

CALL24 Mark III

Callbox User Manual September 2007

Overview

This device is used as an emergency communications call box for remote areas such as parking lots, walkways, or other locations not having easy access to telephone lines. Communications from the call box to security personnel is done via two-way radio or cellular phone. To use, the user presses a call button on the front panel, which causes the unit to activate a strobe light and send one prerecorded voice message to the caller and another voice message to security. The message to security would typically state the nature of the call and the location of the call box, while the message to the caller might state that the call is underway. Security responds by sending a coded signal back to the call box to enable it for two-way communications with the caller. Once enabled, the call box button becomes a push-to-talk switch, allowing the caller to talk directly to security. When a cell phone is being used the call box becomes totally hands free. When communications have ended, security can send another coded signal to the box to re-arm it for another emergency call and deactivate the strobe. Many of the features of the callbox described here are programmable by the factory and/or dealer.

Technical Summary	1
Hardware Components	1
The Software	1
Idle Mode	2
Call Initiation	3
Call Progress, Radio	3
Call Progress, Phone	5
TEST Pushbutton (Call Type 5)	8
Tamper Detection (Call Type 6)	9
Low Battery (Call Type 7)	9
Listen Mode	10
Talk Mode	11
With Radio	11
With Telephone	12
Quiet Mode	13
DTMF Commands	14
DTMF Command List	14
Digital Outputs	17
Auto-Test	18

NightLight	19
ANI Codes	19
Heartbeat	21
Power Management	22
Battery Charging	22
Low Battery Calls	24
Hibernation Mode (near-zero power operation)	25
External Device Power Control	25

Technical Summary

Hardware Components

The components which make up the call box system are: (1) The call box controller, (2) two-way radio or cellular phone adapter, (3) rechargeable battery, (4) power supply delivering 15 volts DC @ 4 amps, (5) speaker & microphone, (6) RED and GREEN front panel lights (LEDs), (7) up to four front panel push-button CALL switches, (8) a strobe light and a nightlight, and (9) a vibration-sensing tamper switch and other normally closed switches wired in series to sense theft or vandalism. Not part of the call box unit itself, but required for use, is a security guard or equivalent with two-way radio or telephone who will be responsible for responding to calls made from the call box. The controller is computer-based, and governs the overall operation of the call box. The controller has the capability of receiving and decoding DTMF signals (commands) sent from the security station. It also is responsible for activating the radio's push-to-talk switch or placing a call via the cell phone, routing audio signals from the microphone or from the voice storage & playback system to the radio or cell phone (for transmission), routing audio signals from the radio, cell phone or the voice system to the front panel speaker, controlling the RED and GREEN lights, the strobe and the nightlight.

The Software

In the software for the callbox there are several modes of operation, and a few sub-modes. The main modes are Idle and Talk modes, where in Idle mode the callbox software is waiting for some event to take place and in Talk mode it is controlling two-way communications between the security office and the caller, either by 2-way radio or telephone (landline or cell phone adapter).

Listen mode is a sub-mode of Idle or Talk mode, and this defines the condition where the caller (the person near the callbox) cannot hear any communications from security but security can hear what is being said near the callbox. The callbox can be in Idle mode or Talk mode and temporarily be switched to Listen for a predetermined length of time, at which time it will automatically revert

¹back into whatever mode was in effect before the switch. Listen mode is primarily used for security to listen to any activity in the vicinity of the callbox without anyone near the callbox being aware of it.

Quiet mode is a sub-mode of Talk mode, and this defines the condition where a call is taking place without any indication at the callbox that it is doing so. Quiet mode is useful for Tamper alarms and Low Battery calls, where the call is normally intended to provide a prerecorded message to security only, and not intended for 2-way communications between the callbox and security.

There are subtle differences in these modes depending on whether the callbox is equipped with a 2-way radio or a phone. The fundamental difference is that a phone provides for 2-way full duplex operation, and when connected via phone, the communications path is to the called party only as opposed to the potential party-line communications method with a 2-way radio.

Idle Mode

When idle the red and green LEDs are off, the strobe is off, and the radio is not transmitting or the phone is on hook. The microphone and speaker are both muted. The unit is monitoring (1) the call button(s) and the TEST button, (2) the tamper switch and other switches in the security current loop (3) battery level, and (4) received DTMF tones from the radio or an incoming call via the phone, and (5) the "Menu" key of the keypad. When any of these events occur the unit will leave idle mode and perform the functions required by the event. These are described in the following sections. If the controller receives either of the two activation codes via radio it will immediately enter Talk mode. If it receives the Listen code it will enter Listen mode, and if it receives one of the digital output activation codes it will activate the specified output. These are the only DTMF codes the unit will respond to while in Idle mode and a 2-way radio is being used. If a phone is being used then an incoming call will either cause the unit to pick up the phone and enter Talk mode (with Quiet mode in

effect) or place a call using one of the programmed callback numbers once the incoming rings have stopped (see [Operating With Cell Phone](#)).

Call Initiation

A call to security is initiated when any of the four possible front panel CALL buttons are pressed, or the TEST switch is pushed, or the tamper circuit is triggered, or when a low battery is detected, or automatically when programmed to make a TEST call at periodic intervals. A TEST call to security is also made when using a phone and the "Callback" feature is enabled and activated. **All call types are handled in the same manner by the controller. There is nothing that distinguishes one call type from another other than the messages, features and timeouts which are programmed by the factory or dealer. One minor exception is a TEST call. See Test Button.** There are 7 "call types" (CT).

They are:

1. Call switch #1
2. Call switch #2
3. Call switch #3
4. Call switch #4
5. TEST switch
6. Tamper alarm
7. Low battery

When activated and a 2-way radio is being used, all calls are processed in the manner described below. The features which are programmable are shown as a link (in [blue](#)) to the corresponding section in Setup Mode.

Call Progress, Radio

1	The front panel green LED will be ON or OFF (Quiet Mode) while any CALL button is pressed to initiate a call.
2	The strobe light will be ON or OFF (Quiet Mode).

3	A voice message for the caller corresponding to the call type will or will not (Caller Messages On) be played repeatedly at the local speaker for the benefit of the caller.
4	The callbox will or will not (COR) wait for a clear channel via the COR signal provided by the radio or by the controller's audio detection circuits. The maximum wait time for the COR has a default value of 30 seconds.
5	The radio transmitter is keyed and ANI codes will or will not (ANI ON) be transmitted.
6	A voice message for security corresponding to the call type, and a common location message (Security Message #8) will or will not (Security Messages On) be transmitted to security simultaneously with the user message in step #3.
7	Step #6 will be repeated a programmed number of times (Message Repeat Count). The caller message will be repeated continuously (if enabled) until the callbox is activated (or deactivated).
8	The radio will be unkeyed and the unit will or will not (determined by Auto-Activate) wait for a programmable period of time (Activation Timeout) for an activation code to be sent from security which will place the unit in Talk mode. If programmed for Auto-Activation the unit will enter Talk mode immediately after playing the security message(s). If the activation timeout expires with no activation code received the unit will repeat from step #5 if the Call Timeout timer has not expired. If the programmed Call Timeout has expired the unit will play the Call Failure Message to the caller (caller message #8), then terminate the call and revert to Idle mode. A separate call timeout is provided for each call type. (Exception: If the activation timeout is set for 0 seconds there will be no activation timeout, therefore the activation time should normally not be programmed for 0 seconds, as this would cause steps #5-8 to be repeated indefinitely.)

9	After an activation code is received (or if auto-activate is enabled) the unit will enter Talk mode. The red front panel LED will or will not (Quiet Mode) be lit. Any of the CALL buttons now become push-to-talk buttons. When pressed, the green front panel LED will be lit and the caller's voice will be transmitted via radio to security; when released the audio from the radio will be heard at the callbox speaker. The caller is allowed to transmit for a limited time (Talk Timeout) for every push of one of the call buttons. If this time expires the green LED will go out and the radio will stop transmitting.
10	The Call Timeout timer is reset to zero upon every push of any CALL switch while in Talk mode and whenever any DTMF signal is heard from the radio. Upon timeout the call will be terminated and the unit will revert to Idle mode.
11	Upon receiving the deactivation code the call will terminate and the unit will revert to Idle mode.

When activated and a telephone is being used, all calls are processed as shown below:

Call Progress, Phone

1	The front panel green LED will be ON or OFF (Quiet Mode) when any CALL button is pressed to initiate a call. It will remain ON until the call is terminated.
2	The strobe light will be ON or OFF (Quiet Mode).
3	A voice message for the caller corresponding to the call type will or will not (Caller Messages On) be played repeatedly at the local speaker for the benefit of the caller. However, if there is no line current or no dialtone (when Dialtone is enabled) then the Call Failure Message (caller message #8) will be played for the caller and the call will terminate.

4	<p>The first (or second) programmed phone number (Number to Call) will be dialed by the callbox. If no answer or the call is busy then the 2nd programmed number will be dialed. If this is the 2nd number being dialed and there is no answer or the number is busy, then the call failure message will be played for the caller and the call will terminate.</p>
5-A	<p>When Auto-Activate is ON: The unit will wait for the occurrence of any sound on the line which is not either a busy signal or ringback tone. When heard, the unit will classify the call as having been answered. If a busy signal is heard or if 8 (programmable number) ringback tones are heard the unit will hang up the call and repeat from step #4, using the 2nd phone number. If this call is already the 2nd phone number then the call failure message will be played for the caller (if Caller Messages are ON) and the call will terminate. The Activation Timeout setting is ignored when Auto-Activate is on (exceeding the allowed number of ringback tones is the event which terminates a call attempt, not a timeout). When the call is answered the ANI codes will or will not (ANI ON) be sent to the called party, followed by the voice message for security corresponding to the call type, and a common location message, provided that Security Messages On is enabled for this call type.</p>

5-B	<p>When Auto-Activate is OFF: The unit will wait for a programmable period of time (Activation Timeout) for the detection of any DTMF tone sent by the called party, while simultaneously playing the security messages to the called party repeatedly (if Security Messages are ON, which they should be). When any DTMF is heard, the unit will classify the call as having been answered and will send the ANI codes if they are enabled (ANI ON). If the activation timeout expires with no DTMF tone received the unit will hang up the call and repeat from step #4, using the 2nd phone number. If this call is already the 2nd phone number then the call failure message will be played for the caller and the call will terminate. If the activation timeout is set for 0 seconds there will be no call timeout, therefore the activation time should normally not be programmed for 0 seconds. (Note: part of the voice message sent to the called party should contain instructions for them to press any key to activate the callbox and begin talking.)</p>
6	<p>Once the call is classified as having been answered, the unit will enter Talk mode. Both the red and green front panel LEDs will or will not (Quiet Mode) be lit. The caller is now free to converse with the called party in semi-full duplex, without having to push any buttons to talk. Exception: If Quiet Mode is enabled the caller will not hear anything from the callbox speaker nor will any of the front panel LEDs be lit, although security will hear everything being said near the callbox. Quiet mode may be turned off by security sending the activation code once in Talk mode.</p>
7	<p>The Call Timeout timer is reset to zero whenever any DTMF signal is heard from security. A short beep will be sent to both security and the caller 5 seconds prior to the call timeout (intended to alert security that a call disconnect is imminent). Upon timeout the call will be terminated and the unit will revert to Idle mode. When the call is terminated a series of 5 short beeps will be sent to security and the caller to notify them that the call has disconnected.</p>

8	Upon receiving the deactivation code or if a line-break is detected the call will terminate (after 5 beeps are sent) and the unit will revert to Idle mode. The deactivation code for a cell phone may optionally be "##". (A line-break is a special line condition sent by most telephone equipment to signal that the distant party has hung up.)
---	---

TEST Pushbutton (Call Type 5)

When the TEST pushbutton is pressed the callbox will make a call as described above, with two exceptions. (1) Prior to the call the callbox will sound a short beep to the speaker and attempt to detect this beep at the microphone. This is done to test the integrity of the speaker/mic combination, and the result of this test is included as part of the ANI codes sent when the call is connected. (2) The controller will turn off AC power while a TEST call is underway in order to test the battery condition. If the battery is found to be low during the test call, or if the controller loses power completely due to a dead battery, it will make a Low Battery call as soon as the test call has ended or it has recovered from the power failure. A Low Battery call after a power failure may take up to 1 minute to be initiated after power is restored.

The TEST pushbutton performs a different function once a call is underway. If pushed while the callbox is waiting for an activate/deactivate code, or detection of an answered phone call, the callbox will behave as though the event it is waiting on has occurred. This is intended to aid in testing or troubleshooting a misbehaving callbox.

Also see Auto-Test.

Tamper Detection (Call Type 6)

When the tamper switch is activated by severe vibration, or if the security current loop circuit is opened via any of several series-connected normally closed switches, or if the nightlight is removed, the controller will initiate a call as described above. This call type would typically be programmed for [Quiet Mode](#), which sets the front panel LEDs and front panel speaker to be disabled during call activation. It would also be programmed for Auto-Activate, so that after the ANI and voice messages have been sent the unit would enter Talk mode immediately. Quiet mode would still be in effect once the unit entered Talk mode, so that Listen could be activated without alerting anyone in the vicinity (applies to radio only - telephone operation is inherently in Listen mode due to the full duplex nature of the call). If an Activation code is received it will turn off Quiet Mode and allow security to have 2-way communications with the call box.

There are three tamper inputs to the controller. One is a vibration sensor, the second is a circuit that senses the removal of the nightlight, and the third is a current loop circuit that must be a closed circuit for a no-alarm condition. A mercury tilt switch, door ajar, or any other normally closed switch may be connected into this loop, where any opened switch anywhere in the loop will activate the tamper alarm. To disable the tamper alarms during servicing an electrical keyswitch accessible from the outside of the unit should be wired so as to short the tamper current loop input to circuit ground to deactivate the loop switches. Also, a second pole of this same switch should be used to open the circuit to the tamper vibration sensor so that it too is disabled prior to gaining access to the callbox.

Low Battery (Call Type 7)

When the controller senses a low battery condition, it will initiate a call as described above. This call type would typically be programmed for Quiet Mode, which sets the front panel LEDs and front panel speaker to disabled during call activation. It would also be programmed for Auto-Activate, so that after the

ANI and voice messages have been sent the specified number of times the unit would enter Talk mode immediately. Furthermore, it would be programmed for a Talk Mode Timeout of a time period of 1 second. This would cause the low battery message to play the desired number of times and the call would be terminated 1 second after completion of the messages.

Once a low battery message has been sent, the unit will not repeat a low battery call until the battery has been charged for 1 hour. This is to help prevent the possibility of the controller sending multiple low battery warnings as the battery teeters on the brink of the threshold of good-to-weak.

Detecting a weak battery is difficult while AC is present and the charger is charging the battery. The only reliable way is to sense the battery voltage under load. When AC or solar power is not present this requirement is met, so low battery detection while operating under battery power is accurate and reliable. So in order to test the battery during charging a TEST call must be placed where the callbox controller will disconnect the AC power during the call (TEST call only). During the TEST call if the battery is found to be weak, it will immediately place a Low Battery call after the TEST call is complete. Also, during the TEST call if power drops so low that the callbox cannot maintain operation, it will make a Low Battery call within about 1 minute after it recovers from the power failure.

Listen Mode

Listen mode is a temporary mode that can be entered by the controller receiving the Listen DTMF code sequence (when using a 2-way radio). In Listen mode, the controller activates the microphone and keys the radio for a preset time interval ([Listen Timeout](#)). The speaker remains muted, and no lights are lit. At the end of the time interval the radio is unkeyed and the unit reverts to whatever mode was previously active (Idle or Talk mode). For a telephone, entering Listen mode is inherent when answering an incoming call or when placing any call in Quiet Mode (see next section).

Talk Mode

With Radio

When in this mode, if Quiet Mode is NOT in effect, the speaker is activated and any audio being received via radio will be heard by the caller. The red LED is lit and will stay lit as long as Talk mode is active. The CALL button becomes the push-to-talk switch for the transmitter when using a radio. When pushed, the green LED will light, the speaker is disengaged, the microphone is activated and the radio is keyed. The controller will only allow the radio to be keyed for a fixed time period (referred to as [Talk Timeout](#), and programmable per each CALL button) in order to guard against tampering or mechanical failure. Normally, the green LED will be lit as long as the CALL button is pressed. If the Talk Timeout period is reached, the green LED will be extinguished even though the CALL button is still being pressed. (The caller can release the CALL button and push again to reset the timeout and talk.)

Note that if Quiet Mode is in effect, no LEDs are lit and the local speaker is disabled. The caller can still push the CALL button to transmit (which also would turn off Quiet Mode), although he/she would not normally know to do so since there would be no visible signs that the callbox is doing anything.

If the DTMF deactivate code is received, the controller will enter Idle mode. If the DTMF activate code is received the unit will stay in Talk mode and will turn off Quiet Mode if it was in effect. (See [DTMF commands](#).) The unit will automatically enter Idle mode if the [Call Timeout](#) time expires with no activity of the CALL button or if no DTMF tones are heard. The Call Timeout is reset to zero on every push of the CALL button during Talk mode and upon hearing any DTMF tones. The Call Timeout time may be set individually for each call button, test button, the tamper alarm and the low battery alarm.

There are 2 activate codes (DTMF command "1" and "8"). Using the "1" command will activate as described above, and using the "8" command will not only activate the callbox but will also activate OUT4 until the callbox is either deactivated, or re-activated using the "1" command. Re-activating using "1" will keep

the callbox activated but will turn off OUT4. OUT4 is intended to be used with an optional relay module to connect a P.A. speaker to the callbox.

With Telephone

When in this mode, if Quiet Mode is NOT also in effect, the speaker is activated and any audio being received via the telephone line will be heard by the caller. The red and green LEDs are lit and will stay lit as long as Talk mode is active. Since a phone call is a full duplex system there is no need for the caller to press any button to talk to security.

Note that if Quiet Mode is in effect, no LEDs are lit and the local speaker is disabled. The microphone is always enabled so security can always hear what is being said near the callbox. This in effect creates a Listen mode by default. Note that when an incoming call is answered by the callbox, Quiet Mode is in effect until turned off by the reception of the DTMF activate code.

If the DTMF deactivate code is received, the controller will enter Idle mode. If the DTMF activate code is received the unit will stay in Talk mode and will turn off Quiet Mode if it was in effect. When used with a telephone the callbox allows an optional DTMF code to activate and deactivate the callbox. A pair of star digits ("**") is an alias for the activate code and a pair of pound digits ("##") is an alias for the deactivate code. (See [DTMF commands](#))

There are 2 activate codes (DTMF command "1" and "8"). Using the "1" command will activate as described above, and using the "8" command will not only activate the callbox but will also activate OUT4 until the callbox is either deactivated, or re-activated using the "1" command. Re-activating using "1" will keep the callbox activated but will turn off OUT4. OUT4 is intended to be used with an optional relay module to connect a P.A. speaker to the callbox.

The unit will automatically enter Idle mode if the Call Timeout time expires with no DTMF being received from security. The Call Timeout is reset to zero upon hearing any DTMF tones during Talk mode. The Call Timeout time may be set individually for each call button, test button, the tamper alarm and the low battery alarm. 5 seconds prior to the Call Timeout expiring a short tone will be

sent to security and to the caller as an indication of an imminent call disconnect. When the call is terminated a series of 5 short beeps will be sent to security and to the caller as an indication of a disconnect.

Quiet Mode

Quiet mode is actually Talk mode but without any front panel LEDs lit and the callbox speaker muted. [Quiet Mode](#) can be set for any call, but is intended for Tamper, Low Battery, and possibly Test calls.

DTMF Command List

Deactivate (Radio): * N .. n 0

If the callbox is in Talk mode this command terminates the call and will put the callbox back into Idle mode. If already in Idle mode this command has no effect. If a callbox is waiting for an activation code (when a call is being placed) this command will have no effect. Wildcards accepted if enabled.

Deactivate (Cell Phone): * N .. n 0 # or optionally # #.

If the callbox is in Talk mode this command terminates the call and will put the callbox back into Idle mode. If a callbox is waiting for an activation code (when a call is being placed) this command will have no effect. Wildcards are accepted if enabled but it makes little sense to use them since a phone connection is always to a single callbox.

Activate (Radio): * N .. n 1

If the callbox is in Idle mode this command puts the callbox into Talk mode with a Call Timeout set to 3 minutes. If already in Talk mode this command will turn off Quiet Mode if it was in effect. In addition, this command will deactivate OUT4 if it was previously activated via the "8" command. Wildcards accepted if enabled.

Activate (Cell Phone): * N .. n 1 # or * *

If already in Talk mode then either * N .. n 1 # or * * will turn off Quiet Mode if it was in effect. Wildcards are accepted if enabled but it makes little sense to use them since a phone connection is always to a single callbox.

Listen (Radio): * N .. n 2

Causes the callbox to key the transmitter and broadcast any audio within range of the callbox for a preset time period. After the transmission the callbox will revert to Idle or Talk mode, whichever was in effect prior to receiving this command. There is no specific Listen command when using a cell phone. See [Operation with Cell Phone](#) for information on how Listen is accomplished when using a phone. Wildcards, if enabled, are not accepted for this command.

Self Test, Auto-OFF (Radio): * N .. n 3 #

This command will cause the callbox to place a TEST call, and will turn OFF the automatic TEST call feature. If the command is given during Idle mode the test call will be placed immediately; if given during Talk mode the test call will be placed as soon as the callbox reverts back to Idle mode. Be aware that if the callbox has been programmed via setup to automatically place a test call, then this command will override that schedule until the callbox is reset or powered down. It will return to its pre-programmed test schedule (if programmed for one) at the next power up or reset. Wildcards, if enabled, are not accepted for this command.

Self Test, Auto-OFF (Cell Phone): * N .. n 3 #

This command will cause the callbox to place a TEST call, and will turn OFF the automatic TEST call feature. This command can only be given in Talk mode. The test call will not be placed until the callbox reverts back to Idle mode, so after this command is issued the Deactivate command should also be given to cause the callbox to hang up, go into Idle mode and place the test call. Wildcards, if enabled, are not accepted for this command.

Self Test, Auto-ON (Radio): * N .. n 4 #

This command will cause the callbox to place a TEST call, and will turn ON the automatic TEST call feature. If the command is given during Idle mode the test call will be placed immediately; if given during Talk mode the test call will be placed as soon as the callbox reverts back to Idle mode. Using this command will activate the automatic daily test call feature, where a test call will be placed automatically 24 hours after this test call is placed (or 24 hours after the last manually initiated test call via the TEST pushbutton). If power is totally lost to the callbox then this auto-test feature will either be turned off upon power up, or auto-testing will be enabled for the time period specified by the fixed [auto-test programming](#) if it has been set. Wildcards, if enabled, are not accepted for this command.

Self Test, Auto-ON (Cell Phone): * N .. n 4 #

This command will cause the callbox to place a TEST call, and will turn ON the automatic TEST call feature. This command can only be given in Talk mode. The

test call will not be placed until the callbox reverts back to Idle mode, so after this command is issued the Deactivate command should also be given to cause the callbox to hang up, go into Idle mode and place the test call. Using this command will activate the automatic daily test call feature, where a test call will be placed automatically 24 hours after this test call is placed (or 24 hours after the last manually initiated test call via the TEST pushbutton). If power is totally lost to the callbox then this auto-test feature will either be turned off upon power up, or auto-testing will be enabled for the time period specified by the fixed [auto-test programming](#) if it has been set. Wildcards, if enabled, are not accepted for this command.

Activate Digital Output #1 (Radio): * N .. n 5 #

This command will cause the callbox to energize digital output #1 for the time period programmed for it. If this digital output has not been programmed for a specified ON-time then this command will do nothing to the digital output. This command may be issued in Idle mode or Talk mode. Wildcards accepted if enabled.

Activate Digital Output #1 (Cell Phone): * N .. n 5 #

This command will cause the callbox to energize digital output #1 for the time period programmed for it. This command can only be given in Talk mode. If this digital output has not been programmed for a specified ON-time then this command will do nothing to the digital output. Wildcards are accepted if enabled but it makes little sense to use them since a phone connection is always to a single callbox.

Activate Digital Output #2 (Radio): * N .. n 6 # Same as above only digital out #2 will be energized. Wildcards accepted if enabled.

Activate Digital Output #2 (Cell Phone): * N .. n 6 # Same as above only digital out #2 will be energized. Wildcards are accepted if enabled but it makes little sense to use them since a phone connection is always to a single callbox.

Activate Digital Output #3 (Radio): * N .. n 7 # Same as above only digital out #3 will be energized. Wildcards accepted if enabled.

Activate Digital Output #3 (Cell Phone): * N .. n 7 # Same as above only digital out #3 will be energized. Wildcards are accepted if enabled but it makes little sense to use them since a phone connection is always to a single callbox.

Activate With OUT4 Energized (Radio): * N .. n 8 # Same as "1" command except OUT4 will be driven active until the callbox is either deactivated or a subsequent "1" command is given (which will leave the callbox activated but will turn off OUT4). OUT4 is primarily intended to drive a relay to connect a P.A. speaker to the callbox for announcement messages to a zone of callboxes, but can be used for any other purpose. Wildcards accepted if enabled.

Activate With OUT4 Energized (Cell Phone): * N .. n 8 # Same as in (Radio) above. In some cases it will be difficult to use this function effectively when using a cell phone due to the fact that a loud PA speaker will have a negative impact on the full-duplex capability of a cell phone. Wildcards are accepted if enabled but it makes little sense to use them since a phone connection is always to a single callbox.

Reserved for expansion: * N .. n 9 # Until this command is assigned a more essential function, it may be used to interrogate a callbox as to the revision level of its firmware. When used, the callbox will transmit an encoded series of beeps that describe the 3-digit firmware revision. For example, for firmware revision "3.31" it will send 3 beeps, pause, 3 beeps, pause, and 1 beep. Wildcards, if enabled, are not allowed.

Digital Outputs

There are 4 digital outputs provided on the callbox circuit board, each with its own individual connector. The connector supplies 3 signals: ground, +13.8v, and a 5-volt CMOS logic output (active high). OUT1 through OUT3 have a dual function as specified by the ON-Time which is programmed by the user for each output. If the ON-Time is set to zero, then the output will automatically go active when its corresponding call type is initiated. For example, Output #1 will go active as soon as Call Switch #1 is pressed, and will remain active until the unit goes back into Idle mode at the end of the call. If any output is programmed

for anything other than zero seconds then this feature is disabled, and the output will not go active until its corresponding "Activate Digital Output" DTMF command is given, at which time it will go active and remain active until the programmed time expires (even if the callbox reverts to Idle mode prior to the timeout). OUT4 is special and is described above in the DTMF "8" command.

Auto-Test

The callbox has the ability to make a Test call at periodic intervals, and may be set to do this in one of two ways. The first, described in [DTMF Commands - Self Test](#), sets Auto-Testing to occur at 24 hour intervals starting at the time the command is issued (this 24-hr timer is also restarted whenever a Test call is made manually via the TEST pushbutton). This test scheduling will remain in effect until canceled (via another DTMF Command, * N..n 3 #) or upon total loss of power (AC/Solar and battery). On the next power-on this scheduling will be lost and Auto-Testing will either be disabled or will resume using the fixed Auto-Test schedule set by the user.

A fixed Auto-Test schedule is set in the following way: While in Idle mode, hold down one of the digit keys 0 through 9 (on the programmer keypad) and press and release the TEST button. This will program Auto-Testing for a schedule of zero to 9 days. If zero, fixed Auto-Testing will be turned off. A Test call will be placed when the TEST pushbutton is pressed, and Auto-Testing will begin starting from this test call. Upon total loss of power, Auto-Testing will resume starting from the time of power-on (unless fixed Auto-Testing was set for zero).

Prior to a test call being placed the callbox will test the speaker and microphone by sending a short beep tone to the speaker and listening for any sound at the microphone which has a no-sound to sound power ratio of 1-to-2 that conforms to the timing of the beep sent to the speaker. The result of this test is included in every ANI code sequence sent by the callbox. (But the test is ONLY done just prior to a TEST type call.)

BlueStar NightLight

The "BlueStar" NightLight, is turned on or off by the callbox controller as determined from the level sensed from a photocell connected to the "Photocell" input. (Low resistance when in light and high resistance when dark.) The day/night switching level of the photocell is changed depending on whether the nightlight is currently on (nighttime) or off (daytime). When in daylight the switching threshold to dark is set to a low light level and at night the switching threshold to daytime is set to a high light level. This wide hysteresis will help prevent the nightlight from switching from on to off to on as passing cars illuminate the callbox. In addition, it requires 10 seconds of continuous darkness to switch on the nightlight, and 60 seconds of continuous light to switch it off. When on the nightlight is modulated on/off at 50Hz when in Idle Mode and is modulated at 25Hz in all other modes, which produces a twinkling effect of the light when the callbox is in use (at night only).

A circuit within the callbox monitors the continuity of the nightlight, and if the nightlight is removed or becomes an open circuit it will trigger a Tamper alarm. If there is no nightlight detected at power-up then there will be no Tamper alarm due to a missing nightlight (it is assumed that if there is no nightlight at power-on then this is a normal condition).

The light is turned off whenever a low-battery call is made (when the battery level drops below the "BATTERY LOW LEVEL" setting) and remains off until the low-battery lockout timer expires, typically after 1 hour of battery charging time.

ANI Codes

When ANI is enabled the codes sent (in DTMF) are as follows, where "N..n" is the callbox number, and can range from 1 to 5 digits. Note that a pound is sent first and a star is last, which is opposite the format of commands sent TO a callbox.

s represents a single digit of either "0" or "1", and is the result code from the last test of the microphone & speaker (test only performed prior to test calls). A "0" result code represents a test failure and a "1" represents passed.

~~x and y each represent a single digit and are status codes reserved for future expansion. Until they are assigned some purpose they will be a DTMF code of "0". Eliminated starting in version 3.34.~~

bbb represents a 3-digit battery condition code. If the callbox Power Management is set for AHR mode then this number is the AHR, in tenths, remaining in the battery at the time the call was placed. If Power Management is in voltage mode then this number is the battery voltage, in tenths also.

The DTMF on and off times of the ANI transmission has a default duration of 50msec but can be changed by the Memory Examine And Change setup function. (DTMF tones used in dialing a phone number are fixed at 100msec on and 100msec off times.)

Call type 1: # N..n 1 s bbb * (From call switch #1)

Call type 2: # N..n 2 s bbb * (From call switch #2)

Call type 3: # N..n 3 s bbb * (From call switch #3)

Call type 4: # N..n 4 s bbb * (From call switch #4)

Call type 5: # N..n 5 s bbb * (From TEST call)

Call type 6: # N..n 6 s bbb * (From Tamper call)

Call type 7: # N..n 7 s bbb * (From Low Battery call)

Heartbeat

Located at the top of the circuit board is a small red LED. This indicator provides some basic information as to the status of the callbox and the rough condition of the battery. It is provided to be of use for callboxes shipped without the LCD display option. The LED pulsates about once per second when the callbox is in Idle mode and about 2 pulses per second in all other modes. The duration of the flash will change from long for a fully charged battery to short for a weak battery, with varying durations between long and short for battery levels of high to low.

Power Management

Battery Charging

The callbox may be used in installations where the battery will be charged by the callbox's battery charger or by a charger external to the callbox. When charged by the callbox it can control the charging voltage to the battery and monitor its state of charge. When externally charged, all the callbox can do is monitor the battery voltage and when necessary turn power on or off to any external devices connected to the callbox. Internal charging is done by applying the primary source of power (either from the 15v power supply connected to the AC line or by a 15v solar panel) to the "15v" input terminals of the POWER connector and connecting the battery to the "BATT" terminals. When Externally charged, no connection is made to the "15v" terminals and the externally charged battery is connected to the "BATT" terminals.

Power management (battery charging and external device on/off control) can be performed using either of two methods, Amp-Hr control or voltage control. This is selected in the Power Management setup menu.

When in AHr control the callbox maintains a software "fuel gauge" for the battery (it measures current into and out of the battery), and this, along with battery voltage, is used to determine the charging process and is also used to determine the power-on and power-off points of the external devices powered from the callbox.

When in voltage control mode the current measured into and out of the battery is ignored, and battery charging and external device control is done strictly by the measured battery voltage. When the battery is externally charged the callbox must be in voltage control mode even though it has no control over battery charging - it still has control over the external device on/off points, and in this case voltage is the only criteria that can be used for external device control.

The charger is designed to be as nice to a gel-cell battery as it can be so that maximum capacity is reached for every charge while not overcharging. Charging is done differently for Ahr and voltage modes, as described below:

Ahr Mode Charging - Initially the battery is charged to some peak voltage (dependent on R23 setting, described below) with a limiting current of about 2.4 amps. Once the charge current at this voltage level has dropped to **60ma** or less and remains below that level for **5** minutes the charger will switch to float charge where the battery voltage is maintained at a lower level, set by R23 "BATT CHRG". Again, current at this level is limited to about 2.4 amps. R23 is typically adjusted for a float charge of 13.8 volts, and the peak charging voltage will track the float charge voltage at a level approximately 0.6 volts above the float level. So, if R23 is set for a float charge level of 13.8 volts, the peak charging voltage will be approximately 14.4 volts.

Every time the battery is discharged, by any amount, and then starts to charge again, the battery is charged to the peak level and then is switched to the float level. When using AC power this occurs whenever AC power is lost and then re-stored again. If **24** hours elapse with the charger charging to the peak level and charge current has not dropped to the float switchover threshold, then a low battery call will be placed and the charger will switch to the float level. This is done for the case where a battery cannot accept the peak charging voltage within **24** hours and therefore it is assumed to be defective. This will never happen with a solar powered callbox since it is not possible to have a high output from a solar panel for 24 continuous hours.

Voltage Mode Charging - Initially the battery is charged to the peak voltage (dependent on R23 setting, described below) with a limiting current of about 2.4 amps. Once the battery voltage has risen to the PEAK CHARGE V voltage and remains at or above that level for **5** minutes, the charger will switch to float charge where the battery voltage is maintained at a lower level, set by R23 "BATT CHRG". Again, current at this level is limited to about 2.4 amps. R23 is typically adjusted for a float charge of 13.8 volts, and the peak charging voltage will track the float charge voltage at a level approximately 0.6 volts above the float level. So, if R23 is set for a float charge level of 13.8 volts, the

peak charging voltage will be approximately 14.4 volts. It is important that the PEAK CHARGE V that the user enters in setup be slightly lower than the peak charging voltage set by R23. PEAK CHARGE V will typically be set for 14.2v if R23 has set the peak voltage to 14.4v. The reason for this is that R23 sets the callbox hardware to strive for a peak charging voltage of 14.4, and the level the user sets via PEAK CHARGE V setup tells the software what this level is set to (minus 0.2v to account for any possible A/D errors).

The default value for PEAK CHARGE V is 14.2v, so normally all the user needs to do for the voltage mode battery charging is to adjust R23 for 13.8v.

Another setup item, FLOAT CHARGE V, tells the callbox software what R23 has set the float charge voltage to. The default value for FLOAT CHARGE V is 13.6v, and should always be set for about .2v less than what R23 has been set to. Again, all the user needs to do for the voltage mode battery charging is to adjust R23 for its normal value of 13.8v and FLOAT CHARGE V can be left at its default value.

Low Battery Calls

The requirement for initiating a low-battery call is based strictly on battery voltage, regardless if the Power Management mode is AHr or Voltage. A low battery call is initiated when the battery voltage drops to or below BATTERY LOW LEVEL V. If in AHr mode the software fuel gauge will be adjusted to read 12% of BATTERY CAPACITY AHR.

There is a method used to prevent a low-battery call from being made repeatedly as the battery capacity teeters on the brink of the low battery threshold. Basically, after a low-battery call is made (or attempted), another will not be done until the battery has been charged enough to reasonably assume that the call can be completed without critical battery voltage loss. Once a low battery call has been made, another low battery call will be prevented from being made until (A) in AHr mode, when the battery has been charged for 1 hour continuously, (B) In Voltage mode, when the battery voltage has been at or above BATTERY FLOAT V for 1 hour continuously.

Hibernation Mode (near-zero power operation)

If the battery voltage ever drops to BATTERY DEPLETED V the callbox will enter a Hibernation Mode. In this mode it will not respond to any call switches, test switches, or tamper alarms, nor will it respond to any incoming DTMF commands or incoming phone calls. It shuts down all external devices and internal subsystems in an effort to consume as little power as possible. If in AHR mode the battery fuel gauge will be reset to 0% charge. The front panel red LED and the circuit board BATT HEALTH MONITOR LED will be made to flash very briefly once every 2 seconds and the LCD will display "HIBERNATION MODE". The LCD and keypad will continue to function, and entering SetUp Mode will be allowed. Only when the battery voltage has risen above BATTERY LOW V (typically 11.8v) for 1 minute will the unit come out of Hibernation Mode and resume normal operation.

External Device Power Control

The callbox can switch power on or off to two external devices at user-programmable battery levels. When using a radio only the radio may be switched, and when using a phone the first device could be the Tellular cell phone adapter or the VOIP adapter and the second device a WI-FI power amplifier. The first device, which will be called "COMM" (the radio or cell phone) is switched by the POWER pin of the RADIO connector J3 (pin 4). This output directly powers the radio, or in the case of a phone, it powers the VOIP adapter or the Tellular cell phone adapter. The second device, "AUX", is switched by an auxiliary power switch controlled by the PTT output (pin 3 of the RADIO connector J3). The PTT output can only be used to control this AUX load when the callbox is configured for phone use. When the callbox pulls this signal low (to ground), the AUX device will be switched ON by an auxiliary power switch.