



Rescue Assistance Series 4200 Operation Instructions

A. GENERAL

The following information provides an overview of the features that are designed into the standard components of the system:

A1. 4200 SERIES ANNUNCIATOR:

4200-Series Annunciators are available in a variety of sizes between 4 and 44 Zones. Each such Annunciator is designated as A-42NN, where NN = Zone Capacity (between “04” and “44” in multiples of four).

Each 4200-Series Annunciator incorporates the following features:

- Green “Power On” LED – Indicates that Annunciator is receiving DC Power from the Power Supply (Normal = On)
- Push-To-Talk (P-T-T) Switch – For initiating Out-Going “Talk” Audio to the selected Call Station
- Reset Switch – to Reset the system, once all calls have been answered / processed (labeled, “RESET ALL ZONES”)
- Microphone – For Out-Going (Talk) Intercom functions
- Speaker – for audible / tone indication, and for In-Coming (Listen) Intercom functions:
- Zone Control and Indication – The following are duplicated for each Zone:
 - Yellow “Line Fault” LED – for visual indication of Fault Status
 - Zone Control Switch – Used to Acknowledge / Answer Calls from the corresponding Call Station
 - Red “Zone Call” LED – For visual indication of Call Status for the corresponding Call Station:
 - Green “Intercom On” LED – For visual indication of Audio connections:

A2. CALL STATION:

4201 Call Stations consist of the following: Model 4201B/VM, 4201B/V, 4201B, 4201A (Newest to Oldest).

Each Such Call Station incorporates the following features:

- Call Switch – for placement of calls from the station: Mushroom-Head, Round Metal, or Square Plastic
- Call Status LED / Lamp – built into, or mounted separately above it (Duplicates Red LED at Annunciator)
- Speaker for Tone and Intercom functions

A3. POWER SUPPLY(S):

Power Supplies that are used for 4200-Series Systems usually consist of Cornell B-5243 Series units. These Power Supplies require a hard-wired connection to a 120 VAC Primary Power Source, which they convert to DC Power, for use by the 4200 System.

Annunciator Models A-4204 thru A-4224 typically require (1) Power Supply, configured to provide 24 Volts DC.

Annunciator Models A-4228 thru A-4244 typically require (2) Power Supplies:

- (1) Configured for Output = 24 Volts DC
- (1) Configured for Output = 12 Volts DC

(Refer to “Troubleshooting” for more information)

B. OPERATION:

Items B1 thru B5 (below) explain how a 4200 Series Rescue Assistance System normally functions, and the process by which Assistance Calls are normally handled:

B1. NORMAL STATUS:

When a Cornell 4200-Series Rescue Assistance System is in the normal, Stand-By state, the following will be observed:

- At each 4201 Call Station: Silent, LED / Lamp not illuminated.
- At the 42XX Annunciator: Audible Indication = Silent. Only the following Visual Indication should be evident:
 - Green “POWER ON” LED = Illuminated Steady

B2. PLACING A CALL (FROM A 4201 CALL STATION):

Momentarily depress the call button on the Call Station. This will trigger the following actions:

- At the 4201 Call Station
 - Audible Indication = A short acknowledge tone will be produced
 - Visual Indication = The Red Call Status LED illuminates Steady
- At the 42XX Annunciator:
 - Red LED, built into corresponding Zone Switch, illuminates Steady
 - Slow Repeating Beep Tone sounds, as long as non-acknowledged calls exist

B3. ACKNOWLEDGING A CALL (FROM THE A-42XX ANNUNCIATOR):

To Acknowledge the Call, press the corresponding Zone Control Switch. When this is done, the following occurs:

- At the Station
 - Acknowledgement of the call is indicated via the Red Call Status LED – changes from Steady to Flashing
- At the 42XX Annunciator, the following actions occur for the corresponding Acknowledged Station Zone:
 - The Red Call Status LED changes from Steady to Flashing
 - The Green “Intercom On” LED, for the corresponding Zone, illuminates Steady
 - A “Listen” Audio Path is established between the Annunciator and the Acknowledged Station (You should be able to hear any activity occurring in the vicinity of the selected Call Station.)
 - The repeating Beep tone at the Annunciator will stop, if there are no other un-acknowledged calls

B4. USING THE INTERCOM FUNCTIONS (FROM THE A-42XX ANNUNCIATOR):

If the person who placed the Assistance Call is capable of conversing via intercom, no further action is required on their part. If you have not already established an Audio Connection, by pressing the corresponding Zone Control Switch, do so for the desired Call Station (This is the same as Step “B3” above). Once you do, observe the following:

- At the Station, the Call Station Speaker is used both as a Speaker and as a Microphone.
- The Intercom Operation provided by the 4200 Area of Rescue System is Half-Duplex – it only works in one direction at a time, and must switch between “Talk” and “Listen” Modes. The default mode is In-Coming / Listen.
- At the 42XX Annunciator - To Talk to the selected Call Station, Press the “PUSH-TO-TALK” switch, and hold it while you are talking. Release it to listen to any reply from the selected Call Station.

B5. RE-SETTING THE 4200 SYSTEM TO NORMAL / STAND-BY MODE:

Each A-42XX Annunciator incorporates circuitry to prevent the system from being Reset if any Non-Acknowledged Calls exist. Therefore, it is important to note that ALL active calls MUST be Acknowledged (see Step “B3” above) prior to any attempt to Reset the Annunciator.

Once all active calls have been acknowledged (ALL active Red LEDs should be flashing / NO Green Zone LEDs should be lit). Momentarily press and release the “RESET ALL ZONES” switch, (you will need to flip-up the spring-loaded clear cap). Once this is done, the system should return to the Normal / Stand-By Mode (see Step “B1” above).

C. FAULT OPERATION:

Each 4200 Area of Rescue Assistance System incorporates features that are intended to continuously monitor the connections between the Annunciator and each of the Call Stations. The following informat

C1. ENABLING AND DISABLING FAULT DETECTION:

Within each A-42XX Annunciator, Configuration Jumpers are provided, with one such jumper provided per each Zone. These jumpers are intended to disable fault detection for Zones that are not used. Operation of these Jumpers is as follows:

- Jumper in “Used” position = A Call Station will be connected to the Zone = Fault Detection Enabled
- Jumper in “Not Used” position = Field wiring will not be connected to the Zone = Fault Detection Disabled

C2. WHEN LINE FAULTS ARE DETECTED:

When a Call Station and/or the associated wiring fails, or becomes disconnected or disarranged, a “LINE FAULT” status condition will be reported at the A-42XX Annunciator, as follows:

- The Yellow “Line Fault” LED corresponding to the affected Zone / Station will illuminate in a steady manner, and will remain illuminated until the Fault condition is corrected.
- The Annunciator Panel Speaker will produce a continuous Beep Tone at regular intervals until the Fault condition is corrected.

D. TROUBLESHOOTING HINTS / SUGGESTIONS:

When problems occur, or when the 4200 System fails to operate as previously described, some sort of failure may exist / may have occurred. Although it is not practical to describe all such failures and their solutions, the following topics may assist you in diagnosing and/or fixing common problems that have occurred in the past:

D1. QUICK CHECKLIST:

Before proceeding with any other troubleshooting, Cornell suggests that you proceed with the following checklist, which will remedy many common installation problems (This list is also highly recommended as a Pre-Installation Checklist.):

- **Obtain a set of the latest 4200 Installation & Wiring Diagrams** – The latest drawings include important information about cable types, terminations, and other important precautions. In order to properly troubleshoot a 4200-Series System, you will most likely need a set of these drawings. (They can be obtained from the Cornell website: www.cornell.com.)
- **Visual Inspection** – (Particularly recommended for Pre-Installation) If you have not already done so, remove the Annunciator faceplate from the back box, and conduct a brief inspection. In particular, look for metal objects which may have vibrated loose in shipment / in operation, and may have lodged between the circuit boards and the metal faceplate or back box.

This procedure is quick and easy, and may prevent problems if it is done for every pre-installation. Found objects should be removed prior to powering the system / power should be removed prior to dislodging them. When such objects are found on a system where power has been applied, test it to determine if the affected circuit board(s) may be irreversibly damaged.

- **Measure your Power Supply Output Voltage** – Power Supplies provided by Cornell are configurable for 12-Volt or 24-Volt operation. To be certain that yours is set correctly, MEASURE this voltage with a Volt Meter:
 - 12 TO APPROX. 16 VOLTS DC = Probably set incorrectly - If you verify that the voltage is set correctly and you still get a voltage in this range, disconnect the Power Supply from the 4200 System and check the “No-Load” Voltage. If it returns to a Normal Range Voltage, you may have some sort of short, over-load, or failed component.
 - 24 TO APPROX. 28 VOLTS DC = Normal Range. The Power Supply should be OK.
 - Significantly higher than 28 Volts DC = Power Supply may have a problem (contact Cornell Technical Support)

If your Power Supply incorporates Batteries, check the Power Supply Voltage with such batteries disconnected.

In this case - if the Power Supply Voltage is normal, but drops when batteries are connected, the batteries may be damaged. The Batteries used with Cornell Power Supplies typically last about 4 years / less if located in hot or cold areas. Such batteries sometimes develop “shorted cells”, which can produce such problems.

You may also want to check for AC Voltage at the DC Output of the Power Supply. If you detect more than a few milli-Volts, your Power Supply (usually the regulator circuitry) may be damaged.

- **Verify Cable Type between Annunciator and each Call Station** – The latest 4200 Installation & Wiring Diagrams provide important information about proper cable types. Use of improper cable is a relatively common problem, and problems resulting from such improper cable often cannot be fully remedied.

Where long wire-runs exist, be sure that the Audio Shields are spliced-thru properly at any splice point – such shield splices should be insulated with electrical tape / heat-shrink tubing, such that they do not contact grounded metal.

- **Check Grounding / Audio Shield Connections** – In addition to electrical safety, proper grounding of the 4200 System is essential for reducing noise on intercom circuits and for eliminating Line Fault problems. The Amplifier used in the 4200 Series is sensitive to grounding issues – not just connections, but the location of such connections within the Annunciator.

If you have not already done so; obtain a set of the latest 4200 Installation & Wiring Diagrams. Then, proceed as follows:

- **VERIFY POWER SUPPLY GROUNDING** – Primary AC Power to each Power Supply should include (3) conductors – Line, Neutral, and Earth Ground. Power Supplies will not operate without Line and Neutral, but a connection to a proper Earth Ground should also exist.

Where this has not been done, add a Green wire (#14 AWG, minimum) from each Power Supply to a suitable Earth Ground source and bond it to the source using appropriate methods, as defined within the NEC (NFPA-70)

- **VERIFY GROUNDING OF ANNUNCIATOR** - Between each Power Supply and the Annunciator, (3) three conductors should be installed: (2) for DC Power, plus (1) Green Earth Ground Conductor. The Ground conductor should be connected as follows:

Power Supply end – it should be connected to the “Ground” terminal, where Primary AC Power connects

Annunciator end – Bond it to the back box via a crimp-on spade / ring terminal, to provide ample surface area, and be sure to scrape the paint where the terminal meets the back box, ensuring metal-to-metal contact.

- **VERIFY GROUNDING OF CALL STATION AUDIO CABLE SHIELDS** – Audio cables, as used for connection of the Call Stations, should only be grounded at the Annunciator End, and it is important that they are grounded to the correct place within the Annunciator. (Refer to the latest set of drawings.)

- **Check Amplifier Settings** – The Amplifier Board (Cornell Model 8010-270RA) is usually installed within the Annunciator back box, and contains (3) Volume Controls, as follows (Viewed from Top - Terminal Strip on Left side of board):

- Volume Control “R9” (Upper RH Corner) Adjusts Out-Going / “Talk” Volume - Annunciator Mic to Call Station.
CW = Louder CCW = Softer
- Volume Control “R22” (Lower RH Corner) Adjusts In-Coming / “Listen” Volume - Call Station to Annunciator.
CW = Louder CCW = Softer
- Volume Control “R44” (Bottom Center) [Thumb-Wheel, usually Blue & White] Adjusts Alert Tone produced at Call Stations, when a call is placed. If it is set at either extreme – the system may not operate properly.

Cornell recommends setting these Volume Controls as follows:

- **INITIAL SET-UP** – Run each control all the way in both directions, then “guesstimate” the middle position. This is usually sufficient for trouble-shooting / set-up purposes, then fine-tune once all stations are connected and operating.
- **FINE-TUNE** – Usually, you should make final adjustments via the Call Station with the longest wire run, which is the worst-case scenario. Once it is adjusted properly for In-Coming, Out-Going, and Tone – all of the stations should be working acceptably. Your goal in adjustment is to provide ample volume with maximum clarity at both ends.

- **Check Jumper Settings** – Within each A-42XX Annunciator, one 8010-300 Control Board is provided for every 4 Zones. These are the boards where the Call Station wiring is terminated. On each of these boards, there are four small, black plastic Jumper Plugs – each of which plugs-onto an associated 3-pin header. Each of these Jumpers is marked “Used / Not-Used”.

Ensure that each of these is set properly (Refer to “C1” above).

D2. PROBLEM(S) ISOLATED TO ONE ZONE / A FEW ZONES:

Whenever a problem is isolated to a single Zone / Call Station, or to a handful of them, (ALL unaffected Zones / Call Stations are functioning properly) such problems are usually the result of one or more of the following – most frequent at the top:

- Wiring Problems – particularly, if the associated “Line Fault” LED is fully illuminated.
- Damaged Call Station(s) – particularly in areas where they are prone to vandalism
- Damaged Zone Circuitry on the associated 8010-300 Control Board

In such cases, the best strategy is to narrow-down the possibilities, as follows:

D2-A. SWAP ZONES – To illustrate this, consider the following example:

Zone 3 is working properly, while the LEDs for Zone 7 do not appear to be working properly.

At the Annunciator end - temporarily swap the field terminations between Zone 3 and Zone 7, then re-test both Call Stations, and note the results:

- Problem Moved with Wiring (Now, Zone 7 works, but Zone 3 does not) - The problem is most likely in the wiring or the Call Station. → Put the wiring for Zone 3 back to the Zone 3 Terminations, and Proceed to “SWAP STATIONS”.
- Problem Stayed with Zone (Zone 3 works, Zone 7 has same problem with different Station / Wiring.) - The problem is most likely within the associated 8010-300 Board. Contact your supplier/Cornell about a repair or replacement board.

D2-B. SWAP STATIONS (Continuing the example from “SWAP ZONES” above) - If the problem has been narrowed-down to a suspect station or the associated wiring, proceed as follows to eliminate or confirm the Call Station as the problem:

BEST = Try Suspect Call Station Locally, on known “Good” Zone - If you can obtain a few feet of “scrap” wire (even unshielded should work for purposes of this test), Disconnect the field wiring for the known “Good” Zone, and temporarily connect the Suspect Call Station to it.

NEXT BEST = Try Swapping the Call Station, in the field, with one that you know works

- Station Now Works (same station with different wiring) – The problem is almost certainly in the field wiring. You will need to thoroughly ring-out and/or trace all of the conductors, and attempt to diagnose the problem, or should simply run new wiring if doing so is relatively easy.
- Station Has Same Problem – The problem is almost certainly in the Call Station. Contact your supplier/Cornell about a replacement Call Station.

D3. NEW SYSTEM – RAN FOR A WHILE, THEN STOPPED WORKING PROPERLY:

Check your Power Supply (See “D1” above) with the batteries disconnected. If the batteries were connected properly (in series), with the Power Supply Voltage set incorrectly, the system will sometimes run for a while from the Batteries, which usually ship near to fully-charged. With the Power Supply set for 12-Volts, the batteries will not charge to full voltage, and the system will fail once the batteries become depleted.

In this case, correct the Power Supply settings. You may also want to test the batteries – particularly if the system has been left this way for a significant time interval.

D4. INTERCOM PROBLEMS:

If ALL of the System LEDs appear to be functioning correctly, and the only problems being experienced are associated with Intercom features, consult the following topics for assistance with diagnosing and possibly fixing such problems:

- **First** – be 100% certain that you have performed the following:
 - “Check Amplifier Settings” checklist items, as described previously
 - “Check Grounding / Audio Shield Connections” checklist item, as described previously.
 - Carefully verify that the Amplifier Module, microphone, and speaker are properly connected at the Annunciator, as shown within the “Factory-Installed Wiring” drawing.
- **No Audio / “Dead”** (There is no Intercom Audio in either direction.) When this occurs, the most common cause is a dead Amplifier Module. The 8010-270RA Amplifier Module may need to be replaced or repaired. However, before you do this, be 100% certain that your problem is not actually one of the one-way audio problems described below.
- **No Out-Going Audio** (At Annunciator – Sound can be heard coming from ALL connected Call Stations, but nothing can be heard at Call Stations.) When such problems occur, the following are the most common causes:
 - Check Power Supply Voltage (refer to “D1”) – The 8010-270 Intercom Amplifier incorporates a relay, which requires 24-Volts to reverse from “Listen” to “Talk” Mode. At 12-Volts, sometimes nearly everything else works.

- Check Push-To-Talk Switch (PTT) – if the switch, or the wiring between it and the Amplifier Module is damaged, it may not be causing the Amplifier Listen / Talk reversal when pressed. This is not a common problem, but it is easy to verify. Touch a short Jumper Wire to both of the “PTT” terminals on the Amplifier Module. If this works, then the PTT Switch or the associated wiring has failed, and should be replaced.
- Check Microphone Capsule – As stated in “A1”, the Annunciator uses a Microphone for Out-Going Intercom Audio. The Microphone Capsule is mounted in a metal L-bracket, behind the Annunciator Speaker – inserted into a rubber grommet. If you suspect the microphone element, look for wires that may have broken-off from the small metallic capsule, or loose connections at the Amplifier. Newer Annunciators use Red, White, & Black wires that are twisted together for the microphone. Older units used very-fine shielded wire.

Meter Test – You can attempt to test the microphone element with a voltmeter, as follows:

The microphone lead wires are as follows:

RED	=	Phantom Power (+) from (Needs +1.5 to 12 Volts DC – from Amplifier Module)
WHT	=	Output Signal (+) [Connect RED Voltmeter Lead here]
BLK	=	Signal Ground [Connect BLK Voltmeter Lead here]

Leave the Red and Black Microphone Leads connected to the Amplifier Module, and make sure that the Annunciator Power is on & connected. This provides the power that the mic element requires.

Whistle near the microphone element, at a constant pitch and sound volume. When you whistle, you should see an AC Voltage, which rises from about 20 milli-Volts to around 150 or higher. If this happens, the element is probably good / If not, the element probably needs to be replaced.

- Damaged Amplifier – If all of the tests above verify OK, plus attempts to adjust the Volumes get no results, the Amplifier Module may be damaged (only working in “Listen” Mode) – it is Cornell Part Number 8010-270RA, and may be repaired or replaced via your supplier / Cornell.
- **No In-Coming Audio** (At Annunciator – Sound cannot be heard from any Call Stations; but sound can be heard at selected Call Stations when “Push-To-Talk” is pressed.) When such problems occur, the following are the most common causes:
 - Check Power Supply Voltage (refer to “D1”) – The 8010-270 Intercom Amplifier incorporates a relay, which requires 24-Volts to reverse from “Listen” to “Talk” Mode. At 12-Volts, sometimes nearly everything else works.
 - Check Speaker - As stated in “A1”, the Annunciator uses a Speaker for In-Coming Intercom. Look for wires that may have broken-off from the speaker. (They sometimes get damaged in shipment / during installation).
 - If Beep Tones are heard at the Annunciator, then the Speaker is good - the problem is something else.
 - Check Push-To-Talk Switch (PTT) – if the switch, or the wiring between it and the Amplifier Module is damaged, it may be causing the Amplifier to “stick” in the “Talk” Mode. This is not a common problem, but it is easy to verify. Disconnect the wiring from both of the “PTT” terminals on the Amplifier Module. If you then can hear activity at the selected stations, then the PTT Switch or the associated wiring has failed / shorted, and should be replaced.
- **Strange Sounds** (Squealing, clicking, or howling is heard at either end – such that Intercom Audio is unintelligible.) When such problems occur, the following are the most common causes:
 - “Check Grounding / Audio Shield Connections” checklist item, as described previously.
 - ACOUSTICAL FEEDBACK – Acoustical Feed-back may be occurring in either of the following cases:

Open space between the Call Station and the Annunciator – Where a relatively short distance exists between the affected Call Station and the Annunciator, (corridor with no doors or open balcony etc. above or below), acoustical feedback may be occurring directly through the air. Where this is the case, only the Call Stations within such areas will be having this problem.

To solve this problem, try adjusting the Volume Levels at the Amplifier Module (See “D1” – page 4). Where this cannot be done to acceptable levels, you may need to discuss re-locating or eliminating the Call Station, having the Architect / Contractor add some sort of door, or re-locating the Annunciator.

Call Station is connected to Annunciator via Electrical Conduit – particularly if the conduit has a relatively short run with only a few bends. Where this is the case, you will probably note a marked difference in performance if the Call Station is removed from its back box. When this occurs, the conduit is acting as a “sound tube” between the Call Station and the Microphone Element within the Annunciator.

To solve this problem, stuff-up the conduit at both ends. Cornell suggests some fiberglass insulation fluff around the wires at both ends of the conduit, and seal in place with a little firestop putty over the top.

- **Annoying Sound when Non-Used Zone is Selected** – When it is desired to silence Annunciator Zones that are not used, a Dummy-Load can be employed as follows:

Add (1) Resistor per each un-used Zone, across the “AUD” terminals. Each such resistor needs to be between 1K and 2K Ohms, and should be designed to handle 2-Watt or larger loads.

D5. FLICKERING YELLOW LINE FAULT LED(S):

When one or more of the “Line Fault” LEDs at the A-42XX Annunciator are flickering (usually, not at full brightness), this most commonly indicates a grounding problem between the panel and the associated station(s).

First – be certain that:

- The LEDs in question are not illuminating at full brightness. When Line Fault LEDs illuminate at full brightness, an actual fault is being indicated - If this is the case; see Section “C” and go back to the Quick Checklist – Item “D1” on Page 3.
- If only a few of the Line Fault LEDs are flickering – double-check the grounding and shield terminations to the affected zones / Call Stations.
- If ALL of the Line Fault LEDs are flickering – double-check the ground connections between the Power Supply and Earth Ground, and connections between the Power Supply and the Annunciator Panel.

E. ADDITIONAL FEATURES

Each A-4200 System provides the following additional features, which may be used for interfacing and/or monitoring purposes:

E1. GENERAL ALARM CONTACT:

Each A-42XX Annunciator provides a single Output Contact, as follows:

LOCATION = 8010-281 Circuit Board (This Board is stacked on top of the Circuit Board that serves Zones 1-4)
 LABELING = (2) Terminals, both are labeled as “AUX”
 CONFIGURATION = Normally Open, Closes when actuated
 CONTACT RATING = 125VDC/AC, 2.5A max.
 OPERATION = Actuates in response to a Call from ANY Zone. Once actuated, remains actuated until ALL Zones have been acknowledged and the A-42XX Panel has been Reset.

E2. ZONE OUTPUTS:

Each A-42XX Annunciator provides one Zone Output per Zone. Each such Zone Output is configured as follows:

LOCATION = Each 8010-300 Control Circuit Board (One such board is provided for every four zones)
 LABELING = (1) Terminal per Zone – “AUX1” = Zone 1 Output, “AUX2” = Zone 2 Output,
 CONFIGURATION = Open-Collector, Sinking (Switched Negative per Output / Tie Positive side to Power Supply “+”)
 OUTPUT RATING = 100 mA (0.1 Amp) maximum per Output at 24-Volts DC
 OPERATION = Actuates in response to a Call from corresponding Zone. Once actuated, remains actuated until ALL Zones have been acknowledged and the A-42XX Panel has been Reset.

E3. POWER SUPPLY TROUBLE OUTPUTS:

Cornell Models P-512243A & B-5243A Power Supplies each provide (2) Form-C (SPDT) Trouble Relays on the Power Supply Circuit Board. These Relay Outputs may be used for remote monitoring of Power Supply status.

LOCATION = (6) small screw terminals near the bottom-center of the Power Supply Circuit Board
 LABELING = One side labeled as “BAT FAIL” / The other side labeled as “AC FAIL”
 CONFIGURATION = SPDT (Labeled in the non-actuated state)
 OUTPUT RATING = 1 Amp @ 30 VDC (resistive) per Output
 OPERATION = BAT FAIL = Actuates upon failure or disconnection of the batteries or charging circuits. Resets once proper battery function is restored (do not use if batteries are not utilized)
 AC FAIL = Actuates upon failure of Primary AC Power to the Power Supply. Resets upon re-application of AC Power.

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