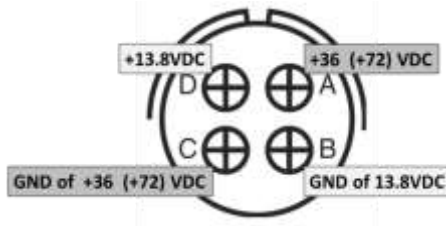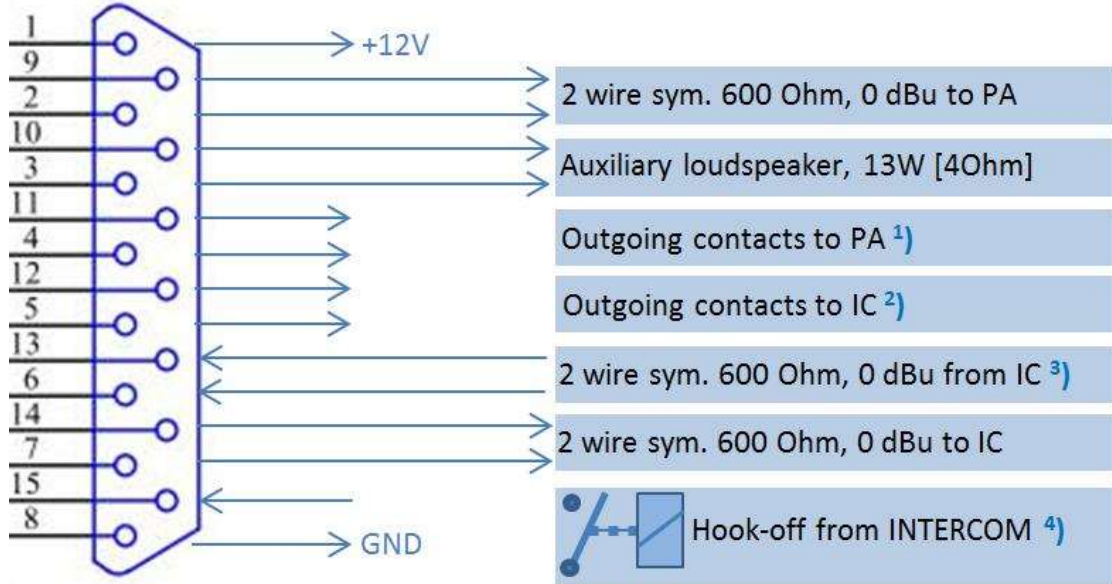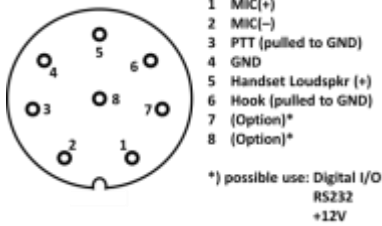
1	10 Watts loudspeaker
2	Ambient light sensor for automatic display brightness adjustment
3	In-built dynamic front panel microphone
4	TFT color display; Dispatch mode indicator for preselected tone (DTMF [D] or single tone [T])
5	Field-strength indicator
6	Indicator for GPS signal reception (Next SW Release)
7	Time indicator
8	Operational mode indicator
9	SDS inbox text-message indicator (digital mode) (Next SW Release)
10	Loudspeaker volume indicator

Railcom

11	Transmitting (Tx) and receiving (Rx) channel indicator
12	Info field; context sensitive display of additional user information
13	Context sensitive functional indication for soft-button below
14	6 Soft-buttons (context sensitive functionalities); customer specific additional functions on request
15	Push-to-talk button keys up the transmitter for voice messages when using the front panel microphone
16	Loudspeaker volume button
17	Dispatcher call button sends the preselected tone (DTMF [D] or single tone [T]) indicated in the display "DISP T/D"
18	CHAN – channel select button initiates the channel select mode for entry of Tx and Rx channels from the numeric keypad
19	DTMF – DTMF button initiates the dispatch DTMF select mode to select and transmit a DTMF dispatch tone via the numeric keypad
20	TONE – Tone button initiates the dispatch tone select mode to select and transmit a single-tone dispatch tone via the numeric keypad
21	HOME – Home button initiates the home channel select prompt for entry of a programmed home channel from the numeric keypad
22	Alphanumeric keypad

3.4   Rear Layout

1	SO239 female; VHF antenna connector Rx / Tx,
2	TNC female; GPS antenna connector,
3	Amphenol MS3102A18-4P; DC Power supply connector, 36 VDC or 72 VDC (order dependent) and 12 VDC **view from outside**
4	USB "B" – CPS programming interface
5	USB "A" – Clean Cab Radio application software update interface
6	Button for "start updating" if USB stick is plugged into USB "A"
7	Lock
8	DSUB-15P female → PIN layout see next page.

Diagram labels:

- 1 / 9 → +12V
- 2 / 10 → 2 wire sym. 600 Ohm, 0 dBu to PA
- 3 / 11 → Auxiliary loudspeaker, 13W [4Ohm]
- 4 / 12 → Outgoing contacts to PA [1]
- 5 / 13 → Outgoing contacts to IC [2]
- 6 / 14 → 2 wire sym. 600 Ohm, 0 dBu from IC [3]
- 7 / 15 → 2 wire sym. 600 Ohm, 0 dBu to IC
- 8 → GND
- Hook-off from INTERCOM [4]

1) Relay- normally open contact; PIN 11 and PIN 4 become connected to each other at active PA channel. (Optional: Relay- normally closed contact: PIN 11 and PIN 4 become disconnected to each other at active PA channel.)

2) Relay-normally open contact; PIN 12 and PIN 5 become connected to each other at active outgoing IC channel. (Optional: Relay- normally closed contact: PIN 12 and PIN 5 become disconnected to each other at active outgoing IC channel.

3) Optionally: Bi-directional IC- audio line according **NGEC PRIIA spec. 305-901** with incoming call detection via DTMF "3".

4) Signalization of incoming IC call by connecting +12 V to PIN 15.

9	DSUB-15P female, Second control head (Future SW Release)
10	M12 female, Ethernet connector (transparent data application interface)
11	M12 female 8-PIN; Handset with PTT or fist microphone with PTT 1 MIC(+) 2 MIC(−) 3 PTT (pulled to GND) 4 GND 5 Handset Loudspkr (+) 6 Hook (pulled to GND) 7 (Option)* 8 (Option)* *) possible use: Digital I/O / RS232 / +12V **view from outside** NOTE: A jumper adapter to the Amphenol connector-type is available.

3.5 Performance Specifications

3.5.1 General

Operating Temperature range	-30°C … +60°C
Storage temperature range	-40°C … +85°C
Power Supply	72V DC floating ground and 12 V DC negative ground <u>or</u> 36 V DC floating ground and 12 V DC negative ground. (72V or 36V must be specifically ordered.)
Maximum current drain at 13,8 V DC operation	Standby: 1.5 A Reception at rated audio output: 4.0 A Transmission at 40 W: 15.0 A Transmission at 30 W: 13.0 A
Maximum current drain at 36 V DC operation	Standby: 1.6 A Reception at rated audio output: 2.0 A Transmission at 40 W: 8.0 A Transmission at 30 W: 7.0 A
Maximum current drain at 72 V DC operation	Standby: 0.8 A Reception at rated audio output: 1.0 A Transmission at 40 W: 4.0 A Transmission at 30 W: 3.5 A
Internal audio (loudspeaker)	Max. 10 W sin at 4 Ohm
External audio (loudspeaker)	Max. 13 W sin at 4 Ohm
External audio (handset)	-14 … +4 dBm at 600 Ohm
Audio distortion	3% typical
OPTION PA interface	Analog 600 Ohm, -14dBu … +4 dBu
OPTION INTERCOM interface	Analog 600 Ohm, -14dBu … +4 dBu

3.5.2 Environmental

Shock and vibration	As per AAR-S5702, section 3.2.4 As per EN50155, Railway applications - Electronic equipment used on rolling stock

3.5.3 Dimension and Weight

Height	4.54" (121mm)
Width	11.25" (285mm)
Depth	12" (305mm)
Weight	8 kg

3.5.4 Receiver

Frequency range	136 … 174 MHz
Channel spacing	12.5 kHz
Frequency stability at -30°C/+25°C/+60°C	+/- 0.5ppm
Analog sensitivity (12dB SINAD)	0.3µV (0.22µV typical)
Digital sensitivity	5% BER: 0.3µV
Intermodulation (TIA603D)	78dB
Adjacent channel sensitivity (TIA603D)	50 dB

Spurious rejection (TIA603D)	80dB
Hum and noise	-40 dB
Conducted spurious emission (TIA603D)	-57dBm

3.5.5 Transmitter

RF output	25 … 45 W
Frequency range	136 … 174 MHz
FCC-ID	ABZ99FT3087 (XPR5550)
IC-ID	109AB-99FT3087 (XPR5550)
Frequency stability at -30°C/+25°C/+60°C	+/- 0.5ppm
Modulation limiting	+/- 2.5 kHz
FM hum and noise	-40 dB
Conducted radiated emission	-36dBm < 1 GHz / -30dBm > 1 GHz
Adjacent channel power	60 dB
Audio response	As per TIA603D
Audio distortion	3%
Modulation (FM [analog])	11K0F3E
Modulation (4FSK [digital])	7K60F1W
Digital vocoder type	AMBE+2 ™
Digital protocol	ETSI 102361-1,-2,-3

3.5.6 GPS Receiver

Accuracy specs are for long-term tracking (95th percentile values > 5 satellites found at nominal signal strength of -130 dBm.

Time to first fix at cold start	< 1 min
Time to first fix at hot start	< 10 sec
Horizontal accuracy	< 10 meters

3.5.7 Channels for AAR mode

All analogue channel numbers can be pre-defined by default according the AAR channel list.

The pre-defined AAR channels are selectable by the user based on the operational needs.

Center Frequencies (MHz)	AAR Channel Numbers (12,5 kHz FM analog)	
160,1850	005	(Canadian channel only)
160,2000	006	(Canadian channel only)
160,2150	007	
160,2300	008	
160,2450	009	
160,2600	010	
160,2750	011	
160,2900	012	
160,3050	013	
160,3200	014	
160,3350	015	
160,3500	016	
160,3650	017	
160,3800	018	
160,3950	019	
160,4100	020	
160,4250	021	
160,4400	022	
160,4550	023	
160,4700	024	
160,4850	025	
160,5000	026	
160,5150	027	
160,5300	028	
160,5450	029	
160,5600	030	
160,5750	031	

160,5900	032
160,6050	033
160,6200	034
160,6350	035
160,6500	036
160,6650	037
160,6800	038
160,6950	039
160,7100	040
160,7250	041
160,7400	042
160,7550	043
160,7700	044
160,7850	045
160,8000	046
160,8150	047
160,8300	048
160,8450	049
160,8600	050
160,8750	051
160,8900	052
160,9050	053
160,9200	054
160,9350	055
160,9500	056
160,9650	057
160,9800	058
160,9950	059
161,0100	060
161,0250	061
161,0400	062
161,0550	063
161,0700	064
161,0850	065
161,1000	066
161,1150	067
161,1300	068
161,1450	069
161,1600	070
161,1750	071
161,1900	072

161,2050	073
161,2200	074
161,2350	075
161,2500	076
161,2650	077
161,2800	078
161,2950	079
161,3100	080
161,3250	081
161,3400	082
161,3550	083
161,3700	084
161,3850	085
161,4000	086
161,4150	087
161,4300	088
161,4450	089
161,4600	090
161,4750	091
161,4900	092
161,5050	093
161,5200	094
161,5350	095
161,5500	096
161,5650	097

3.6 Radio Characteristics

The Clean Cab Radio is freely programmable at all listed channels as shown above for independent transmit and receive purposes as indicated to the operational rules of the railroad.

The radio is undertaking an input plausibility check while typing the channel numbers to make sure the selected channel belongs to the AAR numbering policy.

NOTE: Canadian channels are limited to 30 Watts RF output power.

3.7 Electrical Characteristics

The radio is optionally available for either 36 or 72 V DC external power supply at floating ground input which is in both cases converted into 12 V DC by a power converter that is placed within the Clean Cab Radio.

IMPORTANT: The voltage version of the Clean Cab Radio is indicated at the radio compartment. Never apply 72 V DC to a 36 V DC device. This voids warranty.

NOTE: For test bench and maintenance purposes at both versions it is possible to apply 12 V DC externally via a special maintenance power cable at non-floating operation.

The maintenance power cable has a different PIN allocation for direct access of the 12 volt DC input.

3.8 Environmental Characteristics

To withstand the demanding operating conditions of the railroad environment, the Clean Cab Radio comes in a rugged metal chassis.

The Clean Cab Radio has been designed to meet the environmental requirements according AAR-S5702, section 3.2.4 and the railway requirements according EN 50155 regarding shock and vibration. In addition the transceiver has been also tested according the MIL-STD 810C and 810D for shock and vibration.

3.9 Radio Features

3.9.1 Standard

- Programmable for all AAR frequencies and AAR channel numbers
- Straight analog voice operation at 12.5 kHz narrow band channels
- Freely programmable for straight digital voice operation at 12.5 kHz narrow-band channels with the spectrum efficiency of 6.25 kHz in Mototrbo networks ($\rightarrow$ HOME digital mode).
- HOME mode operation ($\rightarrow$ HOME mode analog, HOME mode digital)
- Network compatible for Motorola IP Site-Connect[TM]

- Menu-driven user interface with context sensitive soft buttons
- Handsetless operation → Built-in microphone and 10 Watt loudspeaker assemblies are located in the front panel of the device.
- Electrical compatibility with AAR specified connectors
- Automatic display adjustment for ambient light conditions
- Day and night display mode
- TFT screen high resolution color display
- Backlit non-abrasive control buttons
- DTMF and single tone transmission
- Transmitting and Receiving indicator
- Fleet administrator programmable for various operational parameters
- Data transmission capability at 9,600 kbps in digital operation mode
- Log-file capability for fault indications and maintenance
- Carrying handle for ease of transportation
- Transmit timeout timer to keep frequently used channels clear (factory-set for 60 seconds)
- Ethernet port for maintenance access and for optional (user requested) applications
- 13 Watt / 4 Ohm external loudspeaker connector (AUX)

3.9.2   Optional

- User requested specific data applications. These functionalities must be specifically ordered.
- PA audio interface for Passenger Announcements. This functionality must be specifically ordered.
- INTERCOM audio interface from/to train conductor- or passenger emergency call terminals. This functionality must be specifically ordered.

4   Field Installation

The Clean Cab Radio must be properly installed on top of the Clean Cab Radio mounting tray.
Push the radio at the mounting tray in a sliding way completely into the tray till you see the rear bolts clamped in the referring side-slots.

Use the rear locking system to fix the radio properly onto the tray. Additionally you may attach a padlock as well.

Make sure to connect the SO239 male antenna jack properly to the SO239 female jack at the rear side of the radio.
Connect the external handset / external microphone / external loudspeaker as required.

Finally connect the DC power supply cable with the appropriate AAR J4000-connector to the Clean Cab Radio.

➔   Make sure the power supply is turned off while connecting.

➔   Make sure to use the correct Clean Cab Railroad Radio - internal DC/DC converter for the locomotive specific voltage supply.

Improper installation and handling will void warranty.

5   Powering up the radio

The radio is operational whenever locomotive power is supplied to the power connector. When the radio is initially powered up, it shows the following screen:
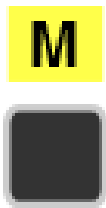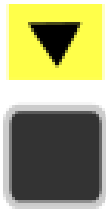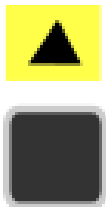
The booting sequence of the operation system is approximately half a minute. The configurations will be loaded in about 10 to 20 sec. this is shown by a progress bar-indicator.

If the radio is turned on for the very first time, it will start in AAR mode.

Railcom

6   User configurable features via menu

6.1   Menu navigation buttons

The six menu buttons below the display are required to navigate within the menu structure of the Clean Cab Radio.

Button	Description
M	**Combined "Menu" and "Selection" (enter) button.** To be used for entering into the main menu or a sub-menu. To be used to confirm/activate a chosen selection. To be used to leave any menu level back to the operational mode screen by pressing the "M" button for 3 sec continuously.
▼	**"Scroll-down" button.** To be used to scroll down and highlight an item for a selection within the offered menu. Once the scroll-down button has reached the bottom line of the menu, the selection bar jumps to the top of the menu and scrolling-down will start again when pressed furthermore.
▲	**"Scroll-up" button.** To be used to scroll up and highlight an item for a selection within the offered menu. Once the scroll-up button has reached the top of the menu, the selection bar jumps to the bottom line of the menu and scrolling-up will start again when pressed furthermore.

⬅	**"Go-back" button.** Use the "go-back" button to leave the sub- and main menus until you get the operational mode screen as shown initially. Alternatively you may press the "M" button for 3 sec continuously.
F1	**Functional shortcut** e.g. for PA or INTERCOM or special function (project dependent customization)
F2	**Functional shortcut** e.g. for PA or INTERCOM or special function (project dependent customization)

NOTE: If you do not confirm any changed settings, the Clean Cab Radio jumps back to the previous active setting after 20 sec. The radio changes back to the active operational mode screen.

6.2   Tone indications

6.2.1   Input tone

On every click of a menu button the user will get an audible feedback at around 1000Hz and duration of 100ms.

6.2.2   Good configuration tone

On every completed and valid entry of a new configuration the user will get an audible feedback at around 2000Hz and duration of 600ms.

6.2.3   Invalid configuration tone

On every completed but not valid entry of a new configuration the user will get an audible feedback at around 300Hz and duration of 300ms. In this case the previous active configuration will persist.

Note: An invalid configuration tone can be either returned at an unauthorized channel entry or when trying to access radio features that are not enabled (e.g. sales package not active).

6.2.4   Volume configuration tone

At volume configuration changes of all LSP channels a tone of around 1000 Hz and duration of 100ms at different volume levels depending on the changed level will be returned at the specified LSP channel.

6.2.5   Transmitter time-out tone

The transmitter employs a Time-Out Timer (TOT) to limit the duration of a transmission to 60 seconds. A low-frequency (around 300Hz), continuous alert tone signals the user that the transmitter will be disabled in three seconds. To reset the TOT, release the PTT button.

6.2.6   Incoming call tone

At incoming calls in home mode digital or at incoming INTERCOM (IC) calls the incoming call tone at around 400&500Hz and duration of 600ms is used.

6.2.7 PA start tone on PA-system

At start of a passenger announcement (PA) initiated by the user a start tone-indication will be transmitted prior to the voice at two tones in 400Hz and 800 Hz, duration 2 x 300ms.

6.2.8 PA end tone on PA-system

At end of a passenger announcement (PA) an end tone-indication will be transmitted at two tones in 800Hz and 400 Hz, duration 2 x 300ms.

6.2.9 IC end tone on IC-system

At end of an INTERCOM voice connection (IC) and end tone-indication will be transmitted at two tones in 800Hz and 400 Hz, duration 2 x 300ms.

6.3   Night and Day Display

The Clean Cab Radio changes automatically the display mode between day and night design depending on the ambient light conditions.

However, the user can change the display mode manually between night-display mode and day-display mode at any time, independently from the automatic change that the Clean Cab Radio performs depending on the ambient light conditions.

In this case the Clean Cab Radio will remain in the manually chosen display mode till the next natural shift of night and day will happen. If the radio will be turned off and on again, the automatic display mode becomes active again.

Initially the operational mode screen is displayed as such (example):
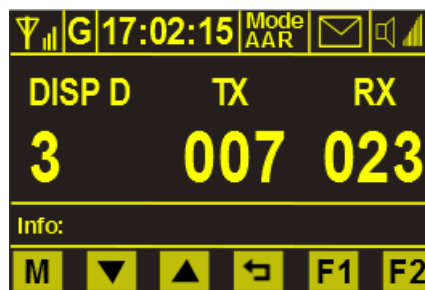
To change the display mode press **M** . Then the operational mode screen switches to the main menu screen:

The sub menu "**Night / Day**" is highlighted. Press **M** again to enter. The display mode changes immediately to the other mode, in this case to the night design:

The operational mode screen becomes active again using the changed design. To switch back to the previous mode, the steps as described above need to be performed again.

6.4 Display and keypad brightness

The Display and keypad brightness can be independently changed within a factory pre-defined value range by using the menu.

To leave the operational mode screen press **M** .

Press the scroll-down button once to scroll-down the menu bar to the sub-menu "**Brightness**":

The sub-menu "**Brightness**" is highlighted. Press **M** to enter. The following screen appears:

Select either the sub-menu "**Display**" or "**Keypad**" using the scroll-down or scroll-up ▼ ▲ button. In the example the sub-menu "**Display**" has been chosen. Press **M** to enter.

The following screen appears, displaying the currently active setting:

Use the scroll-up ▲ or scroll-down ▼ button to increment or decrement the settings level.

The Clean Cab Radio provides a direct response to the changes by changing the screen brightness or the keypad brightness if chosen.

After the adjustments are done, press and hold the **M** button for 1 sec. until you hear the good configuration tone.

The operational mode screen will be displayed again.

NOTE: If you do not confirm any changed settings, the Clean Cab Radio jumps back to the operational mode screen after 10 sec. without any changes.

6.5   Generic volume adjustment

The generic volume adjustment will be controlled by the **▼ VOL ▲** button. All set individual loudspeaker volume settings (pre-configuration by fleet-administrator) such as for:

- Built-in (internal) front loudspeaker
- Connected external loudspeaker
- Connected handset-loudspeaker

will be increased or decreased at the same time in parallel. The relative volume level-distances between all loudspeaker channels remain the same.

To change the generic loudspeaker's volume setting use the **▼ VOL ▲** button. The volume level indication on the upper right screen-corner will change accordingly.
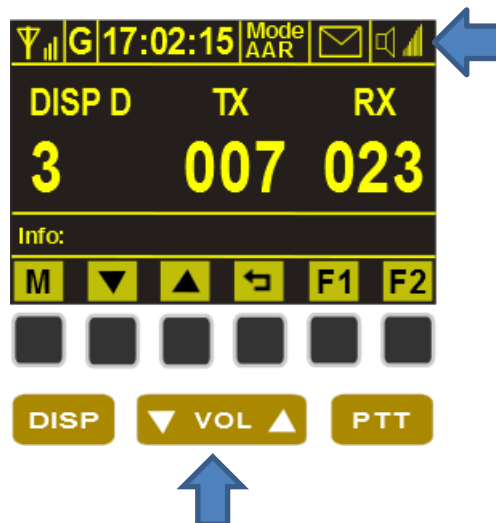
6.6 Individual volume adjustment

The 3 loudspeaker channels "Internal LSP / External LSP / Handset LSP" of the Clean Cab Radio can be adjusted individually by the fleet-administrator. Please contact your admin.

The chosen individual volumes of these 3 LSP channels are saved in a configuration file within the Clean Cab Radio. The relative volume level distances remain the same if the generic volume adjustment is used.

6.7 Retrieval of SW version

The two used software package versions, one for the transceiver, one for the application layer of the Clean Cab Railroad Radio, can be read as follows.

To leave the operational mode screen press **M** .

Use the "Scroll-up / "Scroll-down" ▼ ▲ buttons to navigate to "**SW Version**". Press **M** to select.

Use the "Scroll-up / "Scroll-down" ▼ ▲ buttons to navigate to the SW package you want to see. (example: "**Application**"). Press **M** to select:
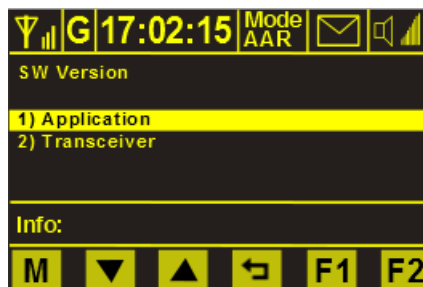
The SW package version number will be shown.

Afterwards use the "go-back" ⬅ button 3 times to leave the menus until you get to the operational mode screen.

Alternatively you may press and hold the **M** button for 1 sec. until you hear the good configuration tone. The operational mode screen will be displayed again.

6.8   Change of Language

The language of the menu can be changed between English, French and Spanish. The factory default language is English.

To leave the operational mode screen press **M**. Use the "Scroll-up / "Scroll-down" ▼ ▲ buttons to navigate to "**Language**".

Press **M** to select and use the scroll-down or scroll-up ▼ ▲ button to select the required language.

Press **M** to select.

The display mode changes immediately to the other mode, in this case to the Spanish language:

After the adjustments are done, press and hold the **M** button for 1 sec. until you hear the good configuration tone.

The operational mode screen will be displayed again.

NOTE: If you do not confirm any changed settings, the Clean Cab Radio jumps back to the operational mode screen after 10 sec. without any changes.

6.9 Set time

The Clean Cab radio has a standard time display field in the upper section of the screen in 24 hour format:
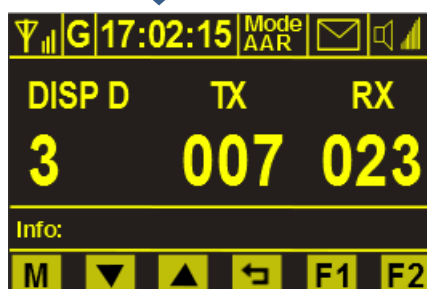
Using internal clock:

The internal clock of the Clean Cab Radio is used. This internal clock has only a limited accuracy and needs manual adjustments from time to time.

To set the time or to change the time zone press **M** . You will leave the operational mode screen.

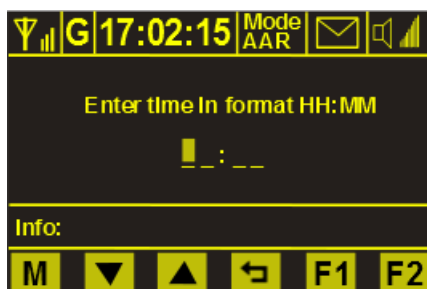Use the scroll-up / scroll-down **▼** **▲** buttons to navigate to "**Settings**".
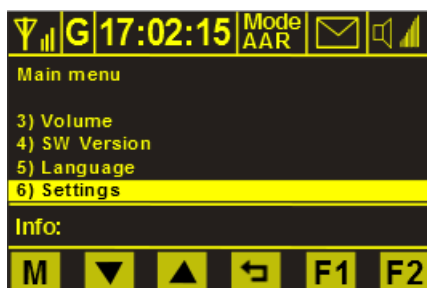
Press **M** to select.

Then use the scroll-up / scroll-down **▼** **▲** buttons to navigate to "**Set time**".

Press **M** to select. The following input screen appears. The local time needs to be set in 24 hour format. Use the keypad to enter the time.

Press the numbering keys only shortly. The referring number will be shown at the display immediately. The cursor steps forward to the next entry field.

If you have experienced a wrong entry, use the go-back [⇐] button to delete.

When all fields are filled correctly, you can confirm by pressing [M] for 1 sec. You will hear the good configuration tone.

The display returns back directly to the operational mode screen.

The time stamp in the upper section of the display changes accordingly. The seconds start counting from zero.

7 Operational modes

7.1 AAR mode

The SPECTRA railroad radio operates either in the AAR mode or one of the possible 'Select" modes. In AAR mode, the basic railroad radio operations are performed.

The factory default operational mode at first start-up of the Clean Cab Railroad Radio is the AAR mode at transmit channel 007 and receiving channel 023 together with the dispatch DTMF tone 3 as shown below.

If the Clean Cab Railroad Radio is currently used in another mode there are two possibilities to change into the AAR mode:

a) Press the [CHAN] button continuously for 3 sec. to change to the AAR mode. The AAR channel configuration that was last used in operation will be activated and displayed. The display indicates the selected dispatch tone and transmit (Tx) and receive (Rx) channels on which dispatch and voice messages will be sent and received.

b) Press the [CHAN] button momentarily. The radio will change directly into the "AAR channel select mode"
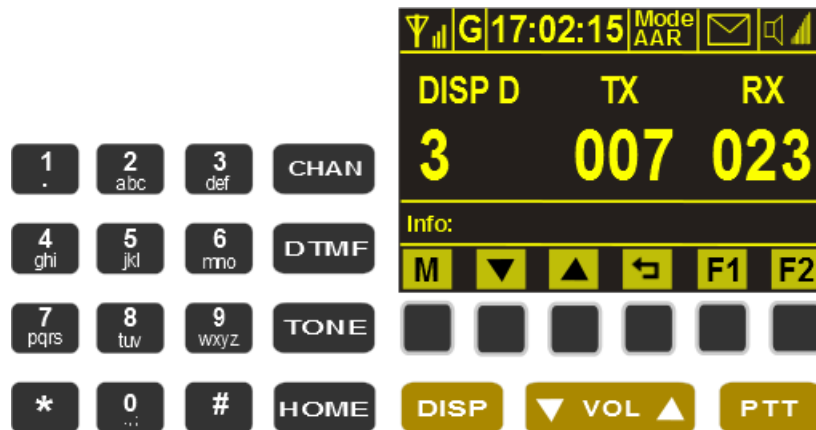
The numeric keypad, 0 through 9, # and *, represents the traditional telephone-type keypad.

When the radio is in the AAR mode, this keypad is used to send standard DTMF tones.

TO TRANSMIT DTMF TONES:

The # button and/or the * button, or the entire DTMF keypad, may be disabled by the fleet administrator. If the DTMF keypad is disabled, it will continue to operate in the Select modes. If the user attempts to send a disabled DTMF tone, the radio will generate an invalid configuration tone in the loudspeaker that the radio will not transmit.

1. Press the appropriate button on the numeric keypad (e.g.) to transmit the required DTMF tone.

   Result: The transmitter will key-up for a programmed duration, the Tx indicator lights and the DTMF tone corresponding to the button pressed will be broadcast. The transmitted tone is also heard at the loudspeaker output to confirm transmission.

   NOTE: The DTMF tone is transmitted for a pre-set time (usually 150ms) within the limits of the programmed minimum and maximum duration times. The total transmit time includes any programmed pre-time and hang time intervals. This programming is set by the fleet administrator.

2. If necessary, repeat the above step for each additional DTMF tone.

   Result: The above result will be repeated for each corresponding button pressed. If the second and all other following DTMF tones are pressed by the user in a very fast manner, those fast entries will be kept in the Clean Cab memory until the pre-defined transmission time of the first pressed buttons has correctly ended.

PURPOSE OF DISP **BUTTON:**

The DISP button is used to transmit the selected dispatch call tone indicated in the "DISP T/D" display as shown above. This can be either a single tone (indicated by a "T" followed by a number) or a DTMF tone (indicated by a "D" followed by a number).

Go to the chapter "**Dispatch DTMF select mode**" or "**Dispatch TONE select mode**" for instructions on programming the DISP button.

TO TRANSMIT VOICE MESSAGES:

Before starting transmission, monitor the traffic on the selected channel to ensure that it is not in use.
To transmit voice messages, execute the following:

1. Press and hold the PTT button.

   Result: The radio is keyed-up and the Tx indicator lights.

   NOTE: The transmitter employs a Time-Out Timer (TOT) to limit the duration of a transmission to 60 seconds. A low-frequency (300Hz), continuous alert tone signals the user that the transmitter will be disabled in three seconds. To reset the TOT, release the PTT button.

2. Speak clearly in the direction of the front grill of the radio set with mouth 8" to 12" away.
   Result: Voice is transmitted.

3. After finishing your message, release the PTT button and wait for a reply.

   Result: Radio is dekeyed and Tx indicator turns off, radio switches to reception mode.

7.2 Select modes

7.2.1 General

In general, to enter a Select mode, the pertinent Select mode button needs to be pressed. The corresponding display(s) change to dashes, with the data entry location being indicated by a flashing underscore. The numeric keypad is now configured to enter numbers.

NOTE: When the radio is in any Select mode, it continues to receive messages on the last selected Rx channel.

Any select mode is automatically terminated after one of the following conditions occurs:

a. Completion of a valid select mode entry. The corresponding displays are updated and a good configuration tone is heard at the loudspeaker.

b. After twenty seconds (exception: in unfinished AAR channel select mode: 3 seconds) of no keypad activity. The display reverts to the last selected display and an invalid configuration tone is heard at the loudspeaker.

c. If after initiating a select mode, the same select mode button is pressed again before complete entry of the number information, then the display reverts to the last selected display.

d. If after initiating one select mode, another select mode button is pressed, then the first select mode is terminated and the second is immediately initiated.

e. Pressing the **PTT** or **DISP** button. The display reverts to the last selected display and the radio transmits either a voice message or a dispatch call tone respectively.

7.2.2 AAR channel select mode

For AAR channel select mode, the numeric keypad is reconfigured for number entry. Separate tones (good configuration or invalid configuration) indicate either success or failure in entering numbers. The display(s) which corresponds to the chosen selection will be updated.

The AAR channel select mode allows the user to change the selected Tx/Rx channel pair within the range of the defined AAR channels. The AAR channel select mode is initiated using the **CHAN** button.

The user can select up to 198 independent AAR channels for transmission and reception using the AAR channel select mode. Channels must be entered as pairs (i.e. six digits must be entered, including leading zeroes).

→ For valid completion of the AAR channel select mode, the selected Tx and Rx channels must be within the available range of pre-programmed channels and must not be locked out by the fleet administrator.

TO SELECT A NEW Tx / Rx CHANNEL PAIR:

1. Momentarily press the **CHAN** button to initiate the AAR channel select mode.
   Result: The Tx and Rx displays become 2 times 3 dashes (--- ---), with a flashing cursor appearing in the leftmost position. The numeric keypad is now configured for number entry.
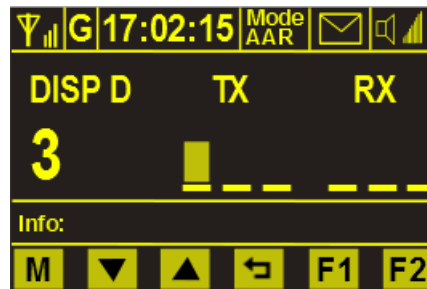
2. Enter the first digit of the 3-digit Tx channel number using the numeric keypad. A leading zero needs to be typed. The user has 3 seconds after a button is pressed to press the next button before Select mode time-out occurs.
    Result: The keypad number entry replaces the flashing cursor which moves right to the next position.

3. Enter the remaining five digits (the first three digits are for Tx channel / the next three digits are for Rx channel) using the numeric keypad.
    Result: For a valid keypad sequence, the Tx and Rx displays are updated to indicate the keypad entries. A good configuration tone occurs (unless it is disabled by the fleet administrator) when the sixth digit has been entered successfully. The Channel Select mode is completed and the radio now transmits and receives on the new channel assignments.

    NOTE: If either the Tx or Rx channel is invalid (i.e. not a valid pre-programmed channel code, or is locked out by the fleet administrator), an invalid configuration tone sounds when the sixth digit is entered and the Tx/Rx displays switches back to the still active previous channel.

    The user may initiate to enter new digits by starting the procedure again using the
    CHAN button.

7.2.3 Dispatch DTMF select mode

The Dispatch DTMF Select mode is used to select and transmit dispatch DTMF tones. The Dispatch DTMF select mode is initiated using the DTMF button.

The radio is capable of transmitting up to twelve different DTMF tones (D0 to D9, D# and D*) using the DISP button. The DISP T/D display indicates the currently selected DTMF tone(s) (if any) as a "D" followed by a single digit that represents the first DTMF tone of a programmed DTMF tone sequence. This represents the DTMF tone which is transmitted upon selection of a particular tone, and re-transmitted using the DISP button.

→ The number of available DTMF tones, their lengths, pre-time, hang-time and modulation deviation are pre-configurable by the fleet administrator.

TO SET AND TRANSMIT DTMF DISPATCH TONES USING THE `DISP` **BUTTON:**

1. Press and hold the `DTMF` button for 3 seconds (until the second beep is heard) to initiate the Dispatch DTMF select mode.
   Result: The DISP T/D display changes to a "DISP **D**" followed by a flashing underscore entry field of up to ten consecutive numbers. The numeric keypad is configured for number entry.

2. Enter the new DTMF number(s) using the numeric keypad. Make sure to press the subsequent numbering buttons always within 3 sec, otherwise the DTMF select mode will be terminated unsuccessfully and the radio goes back to the previous operational mode.

3. Enter the next number or complete the new configuration by pressing again the `DTMF` button. Now a good configuration tone will be heard.

4. *Result:* When a valid button is pressed, the flashing underscore in the display jumps to the next entry field. Enter the next number or complete the new configuration by pressing again the `DTMF` button. Now a good configuration tone will be heard and the new configuration is active.

   NOTE: The # button and/or the * button, or the entire DTMF keypad, may be disabled by the fleet administrator. If the user attempts to select a disabled DTMF tone, the radio produces an invalid configuration tone and the radio goes back to the initial screen.

5. To re-transmit the programmed and displayed DTMF tone(s), only press the `DISP` button.

   Result: The transmitter is enabled, the Tx indicator lights, and the displayed DTMF tone or tone-string is transmitted for the pre-programmed duration. The transmitted tones can also be heard at the loudspeaker output to confirm transmission.

NOTE: If a string of consecutive DTMF tones (up to ten) is programmed the display shows only the first digit of the string followed by a "**+**".

7.2.4 Dispatch TONE select mode

The Dispatch Tone Select mode is used to select and transmit up to twelve pre-programmed dispatch single tones. The Dispatch TONE select mode is initiated using the **TONE** button.

For single tone dispatch calls, the user can select from a group of single tones which have been programmed into the radio (up to a maximum of twelve). The DISP T/D display indicates the currently selected single tone (if any) as a "T" followed by a single digit. This represents the single tone which is transmitted upon selection of the tone, and re-transmitted using the **DISP** button.

→ The number of available single tones and their frequencies are pre-configurable by the fleet administrator. The minimum and maximum duration times for single tones, as well as the singe tone frequencies, are programmable by the fleet administrator.

TO SET AND TRANSMIT SINGLE DISPATCH TONES USING THE **DISP** **BUTTON:**

1. Press and hold the **TONE** button for 3 seconds (until the second beep is heard) to initiate the Dispatch TONE select mode.
    Result: The DISP T/D display changes to a "DISP **T**" followed by a flashing underscore entry field of up to ten consecutive numbers. The numeric keypad is configured for number entry.

2. Enter the new TONE number(s) using the numeric keypad. Make sure to press the subsequent numbering buttons always within 3 sec, otherwise the TONE select mode will be terminated unsuccessfully and the radio goes back to the previous operational mode.

3. Enter the next number or complete the new configuration by pressing again the **TONE** button. Now a good configuration tone will be heard.

4. *Result:* When a valid button is pressed, the flashing underscore in the display jumps to the next entry field. Enter the next number or complete the new configuration by pressing again the **TONE** button. Now a good configuration tone will be heard and the new configuration is active.

NOTE: Some buttons of the keypad may be disabled by the fleet administrator. If the user attempts to select a disabled TONE, the radio produces an invalid configuration tone and the radio goes back to the initial screen.

5. To re-transmit the programmed and displayed TONE(s), only press the **DISP** button.

> *Result:* The transmitter is enabled, the Tx indicator lights, and the displayed TONE or TONE-string is transmitted for the pre-programmed duration. The transmitted tones can also be heard at the loudspeaker output to confirm transmission.

NOTE: If a string of consecutive tones (up to ten) is programmed the display shows only the first digit of the string followed by a "**+**".

7.3 HOME mode

Home channels are fleet-administrator pre-programmed via the CPS to allow the user access to specific combinations of transmit, receive, and optionally dispatch DTMF or single tone frequencies in home mode analog.

The radio may be programmed for Home channels, which can be entirely independent from the AAR channel grid. The channels can be defined within the entire VHF band (136…174 MHz).

If the radio is programmed for HOME channels, the standard display indicates the currently selected Home channel in clear alphanumeric manner. Specific Tx and Rx channel numbers are not shown unless specified as the channel name.

NOTE: All home channels are to be configured via CPS by the fleet administrator.

NOTE: If there are no HOME channels programmed in the radio, pressing the HOME button causes an invalid configuration tone and the mode cannot be entered.

The HOME select mode will be terminated and the Clean Cab Railroad Radio switches back to the previously active mode.

7.3.1 HOME select mode

The HOME mode allows the user to activate a pre-configured HOME channel or to change the already selected HOME channel. The HOME mode must be pre-configured by the fleet administrator.

If the Clean Cab Railroad Radio is currently used in another mode there are two possibilities to change into the HOME mode:

a) Press the HOME button continuously for 3 sec. to change to the HOME mode.

You will see a list showing all pre-configured HOME channels. They can be either analog or digital.

Scroll through the list to highlight your desired channel by using the scroll-up or scroll-down buttons (▼ ▲).

Press M to confirm.

Now the chosen HOME channel is active.

The display indicates the channel ID plus the channel name that was defined by the fleet administrator. The displayed HOME channel is active for transmission and reception.

b) Press the **HOME** button momentarily.

The HOME channel configuration that was last used in operation will be activated and displayed.

The display indicates the channel ID plus the channel name that was defined by the fleet administrator. The displayed HOME channel is active for transmission and reception.

7.3.2 HOME mode digital

All HOME channels can be configured either in analog mode or in digital Mototrbo compliant mode at a voice channel spectrum efficiency of 6.25 kHz.

Additional features in HOME mode digital operation are:

- Doubled voice channel capacity for a 12,5 kHz channel
- No need of any channel grid changes or frequency tuning
- Better user privacy (TDMA digital radio modulation scheme)
- Digital selective call functionalities
- Text messaging (SDS service) (Next SW Release)
- Use of Mototrbo "IP site connect" – network topologies
- Use of digital GPS location based services

Home mode digital is indicated in the upper field of the screen as such:
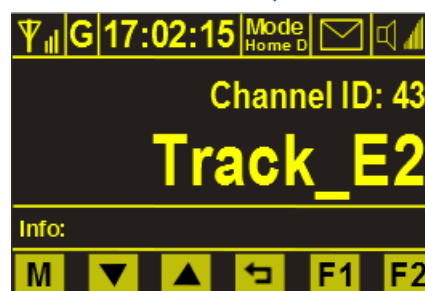
7.4 AAR mode / HOME mode – channel revert

It is possible for the operator to quickly toggle between the last selected HOME channel and the last selected AAR mode channel pair. Note that this is only possible if a HOME channel is configured in the radio.

HOME mode to AAR mode:

Press the CHAN button for 3 sec. continuously.

Result: The display changes to the AAR mode channel screen and shows the last used configured and used channel pair plus the last active DISP function (if any). The successful mode change will be indicated by a good configuration tone. The displayed AAR channel pair is active for transmission and reception.

AAR mode to HOME mode:

Press the HOME button for 3 sec. continuously.

Result: The display changes to the HOME mode screen and shows the last used configured and used channel ID plus the alphanumeric channel name. The successful mode change will be indicated by a good configuration tone. The displayed HOME channel is active for transmission and reception.

7.5 Public Announcement (PA) Call

This functionality must be specifically ordered.

The user is able to initiate a PA-call to the passengers of a commuter train. To do so, the referring Clean Cab Radio wire interface needs to be interconnected to the PA system of the train.

The PA interface of the Clean Cab Radio is an outgoing symmetrical 600 Ohm two-wire line at 0dBu audio level, and relay contacts as specified in **chapter 3.4** - Rear layout.

To initiate a PA call, press the **PA** button.
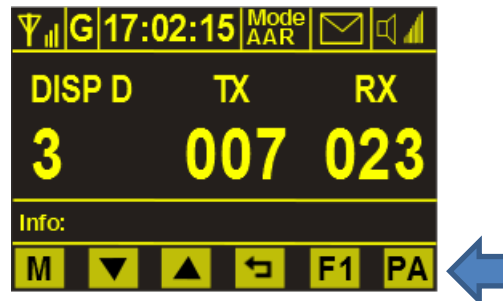
The display changes to the following screen content:

At the same time the PA start tone (see chapter 6.2.7) will be transmitted to the PA system as well as to the Clean Cab Radio loudspeaker.

Now press and hold **PTT** to talk.

After the PA-announcement release the **PTT** button. The display will change automatically back to the operational mode screen after 3 seconds and the PA channel will be deactivated (the **PA** icon changes back to **PA**).

Alternatively you can press the **PA** button or the button. Now the PA channel becomes inactive immediately and the icon changes to **PA** and the operational mode screen becomes active.

If the announcement shall be continued, make sure to press the **PTT** button again within the 3 seconds timeframe. Otherwise you need to re-open the PA channel by pressing the **PA** button.

NOTE: The deactivation of the PA channel will be indicated to the PA system by a PA end tone (see chapter 6.2.8).

7.5.1 Call compatibility

CASE 1:

PA call is ongoing. At incoming voice from the radio channel, the PA call mode will be terminated automatically; regardless if the **PTT** is pressed at that moment or not.

The incoming voice from the radio channel is not to be heard on the PA channel but only on the Clean Cab Radio loudspeaker/handset.

CASE 2:

PA call is ongoing. At incoming call from the INTERCOM channel a line-busy tone will be sent to the train-line for 3 seconds. An incoming call from the INTERCOM channel can only be established after PA call has finished.

7.6 INTERCOM (IC) Call – Outgoing

This functionality must be specifically ordered.

The user is able to initiate an INTERCOM call to an INTERCOM wire line of a commuter train in order to reach e.g. the conductor.

To do so, the referring INTERCOM Clean Cab Radio wire interface needs to be inter-connected to the INTERCOM system of the train.

The INTERCOM interface of the Clean Cab Radio is an outgoing symmetrical 600 Ohm line at 0dBu audio level, and relay contacts as specified in **chapter 3.4** - Rear layout.

To initiate an INTERCOM call, press the **IC** button.
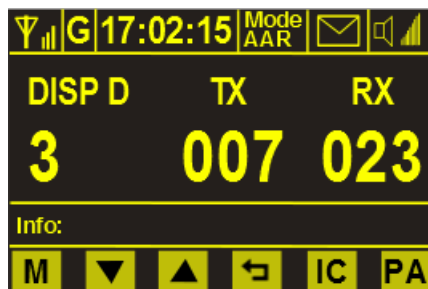
The display changes to the following screen content:

Now press and hold **PTT** to talk.

Release the **PTT** to listen to the voice reply.

After the conversation has finished press the **IC** button again or press ↰ . Now the INTERCOM channel becomes inactive and the icon changes to **IC** . The display changes to the operational mode screen.

NOTE: The deactivation of the IC channel by the user will be indicated to the IC system by an IC end tone (see chapter 6.2.9).

7.6.1 Call compatibility

CASE 1:

INTERCOM call is ongoing. At incoming voice from the radio channel, the INTERCOM call mode will be terminated automatically; regardless if the **PTT** is pressed at that moment or not.

At this occasion a line-busy tone will be sent to the train-line for 3 seconds. Afterwards the PIN 5 and PIN 12 become disconnected from each other.

CASE 2:

INTERCOM call is ongoing. If a second call request from another train-line terminal comes in, then it will be also connected to the active communication.

7.7 INTERCOM (IC) Call - Incoming

This functionality must be specifically ordered.

The train conductor is able to initiate an INTERCOM call to an INTERCOM wire line of a commuter train in order to reach e.g. the engineer (user).

To do so, the referring INTERCOM Clean Cab Radio wire interface needs to be inter-connected to the INTERCOM system of the train.

The INTERCOM interface of the Clean Cab Radio is an incoming symmetrical 600 Ohm line at +4dBu … -14dBu audio level as specified in **chapter 3.4** - Rear layout.

At incoming INTERCOM the Clean Cab Radio opens the INTERCOM channel and displays this at the screen: "INTERCOM channel active".

At the same time the incoming call will be heard as an incoming call announcement tone.

This calling tone is generated within the CleanCab Radio. Default length (recommended: 1 sec) and default volume of the tone is configurable by the administrator, not by the user.

Right after the calling tone just start listening to the incoming voice.

To answer press and hold **PTT** and talk.

Release **PTT** to listen to the voice reply.

After the conversation has finished, press the **IC** button or the ⬑ button. Now the INTERCOM channel becomes inactive and the icon changes to **IC** and the operational mode screen becomes active.

NOTE: The deactivation of the IC channel by the user will be indicated to the IC system by an IC end tone (see chapter 6.2.9).

7.7.1   Call compatibility

CASE 1:

INTERCOM is ongoing. At incoming voice from the radio channel, the INTERCOM call mode will be terminated automatically; regardless if the **PTT** is pressed at that moment or not.
At this occasion a line-busy tone will be sent to the train-line for 3 seconds.

CASE 2:

INTERCOM call is ongoing. If a second call request from another train-line terminal comes in, then it will be also connected to the active communication.

CASE 3:

Radio call is ongoing. At incoming call from the INTERCOM channel a line-busy tone will be sent to the train-line for 3 seconds. An incoming call from the INTERCOM channel can only be established after the radio call has finished.