



CAD-100

PC-Based DTMF Encoder & Decoder

CAD-200

PC-Based 5-Tone Encoder & Decoder

Manual Revision: 2010-05-25

Covers Firmware Revisions:

CAD-100/200: 1.7 & Higher

CAD-200E: 1.3 & Higher

Covers Software Revisions:

CAD: 3.21 & Higher

Covers Hardware Revisions:

CAD: 219F

HARDWARE SPECIFICATIONS

Operating Voltage	7.5-15 VDC
Operating Current	40 mA
Maximum Current	1 A
Operating Temperature	-30 - +60 C
Modem Baud Rate	1200
Audio Input Level (DTMF)	30 mV to 4.5 V p-p
Audio Input Level (5-Tone)	400 mV to 4.5 V p-p
Audio Output Level	0 – 3.5 V p-p

SIGNALING SPECIFICATIONS

CAD-100: DTMF

ANI Length	Up to 8 digits
ANI Timing	60/40 msec
Digits Supported	0-9, *, #, A, B, C, D

CAD-200: 5-Tone

ANI Length	Up to 8 digits
ANI Timing	Varies on Format
Supported 5-Tone formats	CCIR (1 or 2), DZVEI, DDZVEI, EEA, EIA, MODAT, NATEL, ZVEI1
Digits Supported	0-9, A (Group), E (Repeat)

CAD-200E: 5-Tone Expanded

ANI Length	Up to 8 digits
ANI Timing	Varies on Format
Supported 5-Tone formats	CCIR (1 or 2), DZVEI, DDZVEI, EEA, EIA, MODAT, NATEL, PCCIR, PDZVEI, PZVEI, ZVEI1
Digits Supported	0-9, A (Group), B, C, D, E (Repeat), F

SYSTEM REQUIREMENTS

Operating System:	Windows 98 SE, 2000, XP SP2 and higher, Vista (32 bit), 7 (32 bit)
Processor:	Pentium 2 or Higher
Hard-Drive Space:	Minimum 20 MB
RAM:	Minimum 256 MB
USB Port is standard. Serial Port is available upon request.	
Serial to Ethernet Option (decode only) is available (CAD Option B).	

INSTALLATION OVERVIEW

1. Test the radio for functionality.
2. Connect the CAD modem to the radio per the Hardware Installation Section of this manual.
3. Program the CAD software and modem per the Product Programming Section of this manual.

* Midian is not responsible for any damage/loss resulting from the use of Midian's products.

GENERAL INFORMATION

Midian's CAD Series products work with Midian's ANI-F or an ANI equipped radio to display ANI and Emergency ANI to identify which field unit is being keyed. The following is a list of benefits provided by ANI systems:

- Allows dispatchers to know who he or she is talking to.
- Identify system abusers.
- Identify emergency conditions.
- Assign calls fairly.

In addition to decoding ANI and ENI, Midian's CAD-100 and CAD-200 offer selective calling for functions such as individual call, group call, disable/enable, etc. These functions can be used with Midian's UED series products or with a radio capable of these functions.

DTMF:

DTMF (also known as AT&T's Touch Tone) follows a single specification based on the table below. The table shows the DTMF tone pairs generated for any particular DTMF digit. For example the DTMF digit of 1 consists of two tones (697 Hz and 1209 Hz) being generated simultaneously.

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

5-Tone:

In 5-Tone signaling the 0-9, B, C, D and F tones can be used as digits within a unit ID, such as 12345 or 9CB31. Please note that some manufacturers may reserve the B, C, D and F tones for special functions. However, the A and E tones work differently.

The A tone is used as a group tone, which means that if 1234A is encoded then any unit ranging 12340 to 12349 will decode or if 123AA is encoded then any unit ranging from 12300 to 12399 will decode.

The E tone is a repeat tone. For example when sending 12344 in CCIR the second 4 in the sequence will be an E tone (2110 Hz) rather than a second 4 tone (1358 Hz). A sequence of 12444 would send a 4 tone, followed by an E tone, followed by a 4 tone. This is done for reliability purposes. Please note that some manufacturers of radios and service monitors do not follow the standard using the repeat tone. If problems are experienced decoding sequences with repeat digits verify the frequencies the radio or service monitor are encoding.

Another important note regarding 5-Tone signaling is about the tone timings. Under no circumstances should a tone time of less than 30 msec ever be used, as this greatly reduces the reliability of decoding the tones. Midian recommends using 33 msec or higher.

Please see the following table for the frequencies and timings of the various 5-Tone protocols. The frequencies are shown in Hz and the times in milliseconds.

Tone #	Code Digit	CCIR 1 & 2	DZVEI	DDZVEI	EEA	EIA	MODAT	NATEL	PCCIR	PDZVEI	PZVEI	ZVEI1
Tone 0	0	1981	2200	2400	1981	600	637.5	1633	1981	2200	2400	2400
Tone 1	1	1124	970	1060	1124	741	787.5	631	1124	970	1060	1060
Tone 2	2	1197	1060	1160	1197	882	937.5	697	1197	1060	1160	1160
Tone 3	3	1275	1160	1270	1275	1023	1087.5	770	1275	1160	1270	1270
Tone 4	4	1358	1270	1400	1358	1164	1237.5	852	1358	1270	1400	1400
Tone 5	5	1446	1400	1530	1446	1305	1387.5	941	1446	1400	1530	1530
Tone 6	6	1540	1530	1670	1540	1446	1537.5	1040	1540	1530	1670	1670
Tone 7	7	1640	1670	1830	1640	1587	1687.5	1209	1640	1670	1830	1830
Tone 8	8	1747	1830	2000	1747	1728	1837.5	1336	1747	1830	2000	2000
Tone 9	9	1860	2000	2200	1860	1869	1987.5	1477	1860	2000	2200	2200
Group	A	2400	825	885	1055	2151	---	1995	1050	825	970	2800
	B	930	740	810	930	2433	---	571	930	886	810	810
	C	2247	2600	740	2400	2010	---	2205	2400	2600	2800	970
	D	991	885	680	991	2292	---	2437	991	856	885	885
Repeat	E	2110	2400	970	2110	459	487.5	1805	2110	2400	2600	2600
	F	1055	680	2600	2247	1091	---	2694	---	---	680	680
Timing (msec)		100±15 70±15	70±15	70±15	40±4	33±0.5	40±5	70	100±10	70±15	70±15	70±15

HARDWARE INSTALLATION

Be certain to follow standard anti-static procedures when handling Midian products. For installation instructions for a particular radio, please consult Midian's application notes for the CAD if available.

P1-1 – Ground – Connect to ground in the base station.

P1-2 – B+ - Connect to a 7.5-15 VDC source in the base station or from an external power supply.

P1-3 – PTT Output – This open collector provides a ground during PTT.

P1-5 – Squelch Output – Connect to a squelch point in the base station that mutes the speaker.

P1-8 – Alarm Output – This connection is optional as the PC will give an audible tone. This output goes active whenever an emergency status is received. The transistor Q4 provides an open collector to ground to trip a bell, siren, etc. It is necessary to install a jumper from the collector of Q4 to P1-8.

P1-9 – COR Input – Connect to a point in the radio's squelch or CTCSS circuit that changes logic level when a carrier is detected. If a high level is provided, move R40 from its pull up to its pull down position. A radio whose squelch circuit provides a logic-low or high can readily turn Q1 on and off. If the point only makes a small change in voltage, it may be necessary to adjust the values of R39 and R40 to Q1 to change states. If the COR is not being used ground this input and program the COR polarity as ground.

P1-10/P1-11 – RX 600-Ohm Balanced – Optional – This is a 600-Ohm balanced input that is used when directly connected to the RX line from the base station in a remotely controlled base station over a dedicated phone line.

P1-12 – RX HI-Z Input – Connect to the receiver audio output of the base station, preferably after the CTCSS high-pass filter.

The following connections are only needed when encoding.

P1-4 – Trunk Delay Input – This input prevents the modem from transmitting until a channel has been acquired. Hook to a point in the radio that provides an output after the channel has been acquired.

P1-6 – TX Audio Output – Connect to the MIC-High in the radio. Removing JU4 and installing R81 with a value equivalent to the required impedance can change the output impedance.

P1-7/P1-8 – TX 600-Ohm Balanced Output – Optional – The CAD must be ordered with the CAD Option A for this output. Connect this output to the TX side of a 600-Ohm balanced audio source. If using this feature the Alarm Output is not available and JU8 should be removed.

P3 is the USB connector.

The following are the pins used on the optional Female DB-9 connector P2 (RS-232).

P2-2 – TX Output

P2-3 – RX Input

P2-4 – Data Terminal Ready

P2-5 – Ground

P2-6 – Data Set Ready

P2-7 – Clear To Send

P2-8 – Request To Send

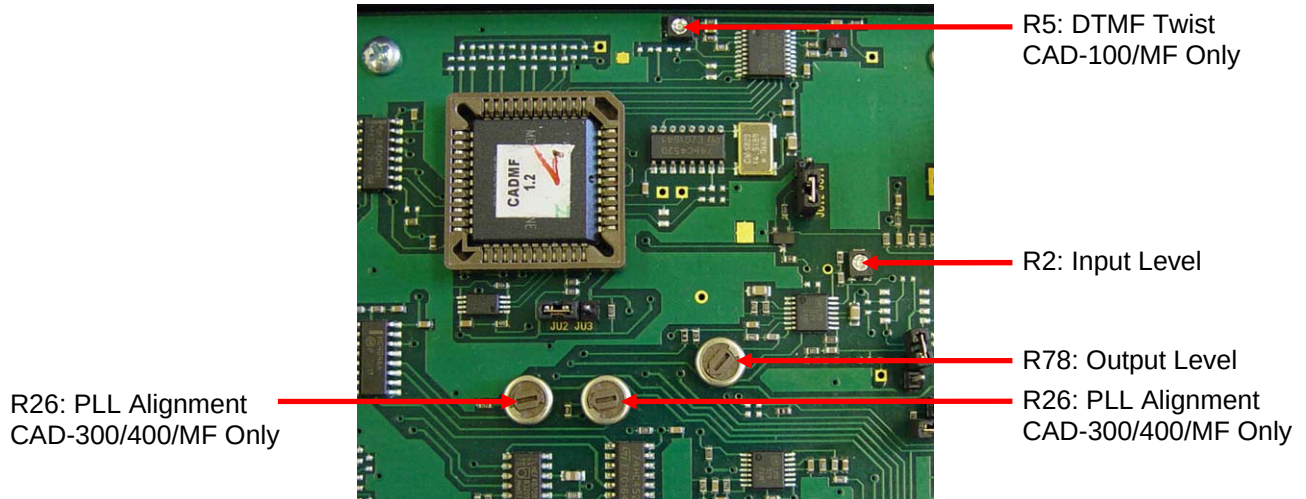
HARDWARE ALIGNMENT

CAD-100/200/200E:

Input Level: Apply a signal that fully quiets the receiver, modulated by a 1000 Hz tone at ± 3.3 KHz (wideband) to the receiver (1.65 kHz for narrowband). While monitoring TP1, adjust R2 just below clipping.

Twist: For DTMF systems modulate the RF carrier with 697 Hz and 1633 Hz tones in succession. Adjust R5 until the 2 tones at U2 Pin 3 are approximately the same size.

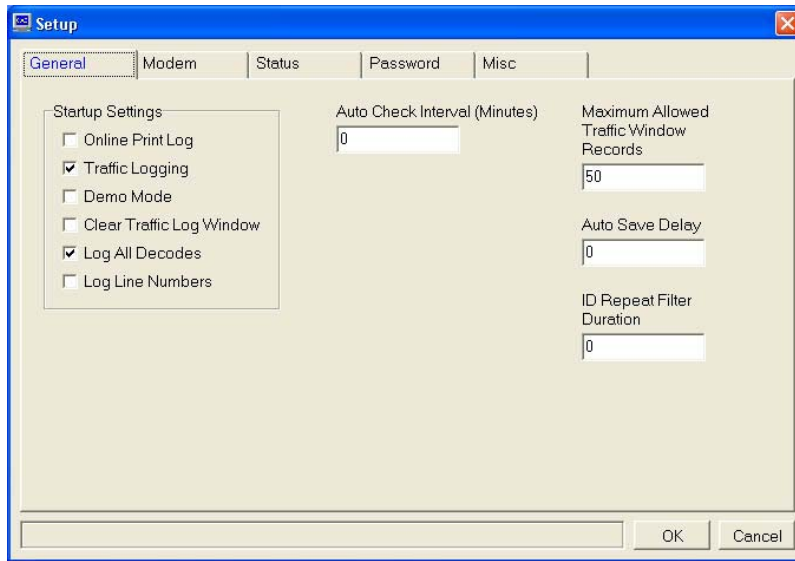
Output Level: Start the CAD-100/200 software and command the unit to send data. Adjust R78 for a deviation of ± 2.8 -3.0 KHz on the system transmitter.



SOFTWARE INSTALLATION

Insert the CD into the CD-ROM drive and close the drive. The CD will auto-run. Click on the side menu bar for miscellaneous software and select the CAD software. Follow the set-up procedures.

General Tab:



Online Print Log: If checked the CAD software will output all incoming traffic to a printer connected to LPT1.

Traffic Logging: If checked the CAD software will log all traffic to a log file. The first time the software is launched a log folder will be created in C:\Program Files\Midian\Cad_v3_xx. Each time the CAD is used and traffic is received the software will output the traffic in ASCII format to a log file in this location. The log file name will be created based on the system date of the PC. These log files can then be exported to Microsoft Excel or Access for reports.

Demo Mode: If checked the software will create fictional ANI and Emergency ANI decodes on the traffic screen using the programmed subscribers.

Clear Traffic Log Window: If checked, upon exiting and restarting the software the traffic window will be cleared of previous activity.

Log All Decodes: If checked the CAD will decode and display any sequence with a valid ANI length, even if the sequence is not in the subscriber database.

Log Line Numbers: If checked the CAD will add a line number to each entry in the log file starting with 1 and increasing incrementally until the log file rolls over into the next day, where it will start at 1 again.

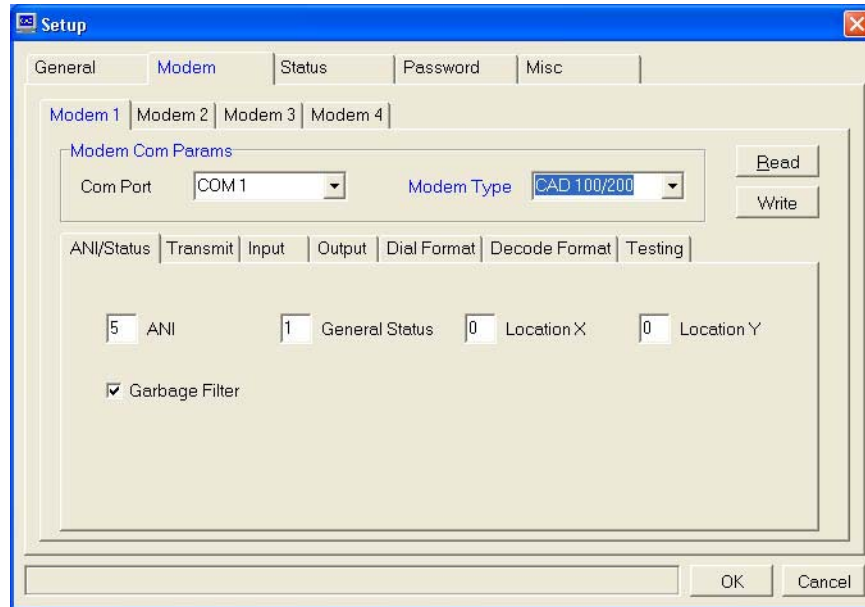
Auto Check Interval: This will set the amount of time that will pass before the Auto Check feature will begin to issue a check command to a subscriber in the database. Subscriber Auto Check must be in each of the desired subscriber records to be checked. If a zero is entered in this field, Auto Check will be globally disabled regardless of the subscriber Auto Check feature.

Maximum Allowed Traffic Window Records: This will limit the number of records kept on the traffic screen in the CAD software.

Auto Save Delay: Setting this option to 0 will disable the Auto Save feature. Setting this field from 1 to 59 minutes will determine when the application will force any changes made out to the disk.

ID Repeat Filter Duration: For example if set for 9 seconds and the CAD displays an ANI and 6 seconds later the same ANI is decoded, the CAD will not display the repeated ANI.

Modem Tab:



Note: Prior to writing to the modem, the RX Input must either be quieted or disconnected. If there is noise present at the RX Input during modem programming, it may interfere with programming and result in EEPROM corruption.

Modem 1-4: The CAD software can support up to 4 different CAD modems connected to different ports on the PC.

COM Port: Select the COM Port that the CAD modem is connected to on the PC.

Modem Type: Select the type of CAD modem that is connected to the COM Port.

ANI/Status Tab:

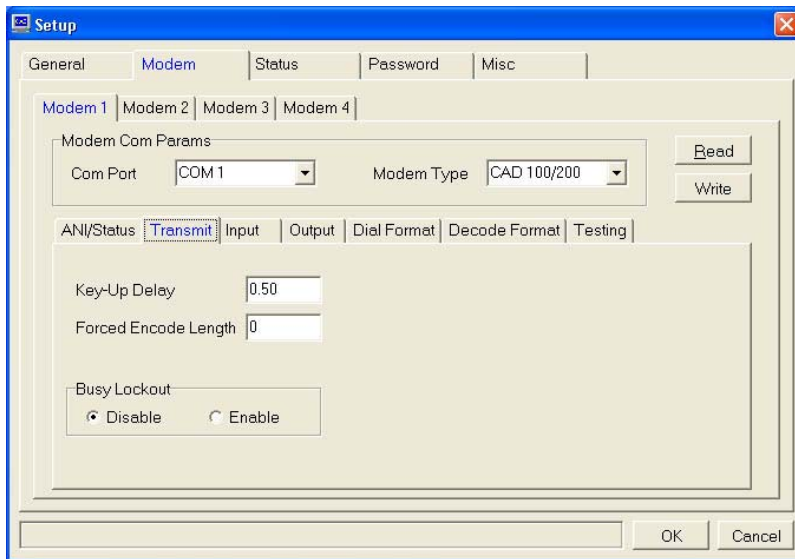
ANI: The range of this field is 0-8 digits. This sets the number of digits the CAD will use as the Unit ID. If fewer digits are received than programmed, the CAD will not decode. If more digits are received than programmed, then those extra digits will be used for the status and location fields. If this field is set to 0 then it will decode any length of digits as a valid ANI.

General Status: The range of this field is 0-2 digits. This sets the number of digits the CAD will use for status reporting. If fewer digits are received than programmed, the CAD will not decode. If more digits are received than programmed, then those extra digits will be used for the location fields.

Location X: The range of this field is 0-1 digits. This enables the decoding of a location. If only using Location X and not Location Y, this is typically a common location such as an airport, mall or park. If using Location X and Location Y, then a grid location is used such as Broadway Blvd and Main St.

Location Y: The range of this field is 0-1 digits. This enables the decoding of a location. When using Location X and Location Y, a grid location is used such as Broadway Blvd and Main St.

Garbage Filter: If checked the CAD will only display ID's programmed into the subscriber database. This is used to prevent the decoding and displaying of false ID's due to noise.

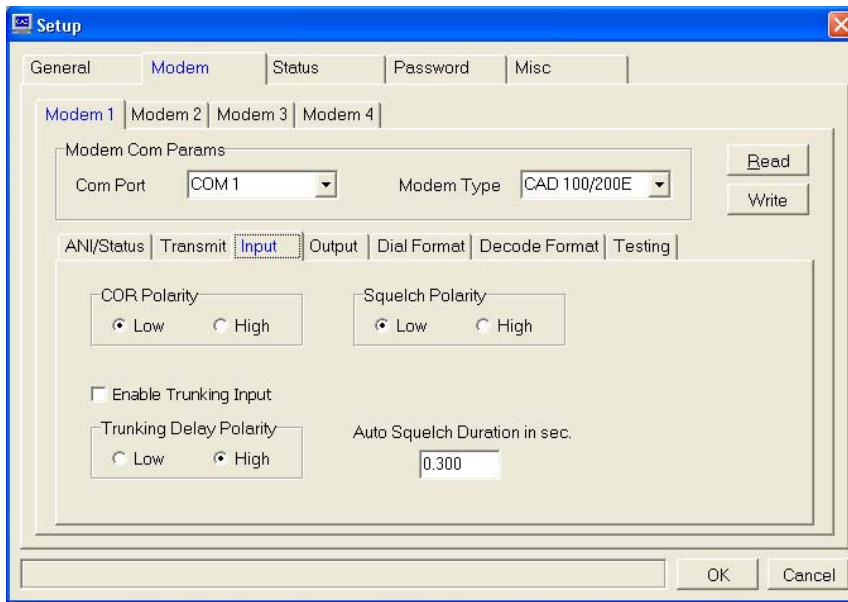


Transmit Tab:

Key-Up Delay: The range of this field is 0.0 to 9.9 seconds. This sets the amount of time the CAD waits for the base station radio to key-up prior to generating tones.

Forced Encode Length: The range of this field is 0-8. This sets a number of digits that the CAD must send for each call. Setting this field to 0 allows the CAD to encode any length of digits from 0-8.

Busy Lockout: If enabled the CAD will not transmit if the COR Input is active. If disabled the CAD will transmit regardless of activity on the channel.



Input Tab:

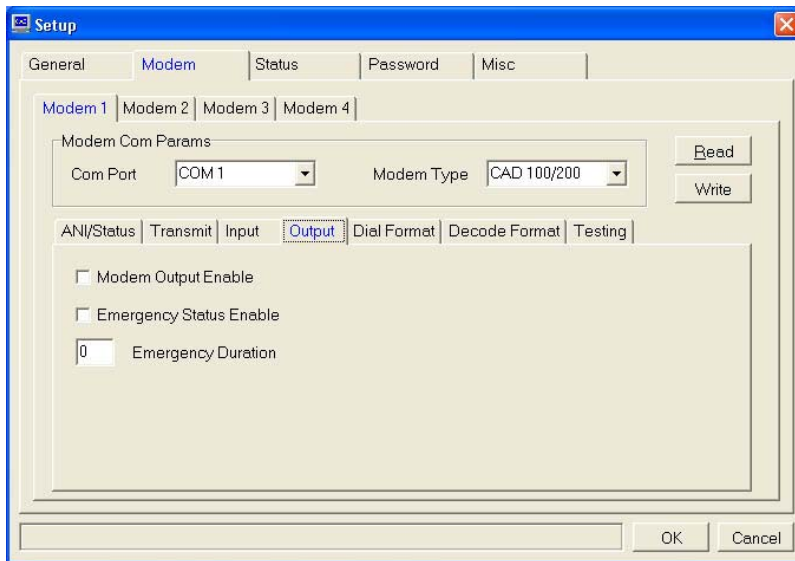
COR Polarity: This sets the active polarity that the CAD looks for from the radio to indicate channel busy. The CAD uses the COR for busy lockout and to validate a decode to reduce falsing.

Squelch Polarity: This sets the polarity that will mute the base station radio from the moment that the COR detects carrier until completion of the ANI. This is used to prevent the dispatcher from hearing the ANI squawk.

Auto Squelch Duration: Set for 0.000-9.999 seconds. To compute the time, it is necessary to know the ANI duration and any front-porch time that the encoding mobile or portable transmits in order to open the base station or the repeater's CTCSS decoder. This timing is programmable in 25 msec increments.

Enable Trunking Input: Check this box if connecting the CAD to a trunking system when using encode features.

Trunking Delay Polarity: If the CAD is being used in a trunking system, this sets the active polarity the radio gives the CAD to indicate a channel has been acquired. If this feature is not used, program as High.

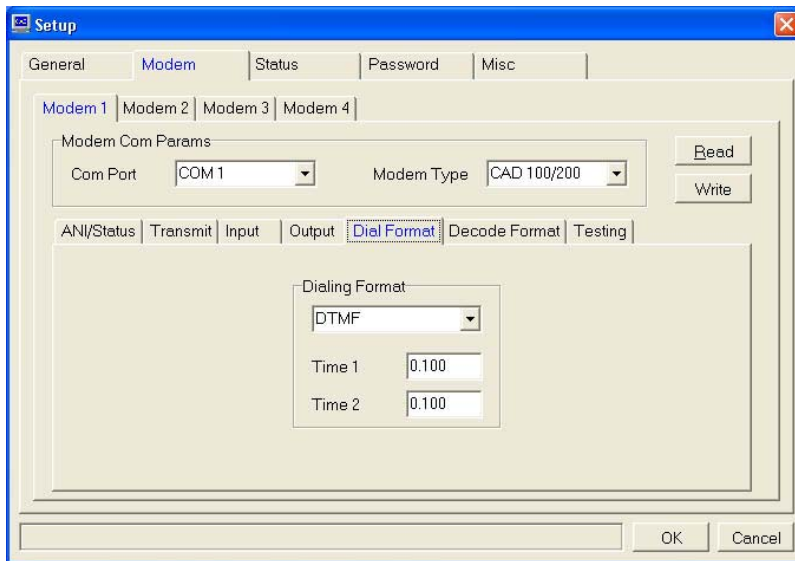


Output Tab:

Modem Output Enable: Not used at this time.

Emergency Status Enable: Not used at this time.

Emergency Duration: Not used at this time.

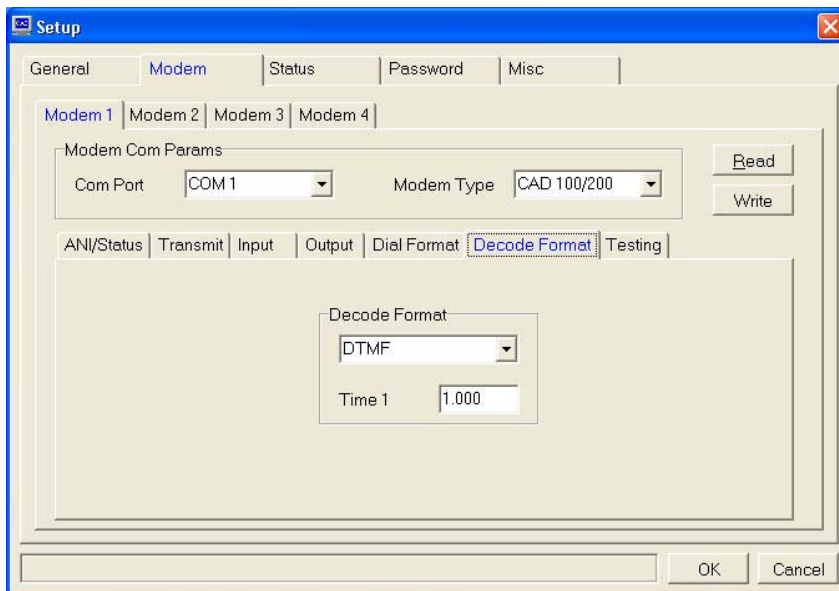


Dial Format Tab:

Dialing Format: Select from the drop down menu the desired dialing format.

Time 1: For DTMF dialing Time 1 sets the Tone On time. For 5-Tone Time 1 sets the length of the first tone.

Time 2: For DTMF dialing Time 2 sets the Tone Off time. For 5-Tone Time 2 sets the length of all subsequent tones.



Decode Format Tab:

Decode Format: Select from the drop down menu the desired decode format.

Time 1: Set for 0.000 to 9.999 in 5 msec increments. For DTMF Midian recommends a time of 1.000, this allows for an inter-digit time of 1 second which allows for automatically encoded or manually encoded DTMF tones to be decoded by the CAD. For 5-Tone Midian recommends a time 1/5 that of the encode time of the tones to be decoded. For example CCIR uses a 100 msec tone time and EIA uses a 33 msec tone time, therefore Midian would recommend a using 20 msec for decoding CCIR and 5 msec for EIA.

Status Tab:

System Status: This allows a System Status Message to be renamed or translated into a different language by entering the desired message in the Message column next to the original message.

General Status: This allows a General Status Message to be renamed or translated into a different language by entering the desired message in the Message column next to the original message. Additionally, the desired digit for an Emergency status is checked in this table. If doing a 2-digit status, then 0-9 will need to be renumbered as 00-09. If doing a 2-digit status and more than 10 statuses are needed then from the last ID field press the down arrow and enter the new status number and create the desired message.

Location X: This allows a Location X Status Message to be renamed or translated into a different language by entering the desired message in the Message column next to the original message. If only using Location X and not Location Y, this is typically a common location such as an airport, mall or park. If using Location X and Location Y, then a grid location is used such as Broadway Blvd and Main St.

Location Y: This allows a Location X Status Message to be renamed or translated into a different language by entering the desired message in the Message column next to the original message. If using Location X and Location Y, then a grid location is used such as Broadway Blvd and Main St.

Password Tab:

If the system administrator wishes to password protect certain functions, check the enable password box and then select which features to protect. When the protected features are accessed the user will be prompted to enter the password.

Misc Tab:

Color Tab: This tab enables the administrator to change the appearances of active text and the various backgrounds.

Audio Tab: This tab enables the administrator to change the sounds of the Emergency and Error files, with other wav files.

Images Tab: This tab enables the administrator to change the appearances of the icons on the subscriber screen.

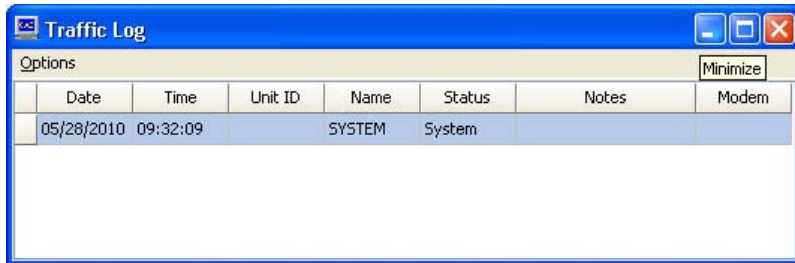
OPERATION

Main Window:

File Menu: Here the user can print and import subscriber and other databases.

Window Menu: Enables the user to change which windows are displayed on the screen.

Traffic Log Window: The information in this screen will show system activity in chronological order with the most recent being at the top of the screen. Columns may be moved into any order by clicking and dragging the filed into the desired position. Columns can be added and removed from the display by going to Options > Traffic > Visible Columns.



Subscribers Window: Clicking a particular column header enables the dispatcher to sort the column. Columns may be moved into any order by clicking and dragging the filed into the desired position.



Add New Subscriber: Clicking on the add icon will open the subscriber information screen. Enter the user description and the desired ID's. Please see the Subscribers section for details on adding new subscribers.



Edit Subscriber: Select the unit to be edited and click on the edit icon. The subscriber information screen will be opened, so the unit details can be edited.



Delete Subscriber: Select the unit to be deleted and click on the delete icon. This will permanently delete the unit from the database.



Subscriber Properties: TBD.



Call: Select the unit to be called and then click the call icon. If the unit is programmed with a call ID then the unit in the field will decode and ring.



Query: Select the unit to be queried and then click the query icon. This will send a query or radio check command to field units capable of this feature, which will in turn cause the radio to send an acknowledgement to the dispatcher to verify the radio is transmitting and receiving.



Enable: Select the unit to be enabled and then click the enable icon. This will re-enable a previously disabled field unit.



Disable: Select the unit to be disabled and then click the disable icon. This will disable a field unit that is capable of the Deadbeat Disable or Radio Kill feature.

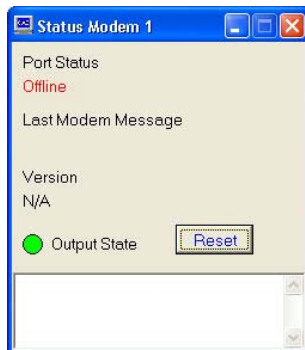


Spy: Select the unit to be remotely monitored and then click the spy icon. If the field unit is capable of this feature the field unit will key-up for a pre-programmed period of time, so the dispatcher can listen in on the field unit.

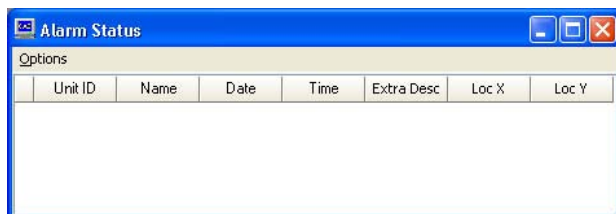


Emergency Acknowledge: When an Emergency Unit ID is decoded the CAD operator can select the unit and press the Emergency Acknowledge button to have the CAD send a command to the field unit to reset if capable of this feature.

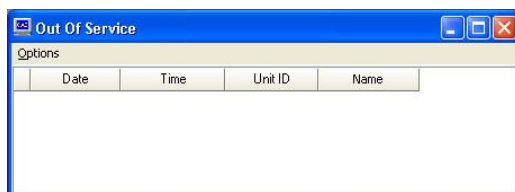
Modem Status Window: This screen will indicate if the modem is on-line or off-line and the version of the modem.



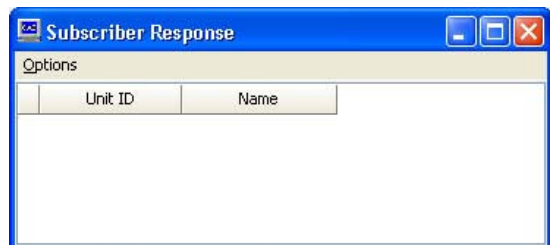
Alarm Status Window: This screen will display incoming emergency statuses in addition to them displaying in the traffic window.



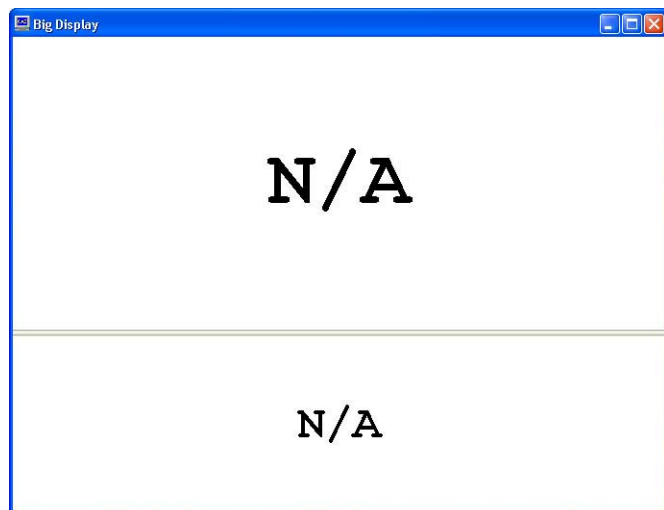
Out of Service Window: When using the Query function this window will show if a subscriber did not respond.



Subscriber Response Window: When using the Query function this window will show if a subscriber responded. The response will also show in the traffic window.



Big Display Window: For easier viewing incoming calls can be displayed in the Big Display with the Unit ID being shown in the top box and the Subscriber name (alias) being shown in the bottom box.



SUBSCRIBERS

Add A Subscriber

General

Name: John Smith Serial Number:

Group ID: 001 Radio Make:

Unit ID: 12345 Radio Model:

Extra Description:

Decode | Encode | Misc

Receive Modem: Modem 1

☐ Receive Modem Lock

Decode Format: CCIR

Transpond Code: 12345

Emergency IDs

Group ID: 001

Unit ID: 123459

Name: This is the alias for the Unit ID that will be displayed when a Unit ID is decoded.

Serial Number: This field can be filled with the serial number of the radio. This field is for informational purposes.

Group ID: Enter the Group ID in this field if using a Group ID in addition to the Unit ID.

Unit ID: Enter the Unit ID (ANI) of the radio in this field. This Unit ID must contain the number of digits that was programmed in the CAD Setup > Modem > ANI/Status tab.

Radio Make: This field can be filled with the radio manufacturer's name. This field is for informational purposes.

Radio Model: This field can be filled with the radio model number. This field is for informational purposes.

Extra Description: This is a text field, so that additional information on the subscriber can be recorded.

Receive Modem: This should be set to the desired modem that was set up in the CAD Setup > Modem.

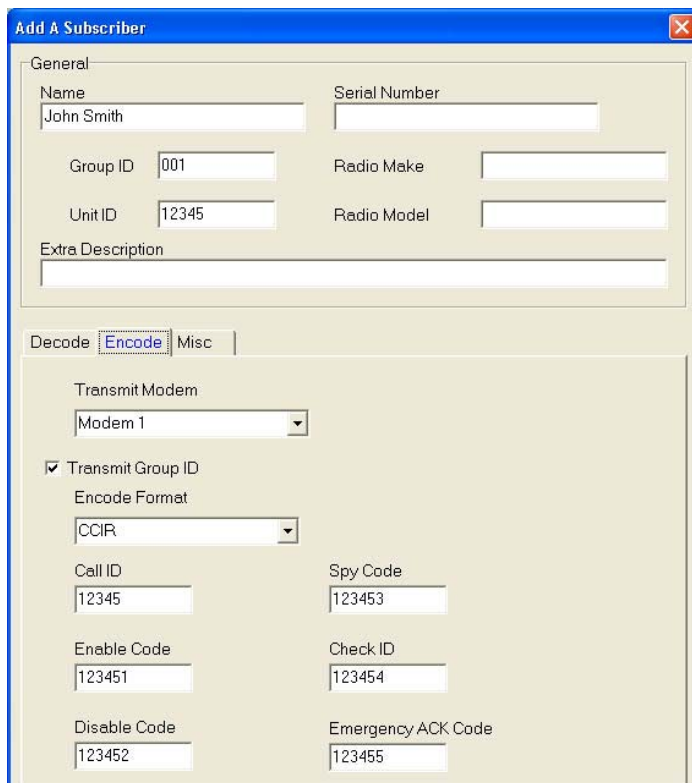
Receive Modem Lock: If checked the CAD software will only display this subscriber in the software when decoded on the selected modem. If more than one modem is used with the box checked and the same Unit ID is decoded on a different modem then the subscriber will not be displayed.

Decode Format: This displays the signaling format for the selected modem.

Emergency ID: Group ID: Enter the Group ID in this field if using a Group ID in addition to the Unit ID.

Emergency ID: Unit ID: Enter the Unit ID (ANI) of the radio in this field. This Unit ID must contain the number of digits that was programmed in the CAD Setup > Modem > ANI/Status tab for the ANI digits and status digits. For DTMF and 5-Tone an Emergency ID is usually the Unit ID plus a status digit of 9. For example if the unit ID is 12345 then the Emergency Unit ID would be 123459.

Transpond Code: When a field unit is called it can transpond back to the CAD to report the call was successful.



Add A Subscriber

General

Name: John Smith Serial Number:

Group ID: 001 Radio Make:

Unit ID: 12345 Radio Model:

Extra Description:

Decode | Encode | Misc

Transmit Modem: Modem 1

☒ Transmit Group ID

Encode Format: CCIR

Call ID: 12345 Spy Code: 123453

Enable Code: 123451 Check ID: 123454

Disable Code: 123452 Emergency ACK Code: 123455

Transmit Modem: This should be set to the desired modem that was set up in the CAD Setup > Modem.

Transmit Group ID: If selected the Group ID field becomes available and when calling a unit it will send the Group ID plus the Unit ID.

Encode Format: This displays the signaling format for the selected modem.

Call ID: This sets the sequence that will be encoded when a call command is sent. This ID usually matches the Unit ID.

Enable Code: If using Radio Kill features this is the command to enable the radio after it has been killed.

Disable Code: If using Radio Kill features this is the command to disable (kill) the radio.

Spy Code: If using Remote Monitor features this is the command to force the field unit into transmitting.

Check ID: If using Query features this is the command to force the radio into sending an acknowledgement back to the CAD if it is on.

Emergency ACK Code: When an Emergency ID is decoded by the CAD the dispatcher can send an acknowledgement back to the radio to cancel additional Emergency transmissions.

Add A Subscriber

General

Name: John Smith

Serial Number:

Group ID: 001

Radio Make:

Unit ID: 12345

Radio Model:

Extra Description:

Decode | Encode | **Misc**

☐ Enable Auto Check

☐ Enable Decode Alert

Decode Alert Audio File:

Response Detection

☐ Enable Response Detect

Enable Auto Check: If checked the CAD will add this subscriber to the Auto Check queue. The subscriber must be programmed with a Query ID.

Enable Decode Alert: If selected the CAD will play an audible alert when the CAD decodes this subscriber.

Decode Alert Audio File: A wav file can be selected from the PC to be played for the Enable Decode Alert function. This wav file will play when the subscriber is decoded. There are 3 wav files in the CAD software that can be selected or a wav file can be used from the PC.

Response Detection: Enable Response Detect: Enabling this feature will allow the CAD to monitor if the subscriber has had any radio activity within a period of time.

TECHNICAL NOTES

Radio Compatibility: Midian has taken the utmost care to ensure the CAD integrates with the radio with minimal impact to the features of the radio. However, some features may not be available in the radio when a CAD is used. If a feature is not available, please contact Midian to see if the feature can be added.

International Windows Versions: Even though Midian has worked to make this product internationally compliant, Midian recognizes that there may be additional issues to be resolved.

MIDIAN CONTACT INFORMATION

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