Teltone Product Manual

CAU--

Call Answer Unit

CAU-100, Issue 2

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AN ISO 9001 REGISTERED FIRM

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FCC COMPLIANCE

To Comply with FCC Part 68 regulations, the following requirements must be met:

- The FCC registration number of this device (AHHUSA-61835-OT-N) and ringer equivalence number (0.5B), if requested by the telephone company, must be reported.
- The sum of ringer equivalence numbers for all devices connected to a single telephone line should not exceed 5.0 for reliable operation.
- This device must not be installed on coin-operated telephone lines or party lines.
- Repair work on this device must be done by Teltone Corporation.

Part 15 Class A Notice: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

The **Canadian Department of Communications** label identifies certified equipment. This certification meant that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to connect it to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by the following authorized Canadian maintenance facility:

Can-am Telecommunications Associates Inc.
1845 Sandstone Manor, Unit 11
Pickering, Ontario L1W 3X9
Phone: (905) 837-7700 Fax: (905) 839-3150

Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment. Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The **Load Number (LN)** assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all devices does not exceed 100. The Load Number assigned to the Call Answer Unit is **10.**

DOC COMPLIANCE NOTICE: This digital apparatus does not exceed the Class A limits for radio nose emissions for digital apparatus as set our in the Radio Interference Regulations of the Canadian Department of Communications.

IMPORTANT SAFETY INSTRUCTIONS

When using your telephone equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock, and injury to person, including the following:

1. Read and understand all instructions.
2. Follow all warnings and instructions marked on the product.
3. Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a camp cloth for cleaning.
4. Do not use this product near water, for example, near a bath tub, wash bowl, kitchen sink, or laundry tub, in a wet basement, or near a swimming pool.
5. Do not place this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.
6. Slots and openings in the cabinet and the back or bottom are provided for ventilation. To protect it from overheating, these openings must not be blocked or covered. The openings should never be blocked by placing the product on a bed, sofa, rug, or other similar surface. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.
7. This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supply to your home, consult your dealer or local power company.
8. This product is equipped with a three wire grounding type plug, a plug having a third (grounding) pin. This plug will only fit into a grounding type power outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the grounding type plug.
9. Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
10. Do not overload wall outlets and extension cords as this can result in fire or electric shock.
11. Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in fire or electric shock. Never spill liquid of any kind on the product.
12. To reduce the risk of electric shock, do not disassemble this product, but take it to a qualified serviceman when some service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the appliance is subsequently used.
13. Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

    A. When the power supply cord or plug is damaged or frayed.
    B. If liquid has been spilled into the product.
    C. If the product has been exposed to rain or water.
    D. If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions, because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.
    E. If the product has been dropped or the cabinet has been damaged.
    F. If the product exhibits a distinct change in performance.

14. Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
15. Do not use the telephone to report a gas leak in the vicinity of the leak.

SAVE THESE INSTRUCTIONS

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1. GENERAL INFORMATION

1.01 This document provides an outline of installation, operation, and maintenance of the Call Answer Unit (CAU), a component of the Teltone 9-1-1 Switched Access System (SAS). Detailed discussions of installation, operation, maintenance, and specifications for each of the other units in the system are covered in separate manuals:

- The **TDU-100** outlines installation, operation, maintenance, specifications, alarms, and related information about the Trunk Dial Unit (TDU).
- The **TMU-100** outlines installation, operation, maintenance, specifications, alarms, and related information about the Trunk Monitor Unit (TMU).
- The **CTU-100** outlines installation, operation, maintenance, specifications, alarms, and related information about the Call Transfer Unit (CTU).
- The **CIU-100** outlines the Cellular Interface Unit (CIU) *documentation pending.*

1.02 Regulatory Compliance: The Call Answer Unit (CAU) meets the requirements of U.S. Federal Communications Commission (FCC) Part 15 Class A, FCC Part 68, Underwriters Laboratories (UL) 1459, and Canadian Standards Association (CSA) C22.2. The CAU Part 68 registration and ringer equivalence numbers are printed on the unit. See page ii for information on FCC compliance and page iii for important safety instructions.

The CAU complies with Bellcore Common Language Equipment Identification (CLEI) and has a CLEI bar code label on the front panel.

1.03 9-1-1 SAS Features:

Trunk Dial Unit (TDU):

- Alternate routing built in
- Primary PSAP, secondary PSAP, and local emergency numbers
- Stores and forwards caller ID (ANI)
- Alternate (night service) numbers
- Call progress status
- Remote access via DTMF to change PSAP numbers and voice messages, place unit in/out of service, release alarms, and reset unit
- Remote access via an internal 2400 bps modem for configuration and report output
- Call completion and event statistics
- Redundant –48 VDC power input
- Security code
- Compatible with the Trunk Monitoring Unit (TMU)
- Provides access over alternate networks
- Trouble, fuse, and audible alarms (relay & LED output)
- Program and database checksum diagnostics
- External, network integrity response test
- Menu interface for programming and diagnostics
- Virtual Trunk minimizes call setup time
- 19 or 23” relay rack mount

Call Answer Unit (CAU):

- Automatic Call Distributor (ACD) or Key System (KS) applications
- 110 VAC power
- Wall or rack mounting
- Alarm release switch
- Alarm contacts

Call Transfer Unit (CTU):

- -48 VDC power
- Standard 19- or 23-inch rack mounting
- Major, minor, and audible alarms
- Alarm release switches

Cellular Interface Unit (CIU)

- Access to cellular networks (*documentation pending)*

2. GENERAL DESCRIPTION

A. Concept

2.01 The 9-1-1 SAS ensures network survivability by routing 911 calls from the local Central Office to a Selective Routing Tandem (SRT) and/or a Public Safety Answering Point (PSAP) over an alternate network. The 9-1-1 SAS can be installed for Primary Service or it can be installed for network survivability so that is provides alternate routes for 9-1-1 calls

2.02 The modular design of the 9-1-1 SAS enable you to integrate the 9-1-1 SAS components into your existing network. It is compatible with basic 9-1-1 features available through dedicated lines, and delivers Automatic Number Identification (ANI) information to the PSAP.

2.03 Figure 1 illustrates the TDU and CAU providing Primary Service in a Cross-LATA boundary application. The TDU is installed at the Public Safety Answering Point (PSAP) of LATA2. A 911 call is routed through the local CO switch to a dedicated trunk, usually a 911 or ANI trunk (throughout this document, the trunk will be referred to as an "ANI trunk"). The 911 call passes to the TDU, which receives and stores the 911 caller's ANI information. The TDU calls the CAU over the alternate network, and transmits the 911 caller's ANI to the PSAP>.

The 9-1-1 SAS is capable of detecting and responding to a number of circumstances that would be likely following a natural disaster: an abandoned PSAP, a busy PSAP, or a network outage. Note that the application in Figure 1 is vulnerable to a network failure between the originating Central Office and PSAP. If failure occurs, calls will not be completed.

Figure 1 Primary Service in a Cross-LATA Application

Figure 2 Primary Service with Alternate Routing

2.04 System reliability can be improved by adding alternate routes. Figure 2, illustrates the introduction of two alternate routes: a second CAU (route B) at an alternate PSAP and a Local Answering Point (route C). Now, if a call cannot be completed to the primary PSAP, the TDU will dial the alternate PSAP over route B. If the alternate PSAP does not respond, the TDU will send the call the Local Answering Point.
If a call has been rerouted because of a failure on route A, the TDU begins automatic testing of the failed route *after* the call has been completed on an alternate route. When the TDU determines that the failed route has been restored, calls will again be completed to route A. To ensure network integrity, the 9-1-1 SAS periodically sends automatic test calls from the TDU to the AU.
You can program the intervals at which test calls are made and which routes are tested. In addition to automatic testing, test calls can be placed manually from the TDU's front panel.

2.05 Figure 3 illustrates an application using the 9-1-1 SAS as a backup to the dedicated trunk. As shown, a TDU is installed at the Local Central Office, a CAU in the PSAP, and an additional CAU in the alternate PSAP. In this application, the 9-1-1 SAS is accessed when the dedicated trunk fails or when calls overflow from the primary network. If wither of these events occur, the TDU routes calls to the primary PSAP on route A. If route A fails or is busy, the TDU routes calls to the alternate PSAP on route B. If route B fails or is busy, the TDU routes calls to the Local Answering Point on route C.

2.06 The previous figures illustrates a direct connection between the Class 5 Switch and the PSAP; however, most 911 networks include a Selective Routing Tandem (SRT). Figure 4 shows the addition of a CTU at the SRT switch. If the dedicated trunk fails or calls overflow, the TDU routes the call to the CTU at the SRT. Upon answering a call from the CTU, the SRT requests the ANI. After receiving the ANI from the TDU, the SRT routes the call to the appropriate PSAP based on the ANI information. If the TDU cannot reach the CTU, the call will be routed directly to the CAU via route B. If B cannot be accessed, the TDU will send the call to route C, the Local Answering Point.

Figure 3 9-1-1 SAS as Backup to Dedicated Trunk

2.07 Even with the addition of the CTU at the SRT, the application illustrated in Figure 4 is vulnerable to a failure at the SRT. Although the dedicated trunk between the Class 5 switch and the SRT is operational, the switch itself may be out of service.

Figure 5 illustrates the addition of a TMU, to monitor the trunks between the Class 5 switch and the SRT. The TMU monitors for the proper signals at the start of the call. If there is a problem, the TMU routes the call to an alternate trunk. If other primary trunks are available when the calling party hangs up, the TMU busies out the failed trunk so the Class 5 does not route calls to it. If other dedicated trunks are unavailable (i.e., they are in use or have also failed), the TMU continues to complete calls over the alternate route.

The TMU has two methods of selecting an alternate route. The first Priority Routing, which means the TMU first tries alternate route A, then B, then C. (Details on Priority Routing are discussed in TMU-100.) If route A fails, the TMU would then try B, then C. The alternate routes can be dedicated trunks or a TDU.

The TMU's second method of routing calls is Rotary. When this method is selected, no priority is given to any route: the first call that must be routed via an alternate route is sent to A, the next call is sent to B, etc. The TMU continues through this cycle until all routes have been used, then it uses alternate route A again.

If the alternate route is a dedicated trunk, the trunk will complete the call if possible. (In Figure 5, the trunk would be unable to route the call if the facilities or the SRT fail.) If the route selected by the TMU is a TDU, like route B, the TDU will receive the call, determine the best route, and direct the call appropriately. In the application illustrated in Figure 5, unsuccessful, it would try the CAU on route E. If all routes fail or are busy, the call will be routed directly to the originating Class 5 local answering point via route F.

Figure 4 CTU Installed at an SRT

Figure 5 Trunk Monitoring with the TMU

Figure 6 Alternate Routing with Virtual Trunks

If there are other dedicated trunks available when the calling party hangs up, the TMU busies out the failed trunk so the Class 5 does not route calls there. The TMU then tests for recovery of the failed trunk. When the failure has been recovered, the TMU removes the busy from the originating Class 5 trunk and calls can be once again routed via the dedicated trunks. (For more detail about TMU operation, please see TMU-100.)
As illustrated in Figure 5, other alternate networks, such as the cellular network, are also viable means to complete calls between a TDU and CAU/CTU.

2.08 Figure 6 illustrates a configuration in which the TDU and CAU/CTU maintain a constant connection. Within the 9-1-1 SAS, this connection is referred to as a Virtual Trunk. Once established, the Virtual Trunk is maintained and 911 calls are completed faster since the connection is already setup.
The Virtual Trunk is established when the TDU dials the CAU/CTU in response to an incoming 9-1-1 call or in response to programming commands. Once the Virtual Trunk is established, the CAU/CTU disconnects from the terminating device at the end of each call. Note that the connection between the TDU and the CAU/CTU is maintained until it is disconnected. Disconnection can occur as a result of a manual command, from the TDU front panel, or as a result of an automatic timeout. Both units must have Virtual Trunk capability; if one of them does not, the Trunk cannot be established.

2.09 The previous diagrams illustrated applications using the 9-1-1 SAS to backup dedicated trunks between the Class 5 and the SRT. This leaves the trunks between the SRT and the PSAP vulnerable to failure. By installing the TMU between the SRT and the PSAP, as shown in Figure 7, network survivability is assured. The 911 call is routed as follows: When it reaches the TMU, the call has been directed to the appropriate PSAP by the SRT. Id the dedicated trunks between the SRT and the PSAP fail, the TMU sends the call over one of the alternate routes to the PSAP. (See the TMU-100 for more information.) The alternate route could be another dedicated trunk, like the one shown in Figure 7 that runs from the TMU to the PSAP. A TDU communicating with a CAU at the PSAP could be an alternate route as well. Figure 7 shows three alternate routes that use Virtual Trunks to connect the TDU to the CAU over the PSTN.

Figure 7 Alternate Routing from SRT to PSAP

3. CALL ANSWER UNIT (CAU)

A. Physical Description

3.01 Installed in the PSAP, the CAU (Figure 9) detects incoming calls from the TDU sets up, and monitors a link with the PSAP. Single units are wall mountable, or groups of CAUs (maximum of six) can be installed in a 19-inch rack using optional mounting bars. The unit uses 110 VAC line power and includes modular jacks for Tip/Ring connections, alarm indicators, and contacts. The CAU periodically runs self-tests to ensure correct operation. It works with the TDU for call processing and transmission tests initiated from the TDU.

3.02 The CAU can be operated in two modes:

- In KS (“A”) mode, it appears like a central office to its PSAP interface, providing a ringing generator, a ringtrip circuit, and –48 VDC battery feed circuit. KS mode is used where the PSAP equipment is either a key system or a standard telephone.
- In Automatic Call Distributor ACD (“B”) mode, it appears like a simple telephone to its PSAP interface, providing only a loop closure to seize the trunk. ACD mode would be used where the PSAP terminating equipment is a two-wire reversible battery interface.

The mode is set by a switch on the back panel. The switch is recessed to prevent accidental actuation.

Note: The CAU must be set correctly for the given application: that is, a key system application cannot use the ACD mode and vice versa. Since the switch is read only on power-up, the unit must be powered down before changing the switch setting or the changes will not take effect.

3.03 Front Panel: The following elements are provided:

- **Status indicators:** LED indicators are shown in Table 1.
- **Alarm release switch:** This momentary push button switch releases an alarm if the trouble that caused it has been cleared.

Figure 8 Brackets for Wall Mounting CAU

Figure 9 Call Answer Unit (CAU)

3.04 Back Panel: The following elements are provided:

- **Power input:** The CAU is powered from a line cord supplied with the unit. Fusing is from a fast-acting 5 x 20 mm, 500 mA, 250 V fuse.
- **A/B mode switch:** This recessed switch is used to select KS (A) or ACD (B) operating mode.
- **Alarm contacts:** A 1 Form C contact set is provided from a terminal strip of connection to a remote alarm system, if remote indication of CAU alarms is desired.
- **Incoming line:** The incoming line is a 2-wire loop of ground start interface appearing on an RJ-11 jack. This interface features a ringing detector, DTMF receiver, and DTMF generator.
- **Outgoing loop start line:** The outgoing line is a 2-wire loop start interface appearing on an RJ-11 jack.
- **Chassis ground** is provided by the center ground terminal of the AC line cord.

B. Installation

Caution:

1. *Never install telephone wiring during a lightning storm.*
2. *Never install telephone jacks in wet location unless the jack is specifically designed for wet location.*
3. *Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.*
4. *Use caution when installing or modifying telephone lines.*

3.05 Unpack the CAU and examine it for evidence of shipping damage. Return any unit that appears damaged to Teltone Corporation.

3.06 Choose a location for the CAU that is within cable distance to an AC outlet. CAU(s) may be installed in a rack or wall mounted as described in paragraph 3.07

3.07 Mechanical Installation: One or two units can be mounted on a wall using the brackets and ¾-inch wood screws supplied with the unit installation kit. The brackets should be secured to a ¾-inch thick plywood panel that has been permanently attached to a wall of UL-approved construction.

- **To wall mount a single unit,** orient the brackets as illustrated in Figure 8A and attach them to the top and bottom of the unit.
- **To wall mount two units,** orient the brackets as illustrated in Figure 8B and attach them to the top and bottom of unit.
- **Rack Mounting (multiple units):** To install up to six units in a 19-inch rack, orient the brackets as shown in Figure 10 and attach them to the top and bottom of each unit. Then install two mounting bars (Teltone 730-00003-01 or equivalent) horizontally in the rack and attach the CAUs to the mounting bars. (Each set of mounting bars can hold up to six units.

3.08 Electrical Installation: Tip/Ring wiring toward the CO and toward the PSAP is shown for Mode A in Figure 11 and for Mode B in Figure 12. The following steps are required for each CAU unit:

(1) **Connect the incoming line from the CO** (standard loop start line) to the CAU RJ-11 jack labeled "CO". (For additional information on installation of CAUs in a hunt group, see paragraph 3.10.)

(2) **Set the mode switch for the application:** The back panel switch must be set as appropriate:

Caution: Always remove power from the CAU before changing the mode switch.

Table 1 CAU Status Indicators

LED	Color	Status	Meaning
PWR/MON	Green	ON	Power is within specifications but Microprocessor is not operating properly And watchdog is holding the LED on.
		OFF	+5 VDC internal power is below specified limits.
		Blinking	Both power and microprocessor are operating normally.
IN USE	Yellow	ON	Call in progress through the CAU.
		Blinking	At 20 Hz: The CAU is being rung. At 2 Hz: The CAU is alerting the PSAP. Also blinks every 5 seconds while alarms LED is ON to indicate one of several types of alarm (see Table 8 for more information).
ALARM	Red	ON	An alarm is active.

Figure 10 Rack Mounting Multiple CAUs

Figure 11 Tip/Ring Wiring for a Key System (Mode A)

- If the terminating equipment requires that the CAU provide battery and ground and ringing (as for a key system or standard telephone), set the switch to "A".
- If the PSAP terminating equipment provides battery and ground to the CAU and requires a loop closure from the CAU to indicate an incoming call (as is the case with an Automatic Call Distributor), set the switch to "B".

(3) **Using standard modular cords:** (available as ordering option 730-00053-09 or –17), connect the PSAP terminating equipment to the RJ-11 jack on the CAU back panel labeled "PSAP".

(4) **Alarm Wiring (Optional):** A 1 Form C alarm contact set is provided for connection to an external alarm system, if remote indication of CAU alarms is desired. See Figure 13.

(5) **Identify PSAP and CO Line Equipment: If** desired, attach the supplied 2" x 3-1/2" card holder to the unit. On the 107-00300-02 information card, write in the identity of the equipment to which the CAU is connected.

3.09 Hunt Groups: When a CAU is going to be one member of a hunt group, it is advisable to be able to busy out the incoming line while the CAU is disconnected. One method of doing this is to have the incoming line from the CO terminate on pins 4 and 5 of an RJ31X block (obtained locally). A 24-gauge wire also needs to be connected between pins 1 and 8 of the RJ31X block to provide a short between Tip and Ring when the modular cord has been removed. If it is a short loop (less than 0.5 mile) to the central office, you may want to install a 100-ohm resistor between pins 1 and 8 to reduce the current on the loop. See Figure 14.

Note: The RJ31X is an 8-pin wide block while the modular jack on the CAU is only a 6-pin wide jack. Thus, an 8-wire to 6-wire cable will be required between the RJ31X and the CAU. Teltone offers this cable as part numbers 740-00053-06 (7ft. length) and 740-00053-07 (25ft. length).

C. Installation Testing (CAU Turnup)

3.10 Testing and Placing the CAU in Service: Call processing through each CAU should be tested in conjunction with TDU installation personnel, after one or more TDUs have been installed, as described in TDU-100. If no TDUs are yet installed, the following minimal tests of CAU functioning can be performed:

(1) Connect the power cord to the CAU and to the AC outlet. The green POWER LED should turn on and blink at a rate of approximately twice per second. The red ALARM LED should turn on briefly, then go off. If the POWER LED is not flashing, refer to Table 3, Number 1.
(2) Go off-hook to the CAU from the PSAP side. You should hear reorder ("fast busy") tone. The yellow IN USE LED should also turn on. If you do not hear reorder tone, see Table 3, Number 3.
(3) An incoming ACD line can be tested by going off-hook with a butt set or test telephone connected to the PSAP line RJ11 interface. When the ACD detects the closed loop, it should ring the operator's console. The operator should be able to seize the ringing line, and, upon answer, will have a talk path to the test phone. If a problem occurs, check the ACD interface wiring, and review troubleshooting guidelines in Table 3.
(4) Place a test call to the CAU from the central office (line) side. The IN USE (yellow) LED will flash as the unit is being rung, then turn ON briefly. You should hear three short bursts of DTMF tone, and then the call is disconnected. If you do not hear three short DTMF tones, see Table 3, Number 4.
(5) Proceed to test CAU operation with TDU. (Instructions for testing the TDU are available in TDU-100).

D. Maintenance and Troubleshooting

3.11 The CAU requires no routine maintenance. For 9-1-1 SAS system troubleshooting, refer to TDU-100, "Maintenance and Troubleshooting". Troubleshooting the CAU is discussed in paragraph 3.14 and guidelines listed in Table 3.

Technical Support

3.12 For technical assistance on this product, contact Teltone Product Support at: **1-800-426-3926 or 206-487-1515.**

Figure 12 Tip/Ring Wiring for ACD (Mode B)

Figure 13 CAU Alarm Wiring

Figure 14 RJ31X Block for CAU Installation in Hunt Group

Alarm Handling

3.13 If the CAU Alarm LED is ON, the IN USE LED will blink an alarm code every 5 seconds. The alarm codes are explained in Table 2.

3.14 CAU alarms can be caused by loss of power, memory or microprocessor failure, or a diagnosis that the unit is unable to accept calls or make connection to the PSAP equipment. The alarm is generated by activation of a 1 Form C contact on a connector block at the back of the unit. It is released by pressing a push button on the unit front panel. The alarm will remain in effect until the cause of the alarm is remedied.

3.15 Criteria for Setting Alarms: Seven different criteria can set an alarm on the CAU. These are:

(1) **Power Down.** Any time the CAU is not powered, the alarm contacts will be activated.

(2) **RAM Read or Write Alarm.** When the RAM read/write test fails three or more consecutive times, an alarm it set.

(3) **Program Memory Checksum Alarm.** When the Program Memory Checksum test fails three or more consecutive times, an alarm is set.

(4) **No PSAP Loop Current (B Mode) Alarm.** When the CAU fails to detect loop current from the ACD when the PSAP is alerted, an alarm is set.

(5) **Tip/Ring Polarity—CO Line (A Mode) Alarm.** If the polarities of the CO Tip and Ring leads are opposite to those in the internal battery feed circuit of the CAU, an alarm is set whenever the PSAP answers a call.

(6) **Tip/Ring Polarity—PSAP Line (B Mode) Alarm.** If the polarities of the PSAP Tip and Ring leads are reversed (showing an answer state) when the CAU is idle, an alarm is set.

(7) **Watchdog Reset.** If the watchdog detects a power fail condition or if a software anomaly is encountered, an alarm is set on reinitialization.

Note: The CAU is automatically taken out of service (i.e., the incoming line from the CO is made busy) during power down (1) or watchdog reset (7) alarm conditions.

3.16 CAU Troubleshooting: Table 3 provides a list of symptoms and recommended actions for typical CAU problems.

3.17 Automatic Alarm Recovery. Alarm six types are automatically recoverable from software. That is, they are released when the problem that caused the alarm is corrected and the software program determines that all is well. Various recovery methods are used to determine the health of the unit. These are:

- **For the Power Down alarm,** the alarm clears when the unit is powered back up and internal diagnostics are run. This takes about 1 second.
- **For the memory-based alarms (RAM and Program Memory),** the memory tests are continually run in background. If a failure occurs, a counter is incremented. When the count reaches three, an alarm is set. If the memory test continues to fail, the count keeps incrementing until it reaches 255 (FF hex), at which point it stops incrementing. When the problem that caused the alarm is corrected, and tests start passing again, the count is gradually decremented back toward 0. As long as more tests pass than fail, the count will eventually reach o and the alarm will clear automatically.
- **For the No PSAP Loop Current alarm (in B mode),** the alarm will clear when the loop current is detected. The CAU drops the call on the CO line, but continues to monitor for loop current on the PSAP line.
- **For the Tip/Ring Polarity—CO Line alarm,** the alarm will stay in effect until a call to the PSAP has the correct polarity.
- **For the Tip/Ring Polarity—PSAP Line alarm,** the alarm will stay in effect until the polarity is corrected.

- **For Watchdog alarm,** the CAU will run the internal memory tests and, if they pass, the alarm will be released, just as for the power-up case above.

In all cases, the Alarm Release push button on the front panel will immediately clear the alarm and will reset the memory fail counts back to zero. An alarm will eventually occur again if the problem that originally caused it has not been corrected.

Table 2 CAU Alarm Codes

No. of blinks	Meaning	Action
1	Polarity reversal-Mode A	Check wiring to CO line jack.
2	Polarity reversal-Mode B	Check wiring to PSAP line jack
3	No PSAP loop-Mode B	Check wiring to PSAP line jack
4	RAM read/write failure	Replace unit
5	Program checksum	Replace unit

Table 3 Troubleshooting

Number	Symptom	LED Status	Action
1	(1) Unit does not answer incoming calls (2) TDU routes calls to alternate answering points. (3) External CAU alarm active (see Figure 13) (4) CAU in alarm (5) PWR/MON LED off	PWR/MON off	Check AC power. If OK, unplug AC cord from unit and check fuse. (The fuse is use part of the AC receptable in Figure 9.) If the fuse is ok, replace the CAU.
		PWR/MON on (Solid)	Check the fuse (see Figure 9), and retest. If the unit continues to malfunction, replace CAU.
		PWR/MON blinking, alarm on, In-Use blinking error code.	Consult Table 2, CAU Alarm Codes, for error code meaning and recommended action.
2	TDU reports CAU in alarm during test call.	PWR/MON blinking alarm on In-Use blinking error code.	Consult Table 2, CAU Alarm Codes, for error code meaning and recommended action.
3	Off-Hook at PSAP equipment, CAU does not return fast busy.	PWR/MON blinking, alarm off, in-use off	Check the wiring from the CAU to the PSAP CPE. If the wiring is OK, replace the CAU
		PWR/MON blinking, alarm off, in-use on	Replace CAU
4	Incoming call to CAU does not return three short DTMF bursts.	PWR/MON blinking, alarm off, in-use on	Replace CAU

Table 3 CAU Specifications

I. ELECTRICAL SPECIFICATIONS	
Incoming and Outgoing Loop Line Interfaces	
Impedance	900 ohms
Insertion loss	<2 dB @ 1 kHz
Return loss	>15 dB (500 to 2500 Hz) >9dB (200-500 and 2500-3200 Hz)
Longitudinal balance	≥60 dB (300 to 3200 Hz)
AC Power Input Requirements	
Input voltage range	95 to 130 VAC
Line current requirement	200 mA maximum
Fusing	Fast acting 5 x 20 mm, ½ A, 250 V fuse
DTMF Signaling	
Transmitter:	
Output level	-10 +0/-3 dBm0/frequency
Frequency tolerance	± 1.5% of nominal
Dialing delay	70 ms after start signal
Digit signal length	70 ± 5 ms
Interdigit time	70 ± 5 ms
Receiver:	
Response range (level)	-8 to –35 dBm/frequency
Minimum response (time, all signals)	≥40 ms
Must not respond (time)	≤20 ms
Minimum digit separation	40 ms

Maximum digit interruption (hit) time	10 ms
Maximum twist	6 dB
Frequency tolerance	± (1.5% = 5) Hz
Call Progress Tone Generator	
Output level (low tone)	-24 ± 3 dBm0/frequency
Output level (audible ringback)	-19 ± 3 dBm0/frequency
Frequency tolerance	± 0.5% of nominal
Tone on delay	5 ms maximum
Tone off delay	5 ms maximum
Other Network Timing Values	
Hit	<300 ms
Flash	300—1100 ms
Undefined	1100—1500ms
Disconnect	1500 ms
Wink (battery reversal)	250 ± 50 ms
Alarm Contacts	
Contact rating	1 Amp @ 50 volts
II. MECHANICAL SPECIFICATIONS	
Dimensions	2.25”W x 10.0”D x 10.5”H (57 x 254 x 267 mm)
Weight	7 lb.
III. ENVIROMENTAL SPECIFICATIONS	
Storage temperature	-40° to +70° C
Operating temperature	0° to + 50° C
Humidity	95% (noncondensing)
IV. REGULAROTY SPECIFICATIONS	
FCC	PARTS 15 and 68
UL	1459
CSA	C22.2

Appendix A: Application Notes

The following documents address specific applications. The notes are available separately. When requesting copies from Teltone, please provide the Application Note #.

Add 9-1-1 Call Capacity Without Network Growth (Application Note #23)

This note discusses how to handle abnormally high volumes of traffic with the 9-1-1 SAS.

E911 Alternate Routing over Cellular Networks (Application Note #24)

This note explains how to use the 9-1-1 SAS to route calls over the cellular network. In this case, the cellular network acts as an alternate network, providing additional routing destinations.

Flexible Access to Public Safety Answering Points (Application Note #25)

This note explains how the 9-1-1 SAS can be used when a 9-1-1 call cannot be completed to the PSAP because all available dedicated lines are busy.

Disaster Recovery in E911 Tandem Switch Environments (Application Note #33)

This note explains how to use the 9-1-1 SAS as a backup to the dedicated trunks to the E911 tandem office.

Maintaining 9-1-1 Service During Natural Disasters (Application Note #30)

This note discusses using the 9-1-1 SAS circuits for redundancy to dedicated 9-1-1 trunks, so that emergency service continues without interruption, even during a natural disaster.

Trunk Monitoring in the Analog CO (Application Note #63)

This note explains how to protect vulnerable emergency service trunks between the 9-1-1 Central Office and the E911 Tandem with the 9-1-1 SAS.

Trunk Monitoring in the Analog CO (Application Note #64)

This note explains how to use the 9-1-1 SAS to backup the vulnerable emergency trunks between the 9-1-1 caller's Central Office and the E911 Tandem.

Trunk Monitoring of the Digital Central Office with an Analog Tandem (Application Note #65)

This note explains how the 9-1-1 SAS can be used for trunk monitoring of the emergency services (ES) trunks in the digital Class 5 Central Office and analog E911 Tandem.

Trunk Monitoring of Digital Class 5 Central Office at Analog Level (Application Note #66)

This note explains how the 9-1-1 SAS can be used for trunk monitoring of the emergency services (ES) trunks at the analog level in the digital Class 5 Central Office with priority access to multiple alternate networks.

Monitoring Analog Trunks Between E-911 Tandem and PSAP (Application Note #67)

This note explains how basic trunk monitoring of the emergency services (ES) trunks between an E-911 Tandem and a Public Service Answering Point (PSAP) can be reinforced by the 9-1-1 SAS>

Appendix B: Ordering Information

SYSTEM UNITS

TDU-B-02 Trunk Dial Unit (TDU), for central office installation. Mounts in a 19-or 23-inch relay rack. –48 VDC powered.

CAU-A-02 Call Answer Unit (CAU), for installation at customer premises. UL listed, 110 VAC powered, cable included.

CTU-A-02 Call Transfer Unit (CTU), for installation at receiving tandem central office. Can be installed in CF-CTU-01. –48 VDC powered.

TMU-A-01 Trunk Monitor Unit (TMU), for installation in a central office. Mounts in 19- or 23-inch relay rack. – 42 – 56 VDC powered.

CARD FILE

CF-CTU-01 Card file for mounting up to 12 CTU units. Includes mounting ears for front or center mounting in a 19- or 23-inch relay rack.

SPARES AND MISCELLANEOUS

M-442 Mounting bars. For 19-inch relay rack. Includes two bars and mounting screws.

198-00007-01 Spare TDU Installation kit. Includes 24-position connector, 2 cable ties, 2 fuses, and mounting hardware.

198-00008-01 Spare CAU Installation kit. For CAU wall or rack mounting. Includes 110 VAC cable and mounting hardware for wall mounting or mounting in 19-inch relay rack.

730-00045-01 CAU AC line cord.

740-00053-06 8-wire to 6-wire modular cable for connection between RJ31X jack and PSAP incoming line (for CAU installations in hunt group). 7ft. long.

740-00053-07 8-wire to 6-wire modular cable for CAU hunt group installations, 25ft. long.

740-00053-09 Cable assembly. 6-position, 6-wire, male to male modular 7-foot cable for connection between J1 and/or J2 and USOC wall jacks RJ11C or RJ12C.

740-00053-17 Cable assembly. 6-position, 6-wire, male to male modular 25-foot cable for connection between J1 and/or J2 and USOC wall jacks RJ11C or RJ12C.

740-00287-01 Card edge connector for CF-CTU-01.

Appendix B: Site Survey

Before installing the CAU, you should work with local and central office personnel to answer the following questions. You may wish to copy the form below and fax it to the installation sire and central office.

Location information

Site Name: Osage PSAP .

Date: 11-17-99 .

Customer Contact: Vern Tanner .

Telephone Number: 515-732-5861 .

How many CAUs will be installed at your site? 2.
Have you ordered the telephone lines for the CAUs?
✔ Yes ☐ No
Are the telephone lines connected as a rotary hunt group?
✔ Yes ☐ No
If yes, what is the pilot number for the CAUs 712-732-4456
What are the telephone numbers for the CAU?
First CAU: 515-732-4456 .
Second CAU: 515-732-4479.
When will this service be available? 11-17-99
Is your CPE equipment running off a UPS power source?
✔ Yes ☐ No
If yes, will you power the CAUs from this source?
✔ Yes ☐ No

Trunk Interface

What type of trunk interface is required at the Customer Premises ANI controller?
☐ Two wire loop ✔ Two wire reverse battery
How does the ANI controller request ANI?
✔ Immediate (OFF HOOK) ☐ WINK (Polarity Reversal)
Do you have sufficient trunk cards installed for the CAUs (one trunk card per CAU)?
✔ Yes ☐ No
If no, when will they be available? _____

Alarms

Is there a local system to monitor CAU alarms?
✔ No ☐ Yes
If so, so you want to monitor the alarms?
✔ No ☐ Yes

CAU Installation

Who will install the CAUs, RJ11 blocks, and in-house wiring?
✔ Contractor ☐ In-house Personnel
Where will the CAUs be installed?_____
_____
_____

Is mounting available (racks, plywood, etc.)?
✔ Yes ☐ No
On what date will the installation be ready for testing? 11-17-99

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A

B

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When you have completed this form, fold, tape, and return to address on back. If you would prefer to fax this form, our fax number is (206) 487-2288. Thank you

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