Dial-up Audio Interface

Model DAI-2

– INSTALLATION AND OPERATION –

DAI-2 firmware version 2.00
DAI-2 hardware revision 1
DAI-RP hardware revision 1

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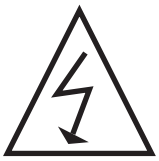
Section 1 — Safety Information

WARNING!

The DAI-2 Dial-up Audio Interface should be installed only by qualified technical personnel. An attempt to install this device by a person who is not technically qualified could result in a hazardous condition to the installer or other personnel, and/or damage to the DAI-2 or other equipment. Please ensure that proper safety precautions have been made before installing this device.

The DAI-2 Dial-up Audio Interface is registered with the Federal Communications Commission and certified to meet specific safety requirements. It is extremely important that the DAI-2 not be modified in any way. Modification of this equipment will void the FCC certification, void the warranty, and perhaps pose a hazard to the user of this equipment or to maintenance personnel of your local telephone company. Service of the DAI-2 Dial-up Audio Interface should be performed only by qualified technical personnel who are familiar with the implications of FCC Part 68 registration. The DAI-2 Dial-up Audio Interface is designed for indoor use in a dry location. Installation and operation in other locations could be hazardous.



High Voltage!

Extreme caution should be used if the DAI-2 Dial-up Audio Interface case is opened without first being disconnected from the telephone line and the DAI-2/RP Relay Panel. High voltages may be present on telephone lines, and although the DAI-2 is powered by 12 volts AC from a "wall plug" transformer, failure of this transformer could cause dangerous and potentially lethal voltages to become present. Only the supplied transformer should be used.

Depending on the installation, substantial voltages may be connected the DAI-2 relay panel. If this is the case, use extreme care when working in the vicinity of the DAI-2 and disconnect all sources of high voltage before contacting it.

The DAI-2 contains self-resetting "fuses" that protect it from excessive current. If these are replaced, the replacement devices should be of the same type and rating.

The DAI-2, as any electronic device, can fail in unexpected ways and without warning. Do not use the DAI-2 in applications where a life-threatening condition could result if it were to fail.

Section 2 — FCC Information

2.1 Part 68 Compliance

The DAI-2 complies with Part 68 of the FCC rules. On the rear panel of the DAI-2 is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN) for this equipment. If requested, this information must be provided to the telephone company.

The REN is used to determine the quantity of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in devices not ringing in response to an incoming call. In most areas, the sum of the RENs should not exceed 5.0. Contact the local telephone company to determine the maximum REN for the calling area.

The DAI-2 is designed for use with standard modular (RJ11C) telephone jacks.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the DAI-2. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications to maintain uninterrupted service.

If the DAI-2 causes harm to the telephone network, the telephone company will notify you in advance of service disconnection. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

Please contact Sine Systems, Inc., for repair and/or warranty information if you suspect that the DAI-2 has malfunctioned. If a defective device is causing harm to the telephone network, the telephone company may request you remove that device from the network until the problem is resolved.

The DAI-2 cannot be used on public coin service lines provided by the telephone company. Connection to Party Line Service is subject to state tariffs. Contact your state public utility commission, public service commission, or corporation commission for information.

The DAI-2 is registered with the Federal Communications Commission and is certified to meet specific safety requirements. It is extremely important that the DAI-2 not be modified in any way. Modification of this equipment will void the FCC certification, void the warranty, and perhaps pose a hazard to the user of this equipment or to maintenance personnel of your local telephone company.

Service should be performed only by qualified technical personnel who are familiar with the implications of FCC Part 68 registration. Extreme caution should be used if the DAI-2 case is opened while still connected to the telephone line. High voltages may be present on telephone lines.

Section 3 — Installation

WARNING!

The DAI-2 Dial-up Audio Interface should be installed only by qualified technical personnel. An attempt to install this device by a person who is not technically qualified could result in a hazardous condition to the installer or other personnel, and/or damage to the DAI-2 or other equipment. Broadcast equipment can operate at voltages that are potentially lethal. Please ensure that proper safety precautions have been made before installing this device.

3.1 System Includes

The DAI-2 Dial-up Audio Interface package contains these items:

- Dial-up Audio Interface model DAI-2
- rack mounted chassis and relay panel
- ribbon cable with two connectors
- 12 VDC wall plug supply
- modular telephone cable
- operation manual

All systems are fully tested before leaving the factory but damage may occur in transport. When the DAI-2 is unpacked, it should be inspected for obvious signs of mechanical damage or loose parts. Loose parts should be tightened before installation. If damage is found, save the packing material and report it to the shipping company and the dealer from which it was purchased. Do not install the system.

3.2 Installing the System

The DAI-2 is easy to install if you are careful, patient and alert. Installation is broken down into a series of logical steps but you should have some previous engineering experience in a broadcast environment before attempting to install the DAI-2. Access to the building does not necessarily qualify you as an engineer. We cannot protect you from yourself, but we want to make this point very clearly: *if you are unfamiliar with this type of equipment, please contact a properly qualified engineer to handle installation and setup of this system.*

3.2.1 Mechanical Installation

The DAI-2 is designed to be mounted in a standard 19 inch equipment rack. The system generates little heat and can be mounted in just about any convenient location. The DAI-2 should be mounted at a location which is convenient to the equipment that will be connected to it.

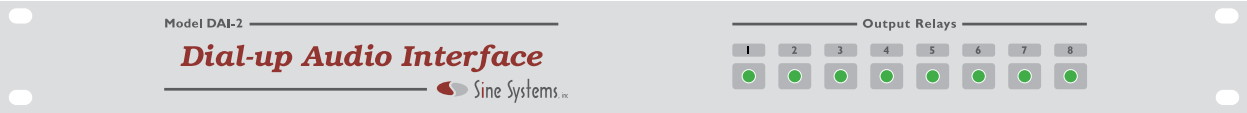


Figure 3.1; DAI-2 Dial-up Audio Interface

3.2.2 DAI-2 Relay Panel Interconnect

The DAI-2 should be connected to its relay panel with the 20 conductor flat (ribbon) cable. This cable is supplied with the system and is terminated with an appropriate connector at each end. One end of the flat cable connects to the rear of the DAI-2 control unit at the connector labeled “Relay Panel” (see Figure 3.2). This connector is keyed to fit in one direction and will be held secure by latches when fully inserted.

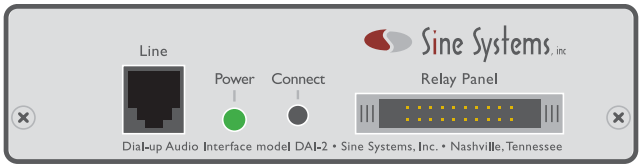


Figure 3.2; Rear panel connectors

On the relay panel, the tab on the flat cable connector should line up with the connector outline around J11 on the relay panel (see Figure 3.3). This connector has no outer shell and is not keyed so make sure that the connector is properly oriented and aligned with all pins before applying pressure.

3.2.3 Telephone Line Connection

The DAI-2 should be connected to a standard (POTS) telephone line with the modular (RJ11C) jack on the rear panel labeled "Line". A telephone cable is supplied with the DAI-2 for this purpose.

3.2.4 Audio I/O Connections

The DAI-2 has one audio input and one audio output. The audio input feeds audio to the telephone line and the audio output provides audio from the telephone line. The DAI-2 control circuits allow only one audio port to be active at a time--the DAI-2 is not a telephone hybrid device. Both the input and output are balanced, high level audio ports.

The audio input and output connections are made through screw terminals on the relay panel. The terminals are located on a connector J9 to the left of the flat cable connector J11 as shown in figure 3.3.

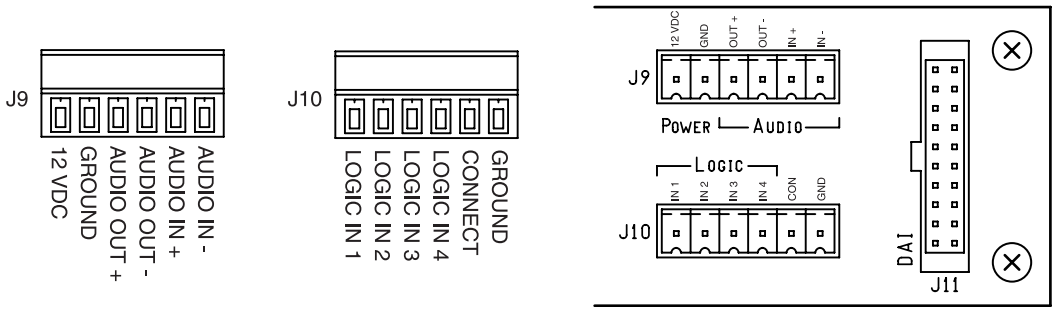


Figure 3.3; Relay Panel power, audio and logic connections

The DAI-2 audio output can drive a balanced high impedance or 600 ohm load at up to about +4dBm. If the DAI-2 audio output is used to drive an unbalanced load, use either output lead and ground. *Do not connect either side of the DAI-2 audio output to ground for an extended period of time or damage to the DAI-2 could result.*

The audio output level of the DAI-2 is adjustable through programming. This is covered in the programming section of this manual. The DAI-2 is factory programmed to a program level of about +2 to +4 dBm with a slight amount of peak clipping. Higher output level settings will result in higher output level and more clipping while lower settings will result in lower output levels and little or no clipping.

The DAI-2 has an internal automatic level control (ALC) that attempts to keep both input and output levels consistent. The behavior of the ALC is programmable. The ALC can also be enabled or disabled on a key-by-key basis.

The DAI-2 audio input is a high impedance, balanced input. It can be driven by either a balanced or unbalanced source. For unbalanced audio sources, connect the source leads to the IN+ and IN- terminals. It does not matter which lead is connected to which input. Unlike the audio output, there are no restrictions on grounding the audio input connections. The DAI-2 is designed to automatically adjust for input levels within the range of -10 dBv to +4 dBv.

3.2.5 Logic-Level Input Connections

The DAI-2 has four programmable logic-level inputs. All logic-level inputs can be driven by a +5 VDC logic signal, a contact closure, or a ground referenced open-collector. Logic is active low and internal pull-up resistors are present.

In other words, when using an open-collector or contact closure, a pull down to ground activates the appropriate function. The logic-level inputs can be held at ground indefinitely. They will trigger one time on the falling edge and will not trigger again until the input signal goes high and falls again.

External logic gates should have the same ground reference as the DAI-2. Unused logic-level inputs should be left unconnected. The time required for a logic-level input change to activate a function is controlled by user-programming and is discussed in the programming section of this manual.

The logic-level inputs are labeled IN 1 through IN 4 on J10 of the relay panel.

3.2.6 Manual Connect Input

There is one single-purpose logic-level input that is used to force the DAI-2 to go off hook. Like the other logic-level inputs, this one can also be driven by a +5 VDC logic signal, a contact closure, or a ground referenced open-collector. Logic is active low and an internal pull-up resistors is present. The manual connect input is labeled CON on J10 of the relay panel.

3.2.7 Control Relay I/O Connections

The DAI-2 has eight control relays built in to the relay panel. Seven of these relays are DPDT and one is 4PDT--typically used to switch stereo audio. All contacts, normally-open (NO), normally-closed (NC) and common (COM) are brought out to pluggable screw terminal connectors. The seperate relay poles are designated A and B. Relay 1 uses two relays to give it a total of four poles. The two relays are identified as 1A and 1B.

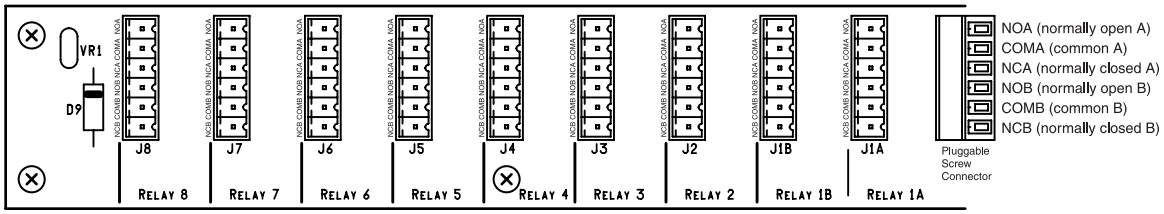


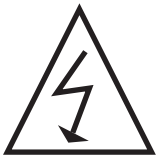
Figure 3.4; DAI-2 Control relay I/O connections

The relay "control" wiring is pre-wired to the DAI-2 control unit via the flat cable, however, the system is fully programmable and any combination of relays can be engaged through system programming.

The control relay contacts are rated to withstand fairly high voltages but we do not recommend routing high voltage through the DAI-2. See the specfications section of the manual for relay contact ratings but keep in mind that the DAI-2 is designed to route *audio signals.* Low voltage, logic-level switching is okay where appropriate.

Sample wiring diagrams are shown later in this section.

3.2.8 Power Supply



High Voltage!

One or both of the DAI-2 GND terminals must be connected to the station ground or other qood quality earth-ground. The DAI-2 contains an internal protection circuit that diverts an abnormally high voltage on the telephone line to the DAI-2 ground connection. It is very important that the DAI-2 ground connection be connected to a good quality earth-ground for this protection to work. Failure to do this could result in a painful or lethal shock to anyone in electrical contact with the DAI-2 if a high voltage were present on the telephone line from lightning, etc.

Power to operate the DAI-2 is supplied by a 12 volt DC wall-plug transformer that is included with the DAI-2. This transformer is designed for 120 volts AC at 50-60 Hz and is rated at 500 milliamps. The leads of this transformer should be stripped and tinned and connected to the appropriate screw terminal connectors on J9 of the relay panel. The positive lead (usually denoted by a white stripe) connects to the +12V terminal and the negative lead connects to GND on the relay panel. (See figure 3.3) Power supply polarity should be verified before the connections are made to avoid damage to the DAI-2.

3.3 Telephone Interface

The RFC-1 is designed to be connected to an ordinary (POTS) telephone line. In some cases a telephone line is either not available or is prohibitively expensive. There are several alternatives to a regular telephone line that are compatible with the RFC-1.

3.3.1 Cellular Telephone with an RJ-11 Adapter

It is possible to connect a cellular telephone to the DAI-2 in place of a telephone line. Some cell phone manufacturers offer devices that provide a cellular telephone with a standard RJ-11 jack. These devices emulate a standard telephone line including dial tone, ring voltage and battery. Additionally, the cell phone will usually need to be outfitted with an external antenna and a constant power supply. Several manufacturers offer these items as part of their product line but product lines change rapidly. The best approach is to discuss your needs with your supplier to find a solution that will work.

Most of these RJ-11 adapters generate a square-wave ring signal on an incoming call instead of the sine-wave ring voltage that is found on a normal telephone line. The DAI-2 has a firmware adjustment that will enable it to recognize the non-standard ring signal. The Programming section of the DAI-2 documentation provides details on making this adjustment.

3.3.2 Fixed Location Cellular Telephones

An alternative to using a mobile cell phone with an RJ-11 adapter is to use a cell phone designed specifically for fixed locations. These phones usually include an RJ-11 connector for outboard equipment and provide a cleaner solution than the adapter approach. They also tend to be more expensive but they include some items that are extra in the mobile cell phone approach. Telular, Inc. is a manufacturer of fixed location cell phones. They can be reached at (800) 229-2326 or http://www.telular.com.

3.3.3 Rural Radiotelephones or Ranch Telephones

Rural radiotelephone systems, or "ranch phones", are systems that use a full duplex VHF or UHF radio circuit to extend a telephone line. Two small transceivers are used in this system. One end is connected to a regular telephone line, the other end has an RJ-11 jack that emulates a regular telephone line. Rural telephones have a range of roughly 1 to 10 miles depending on terrain. The transmitter power levels are usually in the range of 1 to 10 watts. Because they contain transmitters, rural telephones must be licensed. Channels are scarce in the more populated areas of the country but are usually available in the areas where rural telephones are most often needed.

Rural radiotelephones usually cost several thousand dollars for a typical system but there is no recurring cost for service once installed. DX Radio Systems is a provider of radiotelephones. They can be reached at (800) 447-6937 or http://www.tpl-dxrs.com.

3.4 Use with RPU Equipment

It is quite feasible to use the DAI-2 with communications links other than telephone lines. For example, the control and switching capabilities of the DAI-2 often can be useful during remotes using a UHF Remote Pickup Unit (RPU). The audio output of the RPU receiver should be adjusted to a level between -30 dBm and 0 dBm and then fed to the LINE jack on the DAI-2. Bring the DAI-2 online the the manual connect control--either from the front panel pushbutton or the logic-level input.

It is easy to construct an extremely versatile system that allows two communications links to be used with the DAI-2. Either a telephone line or the output of the RPU receiver can be connected to the DAI-2 using the squelch relay in an RPU receiver to control a DPDT relay as shown in Figure 3.5.

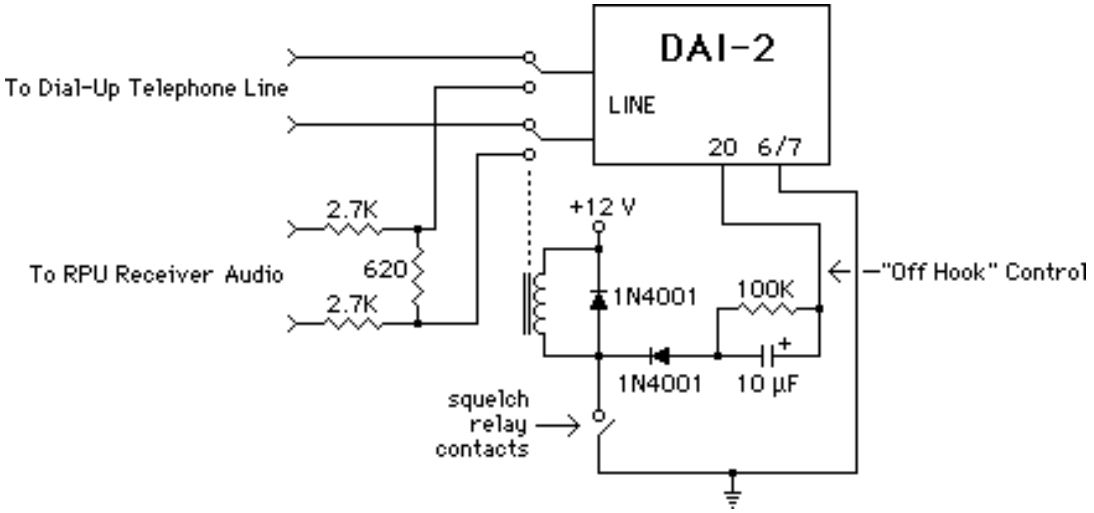


Figure 3.5; Using both and RPU and telephone line with the DAI-2

The DAI-2 contains an internal 4.5 kHz low-pass filter. This will not limit the bandwidth of audio coming from the telephone line but it will restrict bandwidth of the audio coming from the RPU. This is usually not a problem for voice broadcasts, but it may be an issue for music broadcasts.

DTMF tones are used to control the DAI-2 when using a telephone line. DTMF tones can be generated by simple tone-dialers but these devices may require modification to obtain the necessary audio connection.

3.5 RF Interference

The DAI-2 is typically a studio device so there have been few reported RF problems with this device. However, since it can be installed at a transmitter site, a few suggestions on preventing RF interference are in order. The DAI-2 is designed with bypass caps and suitable RF protection on the telephone line for most installations. However, extreme conditions exist that require additional external filtering to obtain reliable operation. Extreme conditions are rare but these problems can be overcome by a combination of one or more of the following remedies:

- Install an RF filter before the "Line" jack near the DAI-2
- Loop the ribbon cable several times through a ferrite core at each end

Telephone line RF filters can be obtained through a wholesale distributor or telephone products. Suttle Apparatus is one manufacturer of these devices. They can be reached at (800) 852-8662 or http://www.suttleonline.com. Be sure to get an RF filter and not simply a spike protector.

3.6 Lightning Protection Tips

WARNING!

Damage to the DAI-2 by lightning is not covered under warranty. See the complete warranty for more information.

In most installations the DAI-2 is connected to both a telephone line and other broadcast equipment. Any equipment in this situation is subject to severe abuse from lightning. In some installations this happens frequently. Lightning can enter through the phone line, mistreat the DAI-2 and exit to the station ground system. It can also hit the tower, elevate the entire ground system above ground by several kilovolts and exit through DAI-2 to ground. This is called a "ground surge." In other words, the telephone line can hit the DAI-2 or the DAI-2 can hit the telephone line. The same thing can happen with the power line.

3.6.1 Proper Ground System

The first step in any protection scheme is to install and maintain a high quality ground system. This will serve two purposes. First, the intensity of the ground surge will be lowered because of the lower resistance to earth ground and second, if everything is tied together with low impedance conductors, all equipment will stay closer to the same electrical potential when the system ground takes a hit. All protection devices, equipment racks and transmitters should be tied together with low impedance conductors, preferably copper strap, as short and as free from bends as possible. Do not depend on metal conduit for ground connections. A properly designed and installed ground system will pay for itself many times over in the damage it prevents.

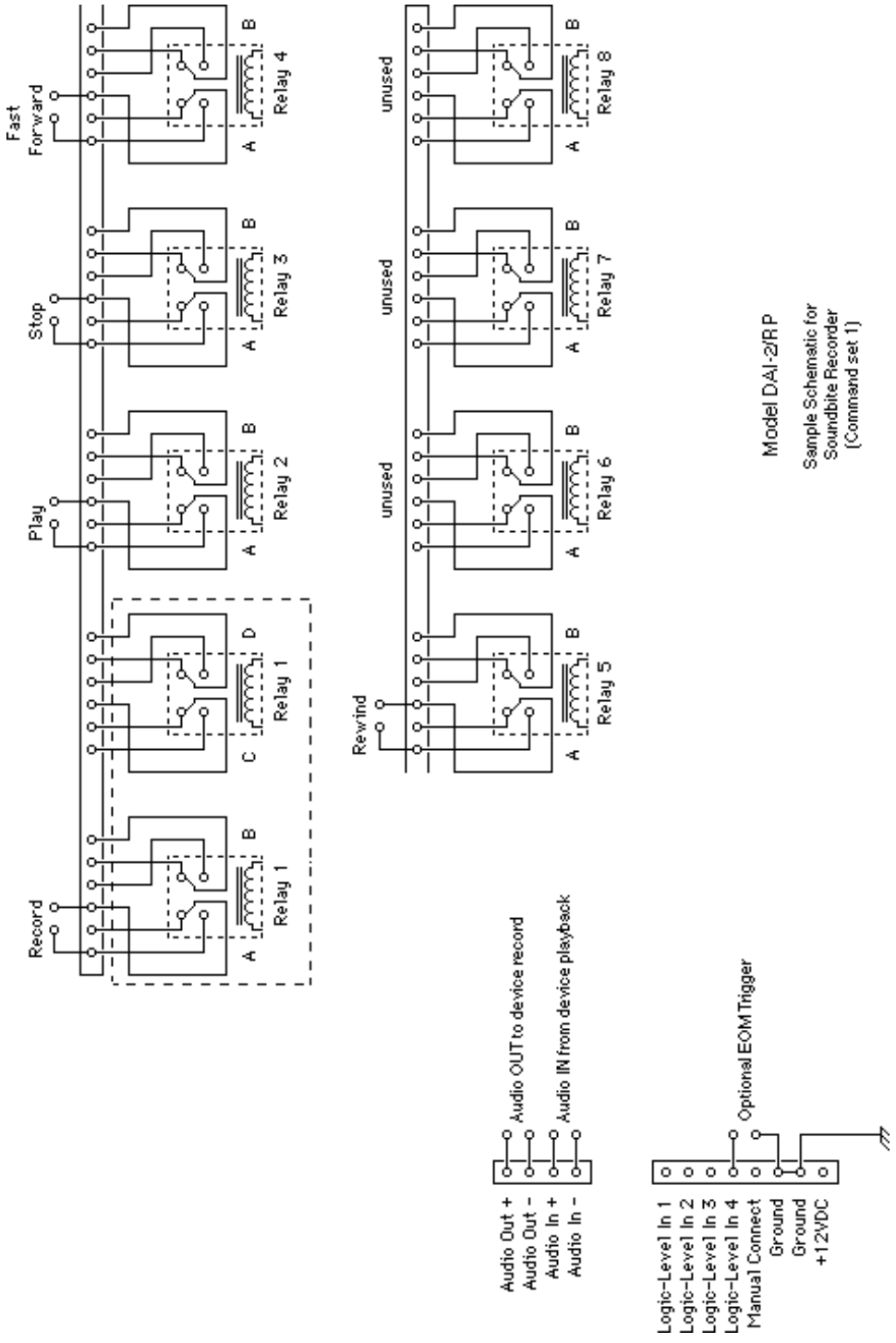
3.6.2 Telephone Line Protection

Be sure your local telephone company has installed gas surge arrestors on your incoming telephone lines. Old installations may contain carbon protectors which tend to provide less reliable protection. Be sure the ground connection used by the telephone company is an integral part of your station ground system. Sometimes the telephone company will use a nearby cold water pipe, metal conduit, or isolated ground rod for their ground and this may be, electrically speaking, quite a distance from your station ground system. Do not disconnect their ground connection, just add a supplemental conductor from their ground point to the station ground.

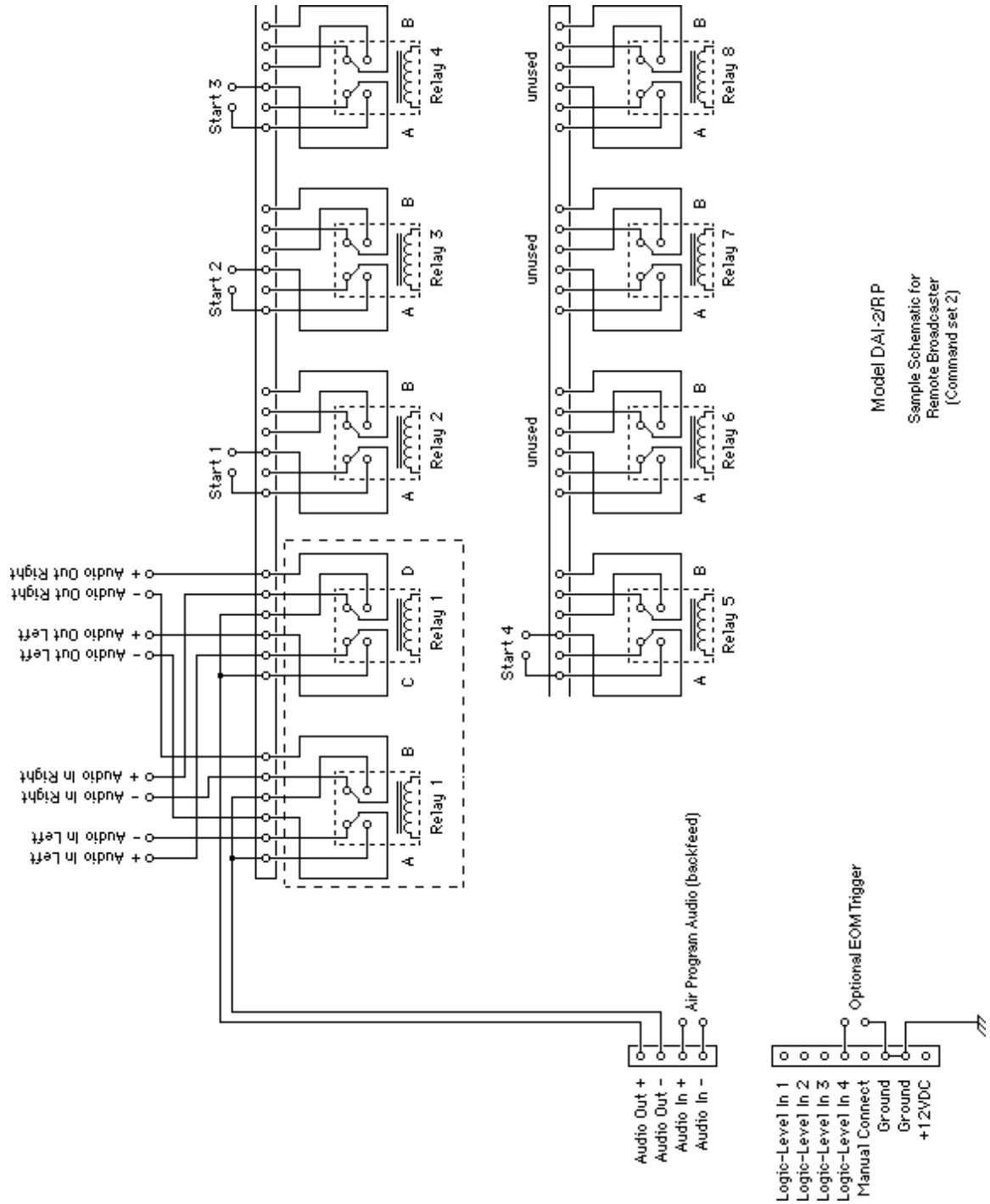
We highly recommend that you purchase and install your own telephone line surge protector in addition to the one installed by the telephone company. Place this between the incoming telephone line and the DAI-2. These spike protectors are designed to pick up a ground connection through the ground prong on a standard AC outlet so be sure this is in fact connected to your station ground by the shortest possible means. For best result, install a "dummy" AC outlet with no AC connections but with a short jumper from the ground terminal on the outlet the metal rack in which the DAI-2 relay panel is mounted. Most protectors have internal, non-replaceable fuses which will blow during a heavy surge. If this happens, replace the protector. Do not attempt to repair it.

3.7 Relay Panel Wiring Diagrams

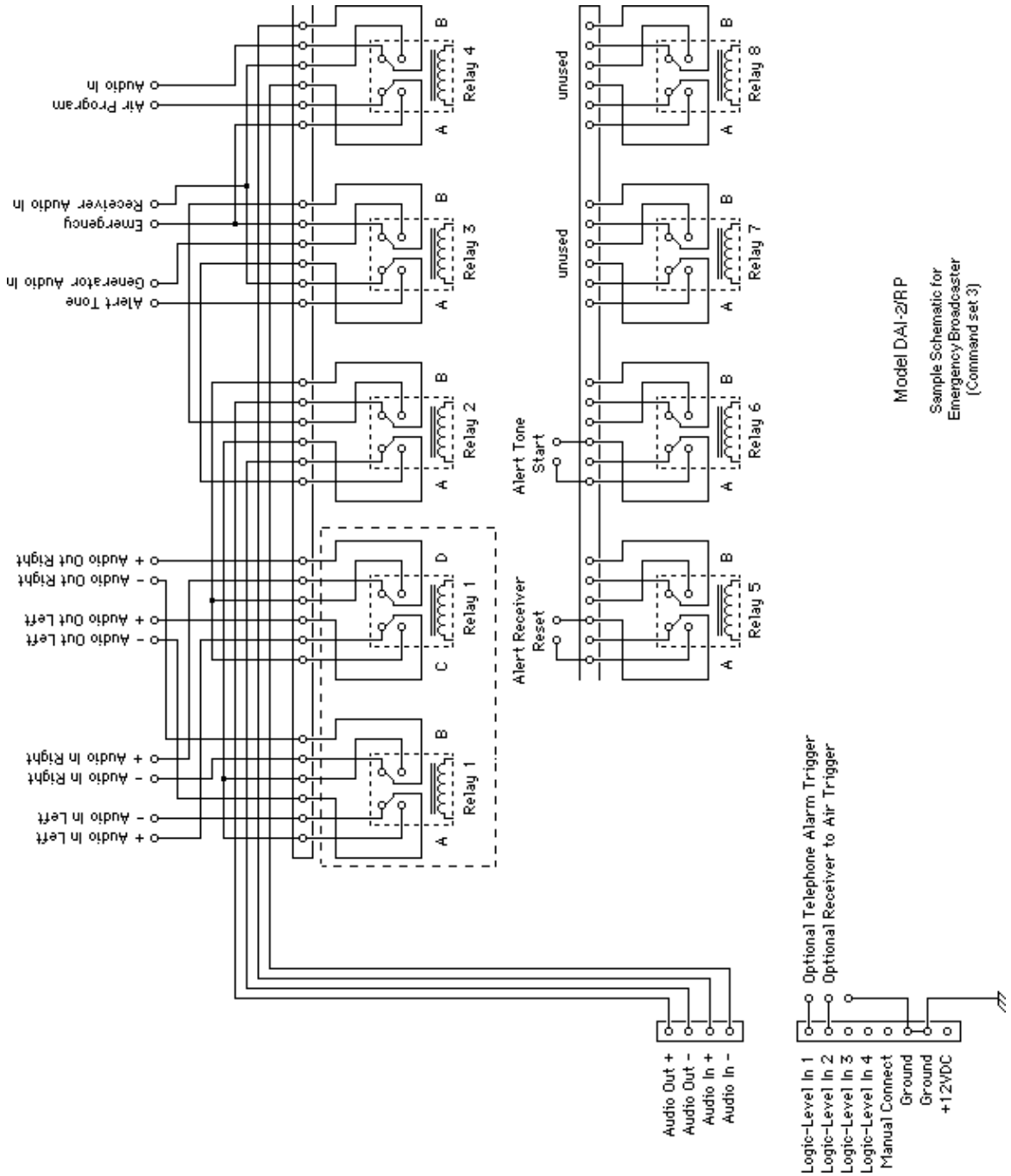
3.7.1 Soundbite Recorder



3.7.2 Remote Broadcaster



3.7.3 Emergency Broadcaster



Section 4 — Operation

4.1 Overview

Since the DAI-2 is controlled by DTMF tones, operating the unit always begins by calling the number where it is located. The DAI-2 must be connected through a telephone line, even when bench testing, because (normally) the unit does not normally provide the necessary operating voltage to the telephone. No special phone line or equipment is required but the controlling telephone must be able to produce DTMF tones. These are the tones generated by the buttons on a TouchTone® telephone.

The DAI-2 responds to DTMF according to user adjustable programming. Every key on the telephone keypad except the ✻ key can be programmed to change the state of the output relays or to change the audio switching in the DAI-2. The ✻ key is used as a function key to change system programming, etc.

4.2 Operation from a Remote Telephone

4.2.1 Going Online with the DAI-2

The DAI-2 will answer the line after two rings (under factory programming) and signal that it has seized the line with one long tone. Enter the main security code using the telephone keypad. The main security code is factory programmed to "12345678". After the security code is correctly entered the DAI-2 responds with two short tones. If the security code is entered incorrectly, the unit will drop the line immediately.

4.2.2 Issuing Commands

The DAI-2 is controlled using one and two digit commands from the keypad of a telephone. The digit keys 0-9 and the # key cause the unit to perform actions as programmed in user programming with the press of a single key. How the DAI-2 responds to key presses is determined by a table stored in memory. You indicate how you want the DAI-2 to respond to each available key by placing specific values in the table. This table effectively forms the command set for the DAI-2. Command sets are discussed later in this section.

4.2.3 Shift Key Commands

In the DAI-2, the ✻ key acts as a shift key which, in conjunction with a second key, causes the unit to perform a specific pre-programmed action. These actions are controlled by the DAI-2 and are not programmable by the user.

Shift Key	*DAI Function*
✻7	Enter programming read mode
✻8	Enter programming write mode
✻99	Hang up
✻0	Read firmware version
✻✻	Shift/Unshift (shift key acts like a toggle)
✻#, 1-6	Reserved for future use

4.2.4 Going Offline with the DAI-2

To end a session with the DAI-2 simply hang up the telephone at any time. The DAI-2 should hang up automatically. To force the DAI-2 to hang up, press ✻ 99 (two nines). The unit will respond with a series of ten short warning tones and, at the end of these tones, it will drop the line. Pressing any key while the unit is sending the warning tones will terminate the hang up sequence and keep the unit in operating mode.

4.3 Operation from a Local Telephone

While this is not the normal method of operation, it is possible to connect to the DAI-2 from a local telephone located near the DAI-2. A local connection is typically used only for initial programming or testing. A local connection bypasses the security codes. This can be particularly helpful if you change one or more codes are forget them.

4.3.1 Connect Button

The following procedure uses the Connect button located on the rear panel of the DAI-2. This button works as either a momentary or maintained contact depending on how you use it. If the button is pressed briefly and released, the DAI-2 will connect to the telephone line and wait for a non-alterable attention signal of ✳✳✳✳. After the attention signal is given, the unit will enter the operating mode and remain there until you hang up the telephone.

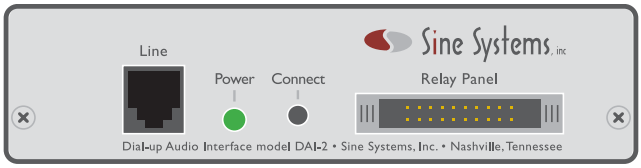


Figure 4.1; Rear panel (location of Connect button)

If the button is pressed and held, the DAI-2 will wait for the attention signal and enter the operating mode as above. It will remain in the operating mode as long as the Manual Connect button is held. The connection will be broken when the button is released for three seconds.

The Manual Connect button is disabled when the DAI-2 is online with a telephone call.

When a connection is made using the Connect button, the DAI-2 does not enforce the programming security code for 10 seconds. This should give you enough time to enter the programming mode in the event that you need to reprogram any security codes that have been lost. If the DAI-2 is still in operating mode after 10 seconds, it will enforce the programming security code as usual.

4.3.2 Manual Connection with Telephone Lines

The easiest way to establish a manual connection to the DAI-2 is to use two telephone lines. Designate one line as the calling line and the other as the receiving line. Connect the DAI-2 to the receiving line and call it from the calling line. Press the Connect button when you hear the line ringing. This will force the DAI-2 to seize the line and place it in the operating mode as if the security codes were successfully entered. The DAI-2 will confirm that it is in the operating mode with two short tones to signal that it is waiting for commands.

It is important to press the button before the DAI-2 answers the line. If the DAI-2 answers first, you will hear one long tone instead of two short beeps. The long tone indicates that the DAI-2 is expecting a security code.

Operate the unit as you would normally, making any changes you need to the system programming. When you are finished, hang up the originating telephone. The DAI-2 will hang up automatically.

If you have only one telephone line but you have a cellular telephone, substitute the cell phone for the calling line and call the DAI-2 as described previously.

4.3.3 Manual Connection without Telephone Lines

WARNING!

This procedure requires that the cover of the DAI-2 be removed. While the voltages inside the unit should not exceed about 12-15 VDC, even low voltages can be potentially lethal under certain conditions. This procedure should only be performed by qualified technical personnel.

The procedure requires you to handle the DAI-2 circuit board. This board contains components that are sensitive to static electricity. Use proper precautions when handling the circuit board.

This procedure places a 12 VDC voltage source on the modular connector J1 to power a telephone set directly. It is important that the DAI-2 not be connected to a telephone line with the jumpers in this position.

This method is similar to the one described in section 4.3.2 except that it does not require any telephone lines or a cellular phone. The only hardware necessary is a telephone with a standard modular plug and two shorting jumpers or clip leads.

- Unplug the supply transformer from the wall outlet and disconnect the telephone line and ribbon cable connectors from the DAI-2 before starting this procedure.

- Remove the rear panel of the DAI-2 case by removing the two securing screws. Carefully slide the circuit board out of the case and place it, component side up, on a non-metallic surface.

- Arrange three jumpers as shown in Figure 4.2 to enable the telephone voltage. If you do not have the extra jumpers, clip leads may be used but make sure that they do not short any components.

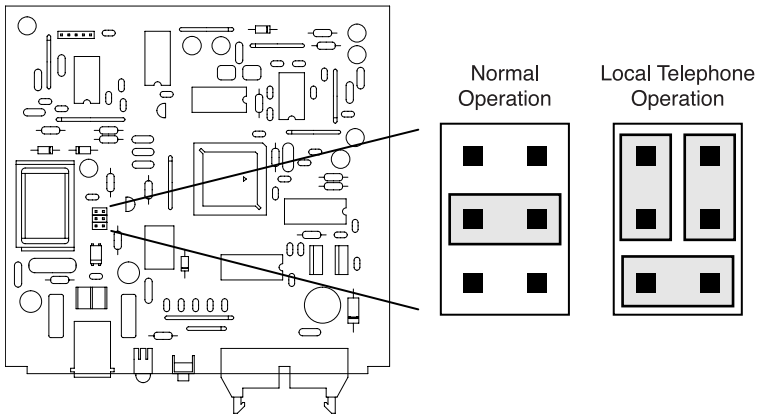


Figure 4.2; Telephone voltage jumpers JP1

- Connect the telephone to the telephone line jack and carefully attach the ribbon cable so that the unit has power. The power LED should illuminate.

- Lift the telephone off hook and press (and release) the Connect button. A relay will click and the DAI-2 will connect to the telephone. Enter the attention code ✻✻✻✻ on the telephone keypad activate the DAI-2. You will hear two short beeps to confirm that you are connected.

- Operate the DAI-2 as you would normally, making any changes you need to the system programming.

- *This step is extremely important!* When you are finished, disconnect the ribbon and telephone cables. Replace the jumper at JP1 to its original position for normal operation as shown in Figure 4.2. Arrows on the circuit board indicate the correct position for the jumper. Failure to install the jumper properly may cause damage to the DAI-2 or other equipment.

- Slide the circuit board back into the case, replace the rear panel and secure it with the two screws removed at the beginning of this procedure.

4.4 Operation on a Shared Telephone Line

The DAI-2 can share a telephone line with other automated equipment. To avoid complications and unexpected interactions, it is not usually desirable to have more than one device seize the telephone line. However, with proper planning a functional solution can be reached.

4.4.1 Transfer from a Dial-up Remote Control

In the scenario, the DAI-2 and a dial-up remote control (such as the Sine Systems RFC-1/B) share a telephone line. Although the DAI-2 is normally installed at the studio, situations do exist where the DAI-2 is installed at a transmitter site. The remote control will probably be used more often than the DAI-2 so it will be given priority. When it is not the desired target device, it can be used to pass the call over to the DAI-2.

Make sure that the remote control is programmed to answer the telephone *before* the DAI-2. The factory default setting of both the DAI-2 and the RFC-1/B is to answer on the second ring. To eliminate this conflict, program the DAI-2 to answer on the fourth ring. Details of changing the ring number to answer are given in the programming section of this manual. When the ring number is adjusted correctly, *the remote control should always answer the line first.* Connect the telephone line to both devices.

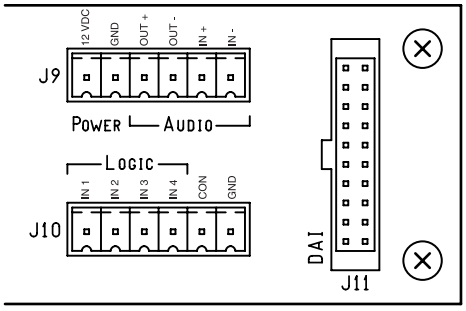


Figure 4.3; Relay panel connections

On the DAI-2 relay panel there is a screw terminal connection labeled “CON”. This terminal is in parallel with the manual “Connect” switch located on the rear panel of the DAI-2. Pulling this contact to ground is exactly like pressing the button. Connect the CON and GND terminals to an unused set of normally open relay contacts on the remote control relay panel (Sine Systems model RP-8). When the appropriate control relay is activated, the CON terminal will be pulled to ground. In this example we will use the channel 7 On/Raise relay of the RFC-1/B.

Make sure that both devices are powered and establish a normal connection to your remote control. Issue the security codes and commands necessary to select and control channel 7. (In the case of the RFC-1/B, enter 07 to select channel 7 and enter the control security code 66.) Issue the command to activate the On/Raise control relay (# on the RFC-1/B). This command will activate the DAI-2 by bridging the Connect switch as described above. Both devices are now connected to the telephone line--but the DAI-2 is not yet active.

Enter the hangup command to the remote control (99 for the RFC-1/B) so the remote control releases the line. Enter ✻✻✻✻ to activate the DAI-2. When the DAI-2 activates this way it will not require security code for access.

When the DAI-2 is waiting for a security code it will not recongize a telephone hang-up (if it did, it would release the line when the remote control drops off). If the remote control hang-up is causing the DAI-2 to release the line, increase the length of the security code timer. During a transfer, do not enter the DAI-2 activation command ✻✻✻✻ until after the remote control disconnects from the line.

4.4.2 Control via VHF or microwave RPU

A variation of the "Transfer from Remote Control" connection described above can be used to connect to and control the DAI-2 using an RPU. This connection can be used instead of (or in addition to) a telephone line. Connect the squelch relay contacts to the CON and GND screw terminals described in the previous section. When the RPU is keyed on, the squelch relay closure will bring the DAI-2 online. Enter ✻✻✻✻ to activate the DAI-2. When the DAI-2 activates it will not require security code for access. The squelch relay will hold the DAI-2 online as long as it is engaged. When the squelch relay releases, the DAI-2 will disconnect.

Audio signals from the RPU must be routed to the input of the DAI-2. A sample schematic is provided in the Installation section of this manual. The DAI-2 will ignore chatter on the squelch relay as long as contact is not lost for more than one full second. You must have an external means of generating DTMF tones to control the DAI-2.

4.5 Command Sets

The DAI-2 stores four command sets in its non-volatile memory. A command set defines how the unit will respond when telephone keys are pressed and when logic level inputs are activated. Three of these command sets are permanent and cannot be changed--the forth is fully user programmable. While four commands sets are stored in memory only one command set can be active at a time. The active command set is selected by changing the programming in system profile at address 358--Active Command Set.

Command sets tell the DAI-2 how to respond when: a key is pressed; a logic level input is detected; or the system is reset. Each key and logic level input can set different conditions except the ✻ key which used by the system and is not programmable. System responses can include: opening, closing or momentarily closing relay contacts; switching audio either into or out of the DAI-2; generating an audible slate tone for cuing; and triggering a series of telephone calls to warn of an alarm condition.

4.5.1 Command Set 0 -- User Defined

Command set 0 is entirely user programmable. From the factory, command set 0 contains the same settings as command set 3 for emergency broadcast operation. Instructions for reprogramming are in the next section of this manual. The three factory programmed command sets provide good examples of the variety of uses and programming options for the DAI-2.

4.5.2 Command Set 1 -- Soundbite Recorder

Command Set 1 is factory programmed to control an open reel or cart recorder as a soundbite recorder. A suggested connection diagram is given in the Installation section of this manual to operate the DAI-2 with this command set.

Establish a connection to the DAI-2, enter the appropriate security code to access the operating mode. The keypad functions for this command set are defined as follows:

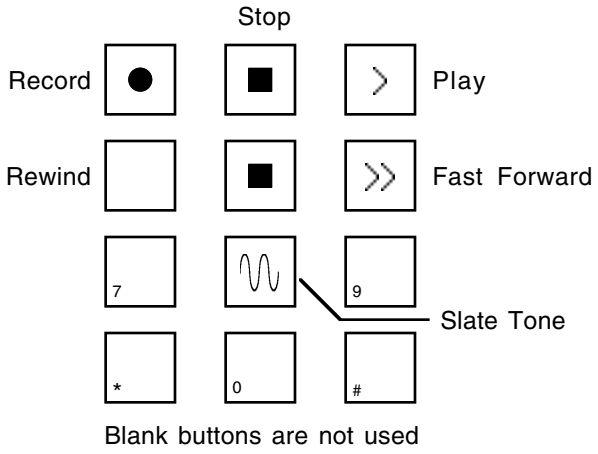


Figure 4.4; Keypad assignments for soundbite recorder

Press	*DAI-2 Response*
1	Record button--record telephone audio to tape
2	Stop button--stop tape movement and mute all audio
3	Play button--monitor tape audio
4	Rewind button--rewind tape with audio monitor
5	Stop button--same as [2]
6	Fast Forward--forward tape with audio monitor
7	not used
8	Slate tone--send 300 Hz tone burst for audible spot breaks
9,0	not used
✻,#	not used
LL1	Logic Level 1--clears activity alert lamp
LL2-4	not used

All functions are triggered by a single key press with the exception of recording. To begin recording, first press play [3]. The play relay will lock down for two seconds allowing record [1] to be pressed. The keys must be pressed in this order or the audio will not be switched to the proper mode for recording. Most machines will recognize clear leader as end of tape. Use it at both the head and tail of the tape to prevent it from winding off the reel.

When the record button [1] is pressed, a constant contact closure is provided that will not clear until LL1 is tripped. This can be used to activate an alert lamp in the studio that lights when something has been recorded. A momentary push button connected from LL1 to ground at the studio will clear the activity lamp.

4.5.3 Command Set 2 -- Remote Broadcaster

Command Set 2 is factory programmed as a control unit for remote broadcasts. In this configuration the DAI-2 is used to start cart machines and switch audio while the air personality is at a remote site. A suggested connection diagram is given in the Installation section of this manual to operate the DAI-2 with this command set.

Establish a connection to the DAI-2, enter the appropriate security code to access the operating mode. The keypad functions for this command set are defined as follows:

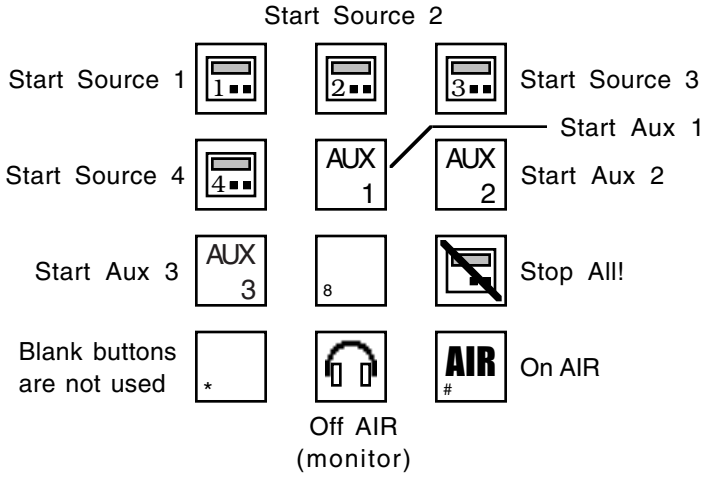


Figure 4.5; Keypad assignments for remote broadcaster

Press	*DAI-2 Response*
1	Start Cart Machine 1
2	Start Cart Machine 2
3	Start Cart Machine 3
4	Start Cart Machine 4
5	Start Auxiliary Device 1
6	Start Auxiliary Device 2
7	Start Auxiliary Device 3
8	unused
9	Stop All!--reset cart machines to idle condition
0	OFF AIR--monitor air signal
#	ON AIR--send telephone audio on air
✻	unused
LL1	ON AIR--send telephone audio on air
LL2	Start Auxiliary Device 1
LL3	Start Auxiliary Device 2
LL4	Start Auxiliary Device 3

All start buttons switch audio into monitor mode. The STOP key resets all start buttons but leaves audio in the selected mode. The Off-AIR key resets all start buttons and switches audio to the monitor mode. On-AIR is the only key that makes the telephone audio live.

4.5.4 Command Set 3 -- Emergency Broadcast

The following text describes one way of using the DAI-2 to help meet EAS obligations. It is not meant to suggest that this is the way to install the DAI-2 to be "FCC legal". There are many ways to install the DAI-2 as part of an effective EAS system, however, we suggest that you discuss your proposed system with your communications attorney or the FCC before installing the DAI-2. Personnel using the DAI-2 must have adequate knowledge of station EAS procedures to use this tool effectively.

Command Set 3 is factory programmed as a control unit for emergency broadcasts. In this configuration the DAI-2 is used to switch audio and control an external receiver from a remote location. A suggested connection diagram is given in the Installation section of this manual to operate the DAI-2 with this command set.

Establish a connection to the DAI-2 from a remote telephone and enter the security code. Once in the operating mode, the keys will function as follows:

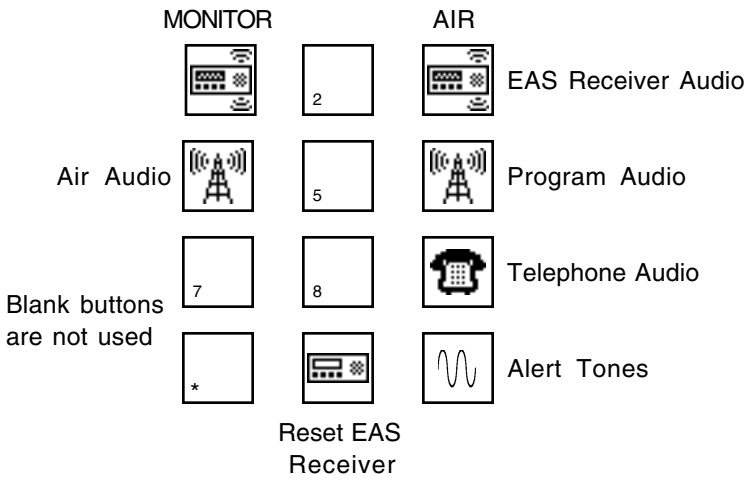


Figure 4.6; Key assignments for Emergency Broadcast Operation

Press	*DAI-2 Response*
1	Monitor emergency receiver audio--program audio stays on air
2	unused
3	Send emergency receiver audio--replace program audio with emergency receiver audio
4	Monitor air audio--selected source stays on air
5	unused
6	Send program audio--replace emergency receiver audio with program audio
7,8	unused
9	Send telephone audio--replace program audio with telephone audio
0	Reset emergency receiver--to standby after receiving alert tones
#	Activate alert tones--send alert tones on air
✻	unused
LL1	Trigger alarm system--call studios to notify of emergency condition
LL2	Activate alert tones--same as [#]
LL3-4	unused

The "MONITOR" keys will send audio from the selected source to the telephone while leaving the air audio source alone. If the telephone is the air audio source it will be muted when the monitor source changes. The "ON AIR" keys change the source of the air audio and automatically switch the monitor to air audio.

Section 5 — Programming

WARNING!

This section is for qualified technical personnel. It contains information that can change most of the operating characteristics of the DAI-2 system. Improper use of this information can cause incorrect readings, erratic behavior or lock remote users out of the system. We strongly recommend that you understand the basic operation of the DAI-2 and the specifics of the installation you are changing before applying the information in this section.

Information in this section is based on the original factory programming. Portions of this chapter may not be accurate if changes have already been made to the system.

5.1 Overview

Because the DAI-2 can be used for such a wide variety of applications, there is no single correct way to set up the system. In fact, there are several ways to program the system for any given task.

Command sets tell the DAI-2 how to respond when a key is pressed or a logic-level input changes. System responses can include relay switching, audio switching, triggering alarm call, etc. The main programming issue is to provide a system where all appropriate options are available and in a system that is easy to understand (and can be programmed with 12 telephone keys).

To solve this problem, the DAI-2 has an area of memory that is arranged as a 16 x 16 table. Each of the 16 rows represents a key or an input to the DAI-2 and each of the 16 columns represents an event that can happen when the input occurs. We call this the *command matrix* (Figure 5.1). Each location in the matrix can store a one-digit number, *command*, that enables or disables a response (column) for an even (row). Each location has an address--a number from 000 to 255--so that it can be programmed individually. By programming the appropriate number at a specific address, you can change how the DAI-2 responds when a key is pressed.

5.2 Introduction to the Command Matrix

To simplify the setup process, the DAI-2 command settings are programmed in the command matrix. The command matrix is a table with events down the left side and responses across the top. An event will result in the programmed responses. The numbers in the matrix are used to turn machine responses on and off and, in some cases, the numbers determine not only if an event will occur but how it will occur.

DAI Response / Input Event	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8	Audio	Slate Tone	Alarm Call	Status 1	Status 2	Reserved	Reserved	Reserved
0 Key	000 1	001 1	002 0	003 0	004 3	005 1	006 2	007 0	008 2	009 0	010 0	011 0	012 0	013 0	014 0	015 0
1 Key	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030	031

Figure 5.1; Command matrix (excerpt)

Any key (or logic-level input) can activate any or all relays. Key 1 and relay 1 are only “connected” if programming makes it so. Key 1 can control relay 1, or relay 2, or relay 7, or all eight relays if necessary. The same is true for all other keys and logic level inputs.Every event is independent. Suppose key 1 is programmed to turn a relay on for two seconds and key 2 is programmed to turn that same relay off. No matter when key 2 is pressed it will turn the relay off--even if key 1 was pressed less than two seconds ago. However, key 2 can be programmed to leave that relay alone while controlling other relays eliminating this interaction.

In addition to the keys and logic level inputs, the command matrix includes an action called "Power up". Power up determines how the relays, etc., will be set when the DAI-2 is powered on or when a call ends and the DAI-2 hangs up.

An empty command matrix and a list of available commands are included in this section. Programming is much easier if you fill the printed matrix with the values you will program before making programming changes to the DAI-2.

5.3 Programming Mode

If you have done any advanced programming on a Sine Systems RFC-1 Remote Control System, the programming method of the DAI-2 Dial-up Audio Interface will seem somewhat familiar. In any case, keep in mind that user programming is not difficult as long as you pay attention to what you are doing. It will take much longer to clear up the damage of a rushed programming job then to take the time to do it correctly the first time.

Programming mode is used to verify or alter the command set and change other operating characteristics of the DAI-2. Read mode allows you to verify system settings but does not allow you to change any settings. Write mode is used to alter system settings. Write mode is destructive--new settings overwrite old settings.

5.3.1 Programming Mode Basics

Normal operations are suspended in the programming modes. Relay positions, audio mode, etc. will not be affected by keystrokes when the DAI-2 is in one of the programming modes.

- the command to invoke programming read mode is: ⁕-7
- the command to invoke programming write mode is: ⁕-8
- the command to exit the programming mode is: ⁕-⁕

You can press ⁕-⁕ at any time to exit programming mode. This key combination has no effect in operating mode so if you are interrupted during programming, it is best to press ⁕-⁕ and simply exit programming mode. Pressing other keys may write data to unknown memory locations and have adverse effects on system functionality.

These items are common to both the read and write programming modes:

- in programming mode, the # key acts like an enter key
- in programming mode, one long tone is a prompt for you to enter something
- in programming mode, two short beeps is an 'OK' response
- in programming mode, one long low tone means that an error has occurred
- the programming security code is: 1266

The DAI-2 will only prompt for the programming security code one time per call. If you exit programming mode and enter again during the same call, you will hear the confirmation beeps instead of the prompt tone.

5.3.2 Read from Memory

Read mode is used to verify system settings without making changes.

- invoke the programming read mode by pressing ✻-7
- the DAI-2 responds with one long tone to prompt for the programming security code
- enter the programming security code: 1266
- the DAI-2 responds with two short beeps to confirm that it is in programming read mode

After the programming security code is correctly entered, the DAI-2 waits for an address. The address identifies what data should be retrieved by where it resides in memory. To determine the address, locate the description of the data you would like to read in the command matrix or the system profile. Each space in the command matrix has a three digit number printed along its edge. In the system profile, each item has a three digit number that is the address. Leading zeros are significant so all three digits of the address are required. The DAI-2 will reply with two short beeps to acknowledge a valid address.

- enter the three digit address for the data you want to read
- press # to read the data from that memory address
- the DAI-2 responds with a number of short beeps equal to the value stored at the address

The value zero will produce one long tone instead of zero beeps. Pressing a key while the DAI-2 is beeping will silence it whether it is finished with the reply or not.

The DAI-2 automatically increments the address one location after it reads the data. If you press the # key again, the DAI-2 will read the data from the next address and so on. It is possible to increment through all addresses this way.

After pressing # to read data:

- press # again to read the value at the next consecutive address , or
- enter *aaa*to jump to a new address--*aaa*, or
- enter ✻-✻ to exit the programming mode

5.3.3 Write to Memory

Write mode is used to change system settings to alter the behavior of the DAI-2. It works just like read mode except that you supply new data before pressing the enter key #.

- invoke the programming write mode by pressing ✻-8
- the DAI-2 responds with one long tone to prompt for the programming security code
- enter the programming security code: 1266
- the DAI-2 responds with two short beeps to confirm that it is in programming write mode

After the programming security code is correctly entered, the DAI-2 waits for an address. The address identifies what data should be retrieved by where it resides in memory. To determine the address, locate the description of the data you would like to read in the command matrix or the system profile. Each space in the command matrix has a three digit number printed along its edge. In the system profile, each item has a three digit number that is the address. Leading zeros are significant so all three digits of the address are required. The DAI-2 will reply with two short beeps to acknowledge a valid address.

- enter the three digit address for the data you want to change
- press *d*# to write the new data value–*d*–to the memory address
- the DAI-2 responds with a number of short beeps equal to the value stored at the address

The value zero will produce one long tone instead of zero beeps. Pressing a key while the DAI-2 is beeping will silence it whether it is finished with the reply or not.

The DAI-2 automatically increments the address one location after it writes the data. If you enter more data, the DAI-2 will write the data to the next address and so on. It is possible to increment through all addresses this way.

After pressing # to write data:

- press *d*# again to write the value–*d*–at the next consecutive address , or
- enter *aaa* to jump to a new address--*aaa*, or
- enter ✻-✻ to exit the programming mode

5.3.4 Telephone Numbers

Data for the DAI-2 typically consists of the digits 0 through 9. There are cases, such as telephone numbers and security codes, where a blank space may be necessary. The ✻ key is used as an empty place holder in these cases. Enter ✻# in programming mode. A ✻ will be read as ten short beeps.

Telephone numbers may also include a two second pause character. This can be programmed using the # key as a data key. Enter ## in programming mode. The # key will be read back as eleven short beeps.

Suppose you want to program the first telephone number in the DAI-2. Look in the system profile for the description "Telephone Number A" . You will find that it is programmed at addresses 256-270. Enter the programming write mode as explained previously in this text. Enter 256 as the starting address. To program the telephone number 228-3500, press 2# 2# 8# 3# 5# 0# 0# ✻# ✻# ✻# ✻# ✻# ✻# ✻# ✻#. The number can be up to 15 digits long but only seven are used in this example. The stars after the final zero are unused digits in the telephone number.

Suppose you need the DAI-2 to dial number using a telephone system that requires a prefix 9 to reach an outgoing line. Enter the programming mode as above but enter the telephone number as 9# ## 2# 2# 8# 3# 5# 0# 0# ✻# ✻# ✻# ✻# ✻# ✻#. The # after the 9 causes a two second pause when dialing so that the system can access the line.

5.3.5 Alarm System

The DAI-2 alarm system monitors the status of the logic-level inputs. When an alarm input appears at one of the logic-level inputs, the DAI-2 will call the telephone numbers stored in its memory to report the condition. The telephone numbers will be dialed in rotation starting with the Telephone Number A, then B, C, D, A, B, etc. until the alarm is cleared or the programmed number of attempts has been made. Program only as many telephone numbers as needed--blank numbers will be skipped during the dialing sequence.

When it places a call, the DAI-2 will send its identification tones repeatedly as an alert message. This is factory set to three short beeps. The tones will be sent for the duration of the call unless a user clears the alarm. Press the ✻ key to clear the alarm. The DAI-2 will respond with one long tone as a prompt to enter the security code. Enter the security code to go online with the DAI-2. Perform whatever actions are necessary in response to the alarm.

There are three mandatory steps to setting up the DAI-2 alarm system:

- program the telephone numbers that will be called when the alarm occurs--starting at address 256
- enable the alarm system by programming the value 1 at address 355
- enable a logic level input by programming a 1 at its control address--starting at address 332

Since alarms are recognized by the DAI-2 on its logic-level inputs, at least one of the logic level inputs must be enabled in the system profile.

These parameters can be changed to vary how the the DAI-2 alarm system works:

- the time that the alarm input must be present before the alarm is triggered--starting at address 333
- the length of the alarm call and the pause between calls at address 340 and 341
- the number of call attempts per telephone number at address 342
- the site identification tones at address 351
- the speed of the tones at address 352

5.3.6 Programming Suggestions

Any unused actions in the command matrix should be programmed so that they do not interfere with actions that are desirable. Relays should be programmed with the value 2 on unused inputs so that they will not change state. The audio switcher should be programmed with value 1 for no change.

The alarm system should only be triggered by logic-level inputs. The matrix has spaces for keys and power up to trip alarms but this is a side effect of using the matrix for programming--these conditions are not valid.

False relay changes can occasionally occur when program audio is feeding through the DAI-2. Occasionally, but rarely, the audio will mimic a DTMF tone and be detected as such by the internal controller. If you experience this problem, try increasing the minimum DTMF length at address 349. This setting changes how long DTMF tones must be present before they are recognized. Keep in mind that this will also increase the length of time that the keys on the telephone must be held when controlling the DAI-2.

5.3.7 Programming Example

We can use an sample from the command matrix to illustrate how this system works. Suppose the data for the 0 key is programmed like this:

DAI Response / Input Event	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8	Audio	Slate Tone	Alarm Call	Status 1	Status 2	Reserved	Reserved	Reserved
0 Key	000 1	001 1	002 0	003 0	004 3	005 1	006 2	007 0	008 2	009 0	010 0	011 0	012 0	013 0	014 0	015 0
1 Key	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030	031

Figure 5.2; Sample key programming

Using this data, when the 0 key is pressed, the DAI-2 will:

- switch relays 1, 2 and 6 on
- switch relays 3, 4 and 8 off
- relay 6 will be switched on momentarily
- relay 7 will be left alone
- switch the audio monitor so that the program audio feed is sent to the telephone line
- not generate a slate tone
- not make any alarm calls
- not read the status of any logic-level inputs

A complete listing of available settings and descriptions is included in this section along with a complete command matrix. Some conditions appear in the command matrix that do not make sense. For instance, do not alarm calls with a key press–trigger alarm calls only with a logic-level input. When the dialing sequence starts, it is likely that you will be disconnected from the DAI-2 if alarm calls are triggered by a key press.

Plan your settings carefully before you begin the process of programming. Watch for cases where two key presses will have conflicting results on a relay. Remember that audio and relays can be left alone on certain key presses by programming "no change" conditions.

Suppose you want to change the command matrix so that relay 3 switches on when the 0 key is pressed.

- invoke the programming write mode by pressing ✻-8
- the DAI-2 responds with one long tone to prompt for the programming security code
- enter the programming security code: 1266
- the DAI-2 responds with two short beeps to confirm that it is in programming write mode
- enter the three digit address for the data you want to change: 002
- enter the new data value for this address: 1
- press # to write the new data to the address
- the DAI-2 responds with one short beep confirming that it wrote a 1
- enter ✻-✻ to exit the programming mode

The address 002 came from the command matrix at the point where the 0 key and relay 3 meet. The command value to turn the relay on (1) is given in a chart later in this section.

5.4 Command Matrix

Command programming consists of placing numbers that represent actions at specific locations in the memory of the DAI-2. It is best represented as a matrix with the possible commands listed down the side and the actions performed across the top.

DAI Response / Input Event	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8	Audio	Slate Tone	Alarm Call	Status 1	Status 2	Reserved	Reserved	Reserved
0 Key	000	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015
1 Key	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030	031
2 Key	032	033	034	035	036	037	038	039	040	041	042	043	044	045	046	047
3 Key	048	049	050	051	052	053	054	055	056	057	058	059	060	061	062	063
4 Key	064	065	066	067	068	069	070	071	072	073	074	075	076	077	078	079
5 Key	080	081	082	083	084	085	086	087	088	089	090	091	092	093	094	095
6 Key	096	097	098	099	100	101	102	103	104	105	106	107	108	109	110	111
7 Key	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
8 Key	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
9 Key	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
# Key	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
Logic 1	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
Logic 2	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
Logic 3	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
Logic 4	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
Power Up	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

Figure 5.3; Command matrix

Every location in the matrix has a unique address denoted by the small three digit number in the upper left corner. To use the matrix, find the location where the input event (key press) and the response (relay, etc.) meet. Make a note of the address.

The lists on the following page contain the valid data (commands) for each type of response. Use the list that corresponds to the feature that you are changing. In that list, locate the appropriate setting. Each setting is represented by a number in the column of the list labeled 'Value'.

Using the programming mode, program the value you selected from the list at the address you read from the matrix.

5.4.1 Command Matrix Settings

The following list defines the sets of numbers and the actions they represent. Use these values to program the command matrix.

Value	*Relay Action*
0	Turn relay off
1	Turn relay on
2	No change
3	Turn relay on for 1/2 second
4	Turn relay on for 1 second
5	Turn relay on for 1 1/2 seconds
6	Turn relay on for 2 seconds
7	Turn relay for 2 1/2 seconds
+	Values over 7 default to 2

Value	*Audio Action*
0	Off--mute audio in and out
1	No change
2	Monitor audio from inputs / ALC active
3	Send audio to outputs / ALC active--telephone sends audio
4	Send audio to outputs/ ALC frozen--telephone sends audio
5	Send audio to outputs / ALC inactive--programmable fixed gain
+	Values over 5 default to 1

Value	*Slate Action*
0	Off--no tone
1	Shortest tone
…	(factory setting 4)
8	Longer tone
9	Longest tone

Value	*Alarm Action*
0	Off--do not trip alarm
1	On--trip alarm
+	Values over 1 default to 0

Value	*Read Status Action*
0	Off--do not report status of input
1	On--report state of input
+	Values of 2 or more default to 1

5.5 System Profile Settings

The following commands are used in the System Profile listing at the end of this section.

5.5.1 Command Set

A *command set* defines how the DAI-2 will respond to DTMF tones during operation. The DAI-2 stores four command sets in memory but only one is active at a time. The active command set is programmed at address 358.

Value	*Active Command Set*
0	User Programmable Command Set (factory setting)
1	Pre-programmed Set 1--Soundbite Recorder
2	Pre-programmed Set 2--Remote Broadcast
3	Pre-programmed Set 3--Emergency Operation
+	Values of 4 or more default to 3

5.5.2 Safeguard Timer

The DAI-2 has a *safeguard timer* to keep the DAI-2 from staying on-line at a remote location indefinitely. If the unit is on-line and has not received a key or logic level command for the programmed length of time, it will hang up the line and reset to power up conditions. The timer can be disabled by programming a value of 10. The safeguard timer is programmed at address 357.

Value	*Time Out Length*
0	5 minutes
1	8 minutes
2	17 minutes
3	32 minutes
4	53 minutes
5	1 hour, 20 minutes (factory setting)
6	1 hour, 53 minutes
7	2 hours, 32 minutes
8	3 hours, 17 minutes
9	4 hours, 8 minutes
10	Disabled

5.5.3 Security Codes

There are two programmable *security codes* in the DAI-2. Each can be up to eight digits in length. Unused digits should be programmed to 10 using the "*" key to program a 10. The Main Security Code is used to gain access to the system and is requested any time the unit answers the phone. It is factory programmed as "12345678" at address 316 through 323. The Programming Security Code is requested when there is an attempt to enter the programming mode of the DAI-2. It is factory programmed to "1266"--the final four digits are 10's so they are ignored--at addresses 324 through 331. While this is not generally recommended, a security code can be entirely disabled by programming all digits to 10.

Value	*Security Code*
0-9	Required digit in security code
10	Unused digit in security code

When the DAI-2 asks for a security code, a *security code timer* starts running. If this timer runs out before the code is given (correctly), the DAI-2 terminates the call. The time set here applies to all security code requests. The length of time that the user is allowed to give the code is programmable at address 359.

Value	*Security Code Timer*
0	10 seconds
1	20 seconds--(factory setting)
…	[(2 to 7) +1] x 10 seconds
8	90 seconds
9	100 seconds

The DAI-2 allows 20 seconds for a response when it requests a security code. If the code is not given or given incorrectly, the unit drops the phone line and, as an added measure of security, does not answer another call for an adjustable length of time. This time is programmed at address 350.

Value	*Incorrect Security Code Lockout Time*
0	10 seconds
1	20 seconds
…	[(2 to 7) +1] x 10 seconds--(factory setting 3)
8	90 seconds
9	100 seconds

5.5.4 Logic-Level Inputs

The DAI-2 has four independent *logic level inputs* to monitor the state of external devices. For each logic level input used, two items must be programmed. First, the input terminal must be enabled so that the monitoring system will acknowledge it. And second, the length that the input condition must be present before the system responds must be set. These are programmed in pairs from address 332 through 339.

Value	*Logic Level Input*
0	Input Disabled
1	Input Enabled (factory setting)
+	Values of 2 or more default to 1

Value	*Input Hold Length*
0	0.1 seconds (factory setting)
1	0.2 seconds
2	0.9 seconds
3	2.8 seconds
4	6.5 seconds
5	12.6 seconds
6	21.7 seconds
7	34.4 seconds
8	51.3 seconds
9	73.0 seconds

5.5.5 Telephone Numbers

The DAI-2 is capable of dialing up to four *telephone numbers* of 15 digits each when an alarm condition is detected. These numbers are programmed from address 256 through 315. The DAI-2 will dial the numbers, in rotation, up to four times each or until the alarm condition is cleared by user input. It sends the identification tones as its alarm message during the call. The DAI-2 then pauses between calls in case station personnel are trying to call it. The length of a call and the length of a pause between calls are programmed at address 340 and 341 respectively. The number of call attempts is programmed at address 342. The alarm system may be enabled or disabled at any time through programming at address 355.

Value	*Telephone Call Length and Pause Length*
0	10 seconds
1	20 seconds
…	[(2 to 7) +1] x 10 seconds--(factory setting 6)
8	90 seconds
9	100 seconds

Value	*Telephone Call Attempts*
0-1	1 Attempt per Telephone Number
2	2 Attempts per Telephone Number
3	3 Attempts per Telephone Number (factory setting)
4	4 Attempts per Telephone Number
+	Values of 5 or more default to 4

Value	*Alarm System*
0	Off--disabled (factory setting)
1	On--enabled
+	Values of 2 or more default to 1

5.5.6 Automatic Level Control (ALC)

The DAI-2 does limited audio processing through an internal *Automatic Level Control* (ALC). The ALC is always active when the DAI-2 is feeding audio to the telephone line to keep audio within legal tolerances. When audio comes from the telephone line to the DAI-2, the ALC can be frozen at a specific gain setting or disabled through programming in the Command Matrix. The ALC characteristics are user programmable starting at address 343.

Value	*ALC Input and Output Release Speed*
0	Fastest release
1	Faster release
…	(factory setting 4)
8	Slower release
9	Slowest release

Value	*ALC Output Level and Fixed Gain*
0	Lowest level
1	Lower level
…	(factory setting 5)
8	Higher level
9	Highest level

5.5.7 Ring Number

In cases where the DAI-2 shares a telephone line with other equipment it may be necessary to delay answering the line for a certain number of rings. Program the *ring number* to answer at address 347.

Value	*Ring Number to Answer*
0-1	Answer on first ring
2	Answer on second ring (factory setting)
…	Answer (3-8) rings
9	Answer on ninth ring
10	Answer on tenth ring

The DAI-2 may need higher *ring sensitivity* if it is used with a UHF radio telephone (sometimes called a "ranch phone"), a cellular-to-RJ11 adapter, or another device which generates a square wave ring signal. However, in installations where there is a significant amount of "hum" on the telephone line, the ring sensitivity may need to be lowered. This prevents the DAI-2 from interpreting the hum as a continuous ring. Ring sensitivity is programmed at address 348.

When ring sensitivity is 0 the DAI-2 does not answer the telephone.

Value	*Ring Sensitivity*
0	Does not answer
1	Least sensitive
2	Less sensitive
…	(factory setting 5)
8	More sensitive
9	Most sensitive
+	Values above 9 default to 9

The DAI-2 normally detects when a telephone connection is cut off prematurely--before the hang-up command has been given. This may occur if the telephone line “goes dead” or the operator hangs up the calling phone by accident. While the *pulse hang-up detection* can be disabled by programming at address 360, it is recommended that you carefully consider the possible consequences before changing this programming.

Value	*Pulse hang-up detection*
0	Enabled--system will drop line automatically
1	Disabled--system will remain on-line if connection is dropped
+	Values above 1 default to 1

5.5.8 DTMF Hold Time

The DAI-2 is controlled by the DTMF tones produced by a TouchTone® type telephone. It is normal for audio passing through the system to occasionally contain sound at the same frequencies as these tones. To reduce the chance of reacting to these false tones, the DAI-2 is programmed to ignore any tone until it has been present for a set length of time. *DTMF hold time* is programmed at address 349.

Value	*Minimum DTMF hold time*
0	60 ms
1	70 ms
2	120 ms--about 1/10 second (factory setting)
3	150 ms
4	220 ms--about 1/4 second
5	310 ms
6	420 ms
7	550 ms--about 1/2 second
8	700 ms--about 3/4 second
9	870 ms

5.5.9 Identification Tones

When the DAI-2 places a telephone call to signal an alarm condition, it sends a series of short tones to identify itself. It will repeat these tones until the alarm is cleared or the programmed call length is reached. It may be necessary in cases where more than one DAI-2 is used to distinguish between the units when they call. Simply program a different value at address 351 to send a different number of *identification tones.*

Value	*Tones Generated*
0-1	1 tone
2	2 tones
…	(3-7) tones (factory setting 3)
8	8 tones
9	9 tones
+	Values above 9 default to 9

The DAI-2 responds to user input through a series of short tones representing numbers. The speed of these tones can be increased or decreased to suit different users. The *tone speed* is programmed at address 352.

Value	*Tone Speed*
0	Fastest
1	Faster
…	(factory setting 4)
8	Slower
9	Slowest

5.5.10 Slate Tone

The DAI-2 can produce an audible *slate tone* that can be used to signal a break between spots when using the Soundbite Recorder. To use the slate tone, it must be programmed onto one of the keys in the command matrix. (In the case of the Soundbite Recorder it is pre-programmed in the matrix to key 8.) This tone is adjustable in length by programming at address 353.

Value	*Slate Action*
0	Shortest tone
1	Shorter tone
…	(factory setting 4)
8	Longer tone
9	Longest tone

A *cue tone* can be generated by the DAI-2 when it is being used to send audio. If the cue tone is enabled, the DAI-2 will send a single tone to indicate that the audio mode has switched and the telephone is sending audio. This will occur any time the audio mode is set to 3 or above. The tone can be used as an "ON AIR" or "RECORDING" cue. It is automatically muted from the DAI-2 audio output. The cue tone enable is programmed at address 354.

Value	*Cue Tone*
0	Off--disabled (factory setting)
1	On--enabled
+	Values of 2 or more default to 1

5.5.11 Delay Unit

The DAI-2 can be used with an optional *delay unit* called the the DB-1. This delay unit is used to mute the 40 ms of DTMF tone that pass through the unit each time a key is pressed. When the DB-1 is installed, the DAI-2 should be programmed to recognize it. However, this programming can be used to bypass the Delay Board without removing the hardware. The Delay Board enable is programmed at address 356.

Value	*Delay Board*
0	Not installed--disabled
1	Installed--enabled (factory setting)
+	Values of 2 or more default to 1

5.5.12 Leased Line Mode

In some installations it is desirable to have the DAI-2 active all of the time. To accommodate this, the DAI-2 can be used in *leased line mode.* In this mode, the DAI-2 is online and active whenever it has power. *The DAI-2 cannot be dialed into when operating this mode.* The leased line enable is programmed at address 361.

Value	*Delay Board*
0	Dialup mode (factory setting)
1	Leased line mode

5.6 Memory Address List

This is a list of all available memory address in the DAI-2. The command matrix occupies the first 256 memory locations from 000-255. System profile parameters start at address 256.

Address	Description	Factory Setting	User Setting
	(Factory Programming--Reset Emergency Receiver)		
000	0 Key, Relay 1	0	_____
001	0 Key, Relay 2	0	_____
002	0 Key, Relay 3	0	_____
003	0 Key, Relay 4	0	_____
004	0 Key, Relay 5	3	_____
005	0 Key, Relay 6	0	_____
006	0 Key, Relay 7	0	_____
007	0 Key, Relay 8	0	_____
008	0 Key, Audio	2	_____
009	0 Key, Slate tone	0	_____
010	0 Key, Alarm call	0	_____
011	0 Key, Read Status 1	0	_____
012	0 Key, Read Status 2	0	_____
013	0 Key, Reserved	0	_____
014	0 Key, Reserved	0	_____
015	0 Key, Reserved	0	_____
	(Factory Programming--Monitor Emergency Receiver Audio)		
016	1 Key, Relay 1	2	_____
017	1 Key, Relay 2	2	_____
018	1 Key, Relay 3	2	_____
019	1 Key, Relay 4	1	_____
020	1 Key, Relay 5	0	_____
021	1 Key, Relay 6	0	_____
022	1 Key, Relay 7	0	_____
023	1 Key, Relay 8	0	_____
024	1 Key, Audio	2	_____
025	1 Key, Slate tone	0	_____
026	1 Key, Alarm call	0	_____
027	1 Key, Read Status 1	0	_____
028	1 Key, Read Status 2	0	_____
029	1 Key, Reserved	0	_____
030	1 Key, Reserved	0	_____
031	1 Key, Reserved	0	_____

	(Factory Programming--Unused key)		
032	2 Key, Relay 1	2	_____
033	2 Key, Relay 2	2	_____
034	2 Key, Relay 3	2	_____
035	2 Key, Relay 4	2	_____
036	2 Key, Relay 5	2	_____
037	2 Key, Relay 6	2	_____
038	2 Key, Relay 7	2	_____
039	2 Key, Relay 8	2	_____
040	2 Key, Audio	1	_____
041	2 Key, Slate tone	0	_____
042	2 Key, Alarm call	0	_____
043	2 Key, Read Status 1	0	_____
044	2 Key, Read Status 2	0	_____
045	2 Key, Reserved	0	_____
046	2 Key, Reserved	0	_____
047	2 Key, Reserved	0	_____
	(Factory Programming--Emergency Receiver Audio on Air)		
048	3 Key, Relay 1	1	_____
049	3 Key, Relay 2	1	_____
050	3 Key, Relay 3	0	_____
051	3 Key, Relay 4	0	_____
052	3 Key, Relay 5	0	_____
053	3 Key, Relay 6	0	_____
054	3 Key, Relay 7	0	_____
055	3 Key, Relay 8	0	_____
056	3 Key, Audio	2	_____
057	3 Key, Slate tone	0	_____
058	3 Key, Alarm call	0	_____
059	3 Key, Read Status 1	0	_____
060	3 Key, Read Status 2	0	_____
061	3 Key, Reserved	0	_____
062	3 Key, Reserved	0	_____
063	3 Key, Reserved	0	_____
	(Factory Programming--Monitor Air Audio)		
064	4 Key, Relay 1	2	_____
065	4 Key, Relay 2	2	_____
066	4 Key, Relay 3	2	_____
067	4 Key, Relay 4	0	_____
068	4 Key, Relay 5	0	_____
069	4 Key, Relay 6	0	_____
070	4 Key, Relay 7	0	_____
071	4 Key, Relay 8	0	_____
072	4 Key, Audio	2	_____
073	4 Key, Slate tone	0	_____
074	4 Key, Alarm call	0	_____
075	4 Key, Read Status 1	0	_____
076	4 Key, Read Status 2	0	_____
077	4 Key, Reserved	0	_____
078	4 Key, Reserved	0	_____
079	4 Key, Reserved	0	_____

	(Factory Programming--Unused key)		
080	5 Key, Relay 1	2	_____
081	5 Key, Relay 2	2	_____
082	5 Key, Relay 3	2	_____
083	5 Key, Relay 4	2	_____
084	5 Key, Relay 5	2	_____
085	5 Key, Relay 6	2	_____
086	5 Key, Relay 7	2	_____
087	5 Key, Relay 8	2	_____
088	5 Key, Audio	1	_____
089	5 Key, Slate tone	0	_____
090	5 Key, Alarm call	0	_____
091	5 Key, Read Status 1	0	_____
092	5 Key, Read Status 2	0	_____
093	5 Key, Reserved	0	_____
094	5 Key, Reserved	0	_____
095	5 Key, Reserved	0	_____
	(Factory Programming--Program Audio on Air)		
096	6 Key, Relay 1	0	_____
097	6 Key, Relay 2	0	_____
098	6 Key, Relay 3	0	_____
099	6 Key, Relay 4	0	_____
100	6 Key, Relay 5	0	_____
101	6 Key, Relay 6	0	_____
102	6 Key, Relay 7	0	_____
103	6 Key, Relay 8	0	_____
104	6 Key, Audio	2	_____
105	6 Key, Slate tone	0	_____
106	6 Key, Alarm call	0	_____
107	6 Key, Read Status 1	0	_____
108	6 Key, Read Status 2	0	_____
109	6 Key, Reserved	0	_____
110	6 Key, Reserved	0	_____
111	6 Key, Reserved	0	_____
	(Factory Programming--Unused key)		
112	7 Key, Relay 1	2	_____
113	7 Key, Relay 2	2	_____
114	7 Key, Relay 3	2	_____
115	7 Key, Relay 4	2	_____
116	7 Key, Relay 5	2	_____
117	7 Key, Relay 6	2	_____
118	7 Key, Relay 7	2	_____
119	7 Key, Relay 8	2	_____
120	7 Key, Audio	1	_____
121	7 Key, Slate tone	0	_____
122	7 Key, Alarm call	0	_____
123	7 Key, Read Status 1	0	_____
124	7 Key, Read Status 2	0	_____
125	7 Key, Reserved	0	_____
126	7 Key, Reserved	0	_____
127	7 Key, Reserved	0	_____

	(Factory Programming--Unused key)		
128	8 Key, Relay 1	2	_____
129	8 Key, Relay 2	2	_____
130	8 Key, Relay 3	2	_____
131	8 Key, Relay 4	2	_____
132	8 Key, Relay 5	2	_____
133	8 Key, Relay 6	2	_____
134	8 Key, Relay 7	2	_____
135	8 Key, Relay 8	2	_____
136	8 Key, Audio	1	_____
137	8 Key, Slate tone	0	_____
138	8 Key, Alarm call	0	_____
139	8 Key, Read Status 1	0	_____
140	8 Key, Read Status 2	0	_____
141	8 Key, Reserved	0	_____
142	8 Key, Reserved	0	_____
143	8 Key, Reserved	0	_____
	(Factory Programming--Telephone Audio on Air)		
144	9 Key, Relay 1	1	_____
145	9 Key, Relay 2	0	_____
146	9 Key, Relay 3	0	_____
147	9 Key, Relay 4	0	_____
148	9 Key, Relay 5	0	_____
149	9 Key, Relay 6	0	_____
150	9 Key, Relay 7	0	_____
151	9 Key, Relay 8	0	_____
152	9 Key, Audio	3	_____
153	9 Key, Slate tone	0	_____
154	9 Key, Alarm call	0	_____
155	9 Key, Read Status 1	0	_____
156	9 Key, Read Status 2	0	_____
157	9 Key, Reserved	0	_____
158	9 Key, Reserved	0	_____
159	9 Key, Reserved	0	_____
	(Factory Programming--Alert Tones on Air)		
160	# Key, Relay 1	1	_____
161	# Key, Relay 2	1	_____
162	# Key, Relay 3	1	_____
163	# Key, Relay 4	0	_____
164	# Key, Relay 5	0	_____
165	# Key, Relay 6	3	_____
166	# Key, Relay 7	0	_____
167	# Key, Relay 8	0	_____
168	# Key, Audio	2	_____
169	# Key, Slate tone	0	_____
170	# Key, Alarm call	0	_____
171	# Key, Read Status 1	0	_____
172	# Key, Read Status 2	0	_____
173	# Key, Reserved	0	_____
174	# Key, Reserved	0	_____
175	# Key, Reserved	0	_____

	(Factory Programming--Trigger Alarm System)		
176	Logic Level In 1, Relay 1	2	_____
177	Logic Level In 1, Relay 2	2	_____
178	Logic Level In 1, Relay 3	1	_____
179	Logic Level In 1, Relay 4	0	_____
180	Logic Level In 1, Relay 5	0	_____
181	Logic Level In 1, Relay 6	0	_____
182	Logic Level In 1, Relay 7	0	_____
183	Logic Level In 1, Relay 8	0	_____
184	Logic Level In 1, Audio	2	_____
185	Logic Level In 1, Slate tone	0	_____
186	Logic Level In 1, Alarm call	1	_____
187	Logic Level In 1, Read Status 1	0	_____
188	Logic Level In 1, Read Status 2	0	_____
189	Logic Level In 1, Reserved	0	_____
190	Logic Level In 1, Reserved	0	_____
191	Logic Level In 1, Reserved	0	_____
	(Factory Programming--Alert Tones on Air)		
192	Logic Level In 2, Relay 1	1	_____
193	Logic Level In 2, Relay 2	1	_____
194	Logic Level In 2, Relay 3	0	_____
195	Logic Level In 2, Relay 4	0	_____
196	Logic Level In 2, Relay 5	0	_____
197	Logic Level In 2, Relay 6	0	_____
198	Logic Level In 2, Relay 7	0	_____
199	Logic Level In 2, Relay 8	0	_____
200	Logic Level In 2, Audio	2	_____
201	Logic Level In 2, Slate tone	0	_____
202	Logic Level In 2, Alarm call	0	_____
203	Logic Level In 2, Read Status 1	0	_____
204	Logic Level In 2, Read Status 2	0	_____
205	Logic Level In 2, Reserved	0	_____
206	Logic Level In 2, Reserved	0	_____
207	Logic Level In 2, Reserved	0	_____
	(Factory Programming--Unused key)		
208	Logic Level In 3, Relay 1	2	_____
209	Logic Level In 3, Relay 2	2	_____
210	Logic Level In 3, Relay 3	2	_____
211	Logic Level In 3, Relay 4	2	_____
212	Logic Level In 3, Relay 5	2	_____
213	Logic Level In 3, Relay 6	2	_____
214	Logic Level In 3, Relay 7	2	_____
215	Logic Level In 3, Relay 8	2	_____
216	Logic Level In 3, Audio	1	_____
217	Logic Level In 3, Slate tone	0	_____
218	Logic Level In 3, Alarm call	0	_____
219	Logic Level In 3, Read Status 1	0	_____
220	Logic Level In 3, Read Status 2	0	_____
221	Logic Level In 3, Reserved	0	_____
222	Logic Level In 3, Reserved	0	_____
223	Logic Level In 3, Reserved	0	_____

	(Factory Programming--Unused key)		
224	Logic Level In 4, Relay 1	2	_____
225	Logic Level In 4, Relay 2	2	_____
226	Logic Level In 4, Relay 3	2	_____
227	Logic Level In 4, Relay 4	2	_____
228	Logic Level In 4, Relay 5	2	_____
229	Logic Level In 4, Relay 6	2	_____
230	Logic Level In 4, Relay 7	2	_____
231	Logic Level In 4, Relay 8	2	_____
232	Logic Level In 4, Audio	1	_____
233	Logic Level In 4, Slate tone	0	_____
234	Logic Level In 4, Alarm call	0	_____
235	Logic Level In 4, Read Status 1	0	_____
236	Logic Level In 4, Read Status 2	0	_____
237	Logic Level In 4, Reserved	0	_____
238	Logic Level In 4, Reserved	0	_____
239	Logic Level In 4, Reserved	0	_____
	(Factory Programming--Program Audio on Air)		
240	Power Up, Relay 1	0	_____
241	Power Up, Relay 2	0	_____
242	Power Up, Relay 3	0	_____
243	Power Up, Relay 4	0	_____
244	Power Up, Relay 5	0	_____
245	Power Up, Relay 6	0	_____
246	Power Up, Relay 7	0	_____
247	Power Up, Relay 8	0	_____
248	Power Up, Audio	2	_____
249	Power Up, Slate tone	0	_____
250	Power Up, Alarm call	0	_____
251	Power Up, Read Status 1	0	_____
252	Power Up, Read Status 2	0	_____
253	Power Up, Reserved	0	_____
254	Power Up, Reserved	0	_____
255	Power Up, Reserved	0	_____

Address	Description	Paragraph	Factory Setting	User Setting
256	A Telephone Number; Digit 1	5	10	_____
257	A Telephone Number; Digit 2	5	10	_____
258	A Telephone Number; Digit 3	5	10	_____
259	A Telephone Number; Digit 4	5	10	_____
260	A Telephone Number; Digit 5	5	10	_____
261	A Telephone Number; Digit 6	5	10	_____
262	A Telephone Number; Digit 7	5	10	_____
263	A Telephone Number; Digit 8	5	10	_____
264	A Telephone Number; Digit 9	5	10	_____
265	A Telephone Number; Digit 10	5	10	_____
266	A Telephone Number; Digit 11	5	10	_____
267	A Telephone Number; Digit 12	5	10	_____
268	A Telephone Number; Digit 13	5	10	_____
269	A Telephone Number; Digit 14	5	10	_____
270	A Telephone Number; Digit 15	5	10	_____
271	B Telephone Number; Digit 1	5	10	_____
272	B Telephone Number; Digit 2	5	10	_____
273	B Telephone Number; Digit 3	5	10	_____
274	B Telephone Number; Digit 4	5	10	_____
275	B Telephone Number; Digit 5	5	10	_____
276	B Telephone Number; Digit 6	5	10	_____
277	B Telephone Number; Digit 7	5	10	_____
278	B Telephone Number; Digit 8	5	10	_____
279	B Telephone Number; Digit 9	5	10	_____
280	B Telephone Number; Digit 10	5	10	_____
281	B Telephone Number; Digit 11	5	10	_____
282	B Telephone Number; Digit 12	5	10	_____
283	B Telephone Number; Digit 13	5	10	_____
284	B Telephone Number; Digit 14	5	10	_____
285	B Telephone Number; Digit 15	5	10	_____
286	C Telephone Number; Digit 1	5	10	_____
287	C Telephone Number; Digit 2	5	10	_____
288	C Telephone Number; Digit 3	5	10	_____
289	C Telephone Number; Digit 4	5	10	_____
290	C Telephone Number; Digit 5	5	10	_____
291	C Telephone Number; Digit 6	5	10	_____
292	C Telephone Number; Digit 7	5	10	_____
293	C Telephone Number; Digit 8	5	10	_____
294	C Telephone Number; Digit 9	5	10	_____
295	C Telephone Number; Digit 10	5	10	_____
296	C Telephone Number; Digit 11	5	10	_____
297	C Telephone Number; Digit 12	5	10	_____
298	C Telephone Number; Digit 13	5	10	_____
299	C Telephone Number; Digit 14	5	10	_____
300	C Telephone Number; Digit 15	5	10	_____

Address	Description	Paragraph	Factory Setting	User Setting
301	D Telephone Number; Digit 1	5	10	_____
302	D Telephone Number; Digit 2	5	10	_____
303	D Telephone Number; Digit 3	5	10	_____
304	D Telephone Number; Digit 4	5	10	_____
305	D Telephone Number; Digit 5	5	10	_____
306	D Telephone Number; Digit 6	5	10	_____
307	D Telephone Number; Digit 7	5	10	_____
308	D Telephone Number; Digit 8	5	10	_____
309	D Telephone Number; Digit 9	5	10	_____
310	D Telephone Number; Digit 10	5	10	_____
311	D Telephone Number; Digit 11	5	10	_____
312	D Telephone Number; Digit 12	5	10	_____
313	D Telephone Number; Digit 13	5	10	_____
314	D Telephone Number; Digit 14	5	10	_____
315	D Telephone Number; Digit 15	5	10	_____
316	Main Security Code; Digit 1	3	1	_____
317	Main Security Code; Digit 2	3	2	_____
318	Main Security Code; Digit 3	3	3	_____
319	Main Security Code; Digit 4	3	4	_____
320	Main Security Code; Digit 5	3	5	_____
321	Main Security Code; Digit 6	3	6	_____
322	Main Security Code; Digit 7	3	7	_____
323	Main Security Code; Digit 8	3	8	_____
324	Programming Security Code; Digit 1	3	1	_____
325	Programming Security Code; Digit 2	3	2	_____
326	Programming Security Code; Digit 3	3	6	_____
327	Programming Security Code; Digit 4	3	6	_____
328	Programming Security Code; Digit 5	3	10	_____
329	Programming Security Code; Digit 6	3	10	_____
330	Programming Security Code; Digit 7	3	10	_____
331	Programming Security Code; Digit 8	3	10	_____
332	Logic Level Input 1; Enable	4	1	_____
333	Logic Level Input 1; Length	4	0	_____
334	Logic Level Input 2; Enable	4	1	_____
335	Logic Level Input 2; Length	4	0	_____
336	Logic Level Input 3; Enable	4	1	_____
337	Logic Level Input 3; Length	4	0	_____
338	Logic Level Input 4; Enable	4	1	_____
339	Logic Level Input 4; Length	4	0	_____
340	Telephone Call Length	5	3	_____
341	Telephone Pause Length	5	3	_____
342	Telephone Call Attempts	5	3	_____
343	ALC Output Level	6	8	_____
344	ALC Fixed Output Gain	6	4	_____
345	ALC Output Release Speed	6	5	_____
346	ALC Input Release Speed	6	2	_____

Address	Description	Paragraph	Factory Setting	User Setting
347	Ring Number (to answer)	7	2	_____
348	Ring Sensitivity	7	5	_____
349	Minimum DTMF Length	8	2	_____
350	Incorrect Security Code Lockout Time	3	3	_____
351	Identification Tones	9	3	_____
352	Tone Speed	9	3	_____
353	Slate Tone Length	10	4	_____
354	Cue Tone Enable	10	1	_____
355	Alarm Enable	5	0	_____
356	Delay Enable	11	1	_____
357	Safeguard Timer	2	5	_____
358	Active Command Set	1	3	_____
359	Security Code Timer	3	1	_____
360	Pulse Hangup Inhibit	7	0	_____
361	Leased Line Mode	12	0	_____

Note: The column entitled "Paragraph" in the System Profile List above refers to the paragraph that describes this feature in Section 5.5.

DAI Response / Input Event	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8	Audio	Slate Tone	Alarm Call	Status 1	Status 2	Reserved	Reserved	Reserved
0 Key	000 2	001 2	002 2	003 2	004 2	005 2	006 2	007 2	008 1	009 0	010 0	011 0	012 0	013 0	014 0	015 0
1 Key	016 3	017 0	018 2	019 0	020 0	021 1	022 0	023 0	024 3	025 0	026 0	027 0	028 0	029 0	030 0	031 0
2 Key	032 0	033 3	034 0	035 0	036 0	037 2	038 0	039 0	040 0	041 0	042 0	043 0	044 0	045 0	046 0	047 0
3 Key	048 2	049 0	050 6	051 0	052 0	053 2	054 0	055 0	056 2	057 0	058 0	059 0	060 0	061 0	062 0	063 0
4 Key	064 0	065 0	066 0	067 3	068 0	069 2	070 0	071 0	072 2	073 0	074 0	075 0	076 0	077 0	078 0	079 0
5 Key	080 0	081 3	082 0	083 0	084 0	085 2	086 0	087 0	088 0	089 0	090 0	091 0	092 0	093 0	094 0	095 0
6 Key	096 0	097 0	098 0	099 0	100 3	101 2	102 0	103 0	104 2	105 0	106 0	107 0	108 0	109 0	110 0	111 0
7 Key	112 2	113 2	114 2	115 2	116 2	117 2	118 2	119 2	120 1	121 0	122 0	123 0	124 0	125 0	126 0	127 0
8 Key	128 2	129 2	130 2	131 2	132 2	133 2	134 2	135 2	136 1	137 1	138 0	139 0	140 0	141 0	142 0	143 0
9 Key	144 2	145 2	146 2	147 2	148 2	149 2	150 2	151 2	152 1	153 0	154 0	155 0	156 0	157 0	158 0	159 0
# Key	160 2	161 2	162 2	163 2	164 2	165 2	166 2	167 2	168 1	169 0	170 0	171 0	172 0	173 0	174 0	175 0
Logic 1	176 2	177 2	178 2	179 2	180 2	181 0	182 2	183 2	184 1	185 0	186 0	187 0	188 0	189 0	190 0	191 0
Logic 2	192 2	193 2	194 2	195 2	196 2	197 2	198 2	199 2	200 1	201 0	202 0	203 0	204 0	205 0	206 0	207 0
Logic 3	208 2	209 2	210 2	211 2	212 2	213 2	214 2	215 2	216 1	217 0	218 0	219 0	220 0	221 0	222 0	223 0
Logic 4	224 2	225 2	226 2	227 2	228 2	229 2	230 2	231 2	232 1	233 0	234 0	235 0	236 0	237 0	238 0	239 0
Power Up	240 0	241 3	242 0	243 0	244 0	245 0	246 0	247 0	248 0	249 0	250 0	251 0	252 0	253 0	254 0	255 0

Figure 5.4; Factory command set 1–Soundbite Recorder

DAI Response / Input Event	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8	Audio	Slate Tone	Alarm Call	Status 1	Status 2	Reserved	Reserved	Reserved
0 Key	000 0	001 0	002 0	003 0	004 0	005 0	006 0	007 0	008 2	009 0	010 0	011 0	012 0	013 0	014 0	015 0
1 Key	016 0	017 3	018 0	019 0	020 0	021 0	022 0	023 0	024 2	025 0	026 0	027 0	028 0	029 0	030 0	031 0
2 Key	032 0	033 0	034 3	035 0	036 0	037 0	038 0	039 0	040 2	041 0	042 0	043 0	044 0	045 0	046 0	047 0
3 Key	048 0	049 0	050 0	051 3	052 0	053 0	054 0	055 0	056 2	057 0	058 0	059 0	060 0	061 0	062 0	063 0
4 Key	064 0	065 0	066 0	067 0	068 3	069 0	070 0	071 0	072 2	073 0	074 0	075 0	076 0	077 0	078 0	079 0
5 Key	080 0	081 0	082 0	083 0	084 0	085 3	086 0	087 0	088 2	089 0	090 0	091 0	092 0	093 0	094 0	095 0
6 Key	096 0	097 0	098 0	099 0	100 0	101 0	102 3	103 0	104 2	105 0	106 0	107 0	108 0	109 0	110 0	111 0
7 Key	112 0	113 0	114 0	115 0	116 0	117 0	118 0	119 3	120 2	121 0	122 0	123 0	124 0	125 0	126 0	127 0
8 Key	128 2	129 2	130 2	131 2	132 2	133 2	134 2	135 2	136 1	137 0	138 0	139 0	140 0	141 0	142 0	143 0
9 Key	144 0	145 0	146 0	147 0	148 0	149 0	150 0	151 0	152 1	153 0	154 0	155 0	156 0	157 0	158 0	159 0
# Key	160 1	161 0	162 0	163 0	164 0	165 0	166 0	167 0	168 3	169 0	170 0	171 0	172 0	173 0	174 0	175 0
Logic 1	176 0	177 0	178 0	179 0	180 0	181 0	182 0	183 1	184 3	185 0	186 0	187 0	188 0	189 0	190 0	191 0
Logic 2	192 0	193 0	194 0	195 3	196 3	197 0	198 0	199 0	200 2	201 0	202 0	203 0	204 0	205 0	206 0	207 0
Logic 3	208 0	209 0	210 0	211 0	212 0	213 3	214 0	215 0	216 2	217 0	218 0	219 0	220 0	221 0	222 0	223 0
Logic 4	224 0	225 0	226 0	227 0	228 0	229 0	230 3	231 0	232 2	233 0	234 0	235 0	236 0	237 0	238 0	239 0
Power Up	240 0	241 0	242 0	243 0	244 0	245 0	246 0	247 0	248 1	249 0	250 0	251 0	252 0	253 0	254 0	255 0

Figure 5.5; Factory command set 2--Remote Broadcaster

DAI Response / Input Event	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8	Audio	Slate Tone	Alarm Call	Status 1	Status 2	Reserved	Reserved	Reserved
0 Key	000 0	001 0	002 0	003 0	004 3	005 0	006 0	007 0	008 2	009 0	010 0	011 0	012 0	013 0	014 0	015 0
1 Key	016 2	017 2	018 2	019 1	020 0	021 0	022 0	023 0	024 2	025 0	026 0	027 0	028 0	029 0	030 0	031 0
2 Key	032 2	033 2	034 2	035 2	036 2	037 2	038 2	039 2	040 1	041 0	042 0	043 0	044 0	045 0	046 0	047 0
3 Key	048 1	049 1	050 0	051 0	052 0	053 0	054 0	055 0	056 2	057 0	058 0	059 0	060 0	061 0	062 0	063 0
4 Key	064 2	065 2	066 2	067 0	068 0	069 0	070 0	071 0	072 2	073 0	074 0	075 0	076 0	077 0	078 0	079 0
5 Key	080 2	081 2	082 2	083 2	084 2	085 2	086 2	087 2	088 1	089 0	090 0	091 0	092 0	093 0	094 0	095 0
6 Key	096 0	097 0	098 0	099 0	100 0	101 0	102 0	103 0	104 2	105 0	106 0	107 0	108 0	109 0	110 0	111 0
7 Key	112 2	113 2	114 2	115 2	116 2	117 2	118 2	119 2	120 1	121 0	122 0	123 0	124 0	125 0	126 0	127 0
8 Key	128 2	129 2	130 2	131 2	132 2	133 2	134 2	135 2	136 1	137 0	138 0	139 0	140 0	141 0	142 0	143 0
9 Key	144 1	145 0	146 0	147 0	148 0	149 0	150 0	151 0	152 3	153 0	154 0	155 0	156 0	157 0	158 0	159 0
# Key	160 1	161 1	162 1	163 0	164 0	165 3	166 0	167 0	168 2	169 0	170 0	171 0	172 0	173 0	174 0	175 0
Logic 1	176 2	177 2	178 2	179 1	180 0	181 0	182 0	183 0	184 2	185 0	186 1	187 0	188 0	189 0	190 0	191 0
Logic 2	192 1	193 1	194 0	195 0	196 0	197 0	198 0	199 0	200 2	201 0	202 0	203 0	204 0	205 0	206 0	207 0
Logic 3	208 2	209 2	210 2	211 2	212 2	213 2	214 2	215 2	216 1	217 0	218 0	219 0	220 0	221 0	222 0	223 0
Logic 4	224 2	225 2	226 2	227 2	228 2	229 2	230 2	231 2	232 1	233 0	234 0	235 0	236 0	237 0	238 0	239 0
Power Up	240 0	241 0	242 0	243 0	244 0	245 0	246 0	247 0	248 2	249 0	250 0	251 0	252 0	253 0	254 0	255 0

Figure 5.6; Factory command set 3–Emergency Broadcaster

DAI Response / Input Event	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Relay 7	Relay 8	Audio	Slate Tone	Alarm Call	Status 1	Status 2	Reserved	Reserved	Reserved
0 Key	000	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015
1 Key	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030	031
2 Key	032	033	034	035	036	037	038	039	040	041	042	043	044	045	046	047
3 Key	048	049	050	051	052	053	054	055	056	057	058	059	060	061	062	063
4 Key	064	065	066	067	068	069	070	071	072	073	074	075	076	077	078	079
5 Key	080	081	082	083	084	085	086	087	088	089	090	091	092	093	094	095
6 Key	096	097	098	099	100	101	102	103	104	105	106	107	108	109	110	111
7 Key	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
8 Key	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
9 Key	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
# Key	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
Logic 1	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
Logic 2	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
Logic 3	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
Logic 4	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
Power Up	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

Figure 5.7; Blank command matrix

Section 6 — Troubleshooting and Repair

6.1 Common Problems and Possible Solutions

Problem: The DAI-2 does not power up.

Solutions: Check for shorts on the flat (ribbon) cable. There should be 12VDC on pin 5. Check the wall-plug power supply for 12 VDC.

Problem: I reprogrammed the command matrix but my changes do not seem to have any effect.

Solutions: Use the programming read mode to make sure that you have made the changes that you think you have. If the data is correct, make sure that the user command set has been activated--address 358. This address is factory programmed with 3. Reprogram it to 0 to activate the user command set.

Problem: I changed (either) security code and now I can't remember it. How do I access the system?

Solutions: Place a call to the DAI-2 while at the rear panel of the DAI-2. When you hear a ring, press the button labeled 'Connect' on the DAI-2. The DAI-2 will answer and the telephone will stop ringing but nothing else will happen. Enter ✳✳✳✳ to activate the DAI-2. It will beet two short beeps to confirm that you are online. You now have 10 seconds to enter the programming mode and read the security code. Enter ✳-7 to enter programming read mode. The DAI-2 will beep twice to confirm that you have changed modes. If you need to check the main security code, enter 316. If you need to check the programming security code, enter 324. Again, the DAI-2 will beep twice. Press the # key. The DAI-2 will beep a number of times corresponding to the first digit of the security code. Press the # key seven more times to read the next seven digits--the code is eight digits max. A long single tone represents zero. Ten short tones represents a blank space. If you read a blank space before reading eight digits, stop. Digits after the blank space are ignored. Enter ✳-✳ to exit the programming mode.

Problem: The DAI-2 is switching relays, etc. by itself. It appears to be receiving false DTMF tones but now keys were pressed.

Solutions: Either the program audio has DTMF tones in it or the program content has phantom DTMF tones--sounds that appear exactly like DTMF tones to the detector. (While this is rare, it does happen.) Increase the DTMF hold time at address 349. This setting controls the amount of time that a tone must be present before the DAI-2 responds. Keep in mind that this adjustment also effects the amount of time that you must press the keys on the telephone to control the DAI-2.

Problem: There is noise (hum) on the telephone line that is interfering with my ability to control the DAI-2.

Solutions: The DAI-2 contains internal protection against RF energy. Additional protection may be necessary in installations near a broadcast transmitter. Keep the telephone line as short as possible. Install an RF filter at the telephone "Line" jack near the DAI-2. Loop the ribbon cable through a ferrite core near the DAI-2. On newer models the ribbon cable is quite short and this should not be a cause of interference.

6.2 Factory Service Policy

These policies are effective August 1999 and are subject to change without prior notice.

6.2.1 Factory Warranty

Sine Systems, Inc. guarantees our products to be free from manufacturing defect for a period of one year from the original date of purchase from Sine Systems, Inc. This warranty covers the parts and labor necessary to repair the product to factory specifications. This warranty does not cover damage by lightning, normal wear, misuse, neglect, improper installation, failure to follow instructions, accidents, alterations, unauthorized repair, damage during transit, fire, flood, tornado, hurricane or acts of God and/or nature.

6.2.2 Factory Return Policy

The factory return policy only applies to equipment purchased directly from Sine Systems, Inc. Equipment purchased through a third party (dealer) is subject to the return policy of the dealer and arrangements for return or exchange must be handled through the dealer.

Sine Systems policy on returns and exchanges with the factory is broken down according to the following schedule:

30 days "no questions asked"

During the first thirty days from the date that equipment ships from our factory we will accept it back for a full refund less shipping charges provided that the equipment is still in new, resellable condition with no cosmetic damage. This does not constitute an evaluation program. It is for legitimate purchases only.

less than 60 days, may be returned less 15% restocking fee

Between 31 and 60 days from the time we ship the equipment, we will accept unmodified equipment back for a refund less shipping charges and 15% of the invoice cost. This is to cover the cost of restocking the items which must then be sold at a discount as reconditioned instead of new.

no return after 60 days

We will recondition the equipment for you according to our repair rates but we will not accept it for refund or exchange after 60 days from the initial purchase.

6.2.3 Factory Service Policy

Sine Systems is proud to offer same day repair service on all of our products. When we receive damaged equipment, we will repair it and ship it back the same day it arrives. Because we offer immediate service, we do not send loaner equipment. If we cannot immediately repair equipment and return it, we may ship a loaner unit at our discretion.

While we do not require prior authorization on repairs, we suggest that you verify our shipping address before returning equipment for repair. Sine Systems is not responsible for items lost in transport or delivered to the wrong address. Emergency service may be made available on weekends or holidays, at our discretion, if arrangements are made with us in advance.

6.2.4 Warranty Service

There is no charge for repair service on items covered under warranty. You are responsible for shipping charges to return damaged equipment to us for repair. Damage due to negligence, lightning or other acts of nature are not covered under warranty.

6.2.5 Service Rates

For service not covered under warranty we have a flat rate repair fee. Flat rate repairs cover only components that fail electrically. Mechanical damage will be assessed on a per repair basis. Repair charges typically fall into one of these categories. Shipping fees are not covered in the repair rate.

Minor programming adjustments or no damage, $50 plus shipping

Sometimes a system works exactly like it is supposed to when we get it or it can be fixed through a simple adjustment in firmware. We will do our best to identify intermittent hardware problems and correct them. The fee covers the time it takes our technician to thoroughly inspect and test the equipment.

Minor repairs are up to $150 plus shipping

Five or fewer defective components are replaced in a minor to moderate repair. This accounts for most of our repairs. These repairs may cost less depending on the components replaced and the amount of time required to complete the repair.

Moderate repairs are $250 plus shipping

Six to ten defective components are replaced in a major repair. Again, we may charge less depending on the components replaced and the amount of time required to complete repairs.

Major repairs cost more than $250 plus shipping

This occurs rarely but it can happen. If the equipment has blown traces and scorch marks from burned components, it's a safe bet that it will take several components and quite a bit of bench time to repair. We assess this type of repair on a per incident basis.

Damaged beyond recognition, assessed on a per case basis

Hopefully you have insurance. In cases where the board is so badly damaged that it is not worth repairing we may, at our discretion, offer to replace the destroyed circuit board. The options and costs vary widely in these cases so we will call with options.

All repairs must be billed to a credit card or shipped COD. Specify which you prefer with your request for service. At your request, we will call with the total amount of the repair (including applicable shipping charges) so that suitable payment can be arranged before a COD shipment. If you need a COD total, do not forget to include a telephone number where you can be contacted.

6.2.6 Instructions for Factory Service

Please include a note with any specific information available about the equipment failure as an aid to our technicians. Pack equipment carefully to avoid further damage in shipping. We are not responsible for damage during transport.

When returning a system with multiple components, we strongly suggest that you return the entire system. We will repair the parts that are returned but lightning is rarely selective enough to damage only a single part of a system.

Be sure to include a street address for return shipping by UPS. The repair will be delayed if you neglect to give us enough information to return your equipment--this actually happens! If you prefer a carrier other than UPS or wish us to bill to your shipping account, we can usually accommodate these requests. Many carriers do not accept COD shipments so credit card billing may be required for carriers other than UPS. If you do not specify otherwise, return shipments will be made by the UPS equivalent of the received shipping method (i.e. Ground shipment, 2nd Day, Overnight).

We suggest that you verify our shipping address before sending equipment for repair. Same day service does not apply if you ship to an incorrect address and/or the carrier delivers the equipment too late in the day for repairs to be completed. Sine Systems is not responsible for equipment that is not delivered to our factory. It will be your responsibility to contact the carrier to retrieve your improperly delivered equipment.

6.3 Repair Procedure

WARNING!

The DAI-2 and its relay panel should be installed or repaired only by qualified technical personnel. An attempt to repair this device by a person who is not technically qualified could result in a hazardous condition to the installer or other personnel, and/or damage to the DAI-2 or other equipment. Please ensure that proper safety precautions have been made before installing or repairing this device.

Because the DAI-2 is an FCC registered device, it must not be modified in any way. Any components which are replaced must be replaced with ones of exactly the same type and rating. This is particularly critical in the circuitry involving connection to the telephone line. Unless repair is performed by a properly qualified technician, it is strongly recommended that the DAI-2 be returned to Sine Systems for repair.

The first step in troubleshooting should be to look for signs of burned or otherwise damaged parts. U9 may run a little warm but should not be hot enough to burn or discolor the PC board. Check the incoming DC voltage (12 volts). Check for +5 volts DC at the output of the regulator (U9). The bottom two resistors in the SIP network R10 form a voltage divider which generates a midpoint reference voltage for the analog circuits. Check to see that this is one-half the main power supply voltage. If it is not, something is pulling it up or down. The current consumption of the DAI-2 at 12 volts DC should be about 80 milliamperes. If it is significantly more than this, remove the ICs one at a time until the current drops.

6.3.1 Circuit Description

The heart of the DAI-2 is a Motorola MC68HC711 microcontroller. It contains the CPU, program ROM and RAM, timers, parallel I/O and an A-D converter. The CD22202 (U7) DTMF decoder, the ULN2803 (U8) octal open-collector driver, the MAX7624 multiplying converter, and the status inputs connect directly to it. The microprocessor operates off a 3.579 MHz crystal oscillator and a portion of this signal is used to drive the DTMF decoder as well.

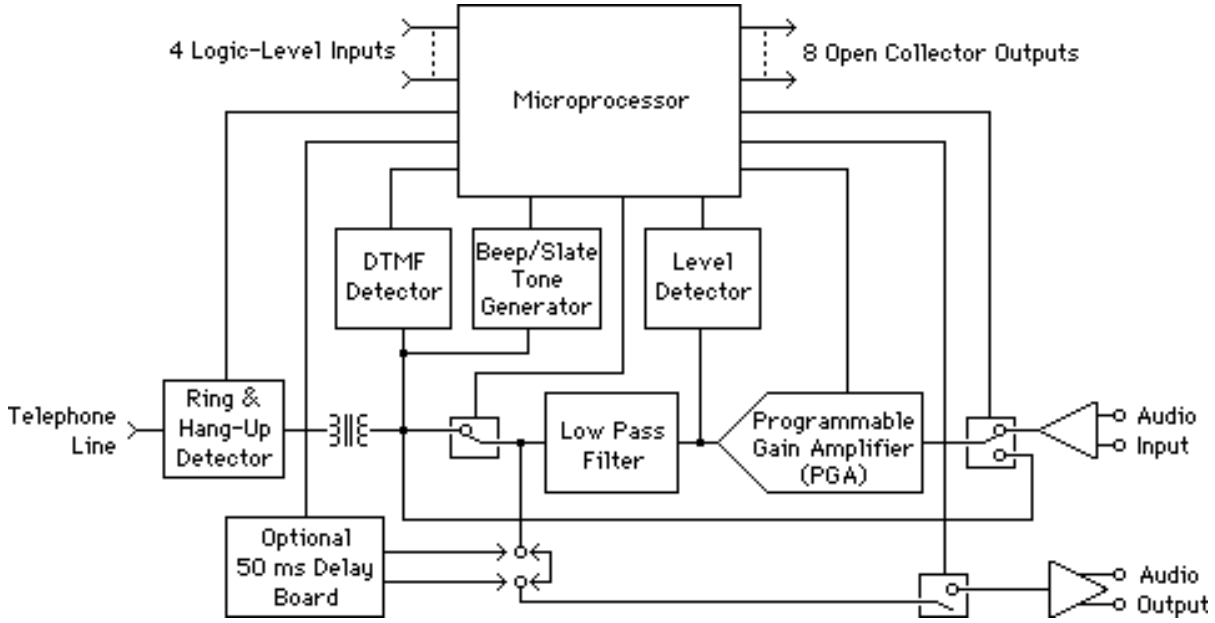


Figure 6.1; DAI-2 block diagram

D5 is a 15 volt, 5 watt zener which protects the DAI-2 from over-voltage and reverse-polarity on the power supply input. U9 is a standard 5 volt regulator. U-1 is a "low voltage interrupt" (LVI) device which resets the microprocessor if its supply voltage falls below 4.5 volts.

U5b and U5c comprise the balanced audio output section. U5a serves in the balanced audio input section. U4 is a multiplying D-A converter which is configured as a programmable gain amplifier (PGA). U5d buffers the output of the PGA. This drives the level detection circuit and a third order low pass filter using U2c. The DC output of the level detection circuit is fed to the analog-to-digital (A-D) converter in the microprocessor. U3 is a CMOS switch with four single-pole-single-throw sections and is used to route audio. U2a and U2d comprise a hybrid circuit that lowers the amount of "send" audio arriving at the DTMF detector.

OC1 detects ring and hang-up signals. A hang-up is detected by a step voltage change on the telephone line caused by a momentary "battery" interruption (loop break). Capacitors C2 and C3, and inductors L1 and L2 form a low pass filter to attenuate radio frequency interference (RFI). SP1 is a three terminal gas surge protector.

Section 7 — Specifications

7.1 DAI-2 Dial-up Audio Interface

Power	12 Volts AC, 0.25 amps
Ports	Relay Panel (20 conductor pin/plug type) Line (RJ-11C modular) Power (screw terminals) Delay (internal 5 conductor pin/plug type)
Controls	Connect (SPST momentary push button)
Inputs	5 Volt DC logic-level active low (screw terminals)
Outputs	7 SPDT relay contact closures (screw terminals) 1 DPDT relay contact closure (screw terminals)
Relay Contacts	Nominal switching: 30 VDC @ 1 A Maximum voltage: 110 VDC/125 VAC Maximum current: 1 A Maximum power: 30 W/37.5 V A
Audio Input	-10 dBv to +4 dBv active balanced with at least 100KΩ load impedance
Audio Output	-4 dBm to +4 dBm active balanced into 600Ω or greater load
Jumpers	internal 3 position jumper to apply phantom power to telephone
Dimensions	19" (w) x 5.5" (d) x 1.75" (h)
Weight	1.5 lbs.
Interference	Complies with the limits for a Class B computing device pursuant to Subpart J of Part 15 of FCC Rules

7.2 Flat Cable Pinout

Pin#	*Connection*	*Pin#*	*Connection*
1	audio output (high)	11	relay low side output #4
2	audio output (low)	12	relay low side output #5
3	audio input (high)	13	relay low side output #6
4	audio input (low)	14	relay low side output #7
5	+12 volts DC	15	relay low side output #8
6	ground	16	logic-level input #1
7	ground	17	logic-level input #2
8	relay low side output #1	18	logic-level input #3
9	relay low side output #2	19	logic-level input #4
10	relay low side output #3	20	logic-level input #5 (manual off-hook control)