C Plus

DISPATCH DISPLAY AND COMPUTER INTERFACE UNIT

Service and Installation Manual
P/N 05 50 0600

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C Plus Dispatch Display and Computer Interface Manual
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FleetSync™ is a trademark of Kenwood Corporation
GE-STAR® is a registered trademark of General Electric Corporation

Not all described features are included with all systems. Contact Cimarron Technologies for instant access to particular features.

Manual revision C Plus 050830

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Features

What Is the C Plus

The C Plus is a data encoder and decoder capable of communicating in any of the following formats: GE Star®, MDC-1200®, FleetSync™, NYSP GE Star® and DTMF. It is built to help fleet dispatchers/controllers to communicate with and manage their fleets. The C Plus family consists of a C Plus I (no alphanumeric display), a C Plus II (Single window alphanumeric display) and a C Plus III (multiple window alphanumeric display).

The C Plus was developed to be:

- Friendly with current technology
- Real-Time
- Interactive and Flexible
- Powerful and Easy to Use
- Flash programmable to allow for future features and systems
- Industrial-strength

Capabilities

The C Plus family provides these capabilities:

- User programmable to communicate in any of the following formats: GE Star®, MDC-1200®, FleetSync™, NYSP GE Star®, and DTMF.

- Dual or triple format decode, allowing one C Plus to decode two or three selected signaling formats.

- Full two way signaling with GE Star® format. Automatic emergency acknowledgments with all formats.

- Two-way compatible with MDC-1200® radio check, sel call, open microphone monitor, and call alert signaling of the Motorola Stat Alert feature set.

- Capable of encoding and responding to MDC-1200® Repeater Access, Setup and Knockdown signaling.

- Programmable to decode, display and acknowledge up to eight MDC-1200® short status messages.

- Large, highly visible main display.

- Multiple window displays are available, capable of simultaneously displaying up to six of the last received ID's.

- Alias programmable, relating ID's to alphanumeric aliases of up to eight characters long.

- In MDC-1200® signaling, decodes and displays the entire allowable HEX ID set.

- All Star bit formats are supported.

- Decodes and displays both the FleetSync™ fleet number and unit ID.

- Message types can be renamed to permit customized systems.

- Allows the review display of the last twenty received messages.

- Data Mute relay output provides N.O. and N.C. relay contacts to be used to mute associated receiver during data reception.

- COS qualified muting. Keeps the associated radio audio muted until after a valid decode and remutes the audio when signal reception ends.

- Two programmable open-collector outputs can be related to the reception of types of messages. Outputs can be used to trigger external alarms, autodialers, counters, etc.

- Internal sounder can be programmed to create different audible alerts depending on message type received.

- "Ambush", permits user to tell the C Plus to send a message to a unit as soon as the unit is heard from again. This allows the preparation of radio-kill or selective call messages even when the target radio is turned off or out of communication range. A maximum of 10 messages can be queued for transmission.

- "Authorize", permits the C Plus to be used to allow only authorized users access to repeater systems.

- "Enunciate" feature allows unique tones to be sounded when specific ID's are received.

- Equipped with Serial port, IR port and USB port to facilitate connection to modern IT equipment. (IR and USB Not yet implemented)

- User programmable for a selection of many output formats.

- Built in ATE performs loop-back tests, data modulation tests and line output tests.

- Programmable display type permits "Taxi Bid", "Scrolling", and "Message and Assignment" presentations.

- Incorporates a real time clock so all received data is time stamped.

- Fully functional in trunking and conventional environments.

- Compatible with Tone remote key and function tones.

- External display clear connection can be attached to a footswitch to clear the display by a dispatcher without reaching for the decoder.

- For two-way signaling, a hand-held terminal (CDT) can be used or Cimarron software can be used in a laptop for wireless connection via the IR transceiver. (IR Not yet implemented)

- Audio connections can be balanced or single ended, 600 ohm or high impedance circuitry.

- AGC conditioning precludes the need for any adjustments on the receive side.

- Rack mountable and many units can be "hubbed" together via USB or serial port to accommodate complex mixed format and/or multiple

radio systems. (USB Not yet implemented)

In order to provide these services, the C Plus must be correctly installed and programmed. Some features may require the use of a compatible laptop computer, pocket computer or hand-held terminal.

Specifications

Data Formats   GE Star®, MDC-1200®, FleetSync™, NYSP, DTMF

Modulation Type

GE Star®   PSK 400 BPS on 1600Hz ± 1.5% carrier

MDC-1200®   FSK 1200 BPS at 1200/1800Hz

FleetSync™   MSK 1200 BPS at 1200/1800Hz

DTMF

Allowed Characters		0 through 9, A, B, C, D, * or E, # or F
Maximum Length		Eight characters or Seven plus status
Twist Acceptance		-8 to +4 dB
Noise Tolerance	-12dB	
Frequency Tolerance		± 2.5% of DTMF Frequency
Minimum digit length		programmable 25mS to 5000mS
Maximum inter-digit pause		programmable 50mS to 9999mS
Status Reporting		If enabled, first or last received character refers to status
ID Qualifying		If enabled, maximum of 5 character prefix qualifies decode

Display Memory   Review twenty previous messages by pressing "REVIEW" button on C Plus II and C Plus III

Display Type

C Plus I   Ten LED's indicating: Mute, Decode, Transmit Busy, Key, Modulation, IR Disable, System Error, Transmit I/O, Receive I/O and Power

C Plus II   Eight large (0.7") 5x7 pixel LED display matrixes capable of displaying up to eight digit number or alphanumeric alias.

C Plus III   Eight large (0.7") 5x7 pixel LED display characters capable of displaying up to eight digit number or alphanumeric alias. Twenty Eight 0.3" 5x7 pixel LED display characters capable of displaying programmed message and assignment fields or up to six of the previously received ID's or aliases

Data Input

Single ended	30mv to 12Vpp
Balanced	600 Ω: -30 to +10dBm; Hi Z: -36 to +4dBm

Data Output

Single ended	600 Ω: to 14Vpp
Balanced	600 Ω: to +10dBm; Hi Z: to +16dBm

Interfaces

Serial	RS-232C, ASCII via RJ-11 connection, programmable
	Baud Rate: 1200, 2400, 4800, 9600
	Data Bits: 7 or 8
	Parity: Odd, Even or None
	Handshake: None
	Power: +5VDC on pin 1 to supply CDT
USB	Type B USB connector on back of decoder
	Complies with USB specification Rev. 1.0
	USB Human Interface Devices /Monitor Control Class (Not yet implemented)
IR	IrDA Compliant, 9600 Baud, Distance up to 12 ft with maximum 15° of Horizontal and Vertical center (Not yet implemented)
Data Mute	Form C Relay, 1A, N.C., N.O. and Armature.
Key Output	Open collector transistor, sinks up to 500mA
External Alarms	Two open collector transistors, sink up to 500mA each. Software programmable to respond to any number of selected message types.

Dimensions

C Plus I	7.87" x 6.25" x 2.5"
C Plus II	7.87" x 6.25" x 2.5"
C Plus III	7.87" x 6.25" x 4.75"

Power Requirements   5 VDC ± 5% at 2 A

Sounder   Audible 3400 Hz 80db(A) @ 2'. Programmable

Enhancements
Cimarron's C Plus is modularized to allow you to enhance your capabilities without returning the unit for upgrade.   Most of these features can be activated over the telephone.

Optional features and software modules include:

- Aliasing

- Two way communications

- Dual and Triple format decode permits multiple ANI signaling type fleets

- Tone remote compatible with Key and function tones

- User interface software to send base to mobile messages (selective call, open mike monitor, interrogate, radio kill, etc.   (Not yet implemented)

- System software for compatibility and access to the C Plus IR and USB ports. (Not yet implemented)

C H A P T E R   2
Installation

Interfacing to a Radio System

Jumper Information

Jumper	Default	Purpose
JP-1	Out	For factory use.
JP-2	Out	Applies 5VDC to the RJ-11 serial connector to power an external CDT.
JP-3	In	Attaches RxMute Output to the normally open contacts of the mute relay.
JP-4	Out	Attaches RxMute Output to the normally closed contacts of the mute relay.
JP-5	8-7 In 6-5 Out 4-3 Out 2-1 Out	Provides 0dB of gain. Provides 12dB of gain. Provides 24dB of gain. Provides 36dB of gain.
JP-6	In	Applies a ground to RxMute Common.
JP-7	In	Internally references the data in common line to ground.
JP-8	Out	Adds 6 dB of attenuation to the data in signal. For use only in balanced systems.
JP-9	Out	Adds 12 dB of attenuation to the data in signal. For use only in balanced systems.
JP-10	Out	Adds 18 dB of attenuation to the data in signal. For use only in balanced systems.
JP-11	In	Adds 6 dB of attenuation to the data in signal. For use only in unbalanced systems.
JP-12	Out	Adds 12 dB of attenuation to the data in signal. For use only in unbalanced systems.
JP-13	Out	Adds 18db of attenuation to the data in signal. For use only in unbalanced systems.
JP-14	Out	Internally applies a 600-ohm termination to the data input lines. For use in balanced systems requiring termination.
JP-15	In	Grounds the microprocessor side of channel busy. If channel busy is programmed for active low and JP-2 is intact, the C Plus will always believe that the associated radio channel is available (not-busy).
JP-16	Out	Adds a pull-up resistor to the PTT input line.
JP-17	Out	For factory use.
JP-18	Out	For factory use.
JP-19	Out	Connects PTT in with KEY out.
JP-20	In	In conjunction with JP-21, selects NPN transistor for PTT input circuit. This provides a crossover point of $0.5VDC \pm 0.3vdc$ for the detection of PTT.

JP-21	In	In conjunction with JP-20, selects NPN transistor for PTT input circuit. This provides a crossover point of 0.5VDC ± 0.3vdc for the detection of PTT.
JP-22	Out	In conjunction with JP-23, selects PNP transistor for PTT input circuit. This provides a crossover point of 2.8VDC ± 0.3vdc for the detection of PTT.
JP-23	Out	In conjunction with JP-21, selects PNP transistor for PTT input circuit. This provides a crossover point of 2.8VDC ± 0.3 vdc for the detection of PTT.
JP-24	Out	Add for 600 Ohm balanced configuration only
JP-25	In	Internally references the Data Out common line to ground.
JP-26	Out	For future use
JP-27	Out	Add for 600 Ohm balanced configuration only
JP-28	Out	For factory use.
JP-29	Out	For factory use.

The C Plus is shipped configured for a High Z ground referenced system. Typically, for a balanced system, you will want to remove JP-11, JP-25 and JP-7 and add JP-8. To have the C Plus terminate the line, also add JP-14 which applies a 600 ohm termination to the data input lines.

Jumpers JP-13, 12, 11, 10, 9 and 8 set up attenuation circuits. Only one of these jumpers should be installed. JP-13, 12 and 11 are for unbalanced systems and JP-10, 9 and 8 are for balanced systems.

Radio Connections

Connection	Signal	Use
P2-1	DATA OUT +	Signal output (high side) from the C Plus. Jumper selectable for high impedance single ended (to 14Vpp) or 600 ohm balanced (to +10dBm). Relay switched, connected only during data generation. Capacitively coupled.
P2-2	DATA OUT -	Signal output (low side) from the C Plus. In high impedance single ended, this line is referenced to ground. In balanced, it is signal return. Relay switched, connected only during data generation.
P2-3	CHBSY IN	High impedance input. Connect to a point that changes state when radio is receiving (busy). Used to prevent the C Plus from transmitting over a busy radio channel. Also used in COS qualified mute and Ambush feature. To enable this line, jumper JP-15 must be removed.
P2-4	CHAQR IN	Used in trunking only. Connect to a point that changes state when the channel has been acquired and transmission is authorized.
P2-5	PTT IN	Detects when the radio is transmitting to prevent sending data while a local user is speaking.
P2-6	TXCTL OUT	Open collector output follows Key output. Active low during data transmission. Used to defeat CTCSS or disable microphone during data transmissions. Sinks up to 500 mA.
P2-7	KEY OUT	Open Collector output, active during attack delay and data transmission. Capable of sinking up to 500 mA to within 0.7v of signal ground. Used to key up the associated transmitter.
P2-8	OUT 1	Programmable to be active with received message types. When the associated message type is received, this open collector output becomes active (low) for two seconds. Capable of sinking up to 500 mA.
P2-9	OUT 2	Programmable to be active with received message types. When the associated message type is received, this open collector output becomes active (low) for two seconds. Capable of sinking up to 500 mA.
P2-10	GROUND	Ground
P3-1	DATA IN +	Signal input (high side) to the C Plus. AGC conditioned. Jumper selectable for high impedance single ended (30mV to 12Vpp), high impedance balanced or 600 ohm balanced (-30dBm to +10dBm).
P3-2	DATA IN -	Signal input (low side) to the C Plus. In high impedance single ended, this line is referenced to ground. In balanced, it is signal return.
P3-3	RXMUTE OUT	Relay output, jumper selectable for N/O or N/C configuration. Used to momentarily interrupt radio speaker audio to prevent the data burst from being heard.
P3-4	RXMUTE	Relay output used in conjunction with RXMUTE

	OUT COM	OUT. Jumper selectable for either "isolated armature" or ground.
P3-5	REM CLR	Isolated input used to clear the display. Performs the same function as the front panel push button "Clear". Ground to activate.
P3-6	RX INHIB	Prevents decoding from taking place if signal is active. Used in shared trunking systems to prevent decoding of all signals present on discriminator.
P3-7	IR DISABLE	Disables the Infrared transceiver when grounded.
P3-8	GROUND	Ground

Data Output
Data output can be jumpered for high impedance or 600 ohm balanced output. If connecting to a radio, data output should be interfaced to a point after pre-emphasis and Data Out - should be jumpered for ground. The output level must be adjusted so that data out deviation is just below that of transmitted voice deviation. Data output is relay coupled to the connector on the back of the C Plus. Because of this, any loading occurs only during data transmission when the relays are activated. The circuit is MOV protected.

When tone remote keying is enabled, the maximum output data level into a 600 ohm balanced load is –2dbm instead of 10dbm. This allows a more flexible range of tone level vs data level. When adjusting transmit levels, adjust the data level first using potentiometer R5. Then adjust the tone level from the setup menu.

Channel Busy
Channel busy input is used to determine if the radio is in the process of receiving (and therefore, the frequency is occupied). Typically, channel busy would be attached to a squelch or CTCSS circuit that changes state when receiving. This line is only necessary in two-way systems that are capable of transmitting. This sense is especially important systems that will autonomously transmit messages to vehicles (e.g. Ambush). Channel Busy input sense can be programmed to be active when high or when low. Channel busy can also be used to qualify data mute. In COS Qualified muting, the associated radio is muted by the C Plus until a valid data decode. Once the data has passed, the radio is unmuted and remains unmuted until the Channel Busy line changes state. At that time, the radio is again muted. When using Ambush feature, this line is necessary to hold off transmitting queued messages when the radio is busy. Note that JP-15, which is inserted at the factory, holds channel busy to a known state. This jumper must be removed for the channel busy input to function.

Channel Acquired
Channel Acquired input is only used in Trunking environments. This line is interfaced to a point in a trunking radio that changes state when granted access. The line is programmable for input sense (active high or active low). Some trunking radios have channel acquired logic which pulses while attempting to be granted access and then remain in a state showing access is granted. For this reason, the line is also programmable to set the debounce time so that pulsing is ignored. The unit will not transmit data until the

specified time period has been exceeded. Two other timers are associated with trunking environments. Those are Trunk Timeout and Trunk Key. Trunk Timeout sets the maximum amount of time that the unit will attempt to acquire a trunk. Once exceeded, the unit will quit attempts. Trunk Key sets the time the unit is keyed while awaiting channel acquisition. In LTR systems, Trunk Key Time and Trunk Timeout should be the same. In MPT-1327, this timer allows the transmitter to be keyed and then unkeyed in order to request channel access. The time selected is the period the unit stays keyed. The C Plus will wait for the period designated in Trunk Timeout for a channel acquisition indication. When received, the unit will again key up and send out data.

PTT Input

PTT input is used to detect when the attached radio is busy transmitting. This line is programmable for input sense active high or active low. There are also jumpers that select whether the input is to NPN transistor circuitry or PNP transistor circuitry. This difference changes the validity threshold. If PNP is selected, the state change voltage is 2.8 ($\pm$ 0.3) VDC. If NPN is selected, the voltage is .5 ($\pm$ 0.3) VDC.

Transmit Control

Transmit Control output is an open collector output which goes low during data transmission. This line can be used to defeat CTCSS when sending data. It can also be used to disable the microphone to avoid data corruption in environments with high ambient noise.

Key Output

Key output is an open collector output that becomes active during transmit attack delay and data transmission. This line is used to key the associated transmitter. Key output is disabled during local loop-back testing.

OUT1, OUT2

OUT 1 and OUT 2 are open collector outputs capable of sinking up to 500 mA to within 0.7v of signal ground. These outputs are programmable to be associated with received message types. When the associated message type is received, the output goes low for two seconds. This is useful for activating external alert systems or auto-dialers. They can also be used to remotely control devices via external relays.

 If the C Plus is placed in the "Authorize mode" from the programming main menu, previously programmed functions of OUT1 and OUT2 are superseded and they perform as follows:

1. Open collector OUT1 becomes active goes to within 0.7v of signal ground (capable of sinking up to 500mA), while OUT2 remains inactive, providing a high impedance.

2. The C Plus begins monitoring channel busy for activity.

3. If activity is detected on channel busy, the C Plus listens for ANI.

4. If ANI data is detected, and the decoded ANI ID is present in the ALIAS table, OUT1 and OUT2 reverse states, bringing OUT1 to high impedance and OUT2 to within 0.7V of signal ground.

5. This reversal remains in effect until channel busy becomes inactive, then

OUT1 and OUT2 reverse to their original states.

6. If no ANI data is detected or the decoded ANI ID is not present in the ALIAS table, OUT1 and OUT2 remain in their original states.

Data Input

Data input can be jumpered for high impedance or 600 ohm terminated, balanced or single ended. The input is capacitively coupled for DC blocking and is MOV protected. When interfacing to a radio, connection should be made before deemphasis (flat audio). Data input should be jumpered for high impedance and data input - should be jumpered to ground. If connected to a balanced line, remove data input - ground jumper (JP-7) and install the 600 ohm jumper (JP-14) to terminate (if this is the only device on the leg) or remove the 600 ohm jumper (JP-14) to offer high impedance (if another device is on the leg and is terminated). Data input is AGC conditioned so generally, no adjustment is necessary. A test point (TP-7) is provided for O'scope analysis. If the signal is clipped and distorted, a potentiometer and a bank of gain jumpers can reduce gain. Alternately, if the signal is too weak, gain can be increased.

Solder bridge jumpers are available as described in the table below. Only one jumper should be used at a time.

Input Signal Attenuation	Unbalanced	Balanced
18 dB	JP-13	JP-10
12 dB	JP-12	JP-9
6 dB	JP-11	JP-8

If necessary, header JP5 provides for an amplification stage to increase the data input signal. The following table describes jumper positions corresponding to amplification factors available.

Input Signal Amplification	Jumper position	Absolute Max signal at TP10
0 dB	7 to 8	1.6 VPP
12 dB	5 to 6	0.65 VPP
24 dB	3 to 4	0.2 VPP
36 dB	1 to 2	0.05 VPP

TP-7 is available from the back of the C Plus enclosure. The signal should be well rounded with no clipping or distortion. A level of 500 mV is optimum. TP-10 monitors the previous stage. If the absolute maximum signal level described above is exceeded, distortion will occur, and decoding will be degraded.

RX Mute Output

RXMute Out and RXMute Out Com provide a data mute output feature that can be used to remove data audio from the local audio path. Two muting methods are available and can be chosen in the C Plus personality programming.

Mute on RX Data Only

In this mode, the C Plus mute relay can be used to momentarily interrupt speaker audio during receipt of data, preventing most of the data burst from being heard through the receiving radio's speaker. The speaker audio can be routed in series with the unit's mute relay, or the mute relay can shunt a low power audio pre-amplifier signal to ground. Jumpers are

provided to select normally open or normally closed relay contacts and to jumper for either isolated armature or ground.

Unmute After Data (COS Qualified)
In COS Qualified muting, the associated radio is constantly muted by the C Plus until a valid data decode. Once the data has passed, the radio is unmuted and remains unmuted until the Channel Busy line changes state. At that time, the radio is again muted. In this manner of muting, the entire data burst is omitted. However, users without ANI data will not unmute the receiver and they will not be heard. To activate the Channel Busy line, remove jumper JP-15.

Remote Clear
Remote Clear is an isolated input which performs the same function as the front panel push button "Clear". This line can be connected to a normally open foot switch. When the dispatcher presses the foot switch, the main display will be cleared. If the switch is pressed again within 1 second of the first press, the C Plus III secondary display will be cleared as well.

RX Inhibit
RX Inhibit prevents the C Plus from decoding and displaying received signals. If the RX Inhibit line is active, the C Plus ignores received data. This is useful in shared systems to qualify which signals on the discriminator should be decoded.
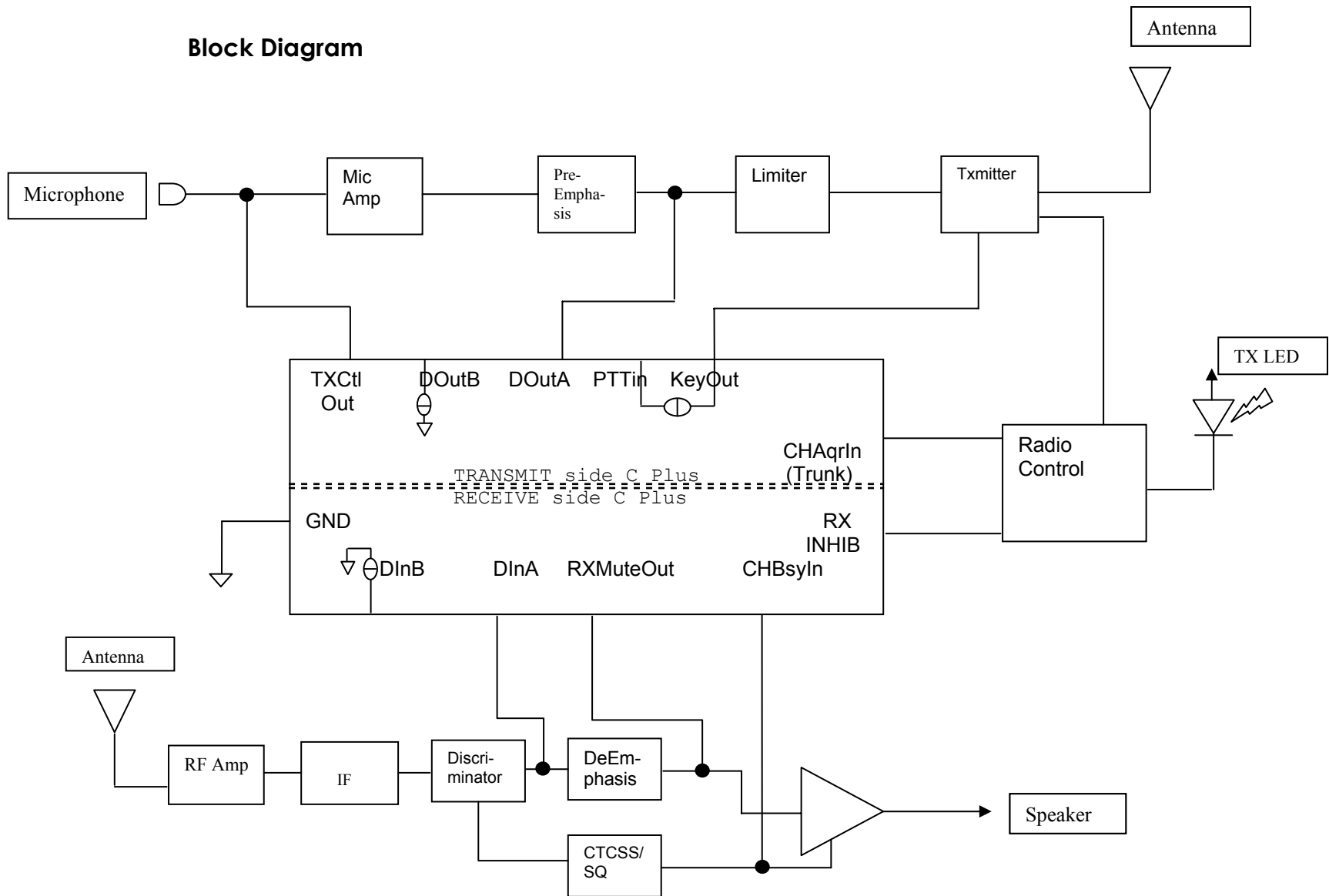
IR Disable
IR Disable disables the Infrared transceiver when grounded.

Ground
It is extremely important that a separate ground line be run between the associated radio system and the C Plus. Incorrect grounding will result in inconsistent encoding, decoding and key and mute functions. In all systems, be sure to attach station ground here.

Block Diagram

Interfacing to a Computer or Printer

The C Plus has three communication ports to facilitate data output to a printer, console or computer. For port specifics, please refer to chapter 5, Technical Information.

RS-232 Port

On the back of the C Plus, there is an "RJ-11" six conductor phone jack. This port can be programmed as a printer port and be connected directly to a serial printer to record channel activity. Output format and characteristics are user programmable. Baud rates available are 1200, 2400, 4800 and 9600 with 7 or 8 data bits and odd, even or no parity. Output format types are user selectable from the following types: Cimarron Standard, MODAT, BED-31/1207, Cimarron Translated Output, Generic 21 Bit Output, CML, Cimarron Traditional and Cimarron Multichannel. Examples of these outputs can be found in chapter 5, Technical Information.

The RS-232 port can also be used to connect to the serial port of a computer. This port is capable of two way communications, accepting commands for transmission to remote radios.

IR Port (Not yet implemented)

The front of the C Plus is equipped with an IR transceiver which complies with the IrDA standard. This port has a typical viewing range of up to 12 feet with a maximum of 15° of horizontal and vertical center. The port can be used in conjunction with pocket PC's or laptop PC's running Cimarron software as a user interface for two way commands. The port can also be programmed to function in the same manner as the RS-232 port described above.

USB Port (Not yet implemented)

The USB port can be used to link multiple C Plus units together into one system by using commercially available USB hubs. Each C Plus can be assigned a channel number and interfaced to independent RF communications systems. In this manner, one computer dispatching system has access to all RF communications systems. The port can also be programmed to function in the same manner as the RS-232 port described above.

C H A P T E R   3
Programming

Programming

The C Plus can be programmed via any of the three I/O ports (the RJ-11 serial connection, the IR transceiver or the USB connection). The IR port and the USB port require Cimarron communications software and a computer equipped with either an IR port or a USB port. The RJ-11 serial connection can be used with any computer running terminal emulation software like "Hyperterm" (Included in Windows 95, 98 and NT), "Terminal" (Windows 3.1) or any version of "Procomm" (third party software). Upon initial power-up, the C Plus begins sending ctrl E (05h) out the RJ-11 port. If a CDT is connected, it will respond with ctrl F (06h). If the response ctrl F (06h) is not present, the C Plus understands that a CDT is not connected. The C Plus begins listening at 9600, N, 8, 1 for a user sign-on message. The C Plus remains in this listening mode for 10 seconds. During the entire 10 second listen mode, the C Plus sends the CDT query once a second. If, during the listen mode, a user enters the phrase "$$CPlus", the device remains at 9600, N, 8, 1 and enters program mode. If no sign-on message is received at the end of 10 seconds, the C Plus configures the serial port in the manner stored in memory. If there is no preference programmed, the C Plus remains at 9600, N, 8, 1. The C Plus will respond to the sign-on message even after the initial 10 seconds if the sign-on is sent in the baud rate/protocol specified in memory.

If the C Plus is permitted to enter program mode, the main menu is outputted and the device awaits input from the user. When in program mode, the C Plus suspends normal operation until program mode is exited.

```
HELLO
MAKE YOUR SELECTION FROM THE FOLLOWING OPTIONS

1.    ACCESS THE ALIAS TABLE
2.    PROGRAM THE C PLUS PERSONALITY
3.    SET THE DATE AND TIME
4.    ACCESS THE MESSAGE TABLE
5.    PROGRAM NEW FLASH
6.    ENABLE "AUTHORIZE MODE"
7.    NORMAL OPERATION

ENTER YOUR SELECTION: _____
```

Editing the Alias Table

Alias tables are created using a text editor like Notepad or Wordpad. A full feature word processor can also be used but the file must be saved in the text only (raw text) format. The constructed alias table must be sorted in order of the eight digit ID field. Microsoft operating systems have a utility called "sort" that can be used to sort the completed alias table. The alias table is constructed as follows:

NNNNNNNN,AAAAAAAA,FFFFFFFFFFFFFFFFFFF,B

Where:

N   Eight digit ID. For GE Star® Format, this number will be between 00000001 and 00016383. In FleetSync™, the entry will be a 3 digit fleet assignment a dash and a 4 digit unit ID. (e.g. 123-3289). The fleet assignment must be between 100 - 349. The ID assignment must be between 1000 – 4999. In MDC, the entry will be a 4 character ID which can include all HEX characters (e.g. A12E).

A   Eight character Alias. Can contain any character in the full ASCII set (except a "," which is used as the field delimiter).

F   Nineteen character assignment field. This information is only displayed or printed if the C Plus is in the "Message and Assignment" presentation instead of the "Scrolling ID's" presentation.

B   For ID sensitive alerts. Can contain a number between 2 and 5. This number reflects the quantity of single beeps the C Plus will sound when PTT ANI is received from the associated ID. (e.g. if the number is 3, the C Plus will sound three short beeps). To have no audible beep for a particular ID, enter a zero (0). If a one (1) is entered, the beep configuration is as described in the message table. This is called the "Enunciate" feature.

The alias table can have a maximum of 4000 entries. The table must be in order by the eight digit unit ID. If the table needs to be sorted using the "Sort" routine (included with Windows operating systems), follow the steps below:

Save your Alias file as "Aliasin.txt"

Run Sort in MSDOS by entering the command as follows:

SORT [drive:][path]aliasin.txt>[drive:][path]alias.txt

After sorting the alias table, open it again in Notepad and append, as the only character in the last line, a dollar sign ($). This is the end of file designator and must be present. Once a table has been constructed and saved, it can be loaded into the C Plus by following the below procedure:

From the main menu, enter selection 1. ACCESS THE ALIAS TABLE. The following menu appears:

```
ALIAS EDIT MODE

     1.    SEND A SORTED TABLE TO THE C PLUS
     2.    RECEIVE THE TABLE FROM THE C PLUS
     3.    ERASE THE C PLUS ALIAS TABLE MEMORY

PRESS BACK SLASH "\" TO GO BACK
OR PLEASE ENTER YOUR SELECTION:_
```

Remember to add a line at the end of the file that contains only a $. This is the end of file marker and must be added after sorting.

Select option 1, SEND A TABLE TO THE C PLUS and when prompted, send (in ASCII format) the previously sorted file (alias.txt) to the C Plus. If a table already exists in the C Plus, it will be overwritten. Note that procedures to send files are different depending on the terminal emulation software you are using. But the file must be sent in ASCII format.

To make changes to an existing alias table, select option 2, RECEIVE THE TABLE FROM THE C PLUS. Save the file to your computer. Then open the saved file using a text editor like Notepad or Wordpad. Make the desired changes, save the file and then send the changed table back to the C Plus. If the file is no longer in order, be sure to sort it first.

If the alias feature is not desired, select option 3, ERASE THE C PLUS ALIAS TABLE MEMORY. This will delete the table. ID's will be displayed exactly as received.

Programming the C Plus Personality
The C Plus is a multi-feature device capable of encoding and decoding various non-compatible formats as selected by the user. Outputs are varied and are can be selected by the user as well. Because of this flexibility, the C Plus must be programmed with a personality that meets user requirements. To program the C Plus personality, from the main menu, select option 2, PROGRAM THE C PLUS PERSONALITY. A map of the programming tree is shown below:

```
C PLUS PERSONALITY PROGRAMMING

1.      SELECT FORMAT TYPE
        1.      GE STAR
                1.      Select STAR T1, T2, S1 values
        2.      GE STAR NYSP
                1.      COMPUTER INTERFACE SERIAL OUTPUT
                2.      PRINTER SERIAL OUTPUT
        3.      MDC-1200
        4.      FLEETSYNC
        5.      DTMF
                1.      ID Qualifying
```

```
                            1.        Total digit quantity
                            2.        Qualifying Quantity
                            3.        Qualifying Definition
                  2.        Timing
                            1.        Minimum character duration
                            2.        Inter-character maximum
                  3.        Status Reporting
                            1.        First/Last/Disable
                            2.        Edit Status Table
                                      1.  Send a Table to the C Plus
                                      2.  Receive table from the C Plus
                  4.        *=E, #=F Enable/Disable
                  5.        Mute Duration in mS
2.        SELECT OUTPUT TYPE
          1.        CIMARRON STANDARD
          2.        MODAT
          3.        EXTENDED BED-31/1207 FORMAT
          4.        BED-31/1207
          5.        CIMARRON TRANSLATED OUTPUT FORMAT
          6.        GENERIC 21 BIT OUTPUT FORMAT
          7.        CML
          8.        CIMARRON MULTICHANNEL ANI
          9.        CIMARRON STANDARD CLASSIC

3.        SELECT DISPLAY TYPE
          1.        TAXI BID
          2.        SCROLLING
          3.        MESSAGE AND ASSIGNMENT

4.        SELECT MUTE TYPE
          1.        MUTE ON RX DATA ONLY
          2.        UNMUTE AFTER DATA (COS QUALIFIED)

5.        DEFINE SERIAL PORT PARAMETERS
          1.        BAUD RATE
          2.        DATA BITS
          6.        STOP BITS
          4.        PARITY
          5.        END STRING WITH <CR> <LF>
          6.        PRINT ONLY CRITICAL MESSAGES

6.        DEFINE RADIO INTERFACE
          1.        PTT ACT HIGH/LOW
          2.        CH ACQ ACT HIGH/LOW
          3.        CH BUSY ACT HIGH/LOW
          4.        RX INHIBIT ACT HIGH/LOW
          5.        ATTACK DELAY
          6.        TRANSMIT MODE
                    1.        CONVENTIONAL
                    2.        TONE REMOTE
                              1.        TONE REMOTE FREQUENCY
                              2.        TONE REMOTE LEVEL
                    3.  TRUNKING
                              1.        KEY TIME
                              2.        DEBOUNCE
                              3.        TIMEOUT
          7.        ENABLE ACK CAPABILITY

7.        ASSIGN PORTS (Not yet implemented)
          1.        INFRARED PORT
                    1.        ENABLE/DISABLE
                    2.        ASSIGN AS PRINTER OUT
                    3.        ASSIGN AS TWO WAY TERMINAL
          2.        RJ-11 SERIAL PORT
                    1.        ASSIGN AS PRINTER OUT
          3.        USB PORT

8.        ASSIGN CHANNEL NUMBER
9.        ASSIGN BASE ID NUMBER
A.        ENABLE/DISABLE SOUNDER

PRESS BACK SLASH "\" TO GO BACK
OR PLEASE ENTER YOUR SELECTION:_
```

Unique Settings for DTMF Mode

If DTMF mode is selected, the following programming options must be

considered:

ID Qualifying

If ID qualifying is configured, the decoder will only report ID's that contain the correct qualifying digits. Say you have multiple users on one frequency and want only the associated dispatcher to decode their units. You could program total digits to 5, qualifying digits to two and qualifying definitions as 10 for one dispatcher C Plus, 20 for another and 30 for a third. ID's for the first group of units would start with 10 and be 5 characters long (e.g. 10123, 10124, 10125). The C Plus with a qualifying definition of 10 would decode the example ID's and report only the last three digits. In this example, 10123 would display "123" and would not report anything if it decoded 20123. The default is *Total Digit Quantity* = 8, *Qualifying Quantity* = 0 and *Qualifying Definition* blank. This effectively disables ID Qualifying.

Timing

There are two timers unique to DTMF decoding. *Minimum Character Duration* is the shortest acceptable length of a character. If the character length is less than the definition, then the character is discarded. This allows an ability to adjust sensitivity. Correct DTMF tones can occur naturally in very short duration. This "noise" will decode if not discarded. The default *Minimum Character Duration* is 50mS. Any occurrence of DTMF that is shorter than 50mS will be treated as noise and discarded. The programmable range is from 25mS to 5000mS. *Inter-Character Maximum* is the maximum allowable time between characters. Subsequent received characters are assumed to be components of the same string only if they occur before the *Inter-Character Maximum* has elapsed. The default is 100mS. Any character received after 100mS will be considered a new string of characters and the display will be cleared to prepare for the new string. The programmable range is from 50mS to 9999mS. For manual DTMF number entry via a DTMF pad, set this number high.

Status Reporting

The C Plus can be programmed for status reporting in DTMF format. In this mode, the first or last character of a string received is considered the status and is not reported as part of the ID but is displayed as the associated status instead. A table is provided to assign 8 character maximum status legends for each status. The status table is constructed as follows:

N,C,SSSSSSSS,B,O

Where:

N   Single digit number that was received as the status character . This number is removed from the ID and is not displayed.

C   Single character abbreviated status (used in the C Plus III scrolling display). This is equivalent to the "S" in the C Plus Message table

S   Eight character status. This is equivalent to the "M" in the C Plus Message table.

B   Audible alert selection. Messages with B = 2 through 5 are classified as critical statuses. See "Editing the Message Table" for further information.

O   Assigns an open collector output to function when the status is
           received.

      0   none

      1   Out1 becomes active for 2 seconds

      2   Out2 becomes active for 2 seconds

The C plus is shipped with Status Reporting disabled and the following
Status table:

```
0,A,-(NONE)-,1,0
1,1,STATUS-1,2,0
2,2,STATUS-2,2,0
3,3,STATUS-3,2,0
4,4,STATUS-4,2,0
5,5,STATUS-5,2,0
6,6,STATUS-6,2,0
7,7,STATUS-7,2,0
8,8,STATUS-8,2,0
9,E,EMRGENCY,3,1
```

Character Substitution
When enabled, * becomes displayed as E and # becomes displayed as F.
This allows DTMF to be compatible with any alias table used in MDC-
1200® Format

Muting
Mute duration is assigned as a value from 25mS to 9999mS. The mute relay
will become active after *Minimum Character Duration* has elapsed on the first
received character until the programmed *Mute Duration* time has elapsed.

Setting the Date and Time
From the Main Menu in program mode, select option 3 `SET THE DATE
AND TIME.` The C Plus will return the currently set date and time and
prompt you to enter the new date and time. After entering the desired
information, press <Enter> to send the information to the C Plus or <ESC>
to cancel. Time must be entered in 24hour format. Date and time will be
retained without external power for a maximum of 12 hours.

Editing the Message Table
Message tables are created using a text editor like Notepad or Wordpad. A
full feature word processor can also be used but the file must be saved in
the text only (raw text) format. The message table is constructed as follows:

`NNN-NNNN,S,MMMMMMMM,B,O`

Where:

N   Seven digit binary Star Code or 111-xxxx where xxxx is a
           message sequence number for MDC1200®. FleetSync™ PTT ANI
           use star 000-0001. FleetSync™ emergency use star 000-0111.
           FleetSync™ mandown use star 000-1111.

S   Single character abbreviated message.

M   Eight character message. Can contain any character in the full
           ASCII set (except a "," which is used as the field delimiter).

B   Audible alert selection. Messages with B = 2 through 5 are
           classified as critical messages.

           0   silent

           1   single beep of 250ms.

           2   short beeps, 250ms on and 100ms off repeated for 5
                  seconds.

           3   long beeps, 500ms on and 500ms off repeated for 5
                  seconds.

           4   short beep, long beep, 250ms on, 250ms off, 500ms on,
                  500ms off repeated for 5 seconds.

           5   continuous tone for 5 seconds

O   Assigns an open collector output to function when the message
           is received.

           0   none

           1   Out1 becomes active for 2 seconds

           2   Out 2 becomes active for 2 seconds

The C Plus is shipped with the message table entries defined in Appendix
A. The table ends with a line containing only "$".

Once a table has been constructed and saved, it can be loaded into the C
Plus by following the below procedure:

From the main menu, enter selection 4. `ACCESS THE MESSAGE TABLE.`
The following menu appears:

```
MESSAGE EDIT MODE


    1.    SEND A TABLE TO THE C PLUS
    2.    RECEIVE THE TABLE FROM THE C PLUS

    PRESS BACK SLASH "\" TO GO BACK
    OR PLEASE ENTER YOUR SELECTION:_
```

Remember to add a line at the end of the file that contains only a $. This is the end of file marker and must be added after sorting.

 Select option 1, SEND A TABLE TO THE C PLUS and when prompted, send (in ASCII format) the previously constructed file (message.txt) to the C Plus. If a table already exists in the C Plus, it will be overwritten. Note that procedures to send files are different depending on the terminal emulation software you are using. But the file must be sent in ASCII format.

To make changes to an existing table, select option 2, RECEIVE THE TABLE FROM THE C PLUS. Save the file to your computer. Then open the saved file using a text editor like Notepad or Wordpad. Make the desired changes, save the file and then send the changed table back to the C Plus.

Programming New Flash
From the main menu, enter selection 5. PROGRAM NEW FLASH and when prompted, send (in ASCII text format) the new flash. Download time is approximately 6 minutes.

Enable "AUTHORIZE" Mode
Authorize mode is a method to filter out unauthorized users of repeater systems or use the C Plus to activate alarms. In this mode, the C Plus monitors channel busy for activity and looks for ANI. If the ANI ID is not present or is present but is not in the authorized users list (alias list) then the C Plus will toggle Out1 and/or Out 2 to lock out the repeater transmitter stage (or activate remote alarms). The lock out will remain in effect until the channel busy line shows lost activity.

If Authorize mode is enabled in programming, the user is asked if the mode is to react to all message types or react only to critical messages. This additional filter can be used to activate remote alarms if the message received was from an authorized user and the message was critical. Critical messages are defined as those with a beep value greater than 1.

C H A P T E R 4
Operation

Decoding Capabilities

The C Plus family consists of the C Plus I computer interface, C Plus II display unit and the C Plus III display unit. All three are capable of decoding the following formats:

Format	Function
GE Star®	ANI, ENI, Status, Two way signaling
MDC-1200®	ANI, ENI, Status, Two way signaling
FleetSync™	ANI, ENI, Status, Two way signaling
NYSP GE Star	ANI and ENI in the special NYSP format
DTMF	ANI, ENI, Status, Decode only

For NYSP GE Star® details, see the NYSP section.

Front Panel Displays and Controls
C Plus I

The C Plus I is a computer interface device. The front panel consists of LED Indicators describing the functioning of the unit. The LED's and their function are as follows:

Indicator	Function
MUTE	Lights when the C Plus detects data which may or may not decode. Stays lighted during the entire reception period. Follows the action of the Mute relay.
DEC	Lights when the C Plus has successfully synchronized with incoming data and is decoding valid data.
TXBSY	Indicates that the attached transmitter is busy.
KEY	Indicates that the C Plus is keying the attached transmitter
MOD	Indicates that the C Plus is modulating data for transmission.
IR DISABLE	Lighted when the IR device is disabled. Will remain dark whenever the IR transceiver is capable of being used.
ERROR	Flashes when there is an equipment failure.
TX IO	Lights when the C Plus is providing data to an IO port (USB, RJ-11, IR).
RX IO	Lights when the C Plus is detecting data from an IO port (USB, RJ-11, IR).
POWER	Indicates that the unit is powered on.

There are two momentary push buttons on the front panel of the C Plus I. The right button is labeled "Reset" and causes the CPU Supervisor to reset all processors. The left button is labeled "IR" and, when pressed, toggles the IR transceiver on or off. If the IR transceiver is disabled, the IR Disable light will be on.

C Plus II

The C Plus II is a single window dispatch display unit. The display consists of eight large 5x7-pixel LED display matrixes. This display will show either the ID or the associated alias if one is programmed. ID's that do not have an alias associated are displayed as follows:

Signaling type	Display	Definition
GE Star®	1234	A PTT ID has been received from radio ID 1234
MDC-1200®	A876, 1234, AD90	A PTT ID has been received from radio ID (displayed number) which can also contain Hex characters.
FleetSync™	123-2289	A PTT ID has been received from radio whose fleet number is 123 and ID is 2289.

ID's can have alphanumeric aliases of up to eight characters in length. Upon receipt of a PTT ID, the alias is displayed instead of the numeric ID. (Requires purchasing the Alias feature)

	This is an example of a received FleetSync™ ID. The three characters to the left of the dash (-) is the fleet ID and the four characters to the right is the unit ID. Fleet and Unit ID pairs can be aliased.
	This is an example of a received MDC ID and contains HEX characters. All valid MDC ID's (0001 through DEEE) can be displayed and aliased.
	This is an example of an alias. The unit ID has been assigned the alias "CAPTAIN1". Any time the ID is received by the C Plus, the display will show the alias instead of the ID
	This is another example of aliasing.

When non-PTT type messages are received, the ID or alias is displayed for 2 seconds and then the message type. The display alternates in 2-second intervals between ID/alias and message type. Message types capable of being displayed for each signaling type are listed below:

Signaling type	Message type and how displayed

GE Star®	Status 0, Status 1, Status 2, Status 3, Status 4, Status 5, Status 6, Status 7, Intg Ack, Req Talk, Mssage C, Mssage D, Taxi Bid, Emrgency, Cncl Ack, StuckMic, Mntr Ack, Mssage F, Mssage G, Mssage H, Mssage J, Man Down, Dsbl Ack, Enbl Ack
MDC-1200®	Emrgency, Call Ack, Status 0, Status 1, Status 2, Status 3, Status 4, Status 5, Status 6, Status 7, Access, Setup, Kdown
FleetSync™	Emrgency, Man Down, Stat 10 through 97
DTMF	Status-1, Status-2, Status-3, Status-4, Status-5, Status-6, Status-7, Status-8, Emrgency

The C Plus II has two push buttons on the front panel. The right button is labeled CLEAR and clears the display. If a critical message was last received, pressing the button once clears the alert and pressing the button the second time clears the display. Critical messages are defined as any message that has been programmed to sound one of four different tone alerts. Clearing the alert stops the tone from sounding and also stops the display from alternately flashing ID and message type.

The left button is labeled REVIEW and when pressed, steps the display through the last 20 received messages. Messages are displayed just as they were received except the left most display shows the order in which the messages were received. The most recent message will be labeled "a". Subsequent messages will be labeled "b", "c" and so forth. To facilitate speedy review, non-PTT messages alternate in 1-second intervals between ID/alias and message type instead of 2-second intervals.

To clear the review buffer, press and hold the review button while pressing the clear button. The review memory will be erased. The review buffer resides in SRAM and as such is volatile. If power is lost or removed, the review buffer will be erased.

C Plus III
The C Plus III is a multiple window dispatch display unit. The main display and its features are the same as the C Plus II. In addition to the main display, there is a secondary, smaller display capable of displaying 28 characters just above the two push buttons. This display area is user programmable to present two different features.

Scrolling ID's

The secondary display area can be programmed for scrolling ID's. In this configuration, when a second ID is received, the first received ID or alias will scroll to the secondary position. Leading and trailing blanks will be suppressed. Thereafter, received ID's will scroll in a similar manner until they scroll off of the secondary display. Redundant (identical subsequent) ID's of the same message type will not be displayed. Non-PTT messages will

display the ID/Alias a dash (-) and the message type (abbreviated).

| E | D | , | | R | O | N | - | E | , | | 1 | 2 | , | | S | U | P | R | V | S | O | R | , | | B | 1 | 6 | - | E | | |

Message and Assignment
The secondary display area can be programmed to display the received message type (8-character max.) and the ID related assignment field (19-character max.) if present in memory.

| M | A | N | | D | O | W | N | - | B | U | I | L | D | I | N | G | | 1 | 3 | | F | L | O | O | R | | 5 |

Taxi Bid Display
Both the C Plus II and the C Plus III can be programmed to display in the Taxi Bid mode. In this mode, the first received data burst is displayed in the main display area. Subsequent ID's are shown in the secondary display area (for a C Plus III) or are not displayed at all (C Plus II). When either the remote clear or the front panel clear button is pressed, the main display clears and is ready to display the next received ID.

Alarms and Alerts, Critical Message Designation

Alarms
In the message table, message types can be flagged to cause an open collector output when received. This output can be used to activate an external alarm system. There are two outputs available at the rear of the C Plus. These are labeled OUT1 and OUT2. The associated transistor circuitry is capable of sinking up to 500 mA. The transistor conducts for a period of 2 seconds when activated by the appropriate received message. Multiple message types can be designated to activate the same output. Only one output can be programmed per message type.

Alerts
In the message table, message types can be flagged to cause an audible alert when received. There are five different sounds that can be assigned to multiple message types. Only one sound can be programmed per message type. The sounds available are as follows:

Value	Alert	Duration
0	Silent	None
1	Single short beep	250 ms duration
2	Short beeps	250 ms on, 100 ms off – repeat for 5 secs
3	Long beeps	500 ms on, 500 ms off – repeat for 5 secs
4	Short beep, Long beep, repeat	250 ms on, 250 ms off, 500 ms on, 500 ms off – repeat for 5 secs

5	Continuous tone	on for 5 seconds

Critical Message Designation

Critical messages are defined as any message that has been programmed to sound one of the alert tones (except single short beep). When a critical message is received, pressing the CLEAR button once stops the tone from sounding. Pressing twice clears the alert and also stops the display from alternately flashing ID and message type. Once a critical message is received, the display will not clear to a new message unless the precedence of the later message is higher than the current message (*Equal to or higher in software version 1.11 and greater)*. Precedence is determined by the number value of the alert sound. For example, say PTT ANI is assigned tone 1 (single short beep), emergency is assigned tone 2 (short beeps) and man down is assigned tone 3 (long beeps). An emergency is received and not cleared by the operator. Receipt of a PTT ANI will not be displayed (but will be placed in the review buffer). Receipt of a man down message will take priority over the emergency message and the emergency will be cleared and man down will be displayed.

ID Sensitive Alerts

Specific ID's can be programmed to cause an audible notice whenever PTT ANI is received from that ID. In the Alias table, place as the last entry for the affected ID, a number between 2 and 5. This number represents the quantity of single (100ms) beeps the C Plus will sound when the PTT ANI is received. To have no audible beep for a particular ID, enter a zero (0). If a one (1) is entered, the beep configuration is as described in the message table.

Authorize Mode

The C Plus can be programmed to filter out unauthorized users of repeater systems. In this mode, the C Plus monitors channel busy for activity and looks for ANI. If the ANI ID is not present or is present but is not in the authorized users list (alias list) then the C Plus will toggle Out1 and/or Out 2 to lock out the repeater transmitter stage. The lock out will remain in effect until the channel busy line shows lost activity. Once placed in this mode, previously programmed functions of OUT1 and OUT2 are superseded and open collector OUT1 becomes active and goes to within 0.7v of signal ground (capable of sinking up to 500mA), while OUT2 remains inactive, providing a high impedance. The C Plus begins monitoring channel busy for activity and, if activity is detected, the C Plus checks for ANI. If ANI data is detected, and the decoded ANI is present in the ALIAS table, OUT1 and OUT2 reverse states, bringing OUT1 to high impedance and OUT2 to within 0.7V of signal ground. This reversal remains in effect until channel busy becomes inactive, then OUT1 and OUT2 reverse to their original states. If no ANI data is detected or the decoded ANI is not present in the ALIAS table, OUT1 and OUT2 remain in their original states.

Operating with a Cimarron CDT

The Cimarron model CDT Hand Held Terminal is used with C Plus series dispatch display units as a means to designate target ID's for outgoing commands.

The CDT hand held terminal contains a 30-button membrane keypad and a 4 x 20 character LCD packaged in a shock resistant plastic case. It can be used as either a hand held or desktop terminal device for controlling radios capable of two way signaling.

The CDT plugs into the RS-232 port in the rear of the C Plus dispatch display which supplies power to the CDT and connectivity to the radio equipment.

Outgoing Commands Supported

GE Star®:

- Selective Call

- Selective Call Cancel

- Radio Disable

- Radio Enable

- Microphone Monitor

- Interrogate

MDC-1200®:

- Voice Selective Call

- Radio Check

- Call Alert (Short)

- Call Alert (Long)

- Radio Disable

- Radio Enable

Ambush:

Additionally, the CDT will accept commands to be held until the target unit is heard from again. The "Ambush" feature allows the preparation of messages when the target radio is turned off or out of communication range. When the C Plus next hears from the target, it waits until the user unkeys and then sends the designated message.

```
   Cimarron C Plus


S)end         A)mbush
```

Upon power-up, the CDT will display the message shown to the left. To immediately send a command, press the "S" button. To use the "Ambush" feature, press the "A" button.

```
Enter I)d or A)lias?

ID = xxxx
Alias = XXXXXXXX
```

After selecting "S" or "A", the C Plus will ask you to designate the target

ID or Alias. The ID field is limited to four characters (0000 through DEEE). The Alias field can contain any 8 characters.

```
   Cimarron C Plus
D)isable    E)nable
M)onitor    I)ntgate
C)all       X)cancel
```

If the C Plus transmit mode is in GE Star® signaling format, the CDT will allow the commands shown here. To send a command, press the Alpha button shown just to the left of the command.

```
   Cimarron C Plus
S)hort call V)SC
L)ong call  D)isable
R)adio chk  E)nable
```

If the C Plus transmit mode is in MDC-1200® signaling format, the CDT will allow these commands. VSC is "Voice Selective Call". The command will be executed when the operator next presses the PTT.

```
   Cimarron C Plus
Disable message sent
to Alias XXXXXXXX
```

Once you have selected the type of message to be sent, the CDT will display an appropriate message similar to the one to the left.

```
   Cimarron C Plus
Disable message sent
to Alias XXXXXXXX
MESSAGE ACKNOWLEDGED
```

When the C Plus receives the acknowledge from the target radio, the user is advised as shown here.

When entering an ID or alias, press the BKSP key to back up one character. Press the CTRL key to back up one screen. If the Ambush Queue screen is being shown, that ambush message can be canceled by pressing the ESC key. If multiple Ambush messages are in Queue, cycling power to the C Plus will terminate all messages awaiting transmission.

Operating in DTMF Mode

DTMF is available in Decode only. The C Plus does not encode or acknowledge in DTMF format.

Serial output formats handle DTMF in the same manner as MDC-1200®.

Decode/Display

The decoded ID is not displayed until the *Inter-Character Maximum* time has lapsed. At that time, the display is blanked and the new ID is displayed. If Status is enabled, a blank eight character status field is defined as PTT ANI and as with GE Star®, MDC-1200® and FleetSync™ only the ID is displayed. However, if the status field is not blank, then the C Plus display alternates between ID and Status.

Unique ID Messages

Some DTMF equipped radios allow the radio to be programmed with a unique ID as an emergency message. This ID would be different from the programmed PTT ID. To take advantage of this type of emergency reporting, turn the C Plus DTMF Status reporting off. Now, using the Alias feature of the C Plus, assign a unique alias which includes the units normal ANI ID and program a unique beep pattern. Here is an example:

Radio PTT ID is 1234, the radio emergency ID is 5678. Using the alias table, place an entry as follows:

`00005678,EMRG1234,Unit 1234 Emergency,5`

This entry will cause the display to present **EMRG1234** and beep five times any time a PTT ID message is received from ID 5678. If this is a C Plus III, the assignment area of the display will present: **Unit 1234 Emergency**.

Resource Mapping

C Plus resources and functions can be mapped to satisfy special user needs. Output functions *OUT1, OUT2, KEY and MUTE* as well as input functions *CLEAR* and *CHBSY (CHANNEL BUSY)* are made more flexible with the following $$ commands:

Outputs

Output functions can be mapped to alternate output ports with the command

$$MAP <function> TO <output>

This would mean that if an individual wanted the mute relay to act like OUT1, he would use "$$MAP OUT1 TO MUTE". If he desired to use OUT2 as the mute function, he would enter $$MAP MUTE TO OUT2". The original <function> remains intact unless also mapped.

Inputs

The input CLEAR (the button on the front of the C Plus) can be mapped to activate the function CHBSY. The original function of

the CLEAR button remains intact.

$$MAP CHBSY TO CLEAR

Resource Status

To find out what the status is of the C Plus resources, enter the command

$$MAP?

The C Plus will return a table describing the current settings

Output OUT1 is function OUT1

Output OUT2 is function OUT2

Output KEY is function KEY

Output MUTE is function MUTE

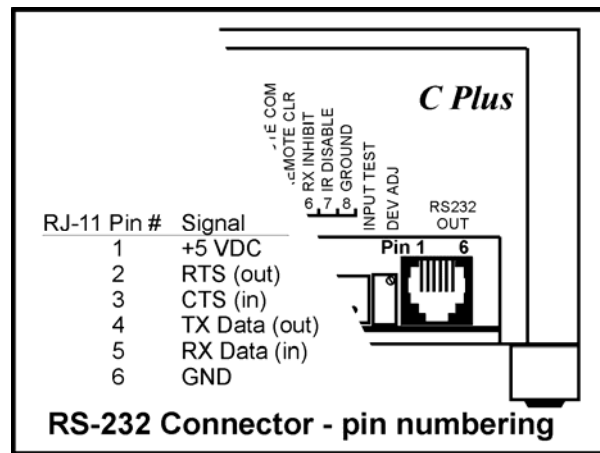**Function CHBSY is input CHBSY**

C H A P T E R   5
Technical Information

Communications Ports

The C Plus has three communication ports which can be independently assigned.

RJ-11 Serial Port Description

The RJ-11 (6 pin modular) connector is RS-232 protocol compatible with pin assignments as described in the figure below:

RS-232 Connector - pin numbering

The +5 VDC is to power a Cimarron CDT. Jumper JP-2 must be installed to connect pin 1 to the fused (1A) +5 V source.

For connection directly into a computer serial port, the following adapter must be used:

RJ-11 Pin #	DB-9F Pin #
1 (Wht)	Not Connected
2 (Blk)	8
3 (Red)	7
4 (Grn)	2
5 (Yel)	3
6 (Blu)	5

For connection directly into a serial printer, the following adapter must be used:

RJ-11 Pin #	DB-9M Pin #
1 (Wht)	Not Connected
2 (Blk)	8
3 (Red)	7
4 (Grn)	2
5 (Yel)	3
6 (Blu)	5

Interconnect cables must be six conductor, with pin-to-pin configuration (pin 1 of one side goes to pin 1 of the opposite side, 2

to 2, 3 to 3 etc.)

Upon initial power-up, the C Plus begins sending ctrl E (05h) out the RJ-11 port. If a CDT is connected, it will respond with ctrl F (06h). If the response ctrl F (06h) is not present, the C Plus understands that a CDT is not connected. The C Plus begins listening at 9600, N, 8, 1 for a user sign-on message. The C Plus remains in this listening mode for 10 seconds. During the entire 10 second listen mode, the C Plus sends the CDT query once a second. If, during the listen mode, a user enters the phrase "$$CPlus", the device remains at 9600, N, 8, 1 and enters program mode. If no sign-on message is received at the end of 10 seconds, the C Plus configures the serial port in the manner stored in memory. If there is no preference programmed, the C Plus remains at 9600, N, 8, 1. The C Plus will respond to the sign-on message even after the initial 10 seconds if the sign-on is sent in the baud rate/protocol specified in memory.

If the C Plus is permitted to enter program mode, the main menu is outputted and the device awaits input from the user.

If the C Plus does not enter program mode and has not detected a CDT device, the unit configures itself for serial communications in the manner stored in memory. If no preference is located in memory, the unit remains at 9600, N, 8, 1 and outputs decoded messages via the serial port. Defaults are used in the setup.

If the C Plus has detected a CDT, the listen mode is skipped and the CDT is configured instead. The CDT operates at 9600, N, 8, 1. The CDT is not capable of editing alias tables.

IR Port Description (Not yet implemented)
The C Plus is equipped with an infrared transceiver to facilitate I/O without requiring access to the back panel. It operates at a maximum range of twelve feet (distance dependent on the strength and capabilities of the IR device in the computer) within 15 degrees of horizontal and vertical center. The IR is compatible with IR systems currently integrated with laptop computers. Cimarron communication software provides a graphic user interface that allows access to the C Plus program mode and performs as an input device for two way messaging and alias editing. Upon power up, the IR port is disabled in a C Plus I and is enabled in a C Plus II/III.

The IR port can be enabled in the C Plus I by a front panel push-button labeled IR. The push-button has toggle action; push to turn on; push to turn off. The front panel LED labeled IR DISABLE represents the status of the IR. The LED is extinguished whenever the IR is activated.

The IR port can be disabled in the C Plus II and III (as well as the C Plus I) by grounding pin 7 of P3 on the back of the decoder. Pin 8 of P3 is ground.

USB Port Description (Not yet implemented)

The C Plus is USB capable. There is a type B USB connector accessible from the back of the decoder. Cimarron communication software provides a graphic user interface that allows access to the C Plus program mode and performs as an input device for two way messaging and alias editing.

In a multichannel environment, multiple C Plus units can be connected via a USB hub to one computer. The hub allows for full duplex communications and precludes data collisions. Each C Plus unit should be programmed with a unique channel number in the program mode. IR conflicts are avoided by enabling only the IR transceiver on the C Plus card to be programmed.

Port Assignments

Each communication port can be assigned a specific task in program mode. Using this assignability, the RJ-11 port may be assigned as an output to a printer while the IR port is communicating with a lap top running the Cimarron user interface software for two way messaging. Regardless of port assignments, if the port receives the sign on message ($$cplus) the C Plus enters program mode.

CDT Hand-held Terminal

The CDT hand-held terminal is equipped with a thirty button membrane key pad. Each key generates a unique HEX output to the C Plus. The CDT display will prompt the user for input, which is translated into actions by the C Plus. The <Shift> key can be used to select uppercase, lowercase or numbers. The table below represents the CDT keypad. The first hex number in each position is the output provided when the button is pressed. Refer to Chapter 4 "Operation" for more information.

11 F1 A	12 F2 B	13 F3 C	14 F4 D	15 ↑ E
2F / F	28 (G	31 1 H	32 2 I	33 3 J
2A * K	29) L	34 4 M	35 5 N	36 6 O
2D - P	23 # Q	37 7 R	38 8 S	39 9 T
2B + U	2C , V	3D = W	30 0 X	2E . Y
5A CTRL Z	41 SHIFT	0B ESC BKSP	20 SPACE	0D ENTER

The CDT must be configured as below to function correctly with the C Plus. Jumper JP2 on the C Plus must be inserted (solder jumper) to allow +5VDC to power the CDT via the interface connector. To enter configuration mode, hold down CTRL and ENTER buttons together and then turn on power.

COM		**DSP**		**KBD**	
Baud	9600	Ctl	No	Echo	No
Parity	None	Esc	No	Rpt	Off
Data/Stop	8/1	Cur	Yes	Aud	No
		Wrap	Yes	Simplified	Yes
SIO Errors	No	CR	No		
AUD Errors	No	Self Test	No	(Press "Main" now
XON/XOFF	No	Back Light	No	and save changes)

Output Formats

The output format can be selected from one of the following:

Note: Regardless of the output format selected, the ANI input format is always "Cimarron MultiChannel ANI Format" (Begins with $CT…).

Cimarron Standard

Cimarron standard format is similar to the Cimarron C-Mark II and III printer output format. For the C Plus II and III (in scroll mode), this format is defined as follows:

`<lf>iiiiiiii-MMMMMMMM-hh:mm:ss-mo/da/yr-CH-cc<cr>`

1   2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42   43

<lf>	Line Feed
i	ID or ALIAS (8 chars)
-	Space (one space)
M	Message (8 chars)
-	Space (one space)
hh	Hours (2 num)
:	Printed : (one colon)
mm	Minutes (2 num)
:	Printed : (one colon)
ss	Seconds (2 num)
-	Space (one space)
mo	Month (2 num)
/	Printed / (one slash)
da	Day (2 num)
/	Printed / (one slash)
yr	Year (2 num)
-	Space (one space)
CH	Printed CH (two characters)
-	Space (one space)
cc	Channel (2 num)
<cr>	Carriage Return

Examples

```
00000300 EMRGENCY 11:06:30 03/20/01 CH 01
SUPRVSOR ANI ID  11:07:28 03/20/01 CH 01
```

123-4567 ANI ID   11:08:01 03/20/01 CH 01

For the C Plus III in message and assignment mode, the output is similar to the Cimarron C-Mark IV format. The format is defined as follows:

<lf>hh:mm:ss-mo/da/yr-CH-cc-iiiiiiii-MMMMMMMM-AAAAAAAAAAAAAAAAAAA<cr>

<lf>	Line Feed
hh	Hours (2 num)
:	Printed : (one colon)
mm	Minutes (2 num)
:	Printed : (one colon)
ss	Seconds (2 num)
-	Space (one space)
mo	Month (2 num)
/	Printed / (one slash)
da	Day (2 num)
/	Printed / (one slash)
yr	Year (2 num)
-	Space (one space)
CH	Printed CH (two characters)
-	Space (one space)
cc	Channel (2 num)
-	Space (one space)
i	ID or ALIAS (8 chars)
-	Space (one space)
M	Message (8 chars)
-	Space (one space)
A	Assignment (19 chars)
<cr>	Carriage Return

Examples

```
11:06:30 03/20/01 CH 01 00000300 EMRGENCY Bldg 23 Floor 6
11:07:28 03/20/01 CH 01 SUPRVSOR ANI ID   SECTOR 5 BEAT 2
11:08:01 03/20/01 CH 01 123-4567 ANI ID   Assignment Blue
```

MODAT
The "Modat" format is as follows

$mmm^^iii^dd/mm/yy^hh:mm:ss<cr>
 1 2 3 4 5 6 7 8 9 10 11 1213 14 15 16 17 18 19 2021222324 25 2627   28

$	Beginning of string delimiter
mmm	Message (PTT for PTT, 440 for Bid)
^	ASCII blank character
iii	Three digit numeric ID (MSD's if present are truncated)
dd/mm/yy	Date (day/month/year)
hh:mm:ss	Time (hour:min:sec)
<cr>	ASCII carriage return

Examples

```
$440  123 13/06/01 15:25:55
$PTT  123 13/06/01 15:26:25
```

BED-31/1207 Output Format
The format consists of twelve ASCII characters providing Unit Identification, Tag Bit Configuration, Message Coding and Radio Channel Identification. In GE Star® signaling, the unit ID field is limited to a maximum number of 2047. Tag bit and status bit coding (depending on type of GE Star® selected) extend the ID range further. If MDC-1200® format is selected, HEX ID's will not be supported. Tag bit and status bit coding is accomplished to be consistent with the output expected from equivalent GE Star® ID's (T1=8192, T2=4096, S1=2048).   The channel identifier field has been modified to display channel 1 through channel Z. Orbacom dispatch consoles require this format. The format is as follows:

<lf>iiiitsSmMc<cr>
  1   2 3 4 5 6 7 8 9 1011   12

<lf>	Line Feed
I	ID 4 digit number max 2047. Fleet ID's in FleetSync™ are not represented.
t	Tag bit configuration (0 thru 3 where 0=00, 1=01, 2=10, 3=11)
s	Status bit MSD (0 or 1)
S	Status bits LSD's (0 through 7)
m	Message bit MSD (0 or 1)
M	Message bits LSD's (0 through 7)

c   Radio Channel Identifier (0 through Z)

<cr>   Carriage Return

Examples:

0025100011
2047000011
2047000071

Extended BED-31/1207 Output Format

The Extended BED-31/1207 format has enhancements to more fully take advantage of the ID range offered by MDC-1200® signaling. The format consists of twelve ASCII characters providing Unit Identification, Tag Bit Configuration, Message Coding and Radio Channel Identification. In GE Star® signaling, this output format is the same as non-extended Bed-31/1207 described above. If MDC-1200® format is selected, the ID field will display the ID through the entire valid range to a maximum of DEEE Hex. The channel identifier field has been modified to display channel 1 through channel Z. The format is as follows:

<lf>iiiitsSmMc<cr>
  1   2 3 4 5 6 7 8 9 10 11   12

<lf>   Line Feed

I   ID (4 digit number max 2047 for GE Star®, DEEE for MDC-1200®. Fleet ID's in FleetSync™ are not represented.

t   Tag bit configuration (0 thru 3 where 0=00, 1=01, 2=10, 3=11) In MDC-1200® and FleetSync™, tag bits are left at 00.

s   Status bit MSD (0 or 1)

S   Status bits LSD's (0 through 7)

m   Message bit MSD (0 or 1)

M   Message bits LSD's (0 through 7)

c   Radio Channel Identifier (0 through Z)

<cr>   Carriage Return

Examples:

95B1000011
A652000011
2047000071

Cimarron Translated Output Format

The Cimarron translated output format is defined as follows. If

MDC-1200® format is selected, HEX ID's are not supported. Tag bit coding is accomplished to be consistent with the output expected from equivalent GE Star® ID's (T1=8192, T2=4096). Status bit S1 is not represented. If values are assigned to T1, T2 and S1, the ID presented on the serial output will be the sum of the bit values. If no value is set (x), the maximum represented ID will be 2047 and T1 and T2 will be defined as below.

`<lf>iiiitMc<cr>`
  `1   2 3 4 5 6 7 8   9`

<lf>   Line Feed

i   ID (4 digit number max 9999)

t   Tag bit configuration (0 thru 3 where 0=00, 1=01, 2=10, 3=11)   In FleetSync™, tag bits are left at 00 and Fleet ID is not reported.

M   Message character A=PTT ANI, E=Emerg, M=Mandown etc. In FleetSync™, any received status other than E or M is represented by "S".

c   Radio Channel Identifier (0 through 9)

<cr>   Carriage Return

Examples:

```
00011E1
00162A1
12570R1
```

Generic 21 Bit Output Format

The generic 21 bit output format provides the 21 radio-transmitted ID and data bits within three ASCII characters. Included in this format is a leading "STX", the three ID/Data characters, and a final "ETX". To avoid imbedding STX and ETX in the data field, the C Plus offsets the actual data value by +5. Serial port data bits must be set for "8". When using this format, the associated computer interprets bits within the incoming format and performs the translation for display, printing, etc. This format is only valid in GE Star®.

☻CCC♥
`1 2 3 4 5`

☻   STX
C   ASCII Character (data value plus 5)
♥   ETX

CML Output Format

The CML output format is used in CML consoles and also Modular Communications (MODUCOM) consoles. The format is as follows:

Note: For console compatibility, the ASCII output data rate should

be programmed for 1200,N,7,2.

`<lf>iiiimthhmm<cr>`
  1   2 3 4 5 6 7 8 9 10 11 12

<lf>	Line Feed
i	ID (4 digit number 0000 through DEEE) or (4 char alias with leading truncated). In FleetSync™, the fleet ID is not represented.
m	Message bit (1 for PTT or 7 for Emergency)
t	Tag bit configuration (0 through 3 where 0 = 00, 1 = 01, 2 = 10, 3 = 11) In MDC-1200® and FleetSync™, these bits remain 00
hh	Hours
mm	Minutes
<cr>	Carriage Return

Examples:

8645121201
BILL121201
0023701205

Cimarron MultiChannel ANI Format

The Cimarron MultiChannel format is primarily used when two way communications is needed and a CAD system is employed to generate data strings between the computer and the base controller (C Plus). This format sends and receives the 16 character ASCII data sentence as described below.

Received Messages

The C Plus receives data messages from remote radio units equipped with encoders and converts the received messages to a serial ASCII data sentence and passes them to the host computer. This "inbound" ASCII data sentence is formatted as follows:

`$CR,iiii,mm,cc<cr><lf>`
`$CR,fff-iiii,ss,cc <cr><lf>` (FleetSync™ Only)
Receive Data Sentence, sent by the controller to the host computer where:

$CR	Receive-data sentence header
fff	Fleet ID (FleetSync™ only. Valid range = 100-349)
iiii	Unit ID (0000 .. DEEE) (F/S Valid range = 1000-4999)
mm	Unit message (00 .. 7F) in ASCII-HEX, as described

below:

00 -   Status One

10 -   Status Two

20 -   Status Three

30 -   Status Four

40 -   Status Five

50 -   Status Six

60 -   Status Seven

70 -   Status Eight

01 -   Unit PTT ID Message (or unit selective call ACK)

02 -   Unit Interrogate (ACK)

07 -   Unit Emergency Message

08 -   Unit Selective Call Cancel (ACK)

09 -   Unit Stuck Mic Message

0A -   Unit Radio Open-Mic-Monitor (ACK)

1B -   MDC generic STAT-ALERT Ack

3B -   MDC Repeater Access

4B -   MDC Repeater Setup

5B -   MDC Repeater Knockdown

0F -   Unit Man Down Message

4A -   Unit Radio Disable (ACK)

5A -   Unit Radio Enable (ACK)

7F -   Remote Base Station ID

ss   Two digit Status for FleetSync™ Only

00   No Ack when ACK expected

01 -   Unit PTT ID Message

10-99   Status messages where the following are defined by Kenwood:

    88 -   Emergency mode Off

    89 -   Horn Alert

    90 -   Radio TX Stun

    91 -   Radio TX and RX Stun

    92 -   Turn Stun Off

    93 -   ACK TX Stun

    94 -   ACK TX/RX Stun

	98 -	Unit Man Down Message
	99 -	Unit Emergency Message

cc   Received channel number (00 .. 99)

<cr>   ASCII carriage return character

<lf>   ASCII line feed character

The ACK messages are received in response to a command sent from the C Plus to the remote unit.

Transmitted Messages
The C Plus may send data messages to remote radios equipped with encoder/decoder capability. The C Plus converts the host computer generated ASCII "transmit" sentence to a data message command, sending it over the selected radio channel. This data sentence is formatted as follows:

$CT,iiii,mm,cc<cr><lf>
$CT,fff-iiii,ss,cc <cr><lf>   (FleetSync™ Only)
Transmit Data Sentence - sent by the host computer to the controller where:

$CT   Transmit-data sentence header

fff   Fleet ID (FleetSync™ only. Valid range = 100-349)

iiiiUnit ID (0000 .. DEEE) (F/S Valid range = 1000-4999)

mm   Unit message (00 .. 7F) in ASCII-HEX, as described
         below:

00 -	Status One
10 -	Status Two
20 -	Status Three
30 -	Status Four
40 -	Status Five
50 -	Status Six
60 -	Status Seven
70 -	Status Eight
01 -	Unit Selective Call or MDC "Voice Sel Call" (CMD)
02 -	Unit Interrogate or MDC "Radio Check"(CMD)
07 -	Unit Emergency Message (ACK)
08 -	Unit Selective Call Cancel (CMD)
09 -	Unit Stuck Mic Message (ACK)

0A -   Unit Radio Open-Mic-Monitor (CMD)

0F -   Unit Man Down Message (ACK)

1B -   MDC Short Call Alert

2B -   MDC Long Call Alert

3B -   MDC Repeater Access

4B -   MDC Repeater Setup

5B -   MDC Repeater Knockdown

7B -   MDC Status ACK

4A -   Unit Radio Disable (CMD)

5A -   Unit Radio Enable (CMD)

ss   Two digit Status for FleetSync™ Only

01 -   Unit PTT ID Message

10-99   Status messages where the following are defined by Kenwood:

88 -   Emergency mode Off

89 -   Horn Alert

90 -   Radio TX Stun

91 -   Radio TX and RX Stun

92 -   Turn Stun Off

93 -   ACK TX Stun

94 -   ACK TX/RX Stun

98 -   Unit Man Down Message

99 -   Unit Emergency Message

cc   Transmit channel target number (00 .. 99)

<cr>   ASCII carriage return character

<lf>   ASCII line feed character

The ACK messages are sent in response to receiving a critical message from the remote unit. When received by the mobile unit, the ACK terminates the remote unit message retry cycle.

Cimarron Standard Classic

Cimarron standard classic format is the Cimarron C-Mark II and III printer output format. For the C Plus II and III (in scroll mode), this format is defined as follows:

```
<lf>iiii-MMMMM-hh:mm:ss-mo/da/yr-CH-c<cr>
 1    2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35    36
```

<lf>	Line Feed
i	ID or ALIAS (4 chars)
-	Space (one space)
M	Message (6 chars)
-	Space (one space)
hh	Hours (2 num)
:	Printed : (one colon)
mm	Minutes (2 num)
:	Printed : (one colon)
ss	Seconds (2 num)
-	Space (one space)
mo	Month (2 num)
/	Printed / (one slash)
da	Day (2 num)
/	Printed / (one slash)
yr	Year (2 num)
-	Space (one space)
CH	Printed CH (two characters)
-	Space (one space)
c	Channel (1 num)
<cr>	Carriage Return

Examples

```
0300 EMERGY 11:06:30 03/20/01 CH 1
SUPR ANI ID 11:07:28 03/20/01 CH 1
4567 ANI ID 11:08:01 03/20/01 CH 1
```

GE Star Format Selections

T1, T2 and S1 are individual bits of the GE-STAR binary message. The differences in formats relate to the functions and/or identification values assigned to the Tag Bits (T1 and T2) and the first bit of the "status" group (S1). T1 and T2 can be used for extended ID's over 4095 or for mobile and portable recognition.

Format	Description	T1	T2	S1	Comments
A	IDs to 2047 (1st 11 bits).	X	X	X	T1, T2, and S1 ignored
*B	IDs to 16383 (14 bit ID)	8	4	2	Expanded-ID STAR #1.
C	IDs to 16383 (14 bit ID)	4	8	2	GE-STAR #3.
D	IDs to 16383 (14 bit ID)	4	2	8	Compatible with GE-STAR #4
E	IDs to 4095 (12 bit ID, T2 = "0")	2	M0	X	GE-STAR #1. T2 = "0" for Mobile.
F	IDs to 4095 (12 bit ID, T2 = "1")	2	P1	X	GE-STAR #1. T2 = "1" for Portable.
G	IDs to 8191 (13 bit ID, T2 = "0")	4	M0	2	GE-STAR #2. T2 = "0" for Mobile.
H	IDs to 8191 (13 bit ID, T2 = "1")	4	P1	2	GE-STAR #2. T2 = "1" for Portable.
I	IDs to 4095 (12 bit ID), Tags="00"	S0	S0	2	System "0"
J	IDs to 4095 (12 bit ID), Tags="01"	S0	S1	2	System "1".
K	IDs to 4095 (12 bit ID), Tags="10"	S1	S0	2	System "2".
L	IDs to 4095 (12 bit ID), Tags="11"	S1	S1	2	System "3".
M - P	IDs to 2047 (11 bit ID)			X	Identical to I - L with capability only to program IDs to max of 2047.

The C Plus allows assignment of various values to the T1, T2 and the S1 bits. All described formats above can be recreated by assigning values as described below.

Value Assignment	Description
8	Bit value is 8192
4	Bit value is 4096
2	Bit value is 2048
M0	If the bit is not set, originator is a Mobile
M1	If the bit is set, originator is a Mobile
P0	If the bit is not set, originator is a Portable
P1	If the bit is set, originator is a Portable
S0 and S1	If the bits match (S0 for zero, S1 for one) then the C Plus reacts to the received message
X	This bit is ignored

Each value except X and S0/S1 can be used only once. If either S0 or S1 is used, only ID's which match the requirement will be acted upon.

As shipped from the factory, the C Plus is programmed to decode GE Star® format B. Here is how to quickly change the designated format.

Changing the format selection:

Enter program mode and from the main menu, select "*Program the C Plus Personality*". Go to "*Select Format Type*", "*GE Star®*", and then "*Select Star T1, T2, S1 Values*". The C Plus will output the following:

```
Your current selection of T1,T2,S1 is:_ 8, 4, 2

Press Back slash "\" to go back
Or enter T1,T2,S1 in this format: T1,T2,S1

Allowable values are: 2,4,8,M0,M1,P0,P1,S0,S1,X
Use spaces if necessary to type in a total
of 8 characters_
```

Referring to the tables, you will find that the current selection of 8, 4, 2 is the definition for format B. If you desired to change the format to "J", you would enter :

S0,S1, 2. Once entering the new values, exit program mode and cycle power on the C Plus.

GE Star Message Descriptions

The GE Star bits designated S2, S3, S4 and M1 through M4 are used to code various messages. The table below describes the Star code and the corresponding message:

STAR CODE	SINGLE CHARACTER DISPLAY	FULL DISPLAY	REMARKS
000-0000	0	STATUS 0	Status
001-0000	1	STATUS 1	Status
010-0000	2	STATUS 2	Status
011-0000	3	STATUS 3	Status
100-0000	4	STATUS 4	Status
101-0000	5	STATUS 5	Status
110-0000	6	STATUS 6	Status
111-0000	7	STATUS 7	Status
000-0001	A	(none)	ANI ID and Sel Call Ack
000-0010	I	INTG ACK	Interrogate Ack
000-0011	R	REQ TALK	Request to talk
000-0100	C	MSSAGE C	Canned Message
000-0101	D	MSSAGE D	Canned Message
000-0110	B	TAXI BID	Taxi Bid
000-0111	E	EMRGENCY	Emergency
000-1000	c	CNCL ACK	Call Cancel Ack
000-1001	S	STUCKMIC	Stuck Microphone
000-1010	o	MNTR ACK	Open Mic Monitor Ack
000-1011	F	MSSAGE F	Canned Message
000-1100	G	MSSAGE G	Canned Message
000-1101	H	MSSAGE H	Canned Message
000-1110	J	MSSAGE J	Canned Message
000-1111	M	MAN DOWN	Man Down
100-1010	d	DSBL ACK	Radio Disable Ack
101-1010	e	ENBL ACK	Radio Enable Ack
(not listed)	!	UNDEFINE	Undefined

Message displays (single character and full display) can be changed in the C Plus program mode by selecting 4, ACCESS THE MESSAGE TABLE from the main menu.

FleetSync™ ID and Message Description

The C Plus is capable of decoding and displaying FleetSync™ Basic and FleetSync™ Version 2.0 data transmissions of the following types: PTT ANI, Emergency(ST99) and (ver 2.0 only) Man Down(ST98). Emergency and Man Down acknowledgments will be encoded and transmitted.

The C Plus is currently not compatible with Kenwood FleetSync™ II Air Protocol.

The C Plus is capable of decoding and displaying the entire set of FleetSync™ Fleet and Unit ID's. The allowable fleet assignment range is from 100 to 349. The allowable unit ID range is from 1000 to 4999.

The C Plus will encode FleetSync™ status messages (value 10 through 99) via the $CT string (Cimarron Multichannel Format). See page 48 for more details. FleetSync™ transmitted messages are formatted without the request for the receiving unit to acknowledge them.

MDC-1200® ID and Message Description

The C Plus is capable of decoding (and encoding) unit ID's in the full hexadecimal range from $0001 through $DEEE. All ID's in the hexadecimal range are displayed as hexadecimal digits and are not converted to their base 10 equivalent. Alternately, if a unit is programmed for ID 10, the C Plus will decode 0010, not 00A0.

Wild Cards

The C Plus supports Wild Card Addressing that uses "F" as a wild card entry. In this manner, if ID 23FF is addressed, all units with the first two digits (23--) will react to the call. If FF34 is addressed, all units with the last two digits (--34) will react to the call.

Variable ID

In addition to a Unit ID, fully capable MDC-1200® radios are assigned a "variable ID". All units with the same variable ID can be targeted by using a destination ID that begins with "E"

Call Alert

The call alert feature sends a page to the selected mobile or to a group. When a mobile receives a call alert, visual and/or audible notification can occur. If a call alert is sent to an individual mobile, the mobile will return an ACK. The C Plus will repeat the individual call alert every five seconds for a total of five times or until an acknowledgment is received from the targeted mobile. If no acknowledgment is received, a nACK message is outputted to the device attached to the C Plus that initiated the call alert. In a C Plus II or III, the display will present the targeted ID and flash the message "NO – ACK" until the clear button is pressed. There is no acknowledgment when a call alert is sent to a group. There are two types of call alert, Short Call Alert and Long Call Alert. The long call alert includes the ID of the sender so the operator of the targeted radio knows who sent the alert.

Radio Check

The radio check feature sends an interrogate to a mobile or a portable. The targeted radio returns an acknowledgment but does not present any visual or audible notification to the operator. (except that the TX LED flashes). The C Plus will repeat the radio check every five seconds for a total of five times or until an acknowledgment is received from the targeted mobile. If no acknowledgment is received, a nACK message is outputted to the device attached to the c Plus that initiated the radio check. In a C Plus II or III, the display will present the targeted ID and flash the message "NO – ACK" until the clear button is pressed.

Voice Selective Call

A voice selective call is similar to a call alert. However, it has the added feature of unmuting the targeted radio regardless of whether the microphone is on or off hook. The radio will remute at the loss of carrier (if the microphone is on hook). A voice selective call data burst is sent when the C Plus detects that the associated transmitter has been keyed.

MDC Repeater control messages

The C Plus is capable of generating and responding to MDC Repeater control messages. For encode capabilities, the ID field is filled with destination ID from $CT string. For decode capabilities ID field is used consistent with source ID.

If "Access" is received and the ID matches the C Plus ID, and the message table describes toggling of out1 or out2, the designated out remains active until loss of carrier (ch bsy).

If "Setup" is received and the ID matches the C Plus ID, and the message table describes toggling of out1 or out 2, the designated out remains active until receipt of a "Kdown" that matches the C Plus ID.

 If "Kdown" is received that matches the C Plus ID and the message table describes toggling of out1 or out2, the designated out remains active until receipt of a "Setup" that matches the C Plus ID. In this way, you should not encounter a correctly edited message table where Setup and Kdown both have out1 or both have out2 enabled.

If a user wanted out1 to be active during setup and out2 to be active during kdown, the message table would look like this:

111-0100,s,SETUP,1,1

111-0101,K,KDOWN,1,2

So, upon receipt of a setup, out1 becomes active and out2 is relaxed – when a kdown is received, out1 relaxes and out2 becomes active.

 If these messages are received where the ID field does not match the ID of the C Plus, they are decoded, displayed and outputted to the serial port – but no acknowledgment is generated and the out toggling does not occur.

NYSP (New York State Patrol) Format

The NYSP format interprets the STAR ANI message format in a unique way to produce a five-character unit ID as described below:

The 21 bit STAR data field is defined as follows

```
zzzzztttttiiiiiiiiiiim
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
```

z   five bit "zone" ID

t   five bit "troop" ID

m   one bit message (0=PTT, 1=Emergency)

The zone and troop ID's characters are 0-9, A-N, V, P-T, X and Z and are assigned numeric values sequentially from 0 (for zero) to 31 (for Z).

0	00000	B	01011	M	10110
1	00001	C	01100	N	10111
2	00010	D	01101	V	11000
3	00011	E	01110	P	11001
4	00100	F	01111	Q	11010
5	00101	G	10000	R	11011
6	00110	H	10001	S	11100
7	00111	I	10010	T	11101
8	01000	J	10011	X	11110
9	01001	K	10100	Z	11111
A	01010	L	10101		

Examples of the C Plus display is shown below:

Display	Definition			
	Zone	Troop	Vehicle	Message
AZ123	A	Z	123	PTT-ID
AZ123e	A	Z	123	Emergency
Z--5	0	Z	5	PTT-ID
X0--1e	X	0	1	Emergency

The NYSP serial output format is selectable and can be either printer serial output or computer interface serial output. These outputs are defined as follows:

Printer Serial Output:

```
<lf>iiiii-mmmmm-hh:mm:ss-dd/mm/yy-CH-cc<cr>
1     2 3 4 5  6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36    37
```

<lf>	Line Feed
i	ID (5 characters)
-	Space
m	Message field(5 characters) (PTT or EMERG)
hh:mm:ss	Time (hour:min:sec)
dd/mm/yy	Date (day/month/year)
CH	Printed CH (two characters)
cc	Channel (2 num)
<cr>	Carriage Return

Examples:

```
AZ123 PTT   16:32:58 06/03/01 CH 01
AZ123 EMERG 16:33:05 06/03/01 CH 01
 Z--5 PTT   16:34:11 06/03/01 CH 01
X0--1 EMERG 16:34:25 06/03/01 CH 01
```

Computer Interface Serial Output:

```
<lf>ABiiimc<cr>
  1   2345678   9
```

<lf>	Line Feed
A	Alpha character Zone
B	Alpha character Troop
i	ID (3 Numbers)
m	Message field(0=PTT, 1=Emergency)
c	Channel (1 num)
<cr>	Carriage Return

Examples:

`AZ12301` PTT message came from channel 1

`AZ12311` Emergency message came from channel 1

DTMF Decoding
The C Plus DTMF mode is compatible with the industry-standard DTMF tones as described in the following table:

Hz	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Tone Remote Compatibility
The C Plus is compatible with tone remote keying in the following manner:

If tone remote keying is selected in the personality programming, In addition to the Key relay being activated for transmissions, the C Plus will output tone remote keying sequence and a user selectable function tone.

The keying sequence for tone keying is as follows:

125ms tone burst of 2175 Hz at 0dBm followed by a function tone for a period of 40ms at -10dBm followed by a 2175 Hz tone at -20dBm for duration of key time.

The function tone is programmable to be one of the following: 2050,1950, 1850, 1750, etc etc down to 950. The user will select which of these to implement when setting up the personality of the C Plus.

When tone remote keying is enabled, the maximum output data level into a 600 ohm balanced load is –2dbm instead of 10dbm. This allows a more flexible range of tone level vs data level. When adjusting transmit levels, adjust the data level first using potentiometer VR5. Then adjust the tone level from the setup menu.

The maximum attack delay available in Tone Remote mode is 3 seconds (3000ms).

Radio Interface Considerations

Trunking/Conventional
The transmit mode decides how the C Plus will determine when the transmitter is ready to accept data. If Conventional mode is selected, PTT input, Channel Busy input and attack delay timer is used. In addition, if Trunk mode is selected, Channel Acquired

Input, Chan Select timer, Trunk Timeout timer and Trunk Key timer are also used for transmit control.

Channel Acq. Input. Used in trunking applications only. Selects the desired input logic of the Channel Acquired Input. This input should be interfaced in the radio to a signal which indicates when the trunked channel is acquired and will hold off data transmission until a trunk channel has been acquired.

Channel Busy Input. Selects the desired input logic of the Channel Busy Input. This input provides the equipment with the status of the interfaced radio and prevents the C Plus from keying the radio when the channel is busy.

PTT Input. Used to detect when the radio is currently transmitting to prevent sending data while a local user is speaking. It is also used to trigger Voice Selective Calls in MDC-1200®. The sense can be programmed depending on the radio and installation. *Active High* means that the PTT sense line goes from logic 0 to logic 1 when the radio is keyed. *Active Low* means that the line goes from logic 1 to logic 0 when the radio is keyed.

RX Inhibit. Prevents decoding from taking place if the signal is true. Used in shared trunking systems to allow decoding only of targeted signals present on the discriminator. As the discriminator "hears" all signals on the selected repeater, this line can be attached to a squelch gate which is active only when the received signal is for the appropriate user group.

Transmit Timers
Transmit timers control the manner in which the C Plus determines radio availability to transmit. There are four independent timers, three of which are used only in Trunk mode.

Attack Delay. Used in Conventional, Trunk and Tone Remote mode. This timer sets the time delay between start of transmit (or channel acquisition in trunking) and data transmission. If too small of a value is selected in conventional mode, the transmit mechanism of the radio may not be ready (stabilized frequency, max power out, repeater accessed, etc.) to effectively transmit data. Available time selections are 0ms to 9999ms in Conventional and Trunk mode. In Tone Remote mode, available time selections are 0ms to 3000ms.

Trunk Debounce. Used only in trunk mode. Some trunking radios have channel acquired logic which pulses while attempting to be granted access and then remain in a state showing access granted. This timer sets the debounce time so that pulsing is ignored. The unit will not transmit data until the specified time period has been exceeded. Available time selections are 0ms to 9999ms.

Trunk Timeout. Used only in trunk mode. This timer sets the maximum amount of time, which the unit will attempt to acquire a trunk. Once exceeded, the unit will quit attempts. See also *Trunk*

Key. Available time selections are 0ms to 9999ms.

<u>Trunk Key Time</u>. Used only in trunk mode. This timer sets the time the unit is keyed while awaiting channel acquisition. In LTR systems, Trunk Key Time and Trunk Timeout should be the same. In more elaborate trunking schemes (e.g. MPT-1327) this timer allows the transmitter to be keyed and then unkeyed in order to request channel access. The time selected is the period the unit stays keyed. The Cimarron equipment will wait for the period designated in *Trunk Timeout* for a channel acquisition indication. When received, the unit will again key up and send out data. Available time selections are 0ms to 9999ms.

<u>Post Dec</u>. Many radios must "relax" after receiving before permitting transmission. The C Plus waits a fixed 800ms after receiving an acknowledgeable message before it sends a response.

C Plus I
Block Diagram
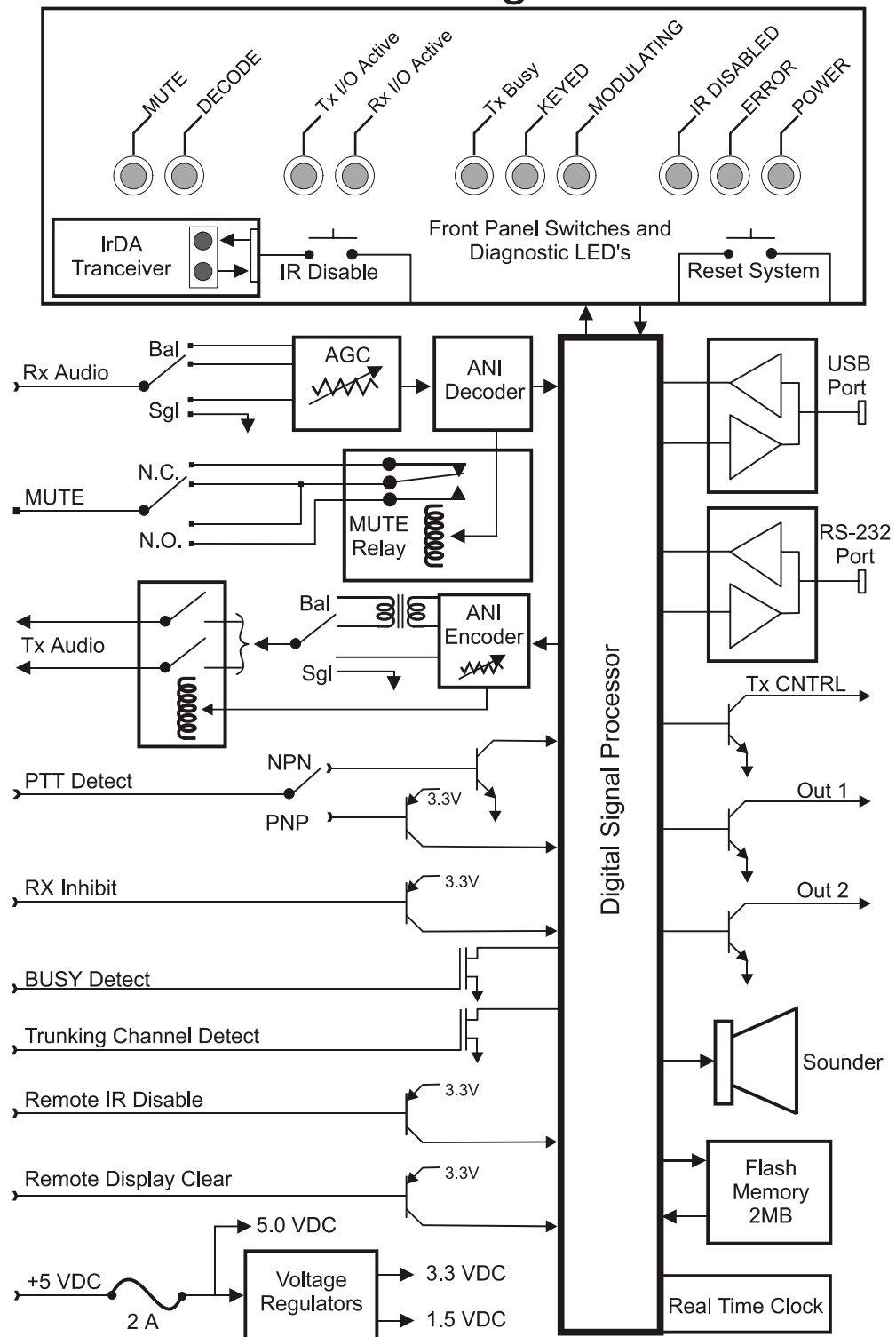
Note: Some jumpers, base resistors, and pull up resistors have been removed for clarity.
Please consult schematic for actual circuits.

C Plus II
Block Diagram
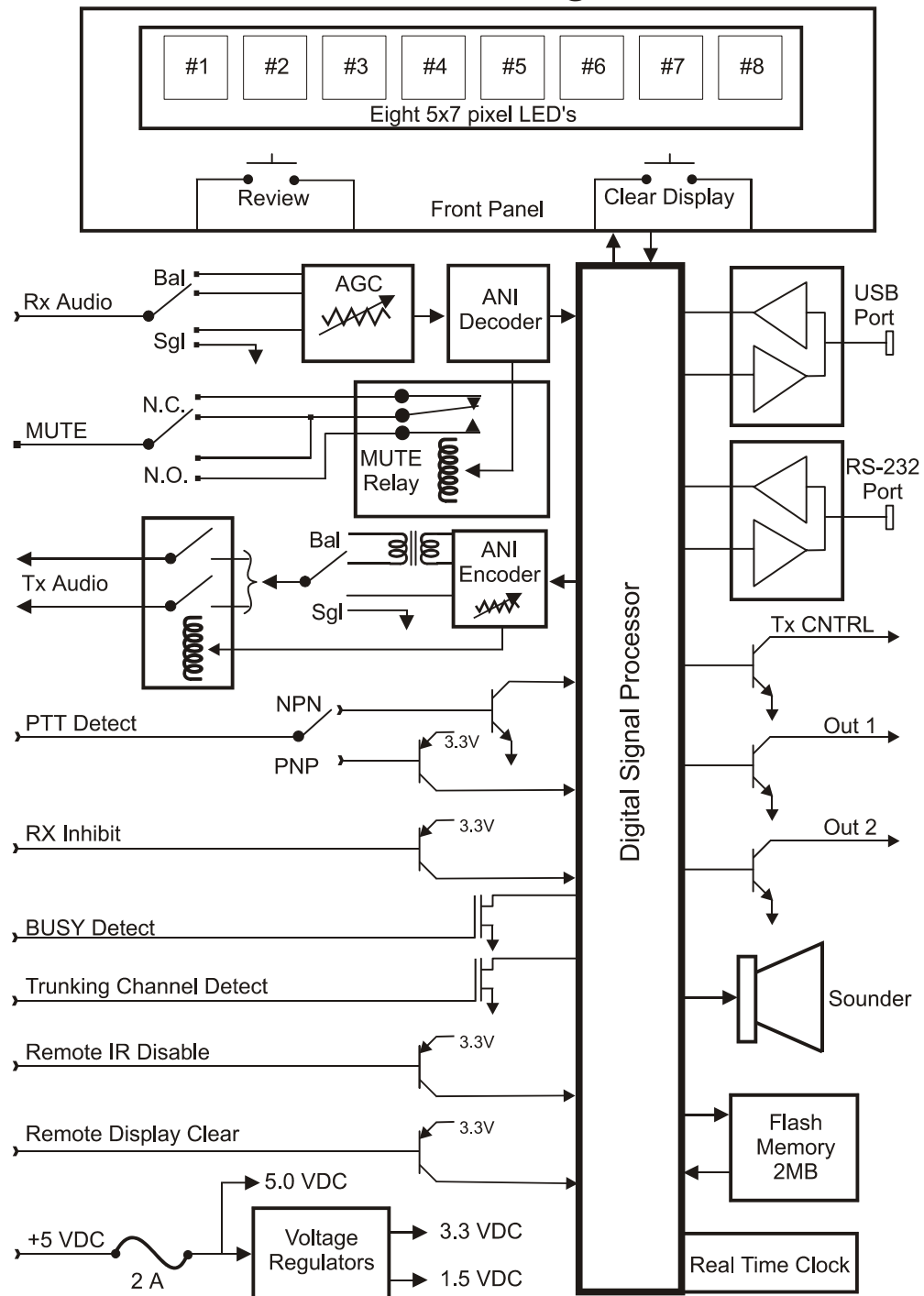
Note: Some jumpers, base resistors, and pull up resistors have been removed for clarity.
Please consult schematic for actual circuits.

C Plus III
Block Diagram
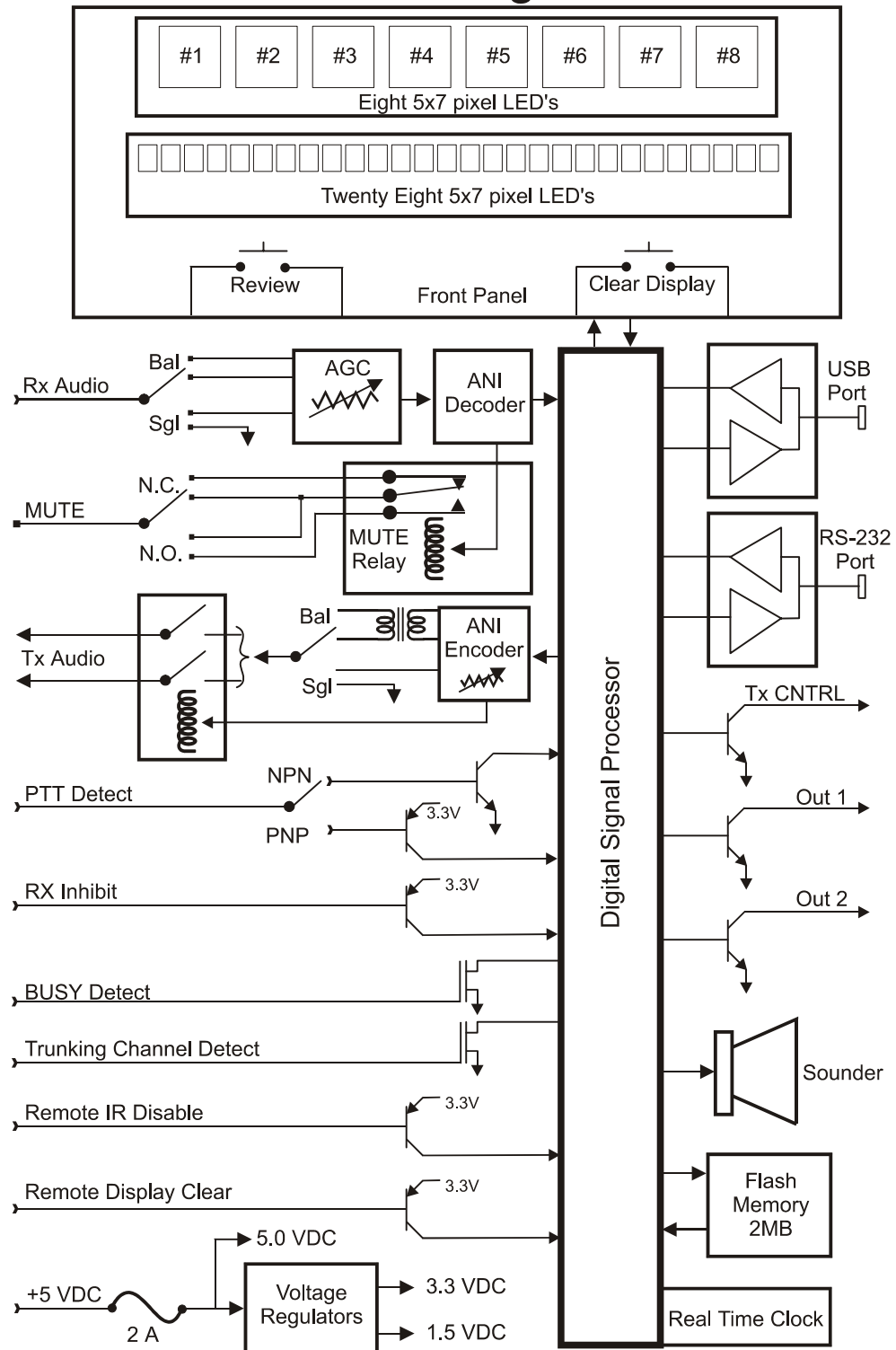
Note: Some jumpers, base resistors, and pull up resistors have been removed for clarity.
Please consult schematic for actual circuits.

C H A P T E R   6
Troubleshooting

Performing Self Tests

To facilitate troubleshooting of the C Plus, the following self test directives exist and can be inputted via any of the three communications ports:

Directive	Definition
$$LOOP	Generates a PTT ANI message and then an emergency message in the signaling format currently in operation. Repeats for 16 seconds, one message per second.
$$KEYT	Keys the C Plus and sends data for 10 seconds in the signaling format currently in operation
$$OUTS	Causes the outputs to individually wiggle for 3 seconds each. Affects Key, RXMute, TXCtl, Out1 and Out 2.
$$DISPLAY	Illuminates all pixels in the display (C Plus II and III)

The Local Loop-Back test ($$LOOP) generates a PTT ANI message and then an Emergency ANI message in the data format selected previously (GE Star®, MDC-1200®, FleetSync™). DTMF encoding is not supported and therefore, $$LOOP does not function in DTMF mode. This signal generation will continue for 16 seconds, with one message being generated per second. Emergency acknowledgments are not sent during this test. If the test is successful, the display will display the decoded messages. If an alias has been programmed for the test ID, then the alias will be displayed. Test ID's are as follows:

Data Format	Test ID
GE Star®	8888
MDC-1200®	8888
FleetSync™	123-1234
DTMF	Not Supported

To prepare for the local loop-back test, disconnect the C Plus from the attached communications system and connect Data Out A to Data In A and connect Data out B to Data In B.

Note that once the emergency message is received, subsequent PTT ID messages will not be displayed unless the clear button is pressed. This is because critical messages must be cleared manually from the display. Serial output, however, will display all messages received.

The Data Modulation Test ($$KEYT) is used to adjust data output for the proper deviation level. When selected, the C Plus will activate the Key line and send 10 seconds of pseudo-data in the data format selected previously. Output level should be adjusted so that data deviation is equal to or just below voice deviation.

The Output Line Test ($$OUTS) "wiggles" output lines to allow verification of operation. (Key, RXMute, TXCtl, Out 1, Out 2). This test should only be performed when the C Plus is not connected to an associated radio. Each of the above mentioned lines will be brought active for 500ms and then inactive for 500ms and then active for another 500ms. This "cycle" will continue for three seconds for each line. Only one line is "wiggled" at a time.

Installation Hints

Probably the C Plus will need to be programmed with your desires before it will work in your system. See Appendix B for the personality that is programmed in the equipment as it is shipped from the factory. Before installation, verify the type of receive audio to which you are interfacing and adjust the C Plus jumpers to match the requirement. Is it Balanced 600 Ohm or Hi Z? Should you terminate or not? Is it single ended? The C Plus permits you to match system requirements with minimal loading. If the system is wireline and already has a device providing termination, set the C Plus for Hi Z balanced. Proper grounding is extremely important. Ensure that station ground is attached to the C Plus ground connections at P1 pin 8 or P2 pin 10.

The C Plus is AGC controlled and generally requires no adjustments to the receive signal. However, if you are having a decode rate of under 100%, try performing the following steps. Refer to the main board schematic. Notice that there are attenuation networks controlled by JP13, JP12 and JP11 (for unbalanced systems) and JP10, JP9 and JP8 (for balanced systems). Also notice that after the attenuation networks, there is an amplifier (U9B) whose gain is controlled by jumper placement on JP5. Use an oscilloscope to view the ANI signal waveform at TP10. Adjust the appropriate jumpers in the attenuation circuitry so that your waveform is not clipped and maximum values are not exceeded. See the table on page 16. Now view the waveform at TP7 and adjust jumper JP5 and VR3 for a 500mV p/p ANI signal.

In two-way systems, the C Plus will be keying the associated transmitter and injecting audio into the radio. This point should be after preemphasis. It is very important to adjust data out using VR5 to ensure the correct deviation level. The deviation level should be just marginally below that of voice. Keep in mind that most transmitters have limiter circuitry. This circuit ensures that the radio will never over-deviate and violate FCC rules. The limiter does this by clipping the transmit audio. The output of the C Plus

must be adjusted to a point just below where limiter clipping occurs. If the limiter is allowed to function, the C Plus data will be distorted.

Isolating System Problems

Today's modern communication systems take advantage of many available resources. Voters, repeaters, various trunking protocols, scramblers and innumerable other devices make passing data substantially more difficult than it was in the "Simplex" days.

Timing is very important. If you have system problems, the first place to spend your energies is with timing issues. Check attack delay in repeater systems. Start with a long delay that gives you 100% decode and then shorten it up.

If you have trunking system problems using the C Plus, review the Channel Acquired section of Chapter two and the Radio Interface Considerations section of Chapter five.

Voting systems can add distortion which our digital signal processor can overcome. But if the voter "votes" in the middle of a data burst, the data will probably be lost.

If installing the C Plus in a system using encryption, interface our data out after encryption and our data in before decryption. Do the same at the mobiles and portables. The idea is to not subject the data bursts to the encryption process.

If you are using a CDT hand-held terminal, make sure that you have ordered the Two-Way feature and that jumper JP-2 has been inserted.

If you are using the channel busy input, be sure that you have removed jumper JP-15.

In all installations, ensure that "station ground" is attached to either P2 pin 10 or P1 pin 8.

Power Supply Schematic
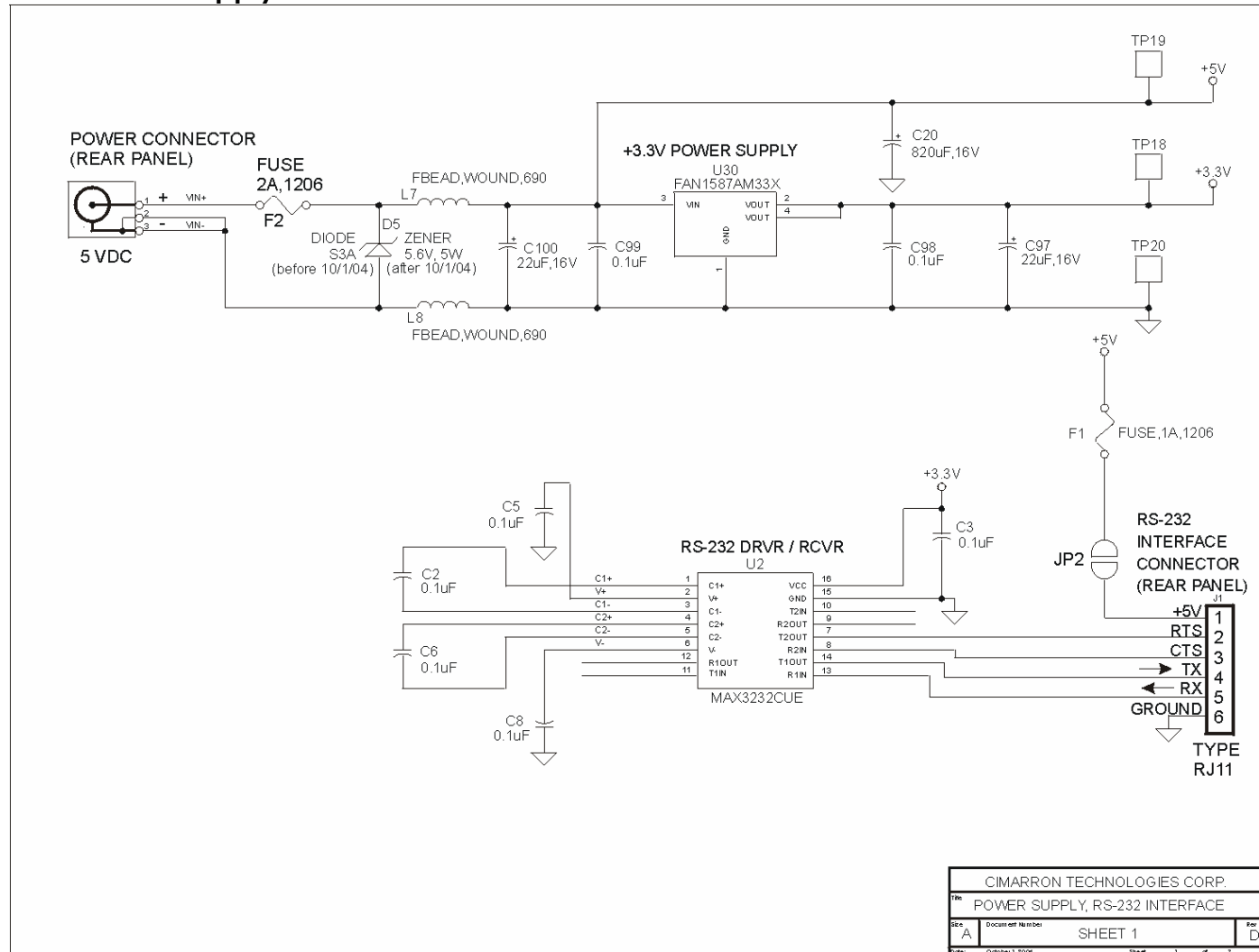
Line Input/Output Schematic
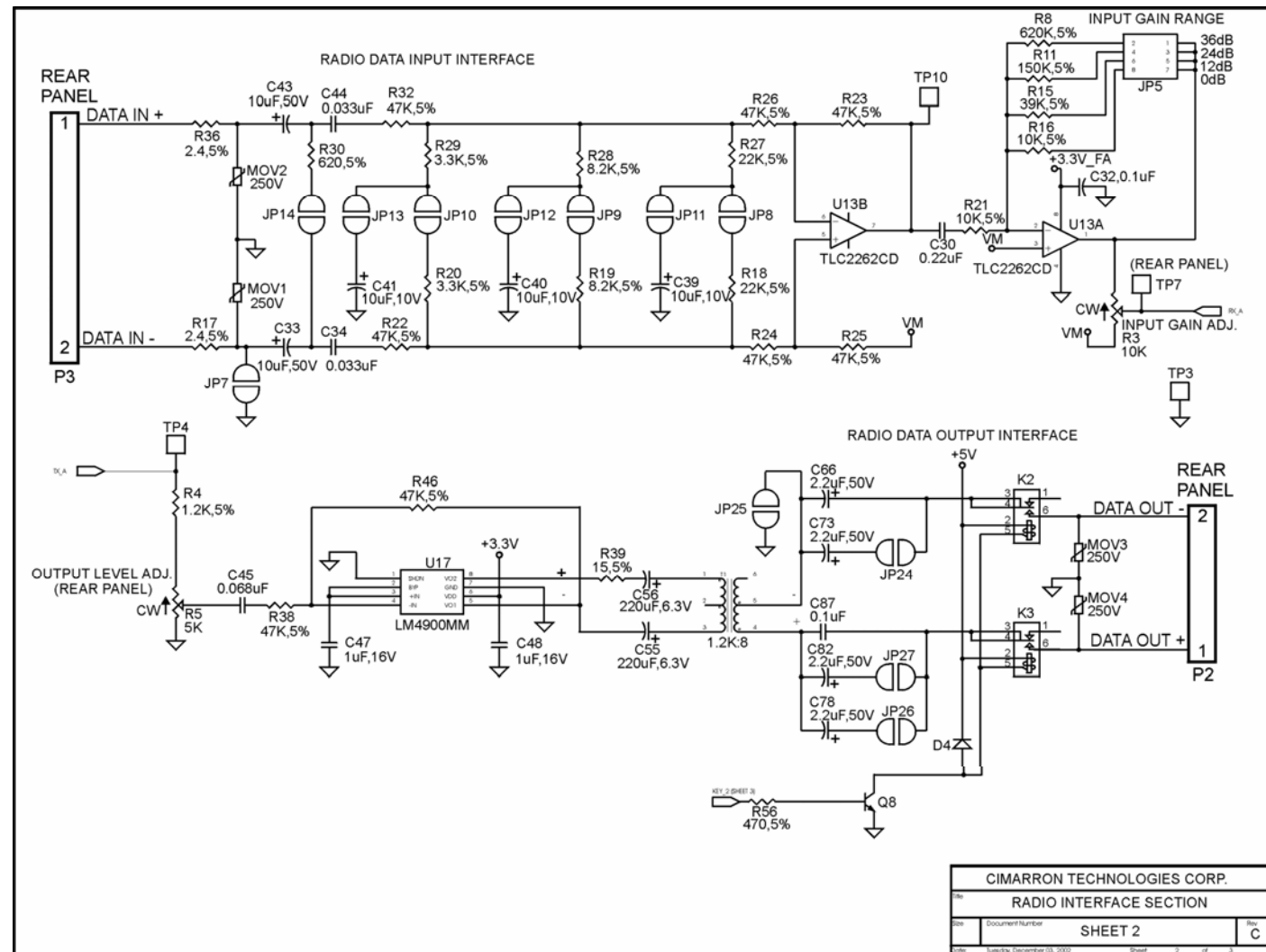
Radio Interface Schematic
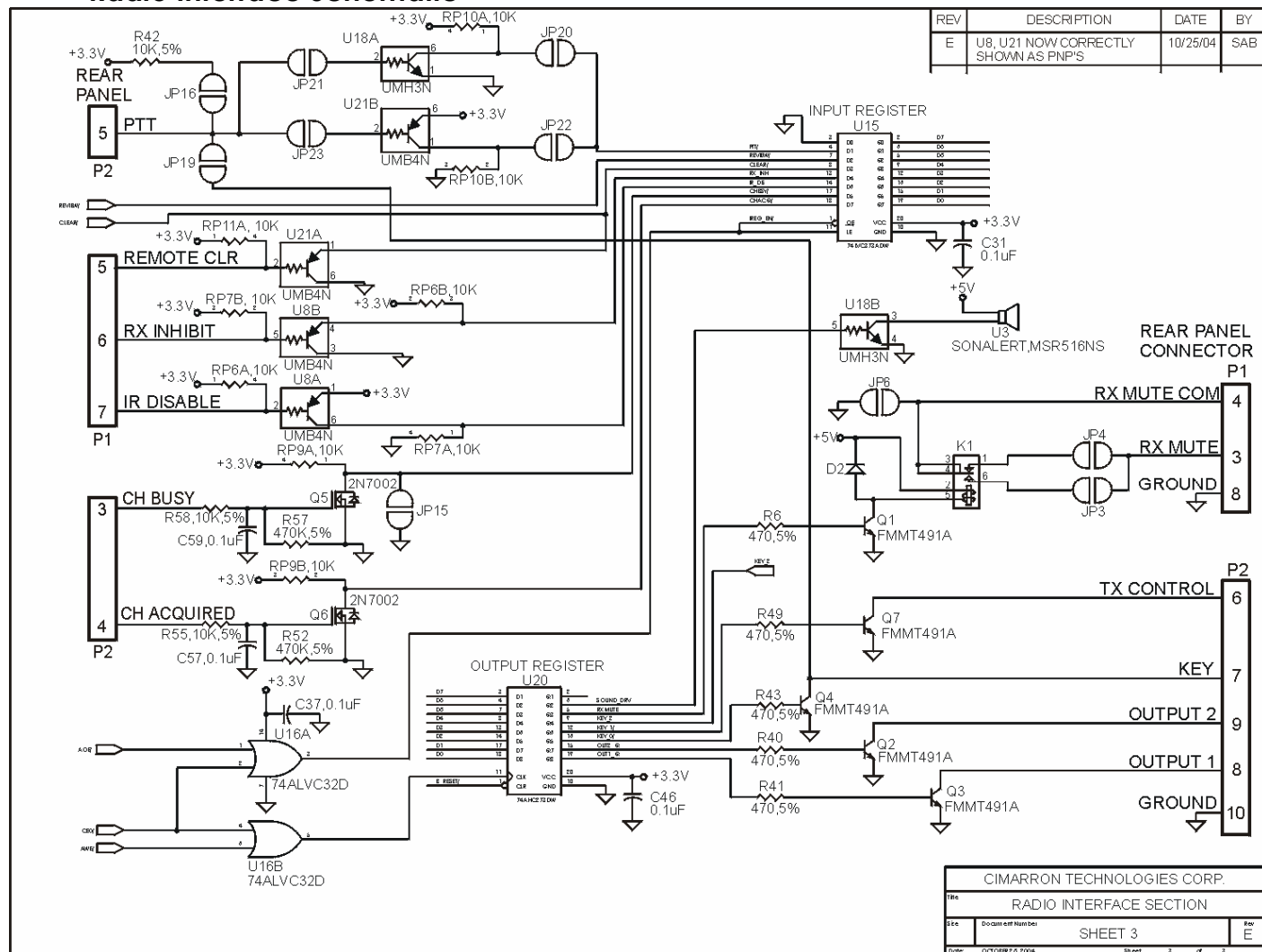
CHAPTER 7
Product Support

If you have any questions or comments about Cimarron products, please make use of our technical support hotline at (760) 738-3285.

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APPENDIX A – Message Table Defaults

```
000-0000,0,STATUS 0,1,0
001-0000,1,STATUS 1,1,0
010-0000,2,STATUS 2,1,0
011-0000,3,STATUS 3,1,0
100-0000,4,STATUS 4,1,0
101-0000,5,STATUS 5,1,0
110-0000,6,STATUS 6,1,0
111-0000,7,STATUS 7,1,0
000-0001,A,-(none)-,1,0   *This is PTT ANI*
000-0010,I,INTG ACK,1,0
000-0011,R,REQ TALK,2,0
000-0100,C,MSSAGE C,1,0
000-0101,D,MSSAGE D,1,0
000-0110,B,TAXI BID,1,0
000-0111,E,EMRGENCY,3,1
000-1000,c,CNCL ACK,1,0
000-1001,S,STUCKMIC,2,0
000-1010,o,MNTR ACK,1,0
000-1011,F,MSSAGE F,1,0
000-1100,G,MSSAGE G,1,0
000-1101,H,MSSAGE H,1,0
000-1110,J,MSSAGE J,1,0
000-1111,M,MAN DOWN,4,2
100-1010,d,DSBL ACK,1,0
101-1010,e,ENBL ACK,1,0
111-0001,A,-(none)-,1,0   *MDC PTT ANI*
111-0011,a,ACCESS,1,0      *MDC REPEATER ACCESS
111-0100,s,SETUP,1,0       *MDC REPEATER SETUP
111-0101,K,KDOWN,1,0       *MDC REPEATER KNOCKDOWN
111-0111,E,EMRGENCY,3,1    *MDC EMERGENCY*
111-0010,P,CALL ACK,1,0    *MDC Generic Ack*
xxx-xxxx,!,UNDEFINE,0,0   (Where xxx-xxxx is any value not
previously listed)
$
```

APPENDIX B – Default Hardware and Personality Conditions

The following conditions are present in equipment as shipped from the factory.

Default hardware conditions for the C Plus

1. CHBSY_IN (input) true when low at P2

2. CHAQR_IN (input) true when low at P2

3. PTT_IN (input) true when low at P2

4. KEY (output) asserted – low on P2, static – high Z on P2

5. TXCTL_OUT (output) asserted – low on P2, static – high Z on P2

6. OUT1 & OUT2 (outputs) asserted – low on P2, static – high Z

7. RX MUTE asserted – relay energized, static – relay relaxed

8. REM_CLR (input) true when low at P3, static – pulled high

9. RX_INHIB (input) true when low at P3, static – pulled high

10. IR_DISABLE (input) true when held low at P3, static – pulled high

Default personality conditions for the C Plus I

1. Signaling type GE Star®

2. Bit values T1= 8192; T2=4096, S1=2048

3. Serial output type Bed-31/1207

4. Display type N/A in C Plus I

5. Serial port parameters 9600 – N – 8 – 1

6. CHBSY_IN act Low

7. CHAQR_IN act Low

8. PTT_IN act Low

9. RX_INHIB act Low

10. Radio mode – Conventional

11. Trunk debounce – 300ms

12. Trunk timeout – 3sec

13. Trunk key time – 3sec

14. Attack Delay – 300ms

15. Acknowledgment capability enabled

16. Channel number – 01

17. Base ID number – 0001

18. Sounder Disabled

Default personality conditions for the C Plus II and III

1. Signaling type – GE Star®

2. Bit values – T1= 8192; T2=4096, S1=2048

3. Serial output type – Cimarron Standard

4. Display type – scrolling

5. Serial port parameters 9600 – N – 8 – 1

6. CHBSY_IN act Low

7. CHAQR_IN act Low

8. PTT_IN act Low

9. RX_INHIB act Low

10. Radio mode – Conventional

11. Trunk debounce – 300ms

12. Trunk timeout – 3sec

13. Trunk key time – 3sec

14. Attack Delay – 300ms

15. Acknowledgment capability enabled

16. Channel number – 01

17. Base ID number –0001

18. Sounder Enabled

APPENDIX C – Dispatch Display Directives

The following set of directives can be inputted to any of the three communications ports:

Directive	Definition
$$CPLUS	Places the C Plus into programming mode
$$SWVER	Returns the version and date of the flashware
$$SOUNDEROFF	Disables the sounder
$$SOUNDERON	Enables the sounder
$$KEYT	Keys the C Plus and sends data for 10 seconds in the signaling format currently in operation
$$UID	Returns the base ID assigned
$$CHAN	Returns the channel number assigned
$$OUTS	Causes the outputs to individually wiggle for 3 seconds each. Affects Key, RXMute, TXCtl, Out1 and Out 2.
$$DISPLAY	Illuminates all pixels of the display for five seconds for test purposes.
$$LOOP	Generates a PTT ANI message and then an emergency message in the signaling format currently in operation. Repeats for 16 seconds, one message per second.
$$DUALDEC	If the dual decode feature has been enabled, this command returns the two types of signaling that are enabled for decode, and which format is enabled for encode.
$$TRIDEC	If the Tri decode feature has been enabled, this command returns the three types of signaling that are enabled for decode, and which format is enabled for encode.
$$MAP <function> TO <output>	Allows the mapping of resources to different outputs. Available functions and outputs are OUT1, OUT2, KEY and MUTE.
$$MAP CHBSY TO CLEAR	Allows channel busy to be affected by the clear button.
$$MAP?	Reports the condition of C Plus resources.

APPENDIX D – Trunking mode

In trunking mode, we will not transmit until we have been given permission and we will not decode unless we know it is for us. This is detected by the use of timers *Trunk Debounce, Trunk Key Time* and *Trunk Timeout* and sense lines *RX Inhib, CHAQR IN* and *CHBSY IN*. Here are a couple of scenarios.

LTR Systems

The C Plus has just been directed to send a selective call to a radio. The C Plus checks the *CHBSY* line and finds that the attached radio is not actively receiving and it checks the *PTT* line and finds that the radio is not currently transmitting. It then activates the *KEY* line for the amount of time described by the timer *Trunk Key*. From the beginning of key time until the expiration of *Trunk Timeout*, the unit is checking *CHAQR* line and waits for the line to become true. Once it changes state, the C Plus watches the line for the time described in *Trunk Debounce* and verifies that the state change remained unchanged for the entire *Trunk Debounce* time. The C Plus then waits the *Attack Delay* time and then encodes and sends the message out the dataout line. If *CHAQR* does not change state (and remains changed for the entire *Trunk Debounce* time) for the duration of *Trunk Timeout* the call is dropped. If, during *Trunk Key Time*, *CHAQR* changes state, but changes state again before *Trunk Debounce* expires, the timer *Trunk Debounce* resets and waits for *CHAQR* to toggle active again and starts counting down again. In LTR systems, *Trunk Key Time* and *Trunk Timeout* are set to the same value.
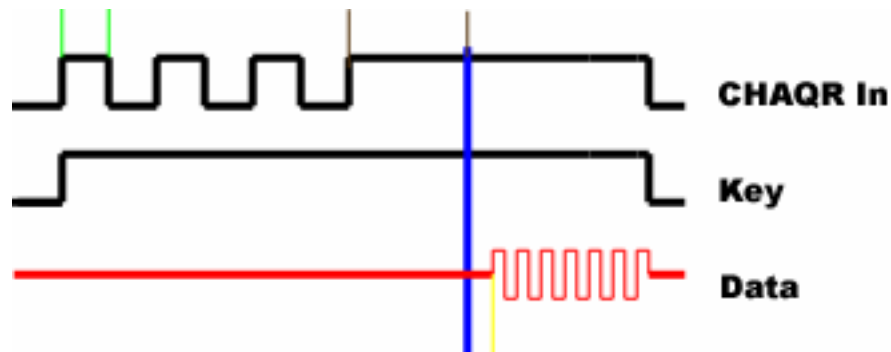
In this timing chart, the distance between green lines is 100mS, between brown lines is 250mS and from the Blue to the Yellow line is 50mS. The C Plus is programmed for *CHAQR* active High, *Attack Delay* of 50mS, *Trunk Debounce* of 250mS and *Trunk Key Time* and *Trunk Timeout* is set to 3 Seconds.

For the receive portion, if *RX Inhib* is active, the received data is discarded without action.

MPT-1327 Systems

The C Plus has just been directed to send a selective call to a radio. The C Plus checks the *CHBSY* line and finds that the radio is not actively receiving and it checks the *PTT* line and finds that the radio is not currently transmitting. It then activates the *KEY* line for the amount of time described by the timer *Trunk Key*. From the beginning of key time until the expiration of *Trunk Timeout*, the unit checks *CHAQR* line and waits for the line to become true. Once it changes state, the C Plus watches the line for the time described in *Trunk Debounce* and verifies that the state remains unchanged for the entire *Trunk Debounce* time. It then rekeys, waits the *attack delay* and sends out data. If *CHAQR* does not change state for the duration of *Trunk Timeout* the call is dropped.
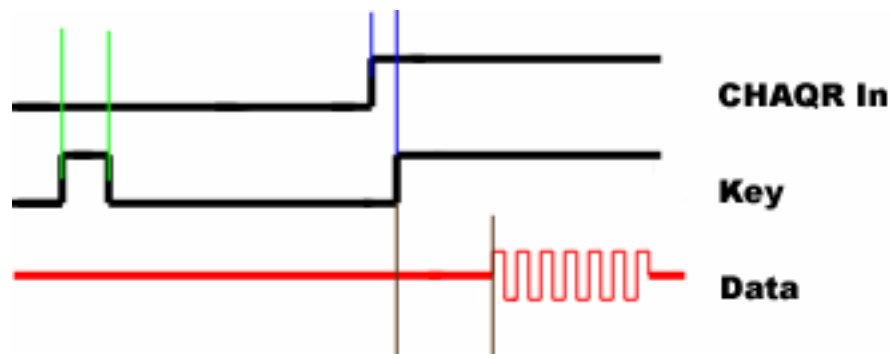
In this timing chart, the distance between green lines is 100mS, between blue lines is 50mS and between brown lines is 200mS. The C Plus is programmed for *CHAQR* active High, *Attack Delay* of 200mS, *Trunk Debounce* of 50mS, *Trunk Key Time* of 100mS and *Trunk Timeout* to 3 Seconds.

For the receive portion, if *RX Inhib* is active, the received data is discarded without action.

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