

DIGITAL CHANNEL MODULE (CMD)

User's Manual and Tune Up Procedures



8A074X06
Rev. Preliminary

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PROPRIETARY STATEMENT

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About this document

This document describes the operation of the Futurecom Digital Channel Module (CMD). It provides setup guidelines and outlines the programming options which are accessible through the programming software (6A074X01).

Notes, Cautions, Warnings, Dangers

Throughout this manual, you will see Notes, Cautions, Warnings and Dangers. Their meaning is as follows:



Note:

A clarifying statement that expands on the text that follows.



IMPORTANT:

*An important statement that **must be considered and / or implemented in order to achieve adequate equipment operation.***



WARNING:

Describes a potentially hazardous situation, which **may** lead to equipment damage, death or injury.



DANGER:

Describes an imminently hazardous situation, which if not avoided, will result in death or serious injury.

Safety Information

FCC Class A Digital Device or Peripheral User Information

NOTE:



This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, can cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING



Changes or Modifications not expressly approved by Futurecom Systems Group Inc. could void the user's authority to operate the equipment.

USA Users:

Do not use the Digital Channel Module in the frequency band 406.0 - 406.1MHz. This frequency band is reserved for use by distress beacons.

General Safety Information

The following information may or may not be applicable to your product. In any case, precautions should always be taken when handling any electrical product.

IMPORTANT



This manual contains important safety and operating instructions, therefore keep this manual always on hand!

Prior to using any product, follow all warning, safety and operating instructions written on the product and in the user's manual. **All instructions should be saved for reference in the future!**

WARNING



Always keep product dry, never expose to any kind of moisture.

Do Not expose product to extreme temperatures- as found near a hot radiator or stove.

Do Not expose product to open flames, cigarettes, etc.

Precautions should be taken to avoid objects falling or liquids spilling onto product.

Do Not incorporate the use of other equipment that is not recommended or sold by the manufacturer. The result may be the risk of fire or electric shock injury.

Connect DC power cord to DC power source as marked on the product.

This product does not contain customer serviceable components, therefore **never** disassemble the product

IMPORTANT



If an outdoor antenna is connected, make sure the system is always grounded to allow for protection against voltage surge and built-up static charges. Outdoor antennas should always be located away from power lines.

DANGER



Never alter the AC cord or plug! If plug does not fit outlet have a qualified electrician install a proper outlet. Failure to do so results in improper connection and increases the risk of electric shock.

Damage Requiring Service

This product should be serviced by qualified service personnel when:

- The power supply cord or the plug has been damaged; or
- Objects have fallen, or liquid has been spilled into the product; or
- The product has been exposed to rain or moisture; or
- The product does not appear to operate normally or exhibits a marked change of performance; or
- The product has been dropped, or the cabinet damaged.

Possible Hazards

The operator of any mobile radio should be aware of certain hazards common to the operation of vehicular radio transmissions.

A list of possible hazards follows:

- Explosive Atmospheres
To ensure safety, make sure that the radio is off while fuelling the vehicle. When the radio is mounted in the back of the trunk, never have containers of fuel in the trunk of the vehicle.
- Interference to Vehicular Electronics Systems
Typical types of electronic devices that malfunction are -Electronic fuel injection systems, electronic anti-skid braking systems, etc., The reason for this is due to the lack of protection from radio frequency energy present when transmitting. If the vehicle contains such equipment, consult the dealer of your vehicle and enlist his aid in determining if such electronic circuits perform normally when the radio is transmitting.
- Dynamite Blasting Caps
Dynamite blasting caps may be caused to explode by operating a radio within 500 feet of the blasting caps. Always obey the "**Turn Off Two Way Radios**" signs posted where dynamite is being used. When transporting blasting caps in your vehicle:
 - A. Carry the blasting caps in a closed metal box with a soft lining.
 - B. Leave the radio **OFF** whenever the blasting caps are being put into or removed from the vehicle.

□ Radio Frequency Energy

Do not operate the transmitter when a person is outside of the vehicle within two feet of the antenna! Failure to heed this warning may result in burns or related physical injury to the person.

□ Liquefied (LP) Gas Powered Vehicles

Mobile radio installations in vehicles powered by liquefied petroleum gas with the LP gas container in the trunk or other sealed-off space within the interior of the vehicle must conform to the National Fire Protection Association standard (NFPA) 58 requiring that:

- A. The space containing the radio equipment shall be isolated by a seal from the space containing the LP gas container and its fittings.
- B. Outside filling connections shall be used for the LP gas container.
- C. The LP gas container shall be vented to the outside of the vehicle.

General Radio Operating Procedures

Industry Canada (IC) and the Federal Communications Commission (FCC) rules and regulations must be incorporated in the use of radio systems. Familiarity with these rules by the operator is essential for proper execution of the type of radio operation that is in question. Following these rules helps to eliminate confusion, assures the most efficient use of existing radio channels, and results in a smoothly functioning radio network. When using this unit remember these rules:

- A. Emergency calls always have priority over all messages! To interrupt any distress or emergency message is a violation of the IC and FCC rules. When operating the radio make sure that the line is clear before sending messages. **KEEP OFF THE AIR** when an emergency message is being sent through.
- B. Use of profane or obscene language is prohibited by Federal law.
- C. Sending false call letters, false distress or emergency messages is against the law.
- D. IC and FCC demand that conversations are kept brief and content limited only to business. Coded messages are encouraged in order to save time.
- E. Only messages that are essential for the business operations are allowed to be sent. Otherwise using the radio to send personal messages is a direct violation of the IC and FCC rules.
- F. Conversations between others sharing a channel is regarded as confidential. Repeating anything overheard on the radio is against Federal Law.
- G. The IC and FCC require the operator to transmit station identification at certain times by means of call letters. Refer to the IC and FCC rules for your station's particular type of operation for the proper procedure.
- H. No changes or adjustments shall be made to the equipment except by an authorized or certified electronics technician.

CMD Technical Description

Main Features

The Digital Channel Module (CMD) is a synthesized, microprocessor-based, high performance, RF channel selective repeater with 30 Watt output power capability. It is available in the VHF, UHF and 800/900MHz bands. It is designed to receive a single RF channel, filter and amplify the channel signal and retransmit it. The CMD is used for extending the RF Coverage area of an existing radio site by receiving and re-broadcasting from host to user (downlink) and from user to host (uplink).

The CMD can be used in On-Channel Repeater (OCR) or Translator mode. In the Translator mode, the CMD transmits on a frequency which is different from the receive frequency. The On-Channel Repeater is programmed to receive and transmit on the same frequency.

The CMD operation is programmable locally from an RS-232 port on the front panel. The CMD operating parameters, such as power output, sensitivity threshold, CTCSS, mode of operation, frequencies of operation, adjacent channel spacing etc can be configured by the Customer via simple set-up software as described in this manual. The currently programmed operating parameters of the CMD determine its personality. The CMD personality is stored in the EEPROM of the unit.

Additional per channel alarm and monitoring functions are available to indicate any Power, VSWR, Temperature and Synthesizer lock conditions.

The CMD installation is performed by simply plugging it into a Eurocard format 19" EIA rackmount card cage.

Principle of Operation

The CMD consists of four main blocks – Front End, IF section, Power Amplifier and Controller.

The Front End consists of band-pass filtering and low-noise amplifier. The sensitivity of the Front End is -120dBm.

After the Front End, the RF frequency is downconverted to 109.65MHz by a mixer stage followed by BP filtering, amplification and another mixer downconverting to IF 450kHz.

The IF signal path continues with an Automatic Gain Control Loop (AGC), which maintains constant signal level, irrespective of the input signal level. The processed signal is fed to a modulator and Upconverter. The upconverted signal (110.520MHz) goes through selective filters and amplifier stages, followed by a mixer, which further upconverts it to the programmed CMD transmit frequency (same as the receive in the OCR or different frequency in the Translator mode). The transmit frequency signal is fed to the power amplifier module where it is filtered and amplified. The driver and power amplifier produce the programmed transmit power output (max 30 Watts).

The Controller Board controls the operation of the CMD. It contains the microcontroller with Flash memory for the firmware, EEPROM personality storage.

The front panel RESET and TX DISABLE inputs are monitored and can be accessed via two front panel holes with a round tool 2.5mm (0.1”) diameter. The front panel indicators (TX DIS, DC ON, TX ON, RX ON, PWR and VSWR) are also controlled by the Controller Board.

CMD Installation (19" rack mount only)

The CMD is easily installed by plugging it into the Eurocard format card cage.

The CMD is powered through its card cage back plane. The card cage back plane DC wiring must be connected to nominal 27.6VDC.

CMD Programming

Introduction

The Controller board EEPROM of the CMD contains the programmed Personality Data (PD) of the specific CMD unit. The PD file determines the functionality of the CMD and it can be created and / or modified by using the CMD programming software.

Connecting and Disconnecting the CMD to a PC

1. Plug the supplied programming cable into the "RS232" connector on the front of the CMD.
2. Plug the other end of the serial cable into the serial port of the PC.
3. Follow the Programming Instructions as described in the next paragraphs.
4. Exit the programming software and only then unplug the serial cable from the CMD.

Installing the Programming Software

The programming software can be run either from Windows or MS DOS. Copy the files from the Futurecom supplied disk into a separate directory / folder on your PC. Create a shortcut (Windows) or use the supplied batch file by typing in the path to the .exe file location on the specific PC. Run the programming software by clicking on the shortcut or typing the batch file name.

Using the Programming Software for Setting up the CMD

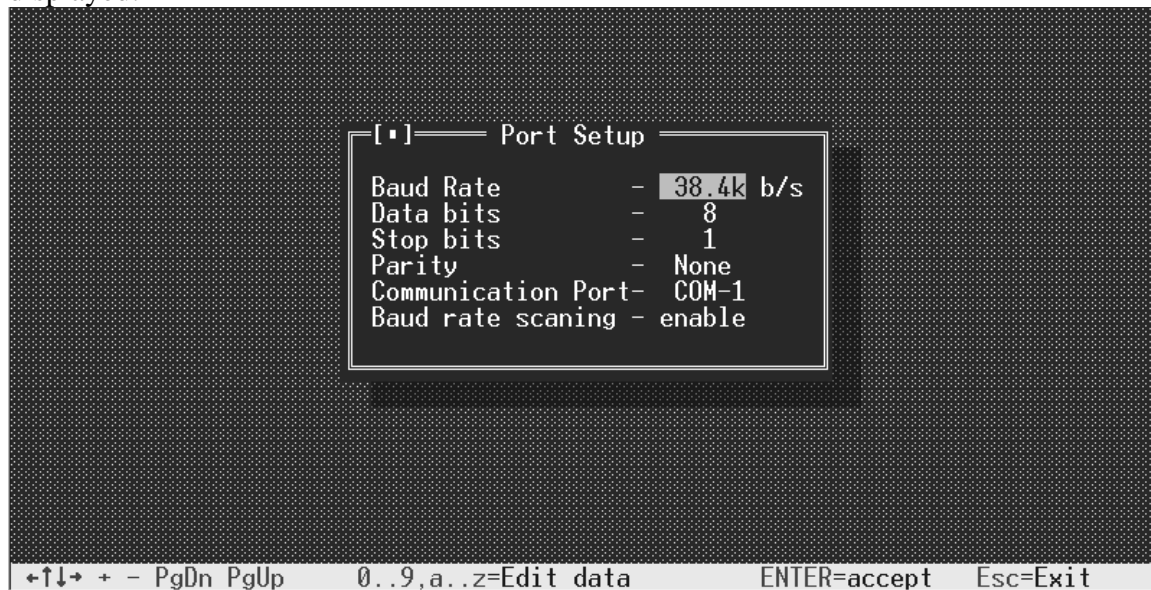
CMD Connections

The CMD needs to be properly connected prior to commencing the programming / system setup:

1. The CMD must be plugged into the Futurecom subrack and supplied with proper DC power supply.
2. The RF IN and RF OUT ports need to be connected to the corresponding multicoupling ports or to adequate power rating 50 Ohm loads (or to the test equipment).
3. The DC power supply needs to be turned on.

Starting up the Programming Software

After connecting the programming cable to the CMD serial port, run the programming software. Go to the **Options** pull down menu and select **Ports**. The following screen will be displayed:



Ensure that the correct communication port is selected and set the **Baud rate** to 9600 b/s. If higher **Baud rate** is selected, ensure that the **Baud rate scanning** is set to **Enable**. Exit from the Ports menu and select “Yes” when prompted “Would you like to update config file?”

Programming the CMD Frequencies of Operation

Go to **File**, select **Upload Data from the CMD** and press Enter.

The programming software uploads the currently stored in the CMD EEPROM data and the **CMD Channel Setup** screen will be displayed:

[.] CM-D Channel Setup													
Ch #	St.	W.W #	W.M	Rx Freq. MHz	Rx PL Hz	Tx Freq. MHz	Tx PL Hz	PL STE	CAS from	RSSI dBm	PWR dBm	CCT min	DOD ms
1	Act	1	FMR	482.5000	OFF	495.0000	OFF	OFF	Sq.	-100	20.0	OFF	OFF
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
Max # of Channels- 1				CM-D Current Active Channel - 1									
F4=Load		F5=Save		Ins=List				F9=comm-ON			F10=poll-ON		

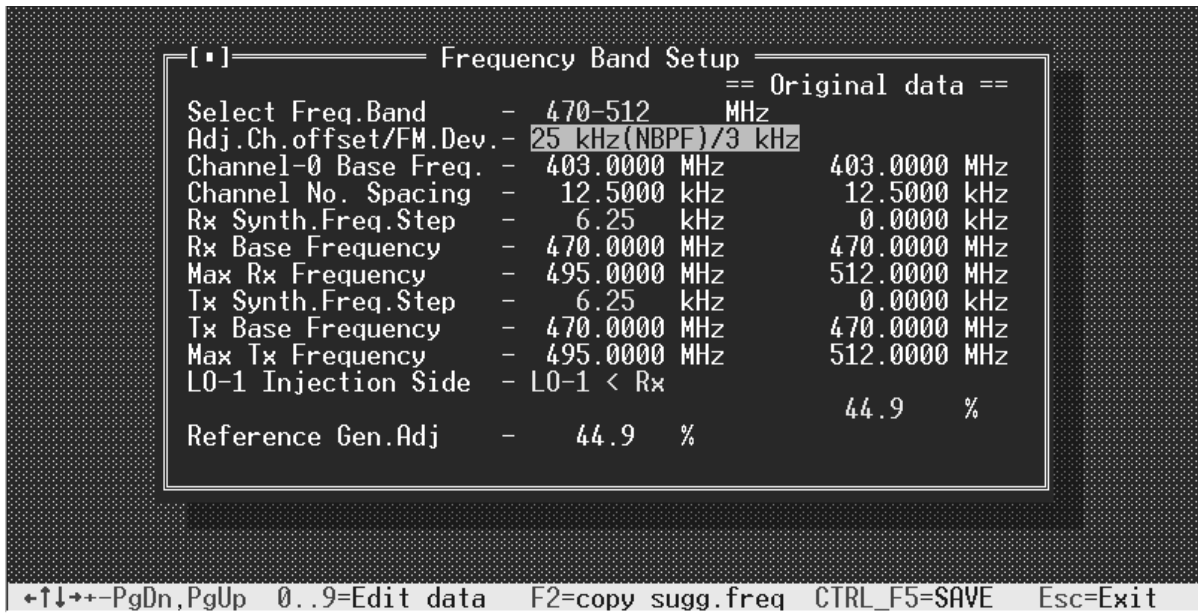


Important:

When programming (or editing the personality of) the currently connected CMD, the user will be asked “Would you like to update the EEPROM” every time he / she tries to close the currently open programming screen. Select “Yes” if the changes need to be kept after the CMD is reset. For some of the changes to take effect the CMD must be reset.

Programming the CMD Channel Spacing

Prior to setting up the rest of the CMD parameters, the global channel spacing needs to be selected. This is done from the **Frequency Band Setup** in the **CMD Setup** pull down menu.



Adjust the **Adj. Ch. Offset / FM Dev** field to the correct channel spacing i.e. 25kHz (NBPF)/3kHz or 12.5kHz / 1.5kHz. All other fields must not be changed by the user.

Setting up the CMD Maximum Gain

The CMD can be used either as an On Channel Repeater (OCR) or as a translator. In the OCR mode, the CMD receive and transmit frequency is the same as opposed to the Translator mode, in which the receive and transmit frequencies are different. The Gain range is 70 to 140dB in OCR mode and 70 to 165dB in Translator mode. However, the gain is limited by the isolation that can be achieved between the rest of the RF system i.e. cables, antennas, filtering etc. The maximum Gain setting must be at least 10 dB lower than the measured overall isolation in order to prevent CMD lock up.

Once the CMD is programmed, installed and connected to the rest of the filtering / antenna system, the **Maintenance** screen can be used for measuring the isolation and setting up the gain. No extra test equipment is required.

Open the **Maintenance** screen from the **CMD Setup** pull down menu. The Maintenance screen is not a programming screen. It is used for diagnostic and setup only. The fields seen on the Maintenance screen are described in the previous sections with the exception of the measured data fields shown on the right hand side and marked with “?”.

CMD Front Panel Indicators

The CMD front panel has several LEDs which provide the following indications:



LED Label	LED Color	DESCRIPTION
TX DIS	RED	<p>The TX DIS LED is steady on when transmit is disabled either by:</p> <ul style="list-style-type: none"> ❑ Triggering the TX DIS switch which is located above the LED (accessible with a round tool 2.5mm in diameter) ❑ Setting the Operating Mode field to Tx-Disable <p>The TX LED indicator is flashing when one of the synthesizers is being out of lock.</p>
DC ON	GREEN	<ul style="list-style-type: none"> ❑ When on it indicates that the CMD is powered up.
TX ON	GREEN	When on it indicates that the CMD is transmitting.
RX ON	GREEN	When on it indicates that the CMD input signal is above the programmed level
PWR	RED	<ul style="list-style-type: none"> ❑ The PWR LED is steadily on when the output RF power is outside of the programmed tolerance.
VSWR	RED	The VSWR LED is on when an excessive reflected power is detected on the Tx port

CMD Specifications

ELECTRICAL SPECIFICATIONS			
	CMD VHF	CMD UHF	CMD 800
Frequency of Operation	136 – 174 MHz	403 – 512 MHz	806 – 960 MHz
Sensitivity	-120 dBm		-117 dBm
Input Carrier Detection Threshold	-120 to -50 dBm		-117 to -50 dBm
Carrier Detection Adjustment Step	1 dB		
Max. Gain Range (Programmable)	70 to 165 dB		
Translator	70 to 140 dB		
On-Channel Repeater			
AGC Range	100 dB		
Output Power	75 mili-Watts to 35 Watts		
Duty Cycle	100%		
Output Frequency Stability	Tracks Input Signal Frequency		
Modulation Types	Narrowband FM Voice and Data		
Channel Spacing	25 kHz / 12.5 kHz		
Selectivity 25kHz / 12.5kHz	>80 / > 70dB		
Receiver Spurious Response Rejection	> 70 dB		
Receiver Conducted Spurious Emissions	< -57 dBm		
Transmitter Conducted Spurious Emissions	< -20 dBm		
Transmitter FM Hum and Noise	> 45 dB		
Input / Output Impedance	50 Ohms		
Input / Output VSWR	< 1.5 : 1		
Power Supply Voltage	22 to 28 VDC		
Power Supply Current Drain			
Standby	< 0.3 A		
Transmit	< 4 A		
MECHANICAL SPECIFICATIONS			
RF Connectors	SMA female		
Environmental	90% humidity @ 50 °C (122°F)		
Operating Temperature Range	-30 to +60°C (-22 to +140°F)		
Dimensions [H x D x W]	260 x 225 x 75 mm (10.25" x 8.86" x 2.95")		
Weight	4.09 kg (9 lb)		