

**OPERATION AND MAINTENANCE
OF THE
MCC-545C
PACKET DATA RADIO**

**OPERATION AND MAINTENANCE
OF THE
MCC-545C PACKET DATA RADIO**

MAN-OM-545C

January 2001

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EXHIBIT VIII

This page MUST be inserted for any copy of this manual going to the United Kingdom.

WARNING WARNING WARNING

Certain power transistors used in this equipment and their associated heatsink components are manufactured partly or wholly from a beryllium compound. Normally these can be handled without risk of toxicity, but there is a toxic hazard if dust or finely-divided particles of the material are inhaled or enter the body through a cut. Consequently, great care must be taken, and hands must be washed after handling.

Any cuts or abrasions on the hands must be covered by dressings while such components are being handled. If beryllium dust does enter the skin through a cut or abrasion, the affected part must be washed thoroughly and treated by a doctor.

Components containing beryllium may only be machined, cut, abraded, or heated above 400 C under strictly controlled conditions approved by the appropriate Safety Authority.

Disposal of Beryllium

Disposal of faulty components must be carried out according to special arrangements. Should a component containing Beryllium be broken, its parts and particles must be gathered carefully using a moistened tissue (preferably while wearing plastic or rubber gloves), placed in a plastic bag together with any contaminated materials, sealed, labeled, and disposed of in a manner approved of by the Safety Authority.

Beryllium Components in MCC-545C RF Power Components

RF power components in the modules listed below incorporate some Beryllium within the transistor package and must be handled as specified in the above warning notice.

TRANSISTOR CIRCUIT MODULE	MANUFACTURER	REFERENCE
545C 100W Transmitter (54505302-01)	Advanced Semi Corp Motorola	Q1,Q4 Q2



GENERAL WARRANTY

Meteor Communications Corporation (MCC) warrants that its products conform to the published specifications and are free from manufacturing and material defects for one year after shipment. Warranty-covered equipment that fails during the warranty period will be promptly repaired at MCC's facility in Kent, Washington.

International customers shall pay shipping costs to the MCC facility, with Seattle as the point of U.S. entry. MCC shall pay incoming U.S. duty fees. MCC shall pay for shipping costs to return the equipment to the customer, with the customer paying any and all return duty fees.

This warranty is contingent upon proper use of the equipment and does not cover equipment that has been modified in any way without MCC's approval or has been subjected to unusual physical or electrical stress, or on which the original identification marks have been removed or altered.

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Introduction

1.0 INTRODUCTION

The MCC-545B PACKET DATA RADIO is part of a Meteor Burst Communications System (MBCS) that allows short and long range communications between any two Stations in the system. The system offers continuous radio signal propagation via ground wave and meteor burst. Ground wave covers short distances, up to 100 km (60 miles). Meteor burst covers longer distances, up to 1,600 km (1,000 miles), reflecting signals off ionized electron trails created by meteors entering the atmosphere at a height of about 100 km (60 miles) above the earth's surface. These trails, called bursts, are random but predictable in number and last from a few milliseconds to several seconds. During this time, information can be exchanged between two Stations. The height of the trails (60 miles) gives the system its 1,000 mile range.

1.1 Presentation

This manual is divided into five major sections:

- Section 2. **DESCRIPTION**
Discusses specifications of each module included in the 545B.

- Section 3: **INSTALLATION**
Presents a brief outline of installation procedures for the 545B. Includes considerations for set-up and cabling, as well as power-up procedures.

- Section 4: **OPERATION**
Outlines operating procedures for hardware and software.

Appendix A contains printouts of 545B commands and command responses.

Appendix B contains for interfacing the Pharos Marine Data Acquisition Unit.

Appendix C contains a list of GPS units supported and instructions for interfacing each unit to the 545B.

Appendix D contains information on configuring the 545B for use in a Flood Warning System.

Appendix E contains information on interfacing to the Campbell Scientific CR10X Data Logger.

Appendix F contains information on the event and I/O programming capability of the 545B.

1.2 Support Documents

Customer Specific System Manual
MCC-520B/MCC-520C Operations Manual

1.3 Conventions

The following conventions are used in this manual:

Any system-dependent options are indicated with an "*".

When presented in the text, user commands and computer printout are boldfaced; e.g., Enter **DELETE**. Command parameters are presented in lower case; e.g., **DEFINE**,id. Optional parameters are enclosed in brackets; e.g., **TIME**{,hh:mm:ss}

Names of terminal keys are capitalized and enclosed in square brackets when mentioned in the text; e.g., Press [ESC].

Names of hardware switches, meters, etc. are capitalized; e.g., PWR ON switch.

NOTE

Used for special emphasis of material

IMPORTANT

Used for added emphasis of material.

CAUTION

Signals the operator to proceed carefully.

WARNING! WARNING! WARNING!

Used in cases where failure to heed the message may result in personal injury or equipment damage.

Description

Description

2**2.0 DESCRIPTION****2.1 General Description**

The MCC-545C Packet Data Radio provides versatile communications from fixed or mobile sites. The 545C can be used for sending and receiving messages, position reporting, data logging, or other specific applications. Designed to operate over a fading groundwave and an intermittent meteor burst communications channel, the unit's low standby-power consumption (<1 watt) makes it ideal for remote locations or mobile operation.

The 545C features rugged construction in a weather-resistant enclosure that measures 10.6 " x 4.0" x 2.42" and weighs less than 3.5 pounds.

A photograph of the 545C is given in Figure 2.1.

The unit operates in a half-duplex mode and contains a solid state Tx/Rx switch that allows a common antenna to be shared for both transmit and receive. It can be operated with a single frequency or on two separate frequencies.

The unit utilizes three phase locked frequency synthesizers to set the Tx and Rx frequencies. The operator can set the frequency to any authorized frequency (10KHz steps) within a 2 MHz band. Authorized frequencies can only be set at the factory by trained technicians. A factory technician is required to retune the transmitter and synthesizer if operation outside a 2 MHz band is desired. The unit can be factory tuned across the full 37 to 50 MHz band

2.2 Send and Receive Messages

The 545C provides full text message capability. With a portable operating terminal, or a PC running terminal emulation software, you can exchange messages with any other Remote Station in the network.

Messages may be plain text or binary data. They can be routed to single or multiple destinations or, to a Host Computer or Data Center.

2.3 Data Logging

The 545C can be programmed to acquire, store, and transmit data from the various I/O signals noted below. Any analog or digital input can be used to trigger a transmission or to set a discrete output level. Output levels can also be set hi or low via a command received from a distant unit.

I/O CAPABILITY OF MCC 545C

NAME	RANGE	QUANTITY
Analog Inputs	0 to +5V	6
Digital Inputs	Optical isolated	4
Digital Outputs	RS232 (+/- 10V)	2
Digital Outputs	0 to +5V (10 ma)	3
Digital Inputs	0 to + 5V or +/-10V	2
Relay Outputs	Form C 2 amp rating	2



**MCC-545C PHOTOGRAPH
FIGURE 2.1**

Refer to Appendix E for detailed operation and control of the I/O capability of the MCC 545C.

The MCC can also be connected via an RS 232 port to a variety of Data Loggers such as the Campbell Scientific CR10X or CR23. Data from these loggers can be collected, stored, and transmitted to a distant unit. Refer to Appendix B and E for a description of data logger interface.

2.4 Position Location

The 545C delivers location data from either a built 12 channel GPS (optional) or from an external GPS with NEMA 0183 format, positioning equipment used in mobile units on land, in the air, and at sea. The 545C sends the position location to a Master or Base Station, which forwards the information to a Data Center or Host Computer for processing. This data can be used in dispatch centers, corporate/district offices, and other monitoring Stations for updating

map displays or additional functions. Refer to Appendix B for a description of the GPS commands.

2.5 Maintenance Features

An operator terminal or a remote command from a distant unit can also be used to read and display the 545C's status such as radio propagation channel statistics, battery voltage during transmission (loaded), battery voltage when not transmitting (unloaded), RF forward and reflected power (checks antenna), and receiver noise levels. It can also be used to display and configure the 545C's operating characteristics, as detailed in Chapter 4.

An internal Li ion battery is used to maintain the internal real time clock and battery backed RAM. This battery is capable of operating the clock in a power down state for a period of approximately 6 months. This battery should be removed if the unit is stored without power for extended periods of time.

2.6 Hardware Organization and Layout

The unit contains five printed circuit assemblies:

A 100 watt all solid-state 2 stage power amplifier.

A 2 watt 2 stage preamplifier and power switch.

A BPSK 4 KB/sec transceiver containing a BPSK receiver, vector phase modulator (+13Dbm output) and three frequency synthesizers.

A low-power microprocessor controller used to perform radio control and link and network protocol functions. This assembly also contains a digital signal processor (DSP) and digital to analog converter (DAC) for generating the in-phase (I) and quadrature-phase (Q) base band signals required to generate the BPSK RF signal.

An 8 channel GPS receiver (optional)

The following paragraphs contain a brief description of each of the five main hardware elements in the 545C. Figure 2.2 presents a block diagram for the 545C. Figure 2.3 presents an outline drawing showing mounting holes, connectors, and dimensions.

2.6.1 MCC-545C Transceiver Assembly

The receiver assembly contains a complete 4K baud Bi Phase Shift Key (BPSK) receiver, a transmit and receive frequency synthesizer module, and a 4K baud BPSK modulator.

BPSK Receiver

- Input band pass filter (37-50 MHz)
- RF amplifier (17 dB)
- Low pass image filter ($F_c=50$ MHz)
- Mixer
- IF amplifiers and filters (10.7 MHz)
- Noise blanker
- Mixer, 2nd IF filter and amplifier (100 KHz), and RSSI circuit
- Coherent Costas Carrier Tracking Loop
- BPSK bit detector and clock generator

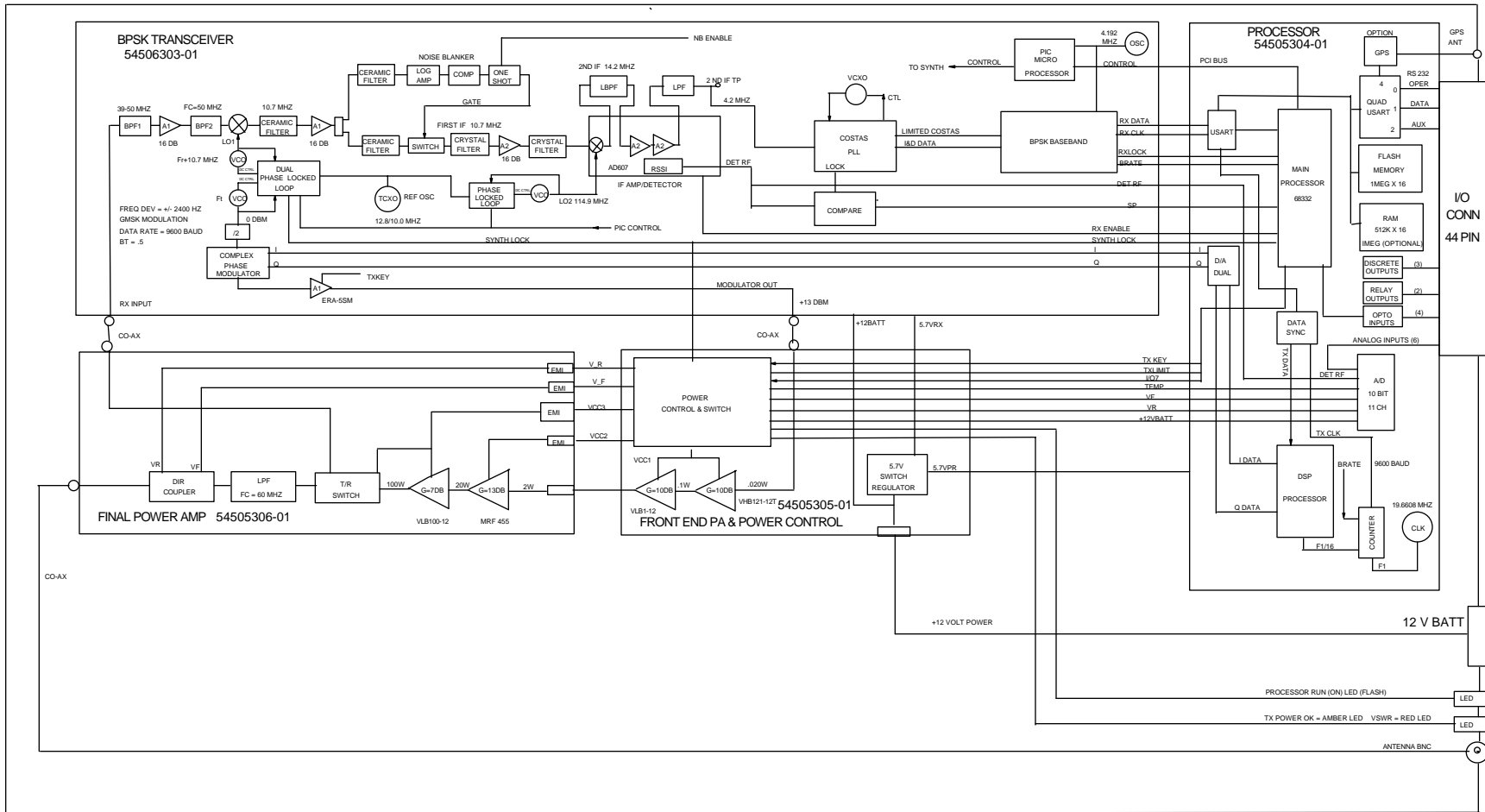
Synthesizer (1st and 2nd local oscillator and transmit oscillator)

- Reference Oscillator (12.8 MHz +/- 2.5 PPM)
- Tx phase lock loop (74-100 MHz output, 20 KHz steps)
- A divide by 2 circuit (37-50 MHz output, 10 KHz steps)
- Rx 1st local oscillator phase lock loop (47.7-60.7 MHz output, 10 KHz steps)
- Rx 2nd local oscillator phase lock loop (10.6 MHz)
- PIC Microcontroller

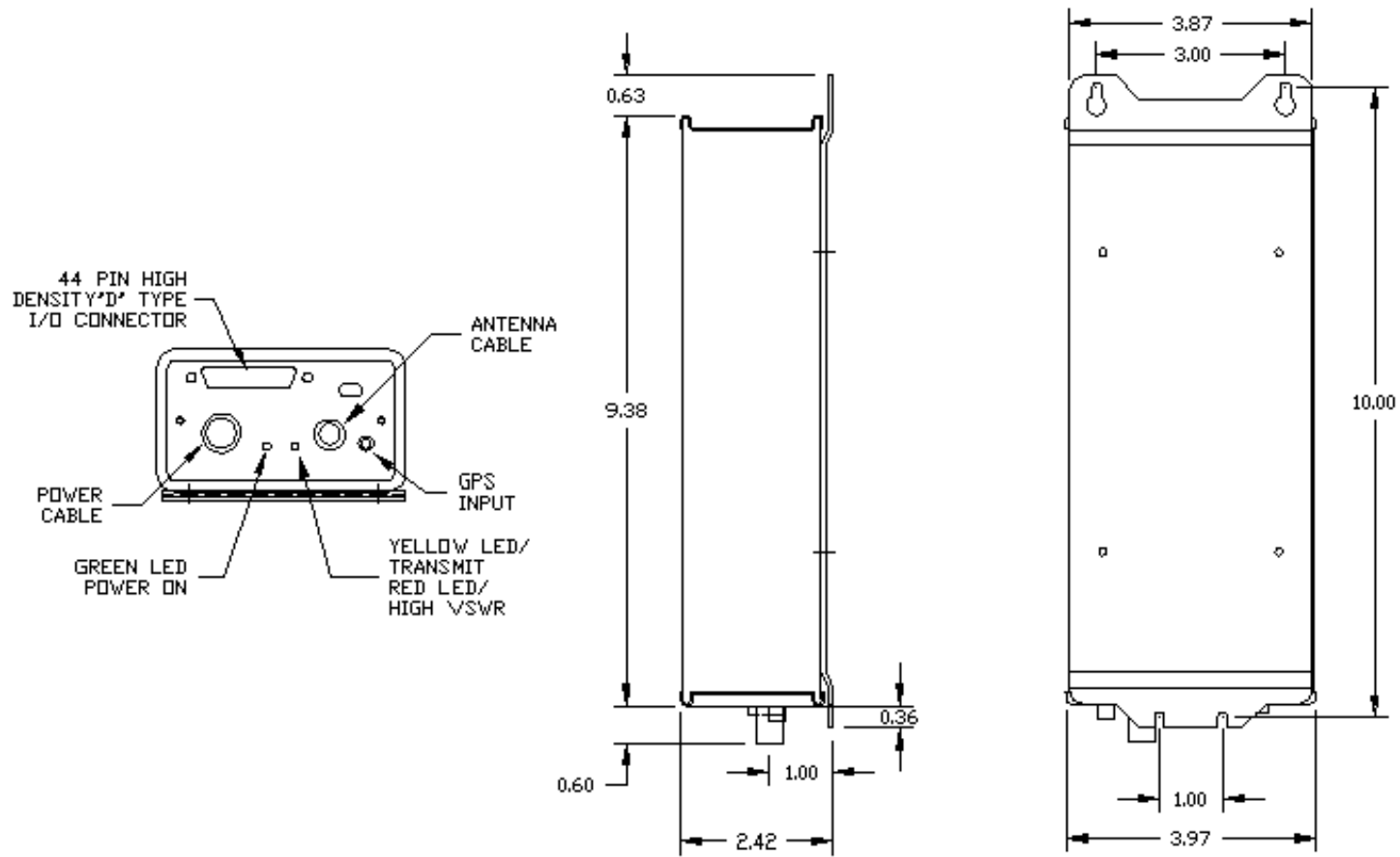
BPSK Modulator

1. I/Q Vector Phase Modulator (BPSK)
2. Pre amplifier (+13 DBM output)

All components are located on a 8.5" by 3.5" two sided printed circuit board. All components are soldered in (surface mounted). As an option the board can be conformal-coated with an acrylic encapsulate that contains a tropicalizing, anti-fungal agent to increase durability and provide protection against moisture and contamination.



MCC 545C BLOCK DIAGRAM
FIGURE 2.2



**MCC 545C OUTLINE DRAWING
FIGURE 2.3**

2.6.2 MCC-545C Power Amplifier

The power amplifier assembly contains two printed circuit boards. One board, the 100 watt power amplifier, is mounted inside an aluminum enclosure to provide RF shielding between the low level phase lock loop synthesizers and the high power output. This board contains a T/R switch for half-duplex operation, a harmonic low pass filter, and a dual directional coupler for power level control.

The second board contains two low level amplifiers which amplify the 20 milliwatt input signal from the modulator to a two watt level required by the final power amplifier stage.

All transmitter components are located on a two 4.0" x 3.5" printed circuit boards. All components are soldered in place. As an option the boards can be conformal-coated with an acrylic encapsulate that contains a tropicalizing, anti-fungal agent to increase durability and provide protection against moisture and contamination.

Both printed circuit boards are mounted to an aluminum heat sink assembly.

2.6.3 MCC-545C Microprocessor

The microprocessor is a Motorola-based, embedded computer housed on a single PCB that contains:

- 512K x 16 of non-volatile flash memory for program storage
- Additional 512K x 16 of non-volatile flash memory for parameter storage
- 1024K x 8 of static RAM for data storage (optionally 2048K x 8)
- External RS-232 I/O ports (3)
- Internal TTL GPS port
- Transmitter communication port
- Receiver communication port
- 10-bit 11 channel A/D converter (6 channels available for external sensors)
- Real-time clock
- Power fail detection circuitry
- Digital Signal Processor with D/A converters
- Optically isolated digital inputs (6)
- Form C Relay Outputs (2) with current rating of 2 amps.

All I/O ports are RS 232 compatible and can be programmed to adapt to various customer protocols. The DATA port contains full flow control hardware lines.

The A/D converter measures TX forward and reverse power, battery voltage, antenna noise voltage, transmitter board temperature, and 6 channels of 0-5V external sensor inputs.

All processor components are located on a 198mm x 95mm (7.8" x 3.75"). All components are soldered in place using the latest in surface mount technologies. As an option the board can be

conformal-coated with an acrylic encapsulate that contains a tropicalizing, anti-fungal agent to increase durability and provide increased protection against moisture and contamination.

Specifications for the unit and the individual circuit boards are given in Tables 2.1 through 2.4.

MCC-545C GENERAL SPECIFICATIONS

CHARACTERISTIC	SPECIFICATION
Dimensions	10.6"L X 4.0"W X 2.42"H
Weight	3.5 lbs.
Temperature Range	-30° to 60° C (-22° to 140° F)
Power Requirements	12 V _{DC} Nominal (10-14 V _{DC}) Standby: 80 ma (Continuous) Transmit: 25 Amps Nominal (100 msec)

TABLE 2.1

MCC-545C RECEIVER SPECIFICATIONS

CHARACTERISTIC	SPECIFICATION
Frequency	37-50 MHz .0005% Synthesized 10KHz steps
Modulation: Type Rate Format	GMSK 9.6 kbps and 19.2 kbps NRZ
Noise Figure	< 7 db minimum
Sensitivity: Bit Error Rate < 10 ⁻³ at 9.6 kbps	-114 dbm
IF Bandwidth (3/80 db)	13/40 KHz typical
RF Bandwidth (3 db)	13 MHz typical
Signal Acquisition Time	< 5 msec
3 rd Order Intercept Point	>- 4 dbm
Image Response Attenuation	> 70 db minimum
Spurious Response Attenuation	> 70 db minimum
SP Threshold	Adjustable from -115 to -106 dbm Triggered by DET RF and Demodulator Lock
Noise Blanker	> 20 db Reduction in Impulse Noise
I/O	MCC Standard (Refer to Section 3.2)

TABLE 2.2

MCC-545C TRANSMITTER SPECIFICATIONS

CHARACTERISTIC	SPECIFICATION
Frequency	37-50 MHz .0005% Synthesized 10KHz steps
RF Power Output	> 100 Watts at 12 V _{DC} Input
Load VSWR	< 2:1 Rated Power
Harmonic Levels	70 db below Unmodulated Carrier
Modulation: Type Rate Format	GMSK 9.6 kbps and 19.2 kbps NRZ
Spurious	> 70 db below Unmodulated Carrier
Transmit Modulation Spectrum	10 KHz offset – 40 db 25 KHz offset – 70 db
Tx Duty Cycle	16% Max without shutting down transmitter 20% will shut down the transmitter
T/R Switch	Solid-State Switching Time < 100 microseconds
I/O	MCC Standard (Refer to Section 3.2)
High VSWR Protection	Withstands Infinite VSWR

TABLE 2.3**MCC-545C MICROPROCESSOR SPECIFICATIONS**

CHARACTERISTIC	SPECIFICATION
Main Processor	Motorola MC68332FC 32-bit Embedded Controller
Memory: Program Storage Data Storage Parameter Storage	512K x 16 non-volatile Flash memory 1024K x 8 static RAM (optional 2048K x 8) 512K x 16 non-volatile Flash memory
Switches: S1	System Reset, Momentary
Jumper: JP2 JP3 JP4	Modulation Select (In for GMSK, Out for BPSK) DSP Clock Select (pins 1-2) Mod Filter Select (In for BT=0.5, Out for BT=1.0)

TABLE 2.4

Installation

3.0 INSTALLATION

This section provides general information on site selection and installation of the MCC-545C for operation in both an MBCS and ELOS network.

3.1 Site Selection

One of the most important considerations for proper operation in a meteor burst network is the selection of the operating site. There are a number of factors to consider in selecting an optimum site:

1. External Noise/Interference
2. Horizon angle
3. DC power source
4. Site dimensions
5. Antenna considerations

These factors are particularly important for meteor burst operation, however, many are applicable for ELOS operation as well.

3.1.1 External Noise/Interference

Noise and signal interference can reduce the performance of the MCC-545C. The most common sources of noise and interference are as follows:

- Cosmic Noise
- Power Line Noise
- Automobile Ignition Noise
- Computer-Generated Interference
- External Signal Interference

Cosmic Noise

Cosmic noise is the limiting noise factor in a meteor burst system. This noise is generated by star systems in the galaxy and is frequency dependent. The noise is approximately 15 db above thermal at 40 MHz and 13 db above thermal at 50 MHz. The noise is also diurnal in nature. It is the highest when the antennas are pointed directly at the center of the galaxy and lowest when they are pointed at right angles to it. Daily variations of 3 to 4 db can be expected. An optimal meteor burst site is one that is limited only by cosmic noise.

The MCC-545C STAT command is very useful in determining the site antenna noise levels. The STAT reading should be between -120 and -115 dbm for an antenna line loss of about 1 to 2 db (100-200 ft of RG-214). The noise blanker is not effective for eliminating cosmic noise, therefore the noise readings will be the same whether the blanker is on or off.

Power Line Noise

One of the main sources of external noise are high voltage power lines. Noise on these lines is generated by high voltage breakdown occurring on power line hardware such as transformers and insulators. This noise can be seen with an oscilloscope at the Receiver IF test point as a series of spikes that occur every 8 ms (1/60 Hz) or every 10 ms (1/50 Hz). The level of the spikes will be much higher than the normal background noise floor. The number of spikes can vary, depending upon the level of interference, from one or two every 8-10 ms to several dozen every 8-10 ms. The impulse noise blanker can remove a large amount of this noise. However, as the number of spikes increase, the effectiveness of the blanker is reduced. When setting up a site always look at the IF test point with a scope to determine the level of the power line noise interference. It is mandatory that power line noise be avoided for an optimum site. Try to set up the receiver antennas well away from power lines and do not point the antennas directly toward nearby power lines.

NOTE.

Power companies are required to properly maintain their power lines to reduce noise. Call your local utility in case of severe noise.

Automobile Ignition Noise

Automobile ignition noise is generated by all gasoline engines and is a result of the high voltage required to fire the spark plugs. Auto ignition noise is similar to power line noise with the exception that it does not have the 8-10 ms period which is associated with power line noise. If the MCC-545C is operated on a vehicle, care must be taken to ensure that the vehicle ignition system, DC motors, or any other source of electrical noise is isolated through shielding, ferrite bead, and/or bypass capacitors.

Computer-Generated Interference

All computers and printers contain high-speed circuits that generate spurious signals throughout the 37-50 MHz band. Interference will result if any of these signals couple into the antenna at the MCC-545C receive frequency. To avoid this type of interference, keep the antenna away from buildings that contain computers. Separating the antennas from the computers by 100 to 300 feet will generally prevent this type of interference. The noise blanker will not suppress computer-generated interference.

Signal Interference

This type of interference will occur whenever another transmitter is operating on the receiver center frequency of the MCC-545C. Antenna nulling and spatial separation can be used to reduce this type of interference.

3.1.2 Horizon Angle

The second consideration in site selection is the horizon angle in the direction of the Master Station. To achieve optimum performance at ranges up to 1600 km (1000 miles) the horizon, or look angle, must be within 2 or 3 degrees of horizontal and must be free from obstructions, buildings, bridges, etc. Trees and shrubbery do not present a problem if they are at least 20 feet from any element of the antenna. At shorter ranges the horizon angle must be higher.

3.1.3 Power Source

The MCC-545C requires a 12 V_{DC} power source. An automobile battery provides an excellent power source. Care must be taken to ensure that proper wire size is used to support the MCC-545C high in-rush current during transmission. Typical transmit current is 25 to 30 amps for a time period of about .10 second. A #14 wire (or two #16 wires) should be used for both the +12 V_{DC} and ground wires. The wire length should be shorter than 10 feet. The MCC-545C does not have an internal fuse and special care must be taken to protect the unit from a power line reversal.

3.1.4 Site Dimensions

To obtain the maximum performance from a meteor burst site, the station must be set up on level, flat ground. The terrain in front of the antenna must be flat and free of buildings and other structures for a distance of at least 30 times the height of the antenna. Operation in an area that does not have a proper ground plane to provide ground reflection can reduce meteor burst performance by a factor of two.

3.1.5 Antenna Considerations

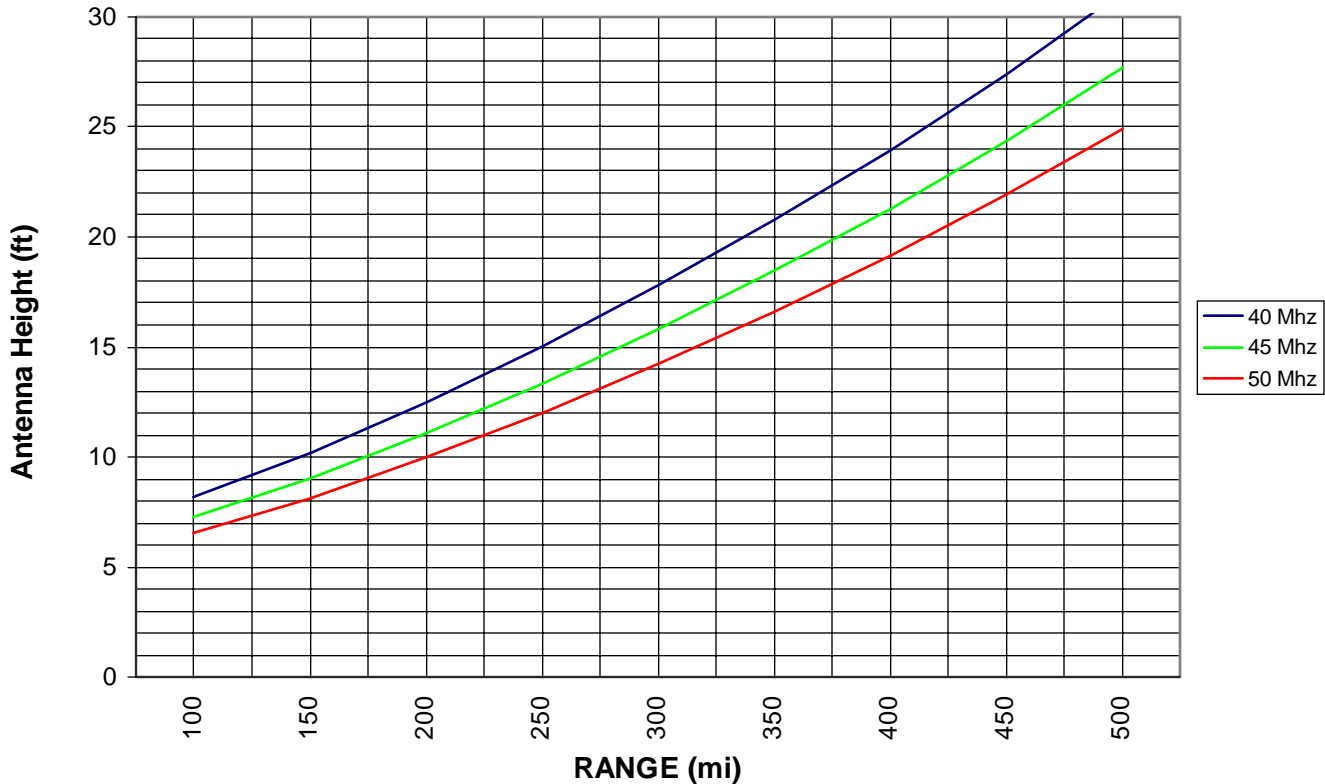
The final consideration in setting up a site is selecting the antenna and the co-ax cable. The antenna must provide a 50 ohm load and this impedance must be maintained at both the Tx and Rx frequency. The information bandwidth of the system is less than 15 KHz. Therefore, in a single frequency system, a very narrow bandwidth antenna can be used.

The higher the antenna gain the better the performance will be. Yagi antennas will work better than dipole antennas (2 to 4 times improvement). Always maintain the same antenna polarization at the remote station as the Master Station antenna. For example, if a whip antenna is used at the MCC-545C, the Master Station antenna must also be vertically polarized.

In a Meteor Burst System, the height of the antenna should be optimized as a function of the distance between the Master Station and the Remote Station. A plot of antenna height vs. range is given in Figure 3.1 below.

In an ELOS System, the higher the antenna the better. In general, every time the antenna height is doubled the system gain will be increased by approximately 6 db.

Best Antenna Height



ANTENNA HEIGHT VERSUS DISTANCE BETWEEN STATIONS
FIGURE 3.1

Antenna cable length must be kept as short as possible to minimize line losses. Try to maintain a line loss between the antenna and the MCC-545C to less than 1 db. A table of cable loss (at 50 MHz) for various types of co-ax cable is given below for reference.

CABLE TYPE	Loss/100 feet (db)	Diam. (Inches)	Weight/100 feet (lbs.)
RG 223, RG 58	3.0	.211	3.4
RG 214, RG 8	1.8	.425	12.6
RG 17	1.2	.870	20.1
LDF4A-50 ½ inch heliax	.48	.500	15.0
LDF5A-50 7/8 inch heliax	.26	.875	33.0

3.2 Equipment Installation

The MCC-545C operates over a temperature range from -30°C to 60°C and is housed in a stainless steel enclosure, however, it is not waterproof. A NEMA waterproof enclosure is therefore recommended for outdoor installation when an environmentally controlled shelter is not available.

To ensure proper operation, shielded cable is recommended for all connectors. Also, use adequate strain relief on all cables and a weatherproof seal at the entry point of the enclosure.

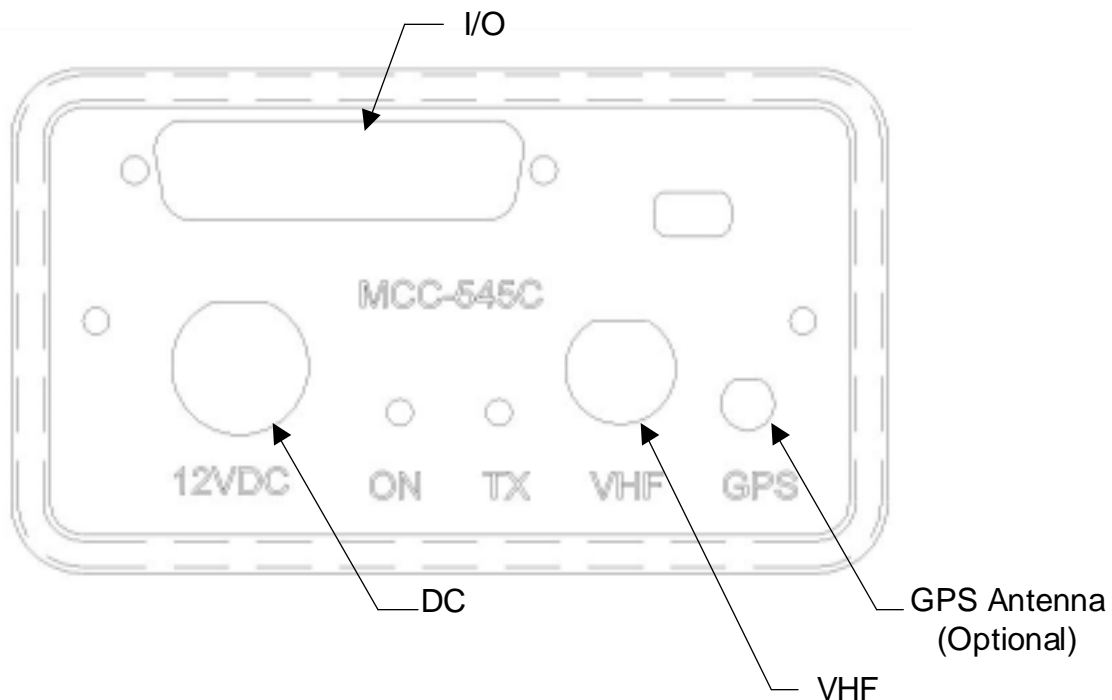
3.2.1 Antenna Installation

Antenna installation is very dependent on the site conditions and proper antenna placement can make the difference between a system that works very well or one that works marginally. Always consult with MCC's engineering department for assistance if any questions arise with respect to proper placement of the antennas.

Assembly instructions are included with each antenna. Please refer to these for proper assembly of all antenna elements.

3.2.2 Cable Connections

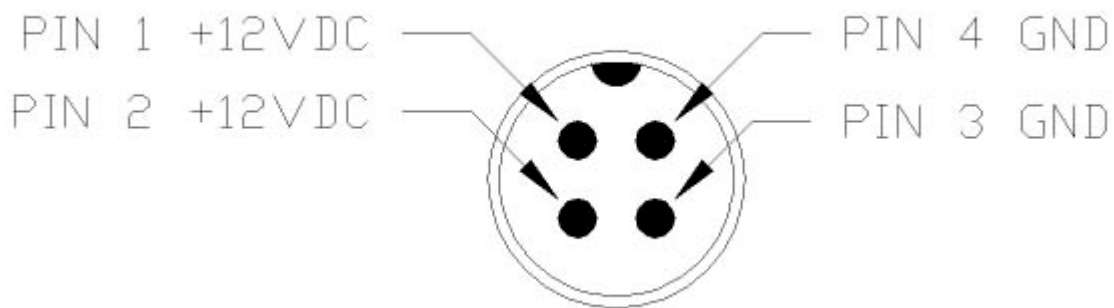
There are a maximum of four cable connections to be made to the MCC-545C as shown below:



3.2.2.1 DC Power

The MCC-545C requires a power source that can deliver up to 25 amps of pulsed power (100 msec) out of a +12 V_{DC} to +14V_{DC} power source. The 25 amp power demand will cause a voltage drop to occur at the transmitter input, resulting in reduced transmit power, unless the power cable to the source is sized appropriately. MCC recommends using two #16 AWG wires for both the power and ground and a cable length that does not exceed 10 feet. If a longer cable is required use #14 AWG. MCC provides a standard 6 foot power cable with lugs for connecting to a 3/8" battery post (Part No. 14001261-03).

The power connector pins are as follows:



The voltage drop at pins 1 and 2 should not drop by more than 2V_{DC} during transmission.

3.2.2.2 VHF Antenna

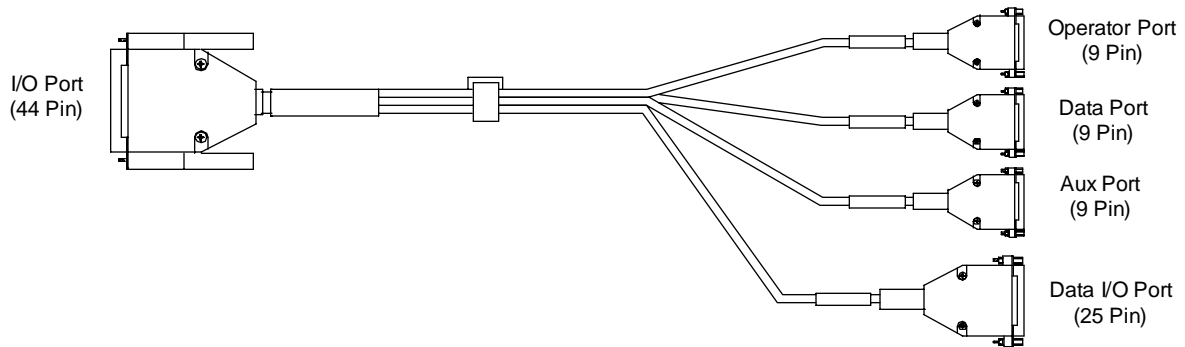
Connect the antenna cable to the BNC RF connector. RG-223 may be used for cable lengths under 20 feet. Use a double shielded cable (RG-214) for cable lengths up to 100 feet.

3.2.2.3 GPS Antenna (Optional)

An external GPS antenna is required if a GPS receiver is installed in the MCC-545C. Connect the GPS antenna cable to the SMA connector on the front panel.

3.2.2.4 I/O Port

The 44 pin I/O connector on the front panel includes three RS-232 ports as one Data I/O port. MCC provides a standard cable harness that breaks out these four ports as shown below:



MCC PART NO. 14001352-01

3.2.2.4.1 Operator Port

The Operator Port is normally connected to a local operator terminal. Use a standard RS-232 cable with a 9-pin male D connector.

OPERATOR PORT – 9S	
Pin	Signal
1	CD (tied to pins 4 and 6)
2	Tx Data (from MCC-545C)
3	Rx Data (to MCC-545C)
4	DTR (tied to pins 1 and 6)
5	Ground
6	DSR (tied to pins 1 and 4)
7	RTS (tied to pin 8)
8	CTS (tied to pin 7)
9	Not Used

3.2.2.4.2 Data Port

The Data Port is normally connected to a data logger, GPS receiver or other serial input device. Use a standard RS-232 cable with a 9-pin male D connector. Refer to Appendix B and C for more information on interfacing to data loggers or other serial input devices.

DATA PORT – 9S	
Pin	Signal
1	Not Used
2	Tx Data (from MCC-545C)
3	Rx Data (to MCC-545C)
4	DTR (to MCC-545C)
5	Ground
6	DSR (from MCC-545C)
7	RTS (to MCC-545C)
8	CTS (from MCC-545C)
9	Ring Ind. (from MCC-545C)

3.2.2.4.3 Auxiliary Port (AUX)

The AUX PORT is normally connected to a GPS receiver or other serial input device. Use a standard RS-232 cable with a 9-pin male D connector. This port is also used for interfacing to MCC test equipment (pins 6, 8, and 9).

AUX PORT – 9S	
Pin	Signal
1	Not Used
2	Tx Data (from MCC-545C)
3	Rx Data (to MCC-545C)
4	Not Used
5	Ground
6	Ant. Clock (from MCC-545C)
7	Not Used
8	Ant. Dir. (from MCC-545C)
9	Ant. Dir. (from MCC-545C)

IMPORTANT

The AUX port connector has three extra pins (pins 6, 8, and 9) whose signals do not conform to the RS-232 standard. These are for MCC test purposes and are not used at this time. These pins will NOT interfere with a normal 3-wire RS-232 connector (pins 2, 3, and 5).

3.2.2.4.4 Data I/O Port

The Data I/O port is used as a general purpose Supervisory Control and Data Acquisition (SCADA) interface requiring limited I/O in lieu of a full data logging capability. Use a mating cable with a 25-pin male D connector for access to the various functions. For convenience, this cable may be routed to a terminal block for interfacing to the various sensors and other external devices.

Data I/O Pins	FUNCTION
1	Optocoupled input #1 positive (500 ohm resistor)
2	Optocoupled input #1 return
3	Optocoupled input #2 positive (500 ohm resistor)
4	Optocoupled input #2 return
5	Optocoupled input #3 positive (500 ohm resistor)
6	Optocoupled input #3 return
7	Optocoupled input #4 positive (500 ohm resistor)
8	Optocoupled input #4 return
9	Ground
10	Relay Output #1 Normally Open (2Amp rating)
11	Relay Output #1 Common
12	Relay Output #1 Normally Closed (2Amp rating)
13	Relay Output #2 Normally Open (2Amp rating)
14	Relay Output #2 Common
15	Relay Output #2 Normally Closed (2Amp rating)
16	Ground
17	Analog Input #1 (0 to 5 V)
18	Analog Input #2 (0 to 5 V)
19	Analog Input #3 (0 to 5 V)
20	Analog Input #4 (0 to 5 V)
21	Analog Input #5 (0 to 5 V)
22	Analog Input #6 (0 to 5 V)
23	+5V Reference (10mA for sensor excitation)
24	+12V (0.5A maximum)
25	Detected RF Test Point

3.3 Power-Up Sequence

IMPORTANT

Before applying power to the MCC-545C check all connections between the MCC-545C and the external equipment (power, antenna, operator terminal, GPS receiver and data logger).. Refer to Section 3.2.2 for complete cabling instructions.

3.3.1 Power On

CAUTION

Disconnect the antenna cable until the unit ID has been set (see paragraph 3.3.2).

To power up the MCC-545C, apply +12V_{DC} to the power connector.

NOTE

When the unit transmits it will draw up to 25 amps, therefore, review section 3.2.2.1 for cabling to the power source. The voltage drop at the input connector during transmission should be less than 2 V_{DC} for proper operation of the unit.

The following message should appear on the operator terminal when power is applied:

```
12/23/00 16:54:10 POWER SHUTDOWN/FAIL OCCURRED.
01/02/01 12:54:44 POWER HAS BEEN RESTORED... RESUMING OPERATION.
+
```

If this message does not appear then the baud rate may not be set correctly in the operator terminal. The default baud rate setting in the MCC-545C is 9,600 baud, 8 data bits, one stop bit and no parity. This baud rate setting may be changed in the MCC-545C using the SETBAUD and SAVE commands, as described in Chapter 4.

The default baud rate settings are stored in flash memory. However, it is possible to lose these settings if the lithium battery has lost its charge after the MCC-545C has been sitting on the shelf for an extended time period. In that event, a message similar to that shown below will appear upon start-up.

```
METEOR BURST RADIO SUBSYSTEM MBCT
(c) Copyright 2000 Meteor Communications Corp.
All Rights Reserved
RF Modem S/W Part Number P1060-00-00 Version 6.25 12/19/00
```

The desired baud rate must then be entered using the SETBAUD and SAVE commands.

3.3.2 Entering the Unit ID

It is very important that the unit ID is entered correctly before transmitting. If the unit transmits with the wrong ID it may conflict with another unit in the system and will result in data or messages being misrouted or lost. In addition, the network topography and statistics will receive incorrect data that will impair network performance. Use the ID Command to set the unit ID:

```
ID,nnnnn,mmmm{,aaaaa},INIT
```

where nnnnn is the unit ID, mmmm is the Master Station assignment and aaaaa is the initial Master Station connectivity setting. Obtain these numbers from your network manager. The MCC-545C will save the ID and reboot whenever the unit is powered up or reset.

3.3.3 Set and Verify the Tx/Rx Frequencies

The MCC-545A is programmed by a factory-trained technician to operate on a number of authorized frequency channels. Once programmed, these frequencies can be selected by the operator from a keyboard.

You can set or display the TX and RX frequencies using the following command:

```
FREQUENCIES, XXXX,YYYY
```

Where XXXX is the desired transmit frequency and YYYY is the desired receive frequency

Example: FREQUENCIES,4550,4550

This will select 45.50 MHz for both the transmit and receive frequency. Only those frequencies that have been previously programmed into the unit at the factory can be selected.

Once the frequencies are selected, confirm that the synthesizer is “ON” and locked by entering the following command:

```
SYNTHESIZER, ON
```

The unit will respond with

```
SYNTHESIZER, ON           Locked or Unlocked
```

If the synthesizer returns an unlocked response, check the frequency command to ensure that the proper frequencies have been entered.

NOTE

The MCC-545C will not transmit if the synthesizer is not locked.

3.3.4 RF Test

A very thorough RF test can be made by typing TEST[CR]. TEST causes the processor to turn the transmitter ON and measures the forward and reverse RF power that is being transmitted. It also measures the battery voltage under load and the antenna noise voltage.

The following response will be displayed on the operator terminal:

```

Syncs   Xmits   Acks   pwr-fwd  pwr-rev  v-bat   det-RF
XXXX    YYYY    ZZZZ   AAAA     BBBB     CCC     DDD

```

where:

- XXXX = # of sync patterns received from the master station.
- YYYY = # of transmissions made by the MCC-545C.
- ZZZZ = # of Acknowledgements received from master station.
- AAAA = Forward power in watts. This should be greater than 80 watts.
- BBBB = Reflected power in watts. This should be less than 5 watts.
- CCC = Battery voltage under load (while transmitting). This should be greater than 10.6 V_{DC}.
- DDD = Received signal strength in dbm. This will normally be the noise level at the antenna.

Troubleshooting Suggestions

If the battery voltage is normal, the forward RF power should be at least 80 watts. If it is lower than 80 watts check for proper cabling to the power source. (see Section 3.2.2.1).

If the reverse RF power is greater than 5 watts check the antenna and coaxial cabling for proper installation.

If both the forward and reverse power are low, the transmitter may be automatically shutting down due to an antenna VSWR greater than 3:1. Check the antenna and coaxial cabling for proper installation.

This completes the power-up sequence of the MCC-545C. The unit is now ready for operation. Refer to Chapter 4 for detailed operating instructions.

Operations

Operations

4.0 OPERATIONS

This chapter covers the fundamental operating procedures of the MCC-545C and is functionally divided into seven sections:

- Getting Started
- Station Operational Parameters
- Sending and Receiving Messages
- Data Logging
- Reporting Position Location
- Master Mode Functions
- Examining System Statistics

4.1 Getting Started

4.1.1 Command Entry and Editing

You must enter carriage returns after every command. A list of all the operator commands are given in Table 4.2.

When a command is accepted, the operator terminal will print the system time. For a description of printouts, see Appendix A.

Before you begin you should familiarize yourself with the special editing functions that you can use when entering commands:

[DEL] Deletes last character entered.

[CTRL] Prints command line on next line down.

[CTRL]-R Repeats last command line

\X Removes current line from command buffer.

[CR], [LF] or [ENTER] Terminates line and causes the command entered to be executed.

4.1.2 Unit Name and Station ID

In command descriptions, the parameter "name" is the assigned Station name. The name is the numeric Station ID. For more information on MCC-545C operation as either a Remote or Master Station, refer to Section 4.2.1. Station IDs, represented by "nnnn", can be assigned as follows:

1 – 245	Master Station
256 – 4095	Remote

Verify the ID is set correctly with the following command:

ID

If it is not correct, refer to section 3.3 for procedures to set it.

4.1.3 HELP Command

Information about many of the MCC-545C commands can be obtained via the HELP command. Typing HELP with no parenthesis produces a single page display of the alphabetized command list. Typing “HELP,command” provides a summary explanation of how to use that particular command. For example, typing HELP,ASSIGN explains the format to use when you enter the ASSIGN command, along with a brief description of the command's function.

4.1.4 System Time and Date

The system calendar is maintained during power outages. If the date and/or time shown is incorrect the calendar can be initialized with the following commands:

DATE,mm/dd/yy

TIME,hh:mm{:ss}

The time of day maintained in the MCC-545C is transmitted to all Remote Stations keeping all units in a network on the same time reference. If the time of day received at a Remote Station differs by more than two minutes from the internal Remote clock, the Remote will set its clock to the received time of day.

To properly manage time, each Master Station and Remote Station must know how its own time zone relates to UTC and the system time. This relationship is established by relating its time zone to known reference points. UTC is always referenced to GMT; however, system time can be referenced to any desired time zone. The time zone offset is defined with the following command:

TIME ZONE,UTC offset,system offset

4.2 Station Operational Parameters

In order for the MCC-545C to operate correctly in your network, it must be properly configured. Configuration requirements will vary from application to application, therefore refer to your systems manual or consult your systems manager for correct settings.

Use the commands described in this section to set the configuration as required. You may use the CONFIG and ASSIGN commands to verify proper configurations have been set.

Finally, enter the SAVE command to write the configuration into the EEPROM for non-volatile storage.

4.2.1 Configuring the MCC-545C

Configuration parameters include the unit ID, the Master Station assignment, I/O port functions and baud rates, transmit and receive parameters and network parameters. Commands which allow you to display/modify the configuration are marked with an * in the command table. Parameters or operational states set by these commands are retained and will determine the way in which the MCC-545C will interact with other equipment at the site and with the communications network.

Most configuration parameters can be viewed with the "CONFIG" and the "ASSIGN" commands. You should use these commands to verify that the configuration is correct. If it is not correct, use the appropriate command(s) to correct the configuration, then enter the "save" command to write the configuration parameters into the EEPROM.

Saving and Restoring the Configuration - The Theory

To aid your understanding how the MCC-545C operational configuration is saved and restored it is helpful to understand the hardware and design philosophy of the MCC-545C.

The MCC-545C is designed to operate unattended in a variety of environments where power may be applied continuously or intermittently. The goal is for the unit to continue to operate without loss of messages, data or configuration even if power is randomly turned on and off. Therefore the software is designed to operate continuously, to save all operational information when power is off and to resume operation from that point when power is restored.

To support this philosophy, the MCC-545C has three types of memory: PROM, RAM and EEPROM. The PROM is non-volatile memory that has been programmed with the MCC-545C's operational software. This software contains the initial values of all operational parameters. The values are referred to as the "factory defaults" because they are programmed in the factory when the unit is first manufactured. The PROM can only be modified by replacing this chip with one programmed with the new data.

The RAM contains all the dynamic data for the MCC-545C. All data logger data, positional data, and messages entered into the MCC-545C are stored in RAM. Also, all command parameters are stored in RAM. But RAM is volatile and can only retain information while power is applied. Turning off or disconnecting power will cause all RAM information to be lost. To prevent this, a small internal NiCad battery is used to maintain power to the RAM when external power is off.

During normal operation, the MCC-545C software operates from the data and the parameters that are stored in RAM. Unfortunately, there are always situations when the RAM data may be lost or corrupted due to total discharge of the battery, software crash or operator error. Since we do not want to lose our configuration data during these situations, we have a third type of memory.

The third type of memory is EEPROM. It is nonvolatile and retains data even when power is removed. Special access is required to program the EEPROM therefore it is not easily corrupted. The MCC-545C can retain a copy of all the programmed configuration parameters in EEPROM. However, EEPROM is limited to 10,000 write cycles per memory location so the MCC-545C only writes to EEPROM using two special commands - "ID" and "SAVE". Only values that have changed are written into EEPROM. A validation checksum is saved in the MCC-545C to verify its data is correct.

When the MCC-545C ships from the factory it programmed with the following default configuration: the Operator Port (port 0) is set for 9600 baud, 8 data bits, 1 stop bit, no parity, ASCII protocol and no flow control. This provides a known starting point for communicating to the unit from a terminal or computer. From this starting point, the user can program the unit ID and other operational parameters and then use the "Save" command to write them to EEPROM. As soon as the parameters are entered they take effect.

CAUTION

Once the software is rebooted or restart due to a crash or failure of the battery backup RAM, all changes will be lost unless they were previously saved in EEPROM.

Saving and Restoring the Configuration - The Operation

1. The software normally executes using the data and parameters stored in RAM. When the unit is turned off, or power is disconnected, the RAM information will be maintained by battery backup. When main power is restored the unit continues operation from RAM.
2. The RAM contents will be lost under the following conditions:
 - (1) if the Reboot command is issued
 - (2) the white Reset button (S1) is pressed
 - (3) the internal battery backup is disconnected (by removing jumper JP1 while external power is off)
 - (4) the NiCad battery fails or
 - (5) the software crashes and restarts.

The software will detect these events and will then recopy the configuration values from EEPROM back into RAM when operation is resumed.

3. The software will revert to the factory settings contained in the PROM if the contents of the EEPROM become invalid.

The user should beware that it is possible to "get in trouble" using the configuration process. For example, assume you accidentally set the protocol for the operator port to MSC. If you do not have the ability to interface using MSC protocol you will immediately lose contact with the

MCC-545C. You will no longer be able to issue commands. Power cycling will not help either because your change will be retained in RAM, even through power cycling. However, you can always recover by removing the lid on the MCC-545C and pressing the Reset button (S1). This will reboot and restore the EEPROM settings.

Alternatively, assume you want to change the operator port to MSC. You connect in ASCII protocol, command the change to MSC protocol, then switch you PC to also use MSC protocol. Operation resumes and all is well. But do not forget to do a SAVE. If the software ever reboots, it will revert back to ASCII. And remember, once you do the SAVE you are committed to MSC protocol. The Reset button now reboots to MSC and there is no easy way back to the factory default settings. You will need an MSC capability to command a change back to ASCII.

4.2.2 Selecting MCC-545C Remote/Master Operation

The MCC-545C can operate as either a Remote Station or as a Master Station. Use the DEVICE command to select the mode you require.

For normal MCC-545C Remote Station operation, enter:

DEVICE,REMOTE

For MCC-545C operation as a Master Station, enter:

DEVICE,MASTER

NOTE

Additional MCC-545C commands are available when DEVICE,MASTER is selected. There is no help for this command.

4.2.3 Selecting Network Parameters

MCC recommends using the given default network parameters (values that are set on power-up or after reset). If you choose to change these parameters, first review the discussion in this Section and in Section 4.8.5, then use the following commands to change to the desired settings:

SNP{,pname,value}

where "pname" is the network parameter and "value" is a limit dependent on "pname". The "pname" parameters are as follows:

TTL – Time-to-live in minutes (default is 120 minutes); this is the time limit for a message to reach its destination before it is deleted from the queue.

The time-to-live parameter input is truncated to a 10-minute boundary. If you enter 60 through 69, the TTL for the next message will be 60 minutes. A resultant value of 0 (parameter range 0 – 9) means the message will never time out.

- TTR – Time-to-retransmit in minutes (default is 20 minutes); i.e., the message is retransmitted if it has not reached its destination within this time frame.
- NUP – Neighbor-up threshold (default is 20 acquisitions); the number of times a Station must hear from another Station within a one minute time interval before it becomes a neighbor.
- NDOWN – Neighbor-down threshold in minutes (default is 20 minutes); if there is no communication with a neighboring Station within the set time, the route to that neighbor is ignored. Setting NDOWN to 0 maintains the routing to the neighbor indefinitely.
- RDOWN – MASTER OPERATION ONLY - Remote-down threshold in minutes (default is 1,440 minutes); if there is no communication with a Remote Station within the set time, the Remote is declared down and is removed from the Remote table. Setting RDOWN to 0 keeps a Remote defined indefinitely.
- OTL – Outstanding text limit (default is 20 texts); the number of messages a Station is allowed to send to another Station without an end-to-end acknowledgment.
- CONNP – MASTER OPERATION ONLY - Connectivity message precedence (default is 1 precedence); information on changes in the connectivity table is given highest precedence (automatic feature).
- ETEAP – End-to-end ACK message precedence (default is 0 [zero] precedence); the acknowledgment of a message when it reaches its final destination is given highest precedence.
- HTO – History file timeout in minutes (default is 10 minutes); maintains information for duplicate filtering.
- TEXTL – MASTER OPERATION ONLY - Text size in segments (default is 32 segments).
- FLOODP – MASTER OPERATION ONLY - Partial "flooding" precedence level (default is A precedence). Messages of this precedence level and above are transmitted over all routes of minimum length; messages below this precedence are not sent over all minimum length routes, but are sent only over the routes where the shortest transmit queues exist.
- MBHOP – meteor burst link hop weight (default is 1 hop). Defines the number of network hops to associate with a meteor burst Master Station link when determining the minimum path to use in routing a message. MBHOP should be set high enough to prevent a meteor burst Master Station link to be chosen over a line-of-sight Remote to Remote link in a network that is predominantly line-of-sight.
- INF – MASTER OPERATION ONLY - Infinity hop quantity (default is 8 hops). Defines the width of the network in hops plus one to determine when connectivity

to a node is broken. Should be as low as possible to minimize auto-connectivity traffic in the network, but large enough to not erroneously flag nodes as being offline.

- RELAY – MASTER OPERATION ONLY - Relay function specification (default is ON). Specifies whether the MCC-545C should act like a Remote in terms of relay functionality (i.e., does not share connectivity table with other Masters).
- DATAP – priority of data reports initiated at the MCC-545C (default is Y precedence). When used in any data collection network, this setting defines the precedence of data reports generated asynchronously by the equipment itself. Typically, it should be lower than operator entered messages and commands.

4.2.4 Selecting the Burst Monitor

The MCC-545C has a unique meteor burst monitoring capability that allows monitoring the number of characters received, the RF signal level and other parameters on each reception.

To turn on the burst monitor and to record statistics on a meteor burst link, type:

```
MON{,d{,r}}
```

The two optional parameters are designed to limit the printout. The burst monitor generates two or three lines of printout for every burst. This could conceivably create hundreds of pages of printout a day in a network environment. The first parameter is the duration character count limit. Only meteors lasting long enough to deliver "d" characters will be monitored. The second parameter is the received character count limit; if at least "r" characters are received on the burst, a monitor line will be generated. The default values are 100 for "d" and 1 for "r". For example, to limit the printout, but still receive some maintenance benefit from the monitor, enter:

```
MON,500,100
```

This will limit the printout to meteors that have a duration character count greater than 500, or a received character count greater than 100. These parameters may be adjusted as desired.

The command MONOFF turns off the burst monitor.

4.2.5 Controlling the Hourly Statistics Report

By default, an hourly statistics report is generated on the maintenance terminal port on the hour. This report consists of the same statistic reports generated by the BINS, MEM, and STAT commands.

The hourly report can be disabled by entering the command:

```
HOURLIES,OFF
```

The hourly report can be re-enabled by entering the command:

```
HOURLIES,ON
```

4.2.6 Scheduling MCC-545C Events

The SCHED command allows you to schedule automated command "events". An "event" simply consists of giving one or more commands a trigger time. When the MCC-545C's real-time clock reaches the trigger time, the scheduler invokes the command as though you had entered it from the MCC-545C's operator terminal.

Two different types of time trigger options are provided for command scheduling: INTERVAL and TIME. The INTERVAL trigger allows you to schedule a command to be invoked at periodic intervals within a 24-hour time period; the TIME trigger allows you to schedule a command to be invoked only once at a specified point within a 24 hour time period. The command schedule list is restarted each time the real-time clock reaches midnight.

To display the current schedule list, enter:

```
SCHED
```

To add a new command to the schedule list, enter:

```
SCHED,type,time{ OFFSET,time },command
```

where: type = INTERVAL or TIME

time = hours:minutes:seconds

OFFSET,hh:mm:ss = time offset from specified timeframe (optional)

command = any MCC-545C command (with parameters)

NOTE

The scheduler ignores certain commands due to their interactive nature. The MESSAGE command is currently the only one ignored

To remove command event(s) from the schedule list, enter:

```
SCHED,DEL,xxx
```

where: xxx = ALL (erases entire schedule)

or

= schedule list number (removes single scheduled event from the schedule list)

IMPORTANT

The MCC-545C currently supports up to 50 scheduled command events. The schedule list will be erased if the system software re-boots (not to be confused with power failure recovery, which will preserve the schedule list).

You can schedule several command events to trigger at the same time, however, you cannot force one command to execute before or after another. After assigning command events to the schedule, the order of commands displayed in the schedule list is the order in which the events will trigger for any given trigger time (i.e., an event with a low schedule number occurs before an event with a higher schedule number).

4.2.7 Setting Timeout Duration

There is one programmable time limit for the I/O port input on the MCC-545C. MCC recommends using the pre-programmed default timeout parameter. If you choose to change the timeout the time limits may be set by entering the number of seconds, from 0 to 32767. Enter a 0 to turn off the time limit.

<u>Command</u>	<u>Description</u>
----------------	--------------------

STT,secs	The Set Teleprinter Timeout command sets the time limit for characters at the maintenance terminal. Default is 60 seconds (1 minute).
----------	---

4.2.8 Setting Frequencies

The FREQUENCIES command is used in systems using synthesized frequencies only (see Section 2.7.4). To enable setting frequencies, you must first enter the following command to identify the system as a frequency synthesized system:

```
SYNTH,ON
```

You can then display/set the TX and RX frequencies using the following command:

```
FREQ{UENCIES{,aaaa,bbbb}}
```

where: aaaa = Tx Frequency (e.g., 4053 for 40.53 MHz)
 bbbb = Rx Frequency (e.g., 4153 for 41.53 MHz)

IMPORTANT

The MCC-545C limits the usable frequency range to a 2 MHz bandwidth. If frequencies are to be changed outside this bandwidth then hardware modifications must also be made to the MCC-545C.

If the synthesizer is unable to establish phase-lock when the **SYNTH,ON** command is entered, the MCC-545C will respond **UNLOCKED** to the request and turn off the TX key. It will try once a minute thereafter to establish phase-lock. If it fails, the message **Synthesizer unlocked** will be displayed; if it succeeds, the MCC-545C will respond **LOCKED** and turn on the TX key.

4.2.9 Defining Data Relays

The ambient noise conditions at a remote station site may sometimes be excessive and a poor communication path to the Master Station will result particularly if the remote station is operating in a meteor burst mode. To overcome this problem, another MCC-545C may be placed in a nearby quiet location and used as relay station between the MCC-545C at the noisy site and its master station. When used as a relay, the MCC-545C will concentrate the data reports it receives from one or more neighboring remote sites and forwards the data to the Master Station.

When used in the relay mode,, the MCC-545C must be defined as a Master Station. The relay will then receive MCC-550C sensor data GROUP reports (see MCC-550C Operations Manual), repackage them and forward them to the Master Station. A relay can handle a total of sixteen GROUP reports. These reports can be in any combination; i.e., four groups from each of four Remote units, one group from each of sixteen Remote units or any combination in between. Substitution tables must be established in both the relay unit and also at the Master Station to manage the relay function.

When a designated GROUP report is received at the relay, it will substitute its own ID and group number in the report as defined in its substitution table and forward the data to a MCC-520B Master Station using the MCC-550C RF format rather than the standard MCC-545C message format. When the relayed data is received at the MCC-520B it reconstructs the original data report based on its own substitution table and route the report as required.

The following command is used to define the entries in the substitution table for a relay unit:

```
SUBST,relay_id,relay_group,remote_id,remote_group
```

where: relay_id is the relay unit's ID
 relay_group is the data group report number at the relay
 remote_id is the originating Remote unit's ID
 remote_group is the data group report number at the originating Remote unit

4.2.10 Scaling A/D Readings

The MCC-545C automatically scales the readings from its A/D converter for operator use. The readings that require scaling are battery level, detected RF and transmit power. The scaling factors that are required for these readings will depend on the type of hardware used at the MCC-545C site and are set by operator command using the SCALE command. The SCALE commands are summarized in Table 4.1.

There are four values that need to be scaled depending on the equipment configuration at the site:

- Battery Voltage (used by the STAT/TEST commands)
- Detected RF in db (used by the MM command, meteor monitor and BINS command)
- Detected RF in microvolts (used by the STAT/TEST commands)
- Transmit power level (used by the STAT/TEST commands)

The required scaling factors are determined by the power supply used in the packet data radio. The RXTYPE command translates the receiver calibration curves from detected RF (in db) to microvolts. These are nonlinear and significantly different for the MCC-527 and MCC-543 receivers..

To apply the scaling factors, the TXPWR A/D value must first be squared and then multiplied by the scaling factor in the table. For the other values, use the A/D reading directly and multiply by the appropriate scaling factor.

MCC-545C SCALING FACTORS

PARAMETER	12V	36V	28V
BAT	0.0623	0.05	0.1749
DETRF	0.0188	0.1074	0.0188
TXPWR	0.000353	0.00116	0.000353
RXTYPE	527	543	527

TABLE 4.1

4.3 Sending and Receiving Messages

The MCC-545C is a packet data radio and therefore enables an operator to send and receive messages to all nodes within the network.

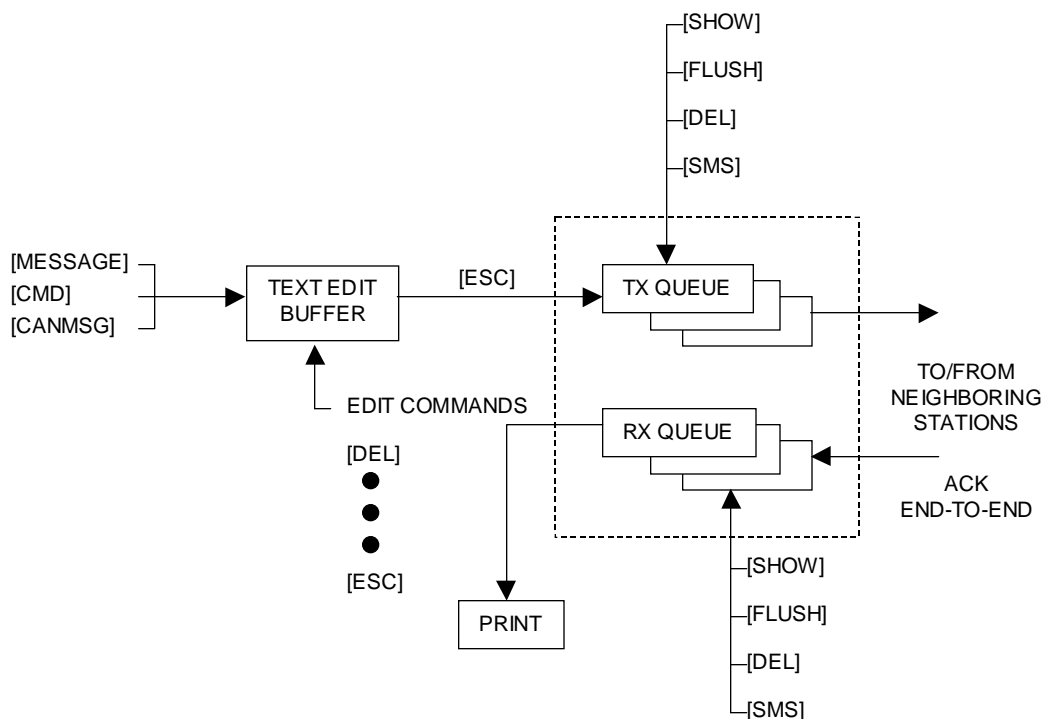
The messages may be entered from an operator terminal that is connected to the OPERATOR PORT of the MCC-545C. There are three basic message types: (1) free-form text messages, (2) canned messages and (3) commands. The general format for all messages is shown below:

MESSAGE, R , dest 1, dest 2, ...dest n

where: R = Message priority; A is highest, Z is lowest.

dest = ID of the station(s) to which the message will be sent.

Messages are first entered and edited in the TEXT EDIT BUFFER. They are then transferred to one or more TX QUEUE buffers for transmission to the designated destinations. The diagram below depicts the general flow of messages within the MCC-545C software and the various commands associated with each step in the process.



**MESSAGE FLOW AND ASSOCIATED COMMANDS
FIGURE 4.3**

The following operations are explained in this section:

<u>SECTION</u>	<u>OPERATIONS</u>
4.3.1	Entering and Deleting Messages
4.3.2	Editing Messages
4.3.3	Sending Messages
4.3.4	Sending Commands
4.3.5	Sending Canned Messages
4.3.6	Receiving Messages
4.3.7	Examining Message Status
4.3.8	Examining and Revising Message Queues

4.3.1 Entering and Deleting Messages

All messages are composed and edited in the TEXT EDIT BUFFER. Messages may be 3,570 characters in length. When composing the message press [CR] at the end of each 80 character line.

There is a default destination programmed into the MCC-545C during the installation and initialization of the unit when it is first brought on-line in the network. If a message is not given a specific destination it will be sent to the default destination only.

To enter a message:

1. Type MESSAGE. The operator terminal will respond with ENTER TEXT. The MCC-545C will now be in the compose and edit mode.
2. Enter a message up to 3,570 characters in length, pressing [CR] at the end of each 80 character line.
3. Press the [ESC] key. The message will now be transferred to a Tx queue and will be automatically transmitted to the default destination at a priority level R.

The following message will be displayed, or printed, on the operator terminal:

```
hh:mm:ss Message No: name:ss,nnnn chars, nnn segments
hh:mm:ss ROUTING name :sss TXT sss/nn TO: name
```

If you wish to send a message to multiple destinations, and at a different priority level, type

```
MESSAGE, R, dest1, dest2, ...dest n
```

where: "R" is any priority level from A to Z. A is the highest and Z is the lowest.
 "Dest" is the numerical ID of the stations to which the message will be routed.

NOTE

If you also want to send the message to your default destination you must enter its station numerical ID as one of the destination parameters ("dest1", "dest2", etc.) as specified above.

NOTE

If you want to use source routing enter 0 for the destination ID. When the master station receives this message it will send the message to the appropriate destination based on it's link table showing which destination(s) are linked with your station. Refer to the master station manual for more information on source routing.

There are three other special editing functions that may be used:

1. To Retransmit A Previously Entered Message

To retransmit a previously entered message simply depress the [ESC] key after the operator terminal prints ENTER TEXT and before any other key is depressed. The previous message entered into the TEXT EDIT BUFFER will then be sent to the destinations that are now designated in the MESSAGE command.

2. To Revise A Previously Entered Message

To revise a previously entered message press [CTRL]T after the ENTER TEXT prompt to revise a previously entered message or to recover from an aborted session. The previous message will be displayed with the cursor placed at the end of the message. You may now resume editing the message.

3. To Delete a Message

To delete a message after it has been placed in the Tx Queue, type

```
DELMSG, ID: sss
```

where: ID is the numerical station ID
sss is the message serial number

The operator terminal will print the date and time, followed by MESSAGE DELETED.

4.3.2 Editing Messages

The following editing functions may be used while the message is in the TEXT EDIT BUFFER.

KEY	FUNCTION
[DEL]	Deletes the last character entered.
[CTRL]R	Prints the current line of text on the next line down.
[CTRL]I	Performs a fixed tab function
\	Removes the current line from the edit buffer.
[CR]	Performs a carriage return and line feed.
[LF]	Performs a carriage return and line feed.
[CTRL]X	Removes the current line from the edit buffer and places the cursor at the end of the previous line.
[CTRL]T	Prints the contents of the edit buffer.
[CTRL]D	Erases the entire contents of the edit buffer.
[CTRK]A	Aborts the edit mode and returns to the command mode. A “+” indicates the command mode.
ESC	Leaves text edit mode and queues the message for transmission.

4.3.3 Sending Messages

Messages are automatically transmitted with the [ESC] command. Each message will be placed in the Tx Queue in accordance with its assigned priority. Messages of equal priority are placed in the Tx Queue in the order received from the TEXT EDIT BUFFER.

The following display will appear on the operator terminal as the MCC-545C begins to transmit a message:

hh:mm:ss Message No: name:ss,nnnn chars, nnn segments
hh:mm:ss ROUTING name :sss TXT sss/nn TO: name

Messages are transmitted in packets and are routed to their destination in a store and forward manner, using the most efficient routing within the packet switched network. The originating station will receive an acknowledgement (ACK) if the message has been received successfully by the first routing station.

mm/dd/yy hh:mm:ss TXTMSG ACK name:sss, xxxx CHARS FROM name

When the entire message has been delivered to its final destination an end-to-end acknowledgement will be displayed on the operator terminal:

hh:mm:ss END-TO-END ACK OF name:sss FROM name

If the end-to-end ACK is not received within the specified time-to-live limit, the MCC-545C will purge the message from the Tx Queue and display the following message:

hh:mm:ss MESSAGE TIME-TO-LIVE EXPIRED, MSG.NO:sss, DESTN: name

You must then reenter the message. Continued failure to successfully transmit a message indicates that something may be wrong with the equipment or the link (e.g., excessive noise interference).

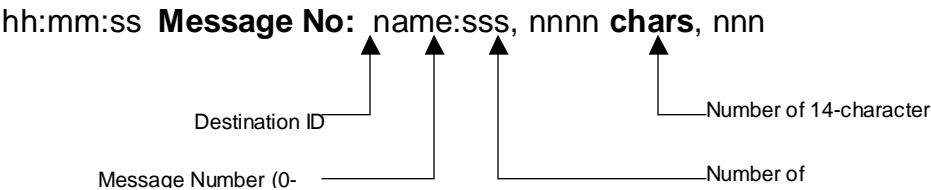
4.3.4 Sending Commands

Commands may be sent to any remote station within the network. The entry of a command is similar to the MESSAGE command described in Section 4.3.1.

REMCMD, R, dest1, dest2, ...destn

where: R = priority level
dest = numerical ID of destination station(s)

The operator is then prompted to enter the text of the command using the message editor. Once the command is entered, press the [ESC] key to send the command. The operator terminal will display:



A response will be received from the destination station(s) if it was successfully received.

4.3.5 Sending Canned Messages

The MCC-545C may be placed into a canned message mode for automatic transmission of a repetitive message to an assigned neighboring station. In the canned message mode no more than 25 messages may be placed into the Tx Queue at one time. You may either send an edited text message or a message that is randomly generated from the alphabet.

To enter a canned message generated from the alphabet, enter:

```
CANMSG,id,msg length{,min.queue depth}
```

where “id” is the neighboring station ID, the message length is from 1 to 3000 characters and the queue depth is from 1 to 25. The default queue depth is 5. Additional canned messages will be injected if the number of canned messages in the queue falls below the minimum queue depth.

To enter an edited canned message, enter:

```
CANMSG,id
```

where “id” is the neighboring station’s ID. After composing your message press the [ESC] key. The MCC-545C will automatically route up to 25 copies of the canned message to the destination station.

Each canned message will be acknowledged by the selected neighboring station. No end-to-end acknowledgement will be received.

To terminate the mode, enter:

```
CANMSG OFF,id
```

Canned messages are normally not printed at destination station. To print canned messages as they are received, enter:

```
CANMSG MODE,PRINT
```

To turn off the print mode, enter:

```
CANMSG MODE,NO PRINT
```

4.3.6 Receiving Messages

When a new message is received it is announced by the following display:

```
hh:mm:ss RECEIVING name:sss TXT sss/nn FROM name ROUTED TO: name
```

The MCC-545C then generates an ACK of the message packet and transmits the ACK to the neighbor from whom the message was received:

hh:mm:ss TXTMSG ACK name:sss, nnnn CHARS FROM name

When the destination MCC-545C receives a complete message, it displays the following message:

hh:mm:ss MSG RECEIVED name:sss, xxxx CHARS
text.....
end-of-message

where "name:sss" is the message serial number.

Messages are deleted as they are displayed or printed unless they are being forwarded to further destinations.

4.3.7 Examining MESSAGE STATUS

The status of all messages may be examined while they are still in the Tx Queue. (Note: once an ETE is received for a message it is deleted from the queue).

To examine a message, enter:

SMS {,ID}

4.3.8 Examining and Revising Message Queues

There are two types of queues for transmitting and receiving messages:

QUEUE NAME	DESCRIPTION
TXQ (Transmit Queue)	This queue is used for transmitting all messages. There is a separate transmit queue for each neighboring station in the network. For example, if you enter a message for DEST1 That message is placed in DEST1's transmit queue.
RXQ (Receive Queue)	This queue is used for all received messages. There is a separate receive queue for each neighboring station in the network. For example, to examine message statistics from NODE5, examine the receive queue from NODE5.

To examine the contents of either queue, type:

SHOW TXQ,ID or SHOW RXQ,ID

You must specify the queue by entering the station ID. For example, SHOW TXQ,006 prints statistics for all messages being transmitted to station 006.

You can only examine the receive and transmit queues for neighbor stations in the network.

To delete the contents of the transmit and receive queues, you must specify the exact queue by entering a station name:

FLUSH TXQ,id or FLUSH RXQ,id

For each message deleted, the terminal prints:

Id:sss unlinked {and deleted}

The “and deleted” text appears only if the message is not present in another queue. When all messages have been deleted, the terminal prints:

queue flushed

To delete a specific message, enter:

DEL MSG,id:sss

The terminal prints:

Message deleted

To delete all messages from all queues, enter:

FLUSH MSG

For each message deleted, the terminal prints:

Id:sss deleted

Entering the FLUSH MSG command deletes all messages in all queues for every node of the network, including connectivity and end-to-end acknowledgment messages.

4.9 Command Reference List

MCC-545C COMMANDS

All implemented MCC-545C commands are listed in Table 4.2 alphabetically for ease of reference. However, many commands are used in conjunction with others. These functional groups are given below. You may also type HELP or HELP,COMMAND to receive an explanation of any listed command. Command responses and unsolicited printouts are shown in Appendix A.

STATION CONFIGURATION**COMMANDS**

†*ASSIGN	†RCT
*BRATE	†REMOTE TYPE
*CHECKIN	†RXTYPE
†CLOSE PORT	SAVE
†CONNECT	†SCALE
DATE	†SCHED
*DESTINATION	SERIAL
*DEVICE	*SET BAUD
*DUTY CYCLE	†*SNP
*FREQUENCIES	*SOURCE RELAY
†HOST MODE	†START
†*ID	†STOP
†LOGOFF	†STT
†LOGON	†SUBST
*LOS CHECKIN	*SYNTH
*MODULATION	TIME
†NEW	†TIME ZONE
PASSWORD	
†OPEN PORT	*TXLIMIT
†PASSWORDMO	
DE	

MODE CONTROL COMMANDS

†CORPAT	†*HALF DUPLEX
*FULL DUPLEX	†*ROLE

MAINTENANCE COMMANDS

BOOT	SHOW TXQ
RESET	SMS
REV	UPDT
SHOW RXQ	

**WARNING/WEATHER SYSTEM
COMMANDS**

†FLOOD	†SENSOR
TIMEOUT	

STATUS**COMMANDS**

BINS	CANMSG
CLS	CANMSG MODE
CONFIG	CANMSG OFF
*HOURLIES	†COMPRESSION
MEM	DEL MSG
MODE	DQE RXQ
†MON	DQE TXQ
†MONOFF	FLUSH MSG
†NETMON	FLUSH RXQ
STAT	FLUSH TXQ
*STAT TIME	*HOLD
T	MESSAGE
TEST	*MSG
	*PRINT
	REMCMD

POSITION LOCATION COMMANDS

†*POS	†RED
†POSRPT	†RTCM

MASTER SIMULATOR COMMANDS

*P

DUAL MASTER STATION COMMANDS

†SWCTL	SWMON
--------	-------

UTILITY COMMANDS

FLASH	HELP
-------	------

DATA LOGGER COMMANDS

P77	SDATA
-----	-------

†GLOF	†STATION TYPE	†\$PENTM
†GLOF	†WARNING	
MONITOR		
†HORN	†WARNING	
	TIMEOUT	
†PRIORITY	†WEATHER	

CR10X COMMANDS

CR10X	CR10X,ORDER	CR10X,SETPTR
†CR10X,ACQMODE	CR10X,REGISTER	CR10X,SIGNATURE
†CR10X,GROUP	CR10X,RESET	CR10X,STAT
†CR10X,INTERVAL	†CR10X,SCALE	†CR10X,TIME
CR10X,MAXQ	CR10X,SECURITY	CR10X,UPLOAD

MASTER MODE COMMANDS

*BASE	NET STAT	SHOW MAINTENANCE MONITOR
CLEAR MAINTENANCE MONITOR	NET STAT PERIOD	SHOW REMOTES
CONFIGURATION	†POLL	SHOW RXQ
LISTM	PRG	SHOW TXQ
LISTT	REMOTE STAT	SML
MM	*REPEATER	SMS
NET	RX STAT	TYPE

* Parameters/settings specified by these commands are stored in the EEPROM. Changes specified by these commands take effect immediately but are lost when the unit is rebooted unless the SAVE command is issued to write the changes to EEPROM. Changing the unit ID automatically saves the entire configuration.

† Parameters/settings specified by these commands are stored in battery backed-up RAM. Changes specified by these commands take effect immediately but are lost when the unit is rebooted unless the SAVE command is issued to write the changes to BBU RAM; in addition, the BBU jumper must be in place to enable RAM back-up.

If both symbols are present on a command, certain aspects are stored in one way and other aspects are stored in the other. See command table below for clarification.

MCC-545C COMMANDS													
COMMAND	DESCRIPTION	PARAMETERS	RANGE										
<p>†*ASSIGN {,function,port,protocol {,timeout}}</p> <p style="text-align: center;">NOTE function, port and protocol information for ports 0, 1, 2 are stored in EEPROM; this information for port 3 and all timeout information is stored in BBU RAM.</p>	<p>Control allocation of user interface functions among physical device channels. When no parameters are entered, displays I/O configurations. Port definitions are as follows:</p> <table border="0" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center; border-bottom: 1px solid black;">Port</td> <td style="text-align: center; border-bottom: 1px solid black;">Front Panel Connector</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">OPERATOR PORT</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">DATA PORT</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">AUXILIARY PORT</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">DIAGNOSTICS PORT (Internal)</td> </tr> </table> <p style="text-align: center;">NOTE It is possible to “lose control” of the MCC-545C software by assigning control functions to ports with no devices attached or by turning off control functions. For example, if you turn off the Operator Port (ASSIGN,MNT,OFF), you will not be able to enter commands or view printouts from the MCC-545C. You must open the MCC-545C and press the Reset button on the microprocessor board to re-enable the Operator Port.</p>	Port	Front Panel Connector	0	OPERATOR PORT	1	DATA PORT	2	AUXILIARY PORT	3	DIAGNOSTICS PORT (Internal)	<p>function = user interface function</p> <p>port = physical device channel</p> <p>protocol = link level protocol</p> <p>timeout in seconds</p>	<p>MNT, POS, MSG, ALT, DTA, C&S,</p> <p>0-2, OFF</p> <p>APCL5, ASCII, CR10X, DATALITE, ENAV, FWS, GPS, GYRO, IDA, IHS, MSC, PHAROS, PKT, RTCM, TM8T</p> <p>0 – 32767</p>
Port	Front Panel Connector												
0	OPERATOR PORT												
1	DATA PORT												
2	AUXILIARY PORT												
3	DIAGNOSTICS PORT (Internal)												
* BASE {,nnn,nnn}	Set display range of Master Station IDs reserved for use as Base Stations	nnn = Master Station ID OFF = no Bases	2 – 245										
BINS	Print link distribution statistics												
BOOT	Cold start of Station software. All volatile memory is lost.												

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
*BRATE ,rate	Set transmit bit rate in kilobits per second. There is a low or high rate setting; effective rate at either setting is based on the componentry installed in the bit clock generator.	rate = 4K/4.8K or 8K/9.6K	
CANMSG ,nnnn (,msg length {,min queue depth})	Automatically generate a message of specified length that repeats until turned off with CANMSG OFF command. You can compose the message by entering only the destination name (not message length or minimum queue depth). Destination node must be a neighbor node. CANMSG cannot contain more than 25 messages in its queue. If the number of canned message in queue falls below minimum queue depth, additional canned messages will be injected.	nnnn = Station ID Master = 1 – 4095 Remote = 256 – 4095 msg length = number of characters in message min queue depth = min. # of canned messages in queue	1 – 4095 1 – 3000 0 – 25
CANMSG MODE {,mode)	Set reception of canned message to two of the following states: PRINT – print all messages NO PRINT – does not print messages	mode = PRINT NO PRINT	
CANMSG OFF ,nnnn	Turn canned message mode off	nnnn = Station ID Master = 1 – 245 Remote = 256 - 4095	1 – 4095
*CHECKIN {,ii}	Select check-in interval in seconds	ii = interval	1 – 65535
CLEAR MAINTENANCE MONITOR	Clear monitor Station		

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† CLOSE PORT ,function {,function,...}	<p>Close specified MCC-545C port from operation. You can enter more than one port name to close, using commas to separate the names on the same line.</p> <p style="text-align: center;"><u>CAUTION</u></p> <p>The OPEN/CLOSE PORT commands directly affect MCC-545C network activity and message flow. Do NOT use these commands unless directed to do so.</p>	function = user interface function	MNT, POS, MSG, ALT, DTA, C&S
CLS	Print current values, then clear link statistics (see STAT).		
† COMPRESSION {,action}	Enable/disable data compression on outbound messages/data reports. Intermediate nodes pass on the information in compressed form. The destination decompresses the information.	action = ON – enable OFF – disable	
CONFIG	<p>Show current configuration parameters report.</p> <p style="text-align: center;"><u>NOTE</u></p> <p>Configuration in EEPROM may differ unless the SAVE command is used after configuration changes are made.</p>		
CONFIGURATION	List major Master Station configuration settings.		
† CONNECT ,{nnn...}	Limits Master-to-Master connectivity for lab and field network configuration	nnn = Master Station OFF = no limitation	1 – 245
CORPAT	Without parameters, display report of available correlation patterns and indicate usage.		

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
†CORPAT,RX,action {,pppp...}	Define Receiver correlation patterns to recognize. Pattern 1 is the default and is the only pattern recognized if no others specified. Up to 16 pre-defined patterns are recognized.	action = ON – define patterns or OFF – use only default pattern pppp = pattern number; ALL means recognize all patterns	1 – 8
†CORPAT,TX,pppp {,ALWAYS}	Define Transmitter correlation pattern to send. Pattern 1 is the default and is the only pattern recognized if no other specified. Up to 16 pre-defined patterns may be used.	pppp = pattern number ALWAYS means use specified pattern instead of received pattern	1-- 8
CR10X	Display CR10X configuration parameters		
†CR10X,ACQMODE,mode	Set CR10X acquisition mode - Get all reports since last UPDT	mode = ALL – get all reports since last update CURRENT – get only the current data report LAST,n – get last “n” data reports	

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† CR10X,GROUP,source	Specify source of data report group assignment.	source = 545C – MCC-545C assigns group numbers; CR10X internal group number matches data array CR10X – CR10X assigns group numbers; MCC-545C gets group number from first sensor	
† CR10X,INTERVAL,n	Acquisition scan interval in seconds. OFF disables acq. scan	n = seconds	0 – 32767
CR10X,MAXQ,nnn	Set maximum number of reports to queue for each scan of the CR10X	nnn = number of reports	1 – 200
CR10X,ORDER,order	Specify order of final storage data (currently only FIFO is available).	order = FIFO – first in, first out LIFO – last in, last out	
CR10X,REGISTER,n{,ddd}	Read/Set internal storage register.	n = register number ddd = value	1 – 28 Signed floating point number (see CR10X manual)

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
CR10X,RESET	Reset CR10X internal error counters to zero		
† CR10X,SCALE,type	Define sensor scaling type.	type = 545C – data scaled in integer hexadecimal units CR10X – data scaled in Campbell Scientific floating point format	
CR10X,SECURITY,nnnn,nnnn,nnnn	Enter CR10X Internal Security Codes. See CR10X manual. If CR10X program contains security codes, this command (with correct security codes) must precede any other command for CR10X to respond.	nnnn = security code	0 - 9999
CR10X,SETPTR,DATE,TIME	Manual set up of last data pointer in the MCC-545C	DATE = mmddy TIME = hhmm	mm = 1 - 12 dd = 1 - 31 yy = 0 - 99 hh = 0 - 23 mm = 0 - 59

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
CR10X,SIGNATURE	Read and Display Current CR10X program signature. The Signature is a checksum of program bytes.	Signature = checksum	0 - FF (hex)
CR10X,STAT	Read and display CR10X internal pointers and error statistics.		
†CR10X,TIME,source	Specify source of data report group timestamp.	source = 545C – MCC-545C assigns timestamp CR10X – CR10X assigns timestamp; MCC-545C gets timestamp from second and third sensors	
DATE {,mm/dd/yy}	Set system date. If no parameters are given, show current date. If parameters are given, DOS calendar will also be updated.	mm = month dd = day yy = year	1 – 12 1 – 31 0 – 99
DEL MSG ,nnnn:sss	Delete specified message.	nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095 sss = message serial #	1 – 4095 1 – 255
*DESTINATION {,nnnn... .}	Set default message/data destination(s). Enter 0 to use source routing at the Master Station. If you turn off the MCC-545C's default destination, no data will be queued, and the message editor will ask you to enter a destination before sending a message. Up to four destinations may be specified.	nnnn = OFF, 0 or Station ID: Master = 1 – 245 Remote = 256 – 4095	0 – 4095

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
*DEVICE {,type}	Select device type mode of operation (i.e., the MCC-545C acts as a Remote or a limited Master Station).	type = REMOTE MASTER	
DQERXQ ,nnnn:sss	Delete specified message from the receive queue	nnnn=Station ID Master = 1 – 245 Remote = 256 – 4095 sss = msg serial number	1 – 4095 1 – 245
DQETXQ ,nnnn:sss	Delete specified message from the transmit queue	nnnn=Station ID Master = 1 – 245 Remote = 256 – 4095 sss = msg serial number	1 – 4095 1 – 245
*DUTY CYCLE {,percent}	Set transmitter duty cycle (default is 10%). Duty cycle increases in increments of 5%.	percent = 1 – 100	1 – 100
FLASH	Initiate flash memory download. You must type a dozen or so “f” characters after entering the command to cause the bootstrap to take control and initiate the download dialog.		
† FLOOD TIMEOUT {,t}	Display/set timeout period in minutes for the time after a flood that the Stations are to report once a minute	t = timeout in minutes	1 – 1440
FLUSH MSG	Delete all messages from all queues.		
FLUSH RXQ ,nnnn	Delete all elements of specified Station from receive queue.	nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095	1 – 4095

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
FLUSH TXQ ,nnnn	Delete all elements of specified Station from transmit queue.	nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095	1 – 4095
*FREQ{UENCIES} {,Tx,Rx}	Set operating frequencies of the MCC-545C/S. Componentry in the MCC-545C/S limits the usable frequency range to a 2 MHz bandwidth. If frequencies are to be changed outside this bandwidth, hardware modifications must also be made. The Frequency Synthesizer must be enabled via the SYNTH,ON command for FREQ{UENCIES} to have any effect. This command is meaningless on an MCC-545C.	Tx = Tx frequency in MHz times 100 Rx = Rx frequency in MHz times 100	4000 – 5000 4000 – 5000
*FULL DUPLEX	Set MCC-545C in full-duplex mode. IMPORTANT When set to full-duplex mode, the MCC-545C's receiver is disabled by the built-in Tx/Rx switch.		
†GLOF {,nnnn,nnnn}	Define the IDs for use as GLOF sensor Stations/display total GLOF setup.	nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095 OFF disables GLOF sensor Stations	1 – 4095
†GLOF MONITOR ,t,action	Setup timeout (in seconds) and action for the GLOF MONITOR Station	t = timeout in seconds action = ALERT, FLOOD	10 – 3600

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† *HALF DUPLEX {,n} <div style="background-color: #e0e0e0; padding: 5px;"> NOTE Duplex state is kept in EEPROM and probe interval is kept in BBU RAM. </div>	Set Master Station to half-duplex mode and specify number of milliseconds between idle probes. If no parameter specified, last setting is used (default = 30).	n = milliseconds between idle probes	30 – 30,000
HELP {,command}	Display help information on specified command. If no parameter entered, all commands are sequentially displayed in alphabetical order.	command = valid MCC-545C command	
*HOLD	Select message hold mode.		
† HORN ,function{,open,close,on,off,duration}	Defines horn timing setup	function = TEST, FLOOD, STAGE 2, STAGE3, ALL CLEAR open = valve opening time close = valve closing time on = on time off = off time duration = overall duration for on/off cycle	All times in seconds 1 – 15 1 – 15 1 – 3600 1 – 3600 1 - 3600

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† HOST MODE {,mode}	Define host mode functionality in composite networks when host link is not available.	STOP = stop transmitting if host connection lost CONTINUE = keep transmitting if host connection lost, but set bit flagging loss in probe OFF = ignore host connection state; keep transmitting and do not set bit flagging loss in probe	
* HOURLIES {,action}	Turn on/off hourly statistics.	action = ON – enable OFF – disable	

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
If device – Remote: Normal operation †*ID{,nnn,mmm{,mode} {,INIT}}	Set MCC-545C’s assigned Master Station ID to number “nnn”. When no parameters are given, current ID is displayed. When system is already initialized, you must enter the INIT parameter to change ID. INIT gives “OK” to save configuration and reboot unit with new ID. ID changes are automatically saved with the entire configuration in EEPROM. “mode” parameter (if used) specifies initial connectivity with specified Master. PREF means Remote considers connectivity established. AUTO means no connectivity established. FIXED (Default) means connect only with specified Master.	nnn = Remote ID mmm = Master ID mode = PREF , AUTO or FIXED	256 – 4095 1 – 245
	<p>NOTE</p> Remote and Master IDs are kept in EEPROM and mode is kept in BBU RAM.		
	<p>NOTE</p> If command does not change the ID or Master Station, the SAVE and reboot are not performed.		
†ID,mode	Change " mode" as discussed above without affecting ID; no reboot performed.	mode = PREF , AUTO or FIXED	
If device = Master: *ID{,nnn{,INIT}}	Set MCC-545C’s assigned Master Station ID to number “nnn”. When no parameters are given, current ID is displayed. When system is already initialized, you must enter the INIT parameter to change ID. INIT gives “OK” to save configuration and reboot unit with new ID. ID changes are automatically saved with the entire configuration in EEPROM.	nnn = assigned Master ID	1 – 245
	<p>CAUTION</p> If you enter INIT , you will lose all current message information.		

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
LISTM {,nnnnn...}	Display Remotes with burst monitor bit set (<u>all</u> Remotes or given IDs up to 12).	nnnnn = Station ID Master = 1 – 245 Remote = 256 - 4095	1 – 4095
LISTT {,nnnnn}	Display Remotes with “Type” flag set (<u>all</u> Remotes or given IDs up to 12)	nnnnn = Station ID Master = 1 – 245 Remote = 256 - 4095	1 – 4095
†LOGOFF	Used to disallow operator commands with automatic 10 minute timeout for LOS role and 60 minute timeout for TRANSPOND role. Logs you off, disables ALL following operator commands except LOGON , \$PENTM , or SDATA .		
†LOGON ,password	LOGON used to allow operator commands. To log onto a unit, enter the LOGON command followed by the current password. This will remain in effect for a timeout period (10 or 60 minutes depending on operating mode), or until you log off. Default = MCC-545C	password = 3-20 character password	A-Z, 0-9, -
*LOS CHECKIN {,ii,rr}	Select check-in interval (in seconds) and retry count for LOS operation.	ii = interval rr = retry	1 – 65535 1 – 65535
MEM	Show usage of dynamic pool memory.		

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
MESSAGE {,p{,dest1...destn}}	Enter a message with text editor. Message priority and destination are optional parameters. After entering message, press [ESC] to queue for transmission. If you do not enter a destination ID, the MCC-545C automatically sends your message to its default destination (set with the DESTINATION command). If you want to use source routing, enter 0 for the destination.	p = priority dest1. . .destn = destination(s) name = node name nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095	A – Z, 0 – 9 A – Z, 0 – 9 1 – 4095
MM	Print current value of RF signal on Receiver		
MODE	Print operating mode information.		
*MODULATION ,degree, encoding	Set the transmit modulation and data encoding. IMPORTANT 545C modulation must be the same as other units in the network.	degree = 90 or 30 encoding = MAN for Manchester, DIFF for differential	
†MON {,d{,r}}	Turn on burst monitor. Only meteors lasting long enough to deliver “d” characters will be monitored. If at least “r” characters were received, a monitor line is generated.	d = duration character count limit r = received character count limit	0 – 32767 0 – 32767

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
MONITOR { action{ ,nnn { ,nnn,...,nnn } } }	Control monitoring of individual units and print burst statistics. Overrides MONOFF command and causes monitor lines to print for each reception from this unit.	action = ON – enable OFF – disable nnn = units to be monitored ALL – default Master = 1 - 245 Remote = 256 - 4095	1 - 4095
‡ MONOFF	Turn off burst monitor		
*MSG	Display and delete top operator message in receive queue when message HOLD is enabled.		
NET	Display network routing table for all selected neighbors. NET – no neighbors NET1,2 – 1,2, etc. neighbors NET,all – all neighbors		
NET STAT	Display network statistics. Statistics accumulate from the beginning of each hour and are cleared at the end of the hour.		
NET STAT PERIOD { ,minutes }	Enable display of network statistics and set period between displays (in minutes). Disable display by setting period to zero (0).	Minutes = number of minutes between each display	0 - 32767
NEWPASSWORD ,old password, new password	Used to change the password. The NEW PASSWORD command is used to change the internal stored password. You must be logged on and know the old password. The password will automatically be saved.	password = 3-20 character password	A-Z, 0-9, -

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
†OPEN PORT	<p>Resume activity on specified closed port. You can enter more than one port name to open, using commas to separate the names on the same line.</p> <div style="background-color: #e0e0e0; padding: 5px; text-align: center;"> <p>CAUTION</p> <p>The OPEN/CLOSE PORT commands directly affect MCC-545C network activity and message flow. Do NOT use these commands.</p> </div>	function = user interface function	MNT, POS, MSG, ALT, DTA, C&S
*P{,?}{,xxx}{,OFF}	<p>Configures MCC-545C for pulse probe mode. If no parameters are entered, transmit single pulse probe. Enter transmit single pulse probe. Enter P,? to display current pulse probe mode settings. Enter P,xxx to send a single periodic probe once every “xxx” seconds. Enter P,OFF to turn off periodic pulse mode (you can still transmit single pulses with P).</p>	<p>? = current settings xxx = periodic pulse period (in seconds) OFF = turn off periodic pulse mode</p>	
P77	<p>The P77 command must be used to place the Julian date into position one, and Hour/Minute into position two. With this setup, the MCC MCC-545C will strip off the first two sensor values and place the date and time derived from these values into the standard MCC 550B report.</p>		

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† PASSWORDMODE ,action, password	Used to enable/disable use of passwords. Default is disabled. To enable or disable the operation with passwords, enter this command giving the desired action along with the current password for the unit. This will trigger an automatic "save" operation. If set to the ON mode, the state of the unit will be set to "logged-off". All operator and remote commands except scheduled commands, \$PENTM commands, and SDATA commands will respond with "ACCESS DENIED!". You will not be able to turn off the mode without first logging on.	action = ON – enable OFF – disable password = 3-20 character password	A-Z, 0-9, -
\$PENTM	Without parameter string, display report of current Entek MDP configuration.		
† \$PENTM, ALERTEVENTS {,mask}	Set bit mask indicating Entek MDP status bits regarding as alarms. Status bits are checked against this mask on intercepted position reports and an alert message is sent to the local MNT and DTA ports for each match.	mask = hexadecimal bit mask	0 – FFFF
† \$PENTM,ALERTMSG S {,nnn...}	Define canned messages constituting an alert. Any number may be defined (up to 10 per line). Intercepted messages matching one of these numbers cause an alert message to be sent to the local MNT and DTA ports.	nnn = canned message number	1 – 120
\$PENTM ,command string	Send command string to local Entek MDP.	command string = any valid Entek MDP command string	
† \$PENTM ,action	Enable/disable Entek MDP interface. When enabled, allows communication with mobile data processor in vehicle tracking applications and causes received status bits from the MDP to be included with the position data in the Remote's data reports.	action = ON – enable OFF – disable	

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
‡ POLL {interval,offset,duration,retry}{,ALWAYS}	Define/display polling schedule for Base/Repeater Station. If ALWAYS parameter specified, do not timeout on-line units (i.e., ignore retry count in this case).	interval = polling interval in seconds offset = offset from top of minute duration = length of poll retry = retry count for failed polls	1 – 86400 1 – 59 1 – 10 1 – 99
* POS {,interval,format,protocol}	Display/initialize internal MCC-545C timing for reporting GPS position data. Specify update period in seconds, in either binary or text format, using given protocol.	interval = reporting interval in seconds format = display format protocol = GPS unit protocol	0 – 65535 BINARY, TEXT NMEA, ARNAV, TAIP, TRANSAS
‡ POS,LOCAL {,interval}	Display/initialize timing for local output of position reports on MNT and DTA ports as well as sending them.	interval = reporting interval in seconds; OFF disables local output	1 – 86400

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† POSRPT {,action}	Enable/disable echoing of intercepted position reports to local MNT and DTA ports. Also used to enable/disable duplicate filtering and control format of these reports.	action = ON – enable OFF – disable DUPL,ON – enable duplicate filtering DUPL,OFF – disable duplicate filtering FORMAT,LON G – output report on two lines FORMAT,SHORT – output report on one line	
PRG ,nnn	Undefine MCC-545C Station from network.	nnn = Master Station ID	1 - 245
*PRINT	Enable messages to print as they are received.		
† PRIORITY ,message type,p	Define priority characters for each message type.	message type = FLOOD , ALERT , ROUTINE p = priority	A - Z, 0 - 9

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† RCT {,action}	Display/set remote control terminal functionality. This functionality is applicable to Packet protocol systems only and controls whether the unit ignores intercepted data reports. If enabled, intercepted reports are ignored.	action = ON – enable OFF – disable	
RED	Without parameters, generates report of current RED setup.		
† RED, ID ,nn- nnn	Enables reception of remote emergency indications from an MCC Remote Emergency Device (RED). The entered ID code is used with RED messages generated by the MCC-545C using RED, TEST or RED, TX .	nn = call sign prefix nnn = call sign suffix	0 – 99 0 – 999
† RED, NUM ,n	Set dead-band interval in which repeated RED activations do not generate another alert message.	n = dead-band interval in seconds	1 – 120
† RED, OFF	Disable reception of remote emergency indications from an MCC Remote Emergency Device (RED).		
RED, TEST	Simulate a RED test message. Unlike a true RED test button depression, this message is also echoed to the local MNT and DTA ports.		
RED, TX	Simulate a RED alert message. Unlike a true RED alert button depression, this message is also echoed to the local MNT and DTA ports.		

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
REMCMD .p,dest1{,...destn}	With the text editor, enter a command to be sent to a Remote. After entering command, press [ESC] to send the command.	p = priority dest1...destn destination(s) name = node name nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095	A – Z, 0 – 9 A – Z, 0 – 9 1 – 4095
REMOTE STAT {,nnnn...}	Display transmit/receive statistics for <u>all</u> Remote Stations or for given IDs (up to 12).	nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095	1 – 4095
† REMOTE TYPE {,aaaa}	Display/set communication characteristics of the unit. Determines how certain statistics are reported and how remote commands/messages are framed.	aaaa = COMM DATA PACKET	
*REPEATER {,nnn}	Define/display Base Station to which the Repeater site repeats.	nnn = Base Station ID OFF clears a previously established definition	1 – 245
RESET	Perform hardware reset to clear and reinitialize I/O channels and RF controller. This command retains previous network configurations and message traffic.		

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
REV	Display part and revision numbers of current Link Controller and Tx/Rx Controller software.		
†*ROLE{,role{,low,high}{,mode}}	<p>Define role played in network, either SILENT (never transmits), TRANSPOND (responds to probes), PROBE (actively probes), or LOS (line of sight) mode. If role is set to TRANSPOND, the low and high parameters can be used to specify the threshold values for automatic meteor burst vs. line of sight modes of operation and the mode parameter can set the starting mode (meteor burst or line of sight).</p> <p>Thresholds are specified in idle probes per minute. To prevent LOS operation altogether, set the low threshold to 1000 if the unit's Master is half duplex or 5500 if it is full duplex.</p>	<p>role = SILENT, LOS, TRANSPOND or PROBE low = threshold for switching from LOS to MB mode in idle probes per minute high = threshold for switching from MB to LOS mode in idle probes per minute mode = MB or LOS</p>	<p>0 – 32767 0 – 32767</p>
†RTCM{,nnn}	Define time latency in seconds between beacon receiver and local time. Without parameter, display report of satellites in view by beacon receiver.	nnn = latency in seconds	0 – 59
RXSTAT{,CLEAR}	Display statistics for the MCC-545C Receiver	CLEAR = clear all statistics after display	
SAVE	Save CONFIG parameters in EEPROM. Reboot of MCC-545C (or restart due to software failure) returns unit to configuration saved in EEPROM.		

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† SCALE {,parameter,value }	Display set A/D scaling factors for the unit. Factors depend on type of receiver and power supply used in the MCC-545C.	parameter = BAT – battery voltage DETRF – detected RF TXPWR – transmit power value = scale factor	
† SCHED {,basis,hh:mm:ss {, OFFSET ,hh:mm:ss}, command string}	Schedule execution of the specified command string. If timeframe basis = INTERVAL , the command string will be executed whenever the specified time interval elapses during the day. If timeframe basis = TIME , the command string will be executed at the specified time. The OFFSET option allows specification of an offset from the timeframe basis.	basis = TIME or INTERVAL hh - hours mm - minutes ss - seconds	0 – 23 0 – 59 0 – 59
† SCHED,DEL ,nn	Delete specified schedule item number. If nn = ALL , the entire schedule will be cleared.	nn = schedule item number	1 – 50
SDATA ,g,c,time stamp, value...	Enter an MCC-550C data report directly from the serial I/O port. Up to 16 values may be entered. Use the LINK command to route the data.	g = group number c = sensor count time stamp = mmdddhhmn value = ASCII hex sensor value	1 – 4 1 – 16 mm 1 – 12 ddd 1 – 365 hh 0 – 23 mn 0 – 59 0 – FFFF

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† SENSOR { function } { weight } { low,high } }	Defines the GLOF sensor data limit for fail/dry/wet determination. Gives the “weight” (i.e., how significant) of each case for the flood calculation.	Function: DRY WET FLOOD FAIL	LOW 1 - 99 HIGH 1 – 9999 WEIGHT 1 - 99
SERIAL { ,sss }	Set next packet serial number. Parameter “sss” is serial number of last packet transmitted.	sss = message serial number	1 – 255
*SET BAUD { ,function,rate,flow }	Adjust baud rate and flow control of specified port. When no parameters are entered, this command displays I/O configurations.	function = user interface function rate = baud rate flow = flow control	MNT, POS, MSG, ALT, DTA, CANDS, 110, 150, 300, 600, 1200, 2400, 4800, 9600 Y or N
SHOW REMOTES	Display ID and assigned 520B of each Remote in system.		
SHOW RXQ,nnnn	Display contents of receive queue for the originating Station.	nnnn = originating Station ID Master = 1 – 245 Remote = 256 – 4095	1 – 4095
SHOW TXQ,nnnn	Display contents of transmit queue for the destination Station.	nnnn = destination Station ID Master = 1 – 245 Remote = 256 – 4095	1 – 4095

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
SML {,nnnn}	Display names and serial numbers of message packets in specified message list. If parameter is not entered, all message packet names and numbers are displayed.	nnnn = destination Station ID Master = 1 – 245 Remote = 256 – 4095	1 – 4095
SMS {,nnnn}	Display status of message packet in specified message list.	nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095	1 – 4095

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
†*SNP {pname,value} <div style="background-color: #e0e0e0; padding: 5px;"> <p>NOTE Some network parameters are only for use in Master Operation mode (RDOWN, CONNP, TEXTL, FLOODP, INF, RELAY).</p> <p>NOTE TTL, TTR, NUP, NDOWN, RDOWN, OTL, HTO, TEXTL, CONNP, ETEAP, FLOODP, RELAY and INF are kept in EEPROM; DATAP and MBHOP are kept in BBU RAM.</p> </div>	Set network parameters. See range column for values entered for each parameter.	pname – TTL time-to-live TTR time-to-retransmit N UP neighbor up N DOWN neighbor down R DOWN Remote down OTL outstanding text limit CONNP connectivity msg. precedence ETEAP End-to-End ACK precedence HTO history file timeout TEXTL text size in segments FLOODP partial flooding prec. level INF infinity hop quantity DATAP priority of data reports created by MCC-545C	0 – 2550 min. (truncated to 10 min. bndry) default = 120 0 – 255 min. default = 20 1 – 255 acq. default = 20 1 – 255 min. default = 20 0 – 32767 default = 1440 1 – 255 default = 20 0 – 9, A – Z default = 1 0 – 9, A – Z default = 0 1 – 255 min. default = 120 5 – 255 default = 32 A – I default = A 2 = 255 hop default = 8 A – Z default = Y 1 – 99 default = 1 ON, OFF

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
*SOURCE RELAY {,nnnn}	Specify source routing table of one entry. The designated Station will receive all information sent without an explicit destination specification. If set to OFF , such information is discarded.	nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095	
†START	Turn transmitter on.		
STAT	Display RF statistics report.		
*STAT TIME {,xx}	Set interval (in hours, starting at midnight) when MCC-545C automatically transmits statistics to Master Station.	xx = interval	1 – 24 hours
†STATION TYPE {,aaaaa}	Display/set special Station functionality. Determines how each Station responds to the messages it receives and limits the type of messages that can be created. Meaningful only in Flood Warning and Maritime Weather Systems.	aaaaa = OFF FLOOD BASE FLOOD WARNING GLOF SENSOR GLOF MONITOR GLOF WARNING RELAY STREAM GAUGE SYSTEM MONITOR WEATHER	
†STOP	Turn transmitter off.		
†STT ,secs	Set command timeout (in seconds). Default is 15 seconds.	secs = time limit before reset (0 -off, >0 -on)	0 – 32767

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
†SUBST,rrr,g1,nnn,g2	Substitute Remote unit information in data reports received from a relay unit.	rrr = relay ID g1 = relay grp# nnnn = Remote ID g2 = Remote grp#	1 – 245 0 – 15 256 – 4095 1 – 4
†SUBST,DEL,ALL	Delete entire substitution table		
†SUBST,DEL,rrr,g1	Delete entry in substitution table	rrr = relay ID g1 = relay grp#	1 – 245 0 – 15
†SWCTL,OFF	Disables the monitoring and switching function.		
†SWCTL,ON,timeout,start delay	When the software boots up from a reset state, it will test the two RS-232 ports to determine which one is currently active, assuming the switch may have been manually controlled while it was off. From then on, it monitors the two Masters assuming the primary Master (1) is connected to the DTA port, and the Secondary Master (2) is connected to the ALT port.	timeout = inactivity time in seconds resulting in switchover. start delay = interval in seconds after starting before monitoring Master Stations.	1 – 32767 1 - 32767
SWCTL,SW,n	Switch to designated Master Station switch position.	n = switch position	1 - 2
SWMON	Monitors both the RS-232 port and RF link. This SWMON command should be placed in the schedule of the MCC-545C at an interval that detects a Master Station failure within the required system design. There are no parameters. A typical example is: SCHED,I,5:0,SWMON		

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
*SYNTH{,action}	Display/set status of frequency synthesizer. This command is applicable only to the MCC-545C/S.	action = ON – enable OFF – disable	
T	Show current date/time.		
TEST	Send test transmission and return updated statistics (uses same format as STAT command).		
TIME {,hh:mm:ss}	Set system time. If no parameters are specified, show current time. If parameters are given, DOS calendar will also be updated.	hh – hours mm – minutes ss – seconds	0 – 23 0 – 59 0 – 59
† TIMEZONE {,UTC,sys}	Set local time zone offsets from UTC time (GMT) and system time.	UTC = offset from GMT sys = offset from system time	-12 – 12 -12 – 12
TRACE ,action,data stream	Diagnostic command used to enable/disable detailed analysis of the specified data stream.	action = ON – enable OFF – disable date stream = RF , GPS , MSC , RTCM	
* TX LIMIT {,count}	Set limit on number of transmissions allowed in a 15-minute period (in minutes).	count = # of transmissions period = minute	

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
TYPE {,action{,nnn{nnn, ... ,nnnn}}}}	Control auditing of messages entered at specified units and routed through the MCC-545C.	action = ON - enable OFF - disable nnn = units to be audited. ALL – default Master = 1 – 245 Remote = 256 – 4095	1 - 4095

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
UPDT{,function,parameters}	Send update message to data logger type device.	<p>NOTX: Read sensors but do not transmit data read</p> <p>TX: Read sensors and transmit data read</p> <p>TIME: Set time of MCC-545C in logger</p> <p>TEST: Operate a component in test mode:</p> <p>ALERT FLOOD HORN GATE WARNING</p> <p>OUT: Set output register:</p> <p>BYTE BIT,BITNUMBER MBER BITS,START BIT, ENDBIT</p> <p>ARM: Enable alarm activation</p> <p>DISARM: Disable Alarm activation</p> <p>RESET: Reset alarm condition</p>	<p>RM: Routine message format</p> <p>RMP: RMP Message format</p> <p>value appropriate to the register: 0 – 255 1 – 8 (bit); 0 - 1 1 – 8 (bits); 0 - 255</p>

MCC-545C COMMANDS			
COMMAND	DESCRIPTION	PARAMETERS	RANGE
† WARNING ,{ nnnn,nnnn }	Define the IDs for use as the Standard Flood Warning Stations. Without parameters, displays total WARNING setup.	OFF = disables nnnn = Station ID Master = 1 – 245 Remote = 256 – 4095	1 – 4095
† WARNING TIMEOUT {,t}	Define/display timeout period in seconds for a Flood Base Station to determine a communications failure	t = timeout in seconds	10 – 3600
† WEATHER {,action }	Enable/disable Maritime Weather system functionality. Without parameters, displays total WEATHER setup.	action = ON – enable OFF – disable	
† WEATHER,REPORT ,t	Defines data reporting interval in minutes for a Maritime Weather Station.	t = report interval in minutes	0 – 32767

TABLE 4.2