Sensaphone®
ISACC

Operator's Manual

version 3.49

Every effort has been made to ensure that the information in this document is complete, accurate and up-to-date. Phonetics, Inc. assumes no responsibility for the results of errors beyond its control. Phonetics, Inc. also cannot guarantee that changes in equipment made by other manufacturers, and referred to in this manual, will not affect the applicability of the information in this manual.

Version 3.49, September, 2000.

Written and produced by Phonetics, Inc.

Please address comments on this publication to:

Phonetics, Inc.
901 Tryens Road
Aston, PA 19014

Updates and addendums to this manual can be found on the Support pages of our web site: http://www.sensaphone.com

SAFETY INSTRUCTIONS

IMPORTANT SAFETY INSTRUCTIONS

Your ISACC has been carefully designed to give you years of safe, reliable performance. As with all electrical equipment, however, there are a few basic precautions you should take to avoid hurting yourself or damaging the unit:

- Read the installation and operating instructions in this manual carefully. Be sure to save it for future reference.
- Read and follow all warning and instruction labels on the product itself.
- To protect the ISACC from overheating, make sure the unit is not subject to direct sunlight. Do not place on or near a heat source, such as a radiator or heat register.
- Be certain that your power source matches the rating listed in the AC power requirements of this manual. If you're not sure of the type of power supply to your facility, consult your dealer or local power company.
- Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
- Do not overload wall outlets and extension cords, as this can result in the risk of fire or electric shock.
- Never push objects of any kind into this product through ventilation holes as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock.
- To reduce the risk of electric shock, do not disassemble this product, but return it to Phonetics' Customer Service, or other approved repair facility, when any service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the unit is subsequently used.
- If anything happens to indicate that your ISACC is not working properly or has been damaged, unplug it immediately and follow the procedures in Appendix E for having it serviced. Return the unit for servicing under the following conditions:

1. The power cord or plug is frayed or damaged.
2. Liquid has been spilled into the product or it has been exposed to water.
3. The unit has been dropped, or the cabinet is damaged.
4. The unit doesn't function normally when you're following the operating instructions.

CAUTION

To Reduce the Risk of Fire or Injury to Persons, Read and Follow these Instructions:

1. Use only the following type and size batteries:

   6V 3.0AH sealed lead-acid rechargable

2. Do not dispose of the batteries in a fire. The cell may explode. Check with local codes for possible special disposal instructions.

3. Do not open or mutilate the batteries. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.

4. Exercise care in handling batteries in order not to short the battery with conducting materials such as rings, bracelets, and keys. The battery or conductor may overheat and cause burns.

5. Do not mix old and new batteries in this product.

6. Battery service should be performed by qualified personnel only.

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CHAPTER 1

INTRODUCTION

ISACC is a unique device that puts monitoring, alarm, and control capabilities all in one system. It can monitor equipment and environmental conditions using 16 universal inputs. In addition, these inputs can be programmed to switch up to 8 digital outputs and four analog outputs in any combination.

Along with control, ISACC offers comprehensive communication. When an alarm occurs, ISACC can dial up to 8 phone numbers and communicate in voice or data with its built-in 1200 bps modem.

One advantage ISACC has over other similar systems is that it is an all-in-one package. There are no additional components to buy to complete the system, and ISACC's programming flexibility provides the control you need to get the job done.

PROGRAMMING ISACC

Even with all of these features, ISACC is easy to use. A terminal or PC is all that is required to communicate and program, locally or remotely. Phonetics also includes a Windows software package, ISACC Manager for Windows, to help you take full advantage of ISACC's powerful capabilities.

Text Mode programming is also available with simple keywords or stand-alone commands. ISACC prompts for everything that is necessary, so you will have the unit up and running in no time!

ISACC also offers the ability to create your own programs in the C language. It is resident within the unit and is easy to use.

LEARNING TO USE ISACC

Reading this manual will help you become familiar with ISACC and its programming. This will enable you to use the unit to its fullest potential. As you read this manual, consider your specific installation and application.

If there are any questions or problems, contact:

PHONETICS, INC.
901 Tryens Road
Aston, PA 19014
(610) 558-2700 Fax: (610) 558-0222
www.sensaphone.com

ABOUT THE MANUAL

The ISACC Instruction Manual is composed of the instructions you need to use ISACC. You should thoroughly read the manual to establish a basic understanding of the system and keep it as a reference.

IMPORTANT!

Phonetics now includes a software package to work with ISACC using the Windows operating system, it is called **ISACC MANAGER for Windows** and it will work with Windows 3.x, 95 and NT. This software makes ISACC even easier to use, and even more powerful. Some of ISACC MANAGER's features include:

AUTOMATIC POLLING - ISACCs can be polled on a programmable schedule to retrieve the data logger.

INFORMATION MANAGEMENT - The PC can store and maintain all programming information, data logger activity, and alarm activity for one or more ISACCs.

ON-LINE HELP - All programming screens feature on-line help to provide information that is pertinent to the parameters you are programming.

REAL TIME SCREEN - The software allows you to build a custom screen that includes the input and output values you want displayed. You can also include your own bitmap graphics for even greater customization. A separate application called **Real Time Screen Builder** is included for this purpose.

For more information on the ISACC MANAGER for Windows Software Package, contact Phonetics at (610)558-2700.

CHAPTER 2

INSTALLATION

This chapter explains the unpacking and installation of ISACC, both the complete package (FGD-5000) and the board level product (FGD-5100). The complete package system is mounted in a NEMA-4 ABS plastic enclosure with 18 VDC rechargeable battery backup. The board-level unit is provided with a mounting kit so that you can mount the system properly in another enclosure, etc. It is important that this chapter be read thoroughly and followed very carefully before operating ISACC. Instructions for the complete package follow. For instructions on installing the board level product, turn to page 15. Refer to Appendix B for a diagram of the ISACC board layout.

COMPLETE PACKAGE INSTALLATION (FGD-5000)

UNPACKING ISACC

ISACC is shipped in specially designed packaging so that no damage will occur during shipment. When unpacking the unit, be careful not to damage the equipment or the box. It is recommended that the packaging be saved for future use.

Within the packaging will be a **Warranty Registration Card**. Please take the time to fill this out and mail. The Limited 1 Year Warranty is explained in the back of this manual.

CAUTION

ISACC is a sensitive electronic device. Personnel and work area should be grounded before handling this device. Do not install ISACC near strong electrostatic, electromagnetic, magnetic or radioactive fields, i.e. generators, huge motors, pumps, or turbines. Do not attach the power supply cord to building surfaces.

GROUNDING WRIST STRAP

Enclosed with the product is a Disposable Grounding Wrist Strap. It is provided to help control and prevent the possibility of damage due to static electricity.

To use the grounding wrist strap, unwrap the strap to expose the adhesive. Wrap this end around your wrist. Unwrap the rest of the strap and peel the liner away from the copper foil, located at the opposite end. Attach the copper foil to the steel back panel in the ISACC enclosure. **NOTE**: The grounding wrist strap is for static control. It will **not** reduce or increase the risk of receiving electrical shock.

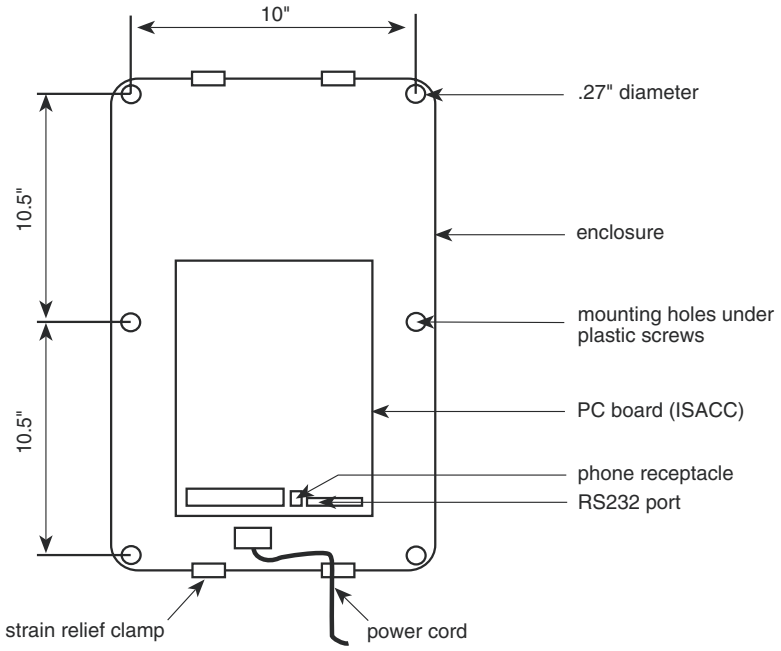
OPERATING ENVIRONMENT

ISACC should be mounted and operated in a clean, dry environment. If this is not possible, NEMA 4 conduit hubs should be installed to seal ISACC off from the hazardous environment. The temperature range that ISACC can operate in is 32°F to 120°F (0°C to 49°C).

MOUNTING ISACC

When you receive ISACC, there will be a PC Board (ISACC) mounted inside an ABS plastic enclosure rated at NEMA 4, 4X, 12 and 13. You will also find the ISACC Instruction Manual, a Communication Hookup Kit and ISACC Communication Software.

Carefully remove ISACC from the box. The mounting holes are located under the six plastic screws. Carefully remove them and the clear top cover to mount the enclosure. Decide where you will be mounting ISACC and drill holes according to the diagram below.

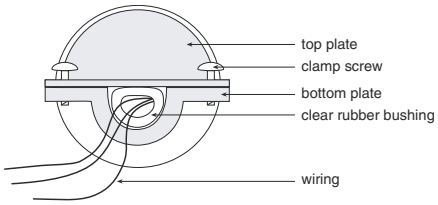


Mounting ISACC enclosure

After the holes have been drilled, you can mount the enclosure. Reinstall the top cover after installation is complete.

STRAIN RELIEF

Strain relief clamps are provided in the ISACC enclosure to prevent wiring from being pulled from the circuit board or damaged when passing through the enclosure. To use the strain relief, thread wires through the clamp and clear rubber bushing. Position the bushing in the clamp and tighten the screws on either side so that the wiring does not move.



Strain relief clamp

POWERING ISACC

IMPORTANT: Before applying power to ISACC, the ON-OFF switch must be in the OFF position. The ON-OFF switch is located to the right of the acrylic panel, below the power supply terminal block.

ISACC is pre-wired with a three prong cord that can be plugged into any 117VAC outlet. The power supply specification for the ISACC circuit board is 20 to 24 Volts AC, 50 or 60 Hz. This is applied through the two terminals labeled **24 AC**.

ISACC is earth grounded. This is done to help protect it from the possible effects of lightning strikes in or around the immediate area. A wire is connected from the terminal labeled **EG** to the third leg of the power cord. The steel panel on the bottom of the enclosure is also connected to earth ground for safety.

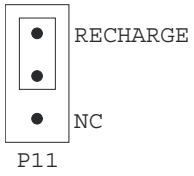
ADDITIONAL SURGE PROTECTION

It is recommended that additional surge protection be obtained for the power and telephone lines, particularly if ISACC will be installed in a lightning-prone area. Additional surge protection is available through Phonetics. Contact the Sales Department for details.

BACKUP BATTERY

ISACC has three 6VDC rechargeable batteries wired in series. The total backup battery voltage is 18VDC and offers a minimum of 3.5 hours and a maximum of 15 hours backup time. The actual battery performance is dependent upon what external devices are wired to the 5V, 12V, 15V and 20V power supplies. If ISACC is not powering any external devices, backup time will be 15 hours.

When the battery is configured for recharge, ISACC supplies a constant charge of 20.4VDC when main power is present. To recharge the battery backup, go to the SIP header at location P11 on the PC board. (P11 is located between the power supply terminal block and the ON-OFF switch.) Using needlenose pliers, move the shunt to the recharge position. See diagram below.



Battery configured for recharge

NOTE: Have battery serviced by qualified service personnel only.

LITHIUM BATTERY

The lithium battery provides backup to the RAM and to the real-time clock, it's function is to retain the time and programming if the power fails and backup battery is exhausted. On the circuit board, the lithium battery is located under the acrylic safety panel on the right side. To activate the battery, pull the paper strip out of the battery clip. The lithium battery is a CR2430, 3 Volts, 270 mAhr. It will provide battery backup for approximately 2 years. Note: The lithium battery will not keep ISACC operational.

TURNING ISACC ON

Now that ISACC has power, the ON-OFF switch may be turned on. The ON-OFF switch is located on the right side of the circuit board below the power supply terminal block. ISACC's buzzer will sound briefly. The "power" LED will come on and be constant and the "pulse" LED will blink steadily. The "phone" LED will not be lit.

When the unit is turned off, it is disabled. Programming parameters are retained by the 3V lithium battery. In the off position, the 3V lithium battery is in use, however 18V battery backup is not.

RESET BUTTON

Under the acrylic safety panel on ISACC's PC board is a reset button. This is provided to manually reset the unit. The button can be pressed by pushing a pen or thin object through the hole provided. When the reset button is pressed, the PC board stays powered, but the system is reset. None of the unit's programming will be affected by resetting the unit. Anything that ISACC recognizes as an alarm will be acknowledged and all dial out processes will be halted.

BUZZER

Located on the PC board is a buzzer. When ISACC is turned on or reset, this buzzer will go on briefly and then go off. The buzzer may also be used as a local audible alarm. It is considered OUTPUT9 in the programming of the parameters and the C program.

PHONE LINE INSTALLATION

ISACC must be hooked up to an analog phone line so that it can dial out for an alarm. On the PC Board there is an RJ11C phone jack. It is located at one end of the PC BOARD and is labeled PHONE (board location P3) . Connect ISACC to a standard 2 wire phone line. ISACC dials using pulse or tone, with loop start only. ISACC will recognize ringer frequencies from 16 to 60 Hz.

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

BOARD LEVEL INSTALLATION (FGD-5100)

This section explains the unpacking and installation of a board level ISACC. For installation instructions of a complete package ISACC (FGD-5000), turn to page 11. It is important that this chapter be read and followed very carefully before operating ISACC.

UNPACKING ISACC

ISACC is shipped in specially designed packaging to eliminate damage during shipment. When unpacking the unit, be careful not to damage the equipment or the box. It is recommended that the packaging be retained for future use.

Within the packaging will be a **Warranty Registration Card**. Please take the time to fill this out and mail. The Limited 1 Year Warranty is explained in the back of this manual.

CAUTION: ISACC is a sensitive electronic device. Personnel and work area should be grounded before handling this device. Do not install ISACC near strong electrostatic, electromagnetic, magnetic or radioactive fields. Do not attach the power supply cord to building surfaces.

GROUNDING WRIST STRAP

Enclosed with the product is a Disposable Grounding Wrist Strap. It is provided to help control and prevent the possibility of damage due to static electricity.

To use the grounding strap, unwrap the strap to expose the adhesive. Wrap the adhesive around your wrist. Unwrap the rest of the strap and peel the liner away from the copper foil, located at the opposite end. Attach the copper foil to an earth-grounded object. NOTE: The grounding wrist strap is for static control. It will **not** reduce or increase the risk of receiving electrical shock.

OPERATING ENVIRONMENT

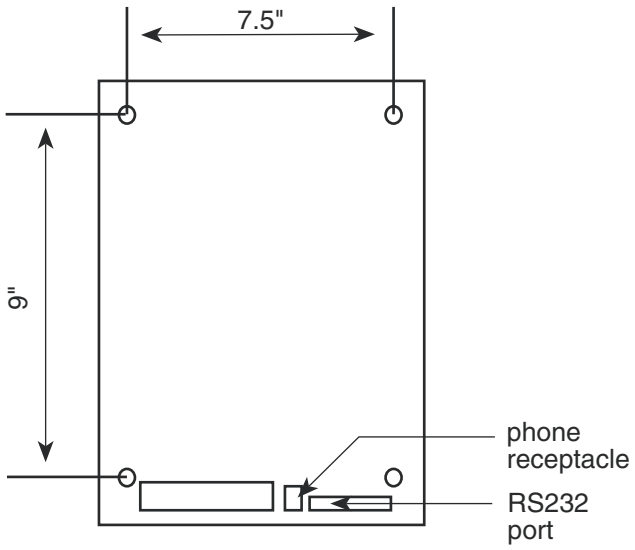
ISACC should be mounted and operated in a clean, dry environment. The recommended temperature range that ISACC should operate in is 32°F to 120°F (0°C to 49°C).

MOUNTING ISACC

When you receive ISACC, there will be a PC Board (ISACC), an instruction manual, and a Mounting Hardware Kit. Inside the Mounting Hardware Kit are the following:

- 4 Hollow Nylon Spacers
- 4 #8-32 1˘" Machine Screws
- 4 #8 °" Wood Screws
- 4 Nylon Washers
- 4 #8-32 Hex Nuts

Carefully remove ISACC from the bubble pack. Decide where you will be mounting ISACC and drill holes according to the diagram on the next page. The circuit board dimensions are 8" by 11".



Mounting ISACC circuit board

After the holes have been drilled, mount the board with the hardware provided. Use a nylon washer between the board and the screw, and a nylon spacer between the board and mounting surface. Both wood screws and machine screws have been provided for your convenience.

POWERING ISACC

IMPORTANT: Before applying power to ISACC, the ON-OFF switch must be in the OFF position. The ON-OFF switch is located to the right of the acrylic panel, below the power supply terminal block.

Located on the board is a terminal block labeled POWER. The power supply specification for ISACC is 20 to 24 Volts AC, 50 or 60 Hz. This is applied through the two terminals labeled **24 AC**.

You may use either an external AC power supply or an external DC power supply. Follow the requirements and connection instructions below exactly so that problems and/or damage do not occur. Three manufacturers of AC transformers that are compatible with ISACC are Magnetek Triad (#F6-20), Thordarson (#FP-507), and Stancor (#P8661).

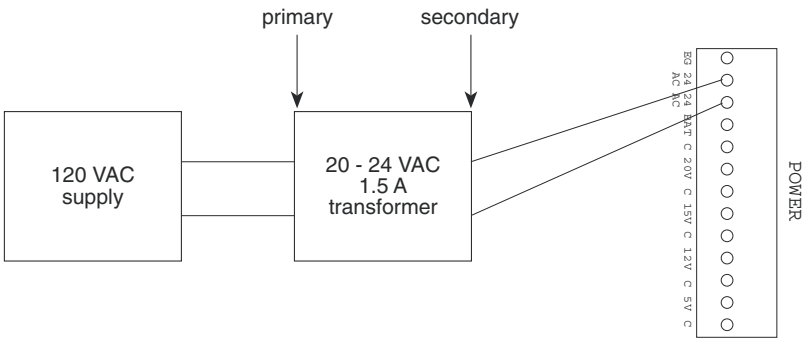
CAUTION: To avoid the danger of shock or damage to the unit, only qualified personnel should wire and service the power supply.

AC supply requirements:

1. The voltage range for powering ISACC is 20 to 24 VAC.
2. The AC supply should be able to provide a minimum of 1.5 Amp at the required voltage.

AC supply connections:

1. Wire the primary side of the 20 - 24 VAC transformer to the 120 VAC supply.
2. Wire the secondary side of the 20 - 24 VAC transformer to the terminals marked 24AC on the ISACC POWER terminal block.



Wiring an AC power supply to ISACC

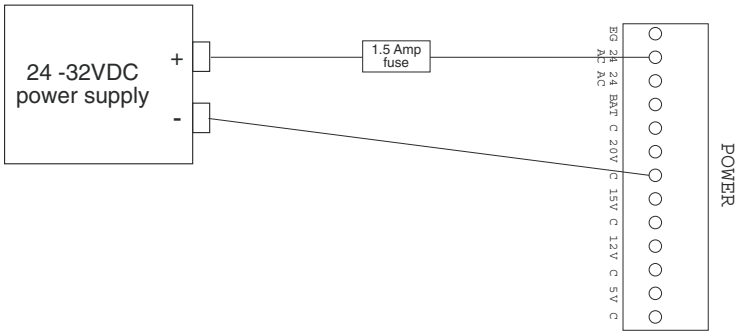
DC supply requirements:

1. The voltage range for powering ISACC is 24 to 28VDC. If the voltage is lower than 24VDC, the batteries will not fully charge. If the voltage is over 28VDC, excess heat will be generated in the power supply and components may fail.
2. The DC supply should be able to provide a minimum of 1.5 Amp at the required voltage.
3. The negative terminal on the DC supply must be either floating or connected to "Earth Ground." If it is not, you will create a ground differential between ISACC, your computer, and your sensors that may seriously damage these devices.
4. The positive terminal should have a 1.5 Amp Slo Blo fuse in-line between the supply and ISACC. This is required because the fuse on the circuit board will be bypassed with the new wiring.

DC supply connections:

1. Connect the negative wire from the DC supply to one of the common terminals on the POWER terminal block.
2. Connect the positive wire from the DC supply (with the in-line fuse) to the terminal marked 24AC that is directly to the right of the EG terminal.

See diagram next page.



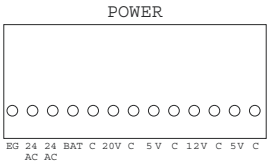
Wiring a DC power supply to ISACC

GROUNDING ISACC

ISACC should be earth grounded by connecting a true earth ground to the terminal labeled **EG**. This is not essential for ISACC to operate, but this will help protect against the possible effects of lightning strikes in or around the immediate area.

BACKUP BATTERY

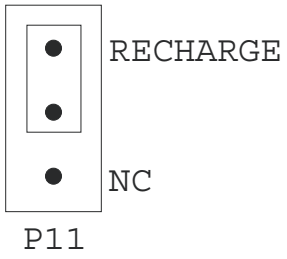
ISACC offers the ability to wire a backup battery to the power terminal block. The backup battery can be a rechargeable or non-rechargeable 18VDC. To hook up your backup battery, wire the positive terminal of your battery to the terminal labeled BAT on ISACC and wire the negative terminal of your battery to the terminal labeled C on ISACC. See diagram below:



Wiring a backup battery to ISACC

If you are providing ISACC with rechargeable backup batteries, the board must be configured so that ISACC knows to recharge the batteries.

When the battery is configured for recharge, ISACC supplies a constant charge of 20.4VDC, with maximum current limited to 185 mA. To recharge the battery backup, go to the SIP header at location P11 on the PC board. (P11 is located between the power supply terminal block and the ON-OFF switch.) Using needlenose pliers, move the shunt to the recharge position. See diagram next page:



Battery configured for recharge

LITHIUM BATTERY

The lithium battery provides backup to the RAM and to the real-time clock. To activate the battery, pull the paper strip out of the battery clip. The lithium battery is a CR2430, 3 Volts, 270 mAhr. It will provide battery backup for approximately 2 years. NOTE: The lithium battery will not keep ISACC operational. Its function is to retain the time and program if the power fails and backup battery is exhausted.

TURNING ISACC ON

Now that ISACC has power, the ON-OFF switch may be turned on. ISACC's buzzer will sound briefly. The "power" LED will come on and be constant and the "pulse" LED will blink steadily. The "phone" LED will not be lit.

When the unit is turned off, it is disabled. Programming parameters are retained by the 3V lithium battery. In the off position, the 3V lithium battery is in use, however 18V battery backup is not.

RESET BUTTON

Under the acrylic safety panel on ISACC's PC board is a reset button. This is provided to manually reset the unit. The button can be pressed by pushing a pen or thin object through the hole provided. When the reset button is pressed, the PC board stays powered, but the system is reset. Anything that ISACC recognizes as an alarm will be acknowledged and all dialout processes will be halted.

BUZZER

Located on the PC board is a buzzer. When ISACC is turned on or reset, this buzzer will go on briefly and then go off. The buzzer may also be used as a local audible alarm. It is considered OUTPUT9 in the programming of the parameters and the C program.

PHONE LINE INSTALLATION

ISACC must be hooked up to an analog phone line so that it can dial out for an alarm. On the PC Board there is an RJ11C phone jack. It is located on the PC board to the right of the input terminal block and is labeled PHONE (board location P3). Connect ISACC to a standard 2 wire phone line. ISACC dials using pulse or tone, with loop start only. ISACC will recognize ringer frequencies from 16 to 60 Hz.

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

FCC REQUIREMENTS

PART 68 - This equipment complies with Part 68 of the FCC rules. On the acrylic panel there is a label that contains, among other information, the FCC Registration Number and the Ringer Equivalenzce Number (REN) for this equipment. You must, upon request, provide this information to your local telephone company.

The REN is useful to determine the quantity of devices that you may connect to your telephone line and still have all of those devices ring when your telephone number is called. In most, but not all areas, the sum of the REN's of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices that you may connect to your line, you may want to contact your local telephone company to determine the maximum REN for your calling area.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

Should ISACC cause harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance. But if advanced notice isn't practical, you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

If you experience trouble with this equipment, please contact:

PHONETICS, INC.
901 Tryens Road
Aston, PA 19014
(610) 558-2700
Fax: (610) 558-0222
http:www.sensaphone.com

for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

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

CANADIAN DEPARTMENT OF COMMUNICATIONS NOTICE

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

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

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

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

The Load Number(LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100. For Sensaphone ISACC Models 5000 and 5100, the Load Number is 8.

CHAPTER 3

COMMUNICATION SETUP

After you have installed the unit, you must set up communications with ISACC before you can begin programming. To communicate with ISACC you must have the following:

- IBM PC or compatible with the Microsoft Windows Operating System, an RS232 serial port and/or a Hayes compatible modem and the supplied DB25 cable.

OR

- Dumb terminal with an RS232 serial port and/or a Hayes compatible modem and the supplied cable DB-25.

Whether you use a PC or a dumb terminal, you may communicate with ISACC in two ways: 1) Locally through the PC or terminal's RS232 port to ISACC's RS232 port, or 2) remotely through a modem connected to the PC or terminal to ISACC's built-in modem.

This chapter is divided into two sections: 1) SETUP FOR PC, and 2) SETUP FOR TERMINAL. Each section explains how to setup for local and remote communication with ISACC. Refer to *Appendix B* for a diagram of the ISACC Board layout.

Included with your unit is a software program designed to be used with your ISACC. Before using this program please read the *ISACC MANAGER for Windows User's Manual* within this binder.

SETUP FOR PC

LOCAL COMMUNICATION THROUGH RS232 PORT

To communicate locally using your PC, you must first hook up and configure ISACC's RS232 port with your PC's RS232 port. ISACC's RS232 port is positioned on the circuit board at location P4 next to the phone jack and is labelled **RS232 PORT (DCE)**. Provided with ISACC is a Communication Hookup Kit that contains the following:

- Male DB25 plug to RJ11C
- Female DB25 socket to RJ11C
- Female 9-pin socket to RJ11C
- 10 feet of RS232 wire with male RJ11C on each end

To connect your PC to ISACC's RS232 port, do the following:

1. Insert the male DB25 plug into ISACC's RS232 port

2. Insert one end of the RS232 wire into the male DB25 plug

3. Insert the other end of the RS232 wire into the female DB25 socket

4. Insert the female DB25 socket into your PC's male RS232 port. Make sure that you are connecting to one of the PC's COM ports and not to a parallel port. If your PC's COM port is a 9 pin connector, then use the included 9-pin socket instead.

See page 30 for ISACC's RS232 Specifications and a diagram of the RS232 DB25 socket.

5. After connecting the PC with ISACC, you may need to configure the PC's RS232 port to communicate at the same speed (bps) as ISACC (see the ISACC Manager User's Manual). If this is not an option, you can change ISACC's communication rate by configuring the shunts at location P10 on the ISACC board. Before changing anything, read the following:

> **IMPORTANT:** The speed of ISACC's RS232 port is **completely independent** of ISACC's built-in modem or modem speed. ISACC's modem has its own separate RS232 port built in. Therefore, you **do not** need to configure ISACC to communicate at the same speed as its built-in modem (1200 bps) when you are communicating locally. Use the rate at which your PC can communicate.

ISACC is factory configured at 9600 bps, which is the fastest it can communicate. All PCs can communicate at least that fast. Unless your PC definitely communicates at a slower speed, **do not** change the configuration of the shunts for local communication.

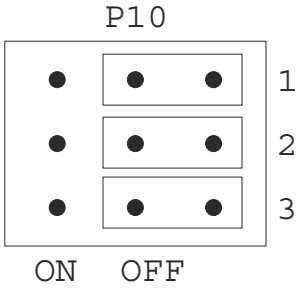
ISACC is capable of communicating locally at the following speeds:

150 bps	2400 bps
300 bps	4800 bps
1200 bps	9600 bps

There are 9 pins at board location P10. (P10 is located under the acrylic safety panel next to the digital outputs terminal block.) Three shunts are provided to configure the communication speed for the RS232 port. The speed is determined by the different positions of the shunts. All three shunts must be used for ISACC to communicate properly. To configure the shunts, you must first remove the acrylic panel. Using needlenose pliers, move the shunts to the

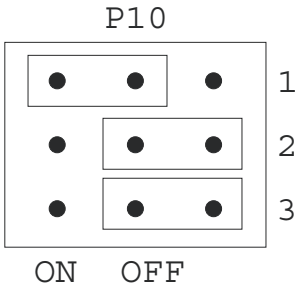
appropriate positions. Replace the acrylic panel when finished. See diagrams below.

To configure P10 for 150 bps, the shunts must be OFF OFF OFF:



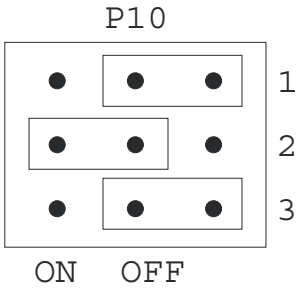
Shunt configuration for 150 bps

To configure P10 for 300 bps, the shunts must be ON OFF OFF:



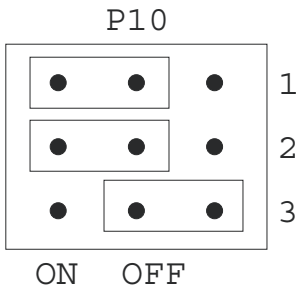
Shunt configuration for 300 bps

To configure P10 for 1200 bps, the shunts must be OFF ON OFF:



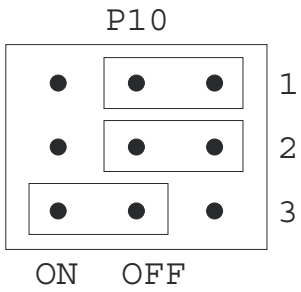
Shunt configuration for 1200 bps

To configure P10 for 2400 bps, the shunts must be ON ON OFF:



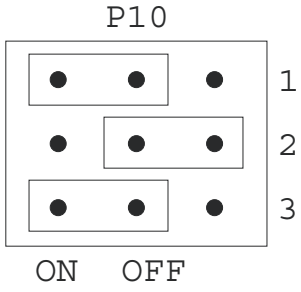
Shunt configuration for 2400 bps

To configure P10 for 4800 bps, the shunts must be OFF OFF ON:



Shunt configuration for 4800 bps

To configure P10 for 9600 bps, the shunts must be ON OFF ON:



Shunt configuration for 9600 bps

NOTE: Again, do not change the configuration of the shunts for local communication unless you are positive that your PC cannot communicate at 9600 bps.

6. If you changed the position of the shunts, you must reset ISACC so that the unit can recognize the new configuration. To do this press the reset button (a hole is provided in the acrylic safety panel) or turn the ON-OFF switch off and back on again. If you did not reconfigure the shunts, you do not need to reset ISACC.

7. When using a PC to communicate locally with ISACC, you must next install communications software. Provided with ISACC is the ISACC MANAGER for Windows Software. The package comes with four 3.5" floppy disks. Follow the instructions in the ISACC MANAGER User's Manual to install the software.

SETUP FOR TERMINAL

LOCAL COMMUNICATION THROUGH RS232 PORT

To communicate locally, you must hookup and configure ISACC's RS232 port with your terminal. ISACC's RS232 port is positioned on the circuit board at location P4 next to the phone jack and is labelled **RS232 PORT (DCE)**. Provided with ISACC is an Accessory Bag that contains the following:

- Male DB25 plug to RJ11C
- Female DB25 socket to RJ11C
- Female 9-pin socket
- 10 feet RS232 wire with male RJ11C on each end

To connect your terminal to ISACC's RS232 port, do the following:

1. Insert the male DB25 plug into ISACC's RS232 port

2. Insert one end of the RS232 wire into the male DB25 plug

3. Insert the other end of the RS232 wire into the female DB25 socket

4. Insert the female DB25 plug into your terminal's male RS232 port.

NOTE: You may encounter a common problem at step four. Some terminals have a female RS232 port. Since the provided equipment has a female DB25 socket, you may have to obtain a gender changer to connect the socket to your terminal.

See page 30 for ISACC's RS232 Specifications and a diagram of the RS232 DB25 socket.

5. After connecting the terminal with ISACC, you may need to configure your terminal's RS232 port to communicate at the same speed (bps) as your terminal (refer to your terminal's operator's manual). If this is not an option, you can change ISACC's communication rate by configuring the shunts at location P10 on the ISACC board. Before changing anything, read the following:

> **IMPORTANT:** The speed of ISACC's RS232 port is **completely independent** of ISACC's built-in modem or modem speed. ISACC's modem has its own separate RS232 port built in. Therefore, you **do not** need to configure ISACC to communicate at the same speed as its built-in modem (1200 bps) when you are communicating locally. Use the rate at which your terminal can communicate.

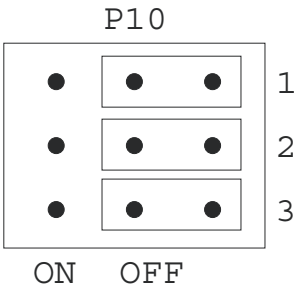
ISACC is factory configured at 9600 bps, which is the fastest it can communicate. Most terminals can communicate at least that fast. Unless your terminal definitely communicates at a slower speed, **do not** change the configuration of the shunts for local communication.

ISACC is capable of communicating locally at the following speeds:

150 bps	2400 bps
300 bps	4800 bps
1200 bps	9600 bps

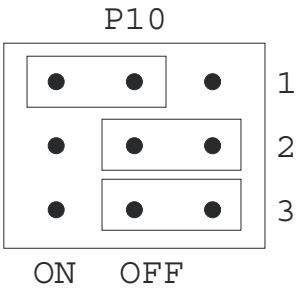
There are 9 pins at location P10. (P10 is located under the acrylic safety panel next to the digital outputs terminal block.) Three shunts are provided to configure the communication speed for the RS232 port. The speed is determined by the different positions of the shunts. All three shunts must be used for ISACC to communicate properly. To configure the shunts, you must first remove the acrylic panel. Using needlenose pliers, move the shunts to the appropriate positions. Replace the acrylic panel when finished. See diagrams below.

To configure P10 for 150 bps, the shunts must be OFF OFF OFF:



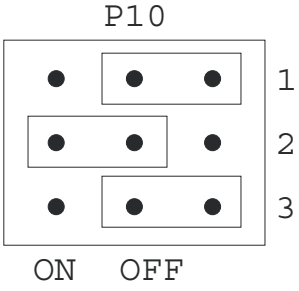
Shunt configuration for 150 bps

To configure P10 for 300 bps, the shunts must be ON OFF OFF:



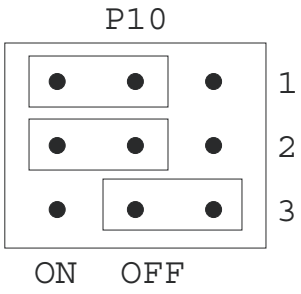
Shunt configuration for 300 bps

To configure P10 for 1200 bps, the shunts must be OFF ON OFF:



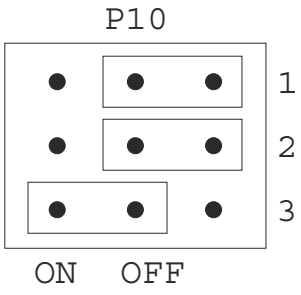
Shunt configuration for 1200 bps

To configure P10 for 2400 bps, the shunts must be ON ON OFF:



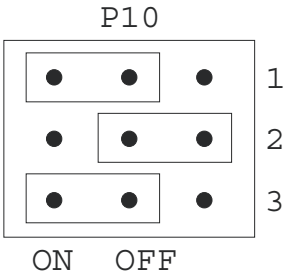
Shunt configuration for 2400 bps

To configure P10 for 4800 bps, the shunts must be OFF OFF ON:



Shunt configuration for 4800 bps

To configure P10 for 9600 bps, the shunts must be ON OFF ON:



Shunt configuration for 9600 bps

NOTE: Again, do not change the configuration of the shunts for local communications unless you are absolutely positive that your terminal cannot communicate at 9600 bps.

6. If you changed the position of the shunts, you must reset ISACC so the unit can recognize the new configuration. To do this, press the reset button (a hole is provided in the acrylic panel for easy access) or turn the ON-OFF switch off then on. If you did not reconfigure the shunts, you do not need to reset ISACC.

7. Go to your terminal setup screen. Set the baud rate of the terminal to 9600 bps.

8. Press <RETURN>. You will receive the ISACC welcome screen. You are now online with the unit and may begin programming and communication.

If you do not receive the ISACC welcome screen, there are only two possible problems. First, the baud rates do not match. Double check that the terminal and ISACC are set to be the same. If you are sure that they are correct, then you may need to add a null modem adaptor to the terminal.

REMOTE COMMUNICATION VIA MODEM

To communicate with ISACC remotely, you must have a Hayes compatible modem installed on your terminal. ISACC must be connected to an analog phone line (see *Chapter 2: INSTALLATION: "Phone Line Installation"*).

1. Go to your terminal setup screen. Next, you must set your terminal modem speed. The calling modem (in this case, your terminal's) establishes the baud rate of communication for the receiving modem (ISACC). If the calling modem communicates at a faster speed than the receiving modem can, there will be no communication. Therefore, set your terminal modem rate to the fastest speed at which both the terminal modem and ISACC's modem can communicate. For example:

If your terminal modem can communicate at 9600 bps, it can also communicate at 2400 bps, 1200 bps, and 300 bps. ISACC's modem is a 1200 bps modem, it can communicate at 1200 bps and 300 bps. Set the terminal modem (calling modem) to call ISACC at 1200 bps because this is the fastest that both can communicate. If you were to set the terminal baud rate to 300 bps, both will still communicate, but not at the optimum speed (not recommended).

> **NOTE: DO NOT RECONFIGURE THE SHUNTS AT LOCATION P10!** ISACC's modem has a completely independent RS232 port that automatically configures itself. The shunts at P10 are ONLY for local communication.

2. Type (in capital letters): ATZ

This will reset your terminal modem to recognize the new baud rate. You are now ready to dial ISACC's phone number.

3. Type (in capital letters): ATD followed by ISACC's phone number. Or, if you want to dial in touch-tones, type: ATDT followed by ISACC's phone number. For example:

ATD5555674
ATDT5555674

4. Your modem will call ISACC. When it connects, you will receive the message CONNECT on your terminal screen, followed by the ISACC welcome screen. You are now online and ready to begin programming and communication.

ISACC RS232 SPECIFICATIONS

Start/Stop protocol: XON/XOFF only

Communications protocol: 8 data bits, no parity, 1 stop bit

DB25 socket configuration: DCE female

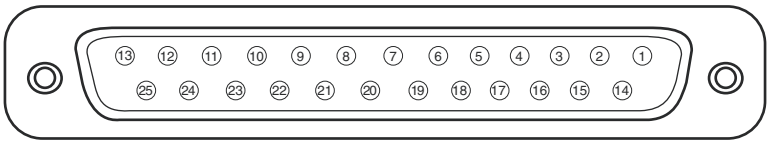
RS232 receptacle configuration (refer to diagram below):

Pin 2 = Received Data (Receive)

Pin 3 = Transmitted Data (Send)

Pin 6 = DSR (Data Set Ready)

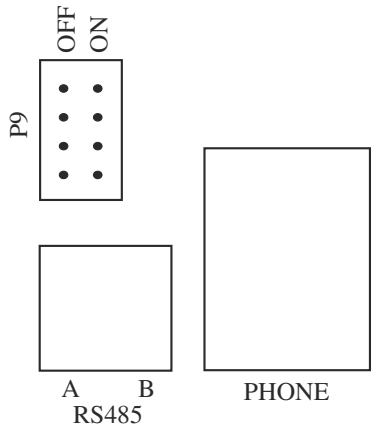
Pin 7 = Ground



ISACC's RS232 DB25 Socket

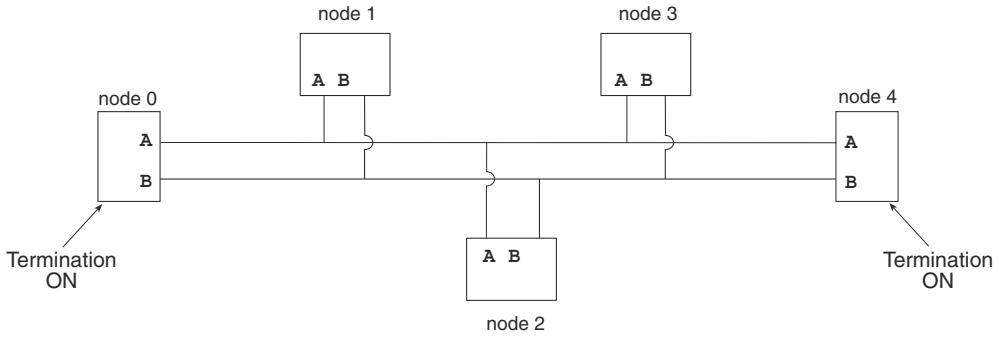
NETWORK WIRING

ISACC units may be connected in a network using as few as two units and as many as 16 units. The units are connected together using 2 conductor twisted pair cable (Belden 9841 or equivalent) to the networking terminal block (also called a port) labelled RS485. The 2-position RS485 terminal block is positioned next to the RJ11 phone jack on the circuit board. See below:



RS485 networking port

ISACC units are networked by connecting the **A** terminals together, and the **B** terminals together. Next, it is necessary to enable a termination on the two units that are located farthest apart. This termination is located at pin header P9, located directly above the RS485 terminal block. To enable termination, move the two black jumpers from the off position to the on position. If only two ISACC units are being networked, enable both. See the following diagram:



Five ISACC units networked

After the units are networked, you must determine the node number for each unit. This must be done so that the each unit is identified in the network. The "master" unit is identified as 0 (zero). See *Chapter 7: PROGRAMMING: "System"*, for information on how to program the network node number. See *Chapter 7: PROGRAMMING: "Network"* for information on how to make a network request. See *Chapter 8: C PROGRAMMING* for information on how to use network information in C programming.

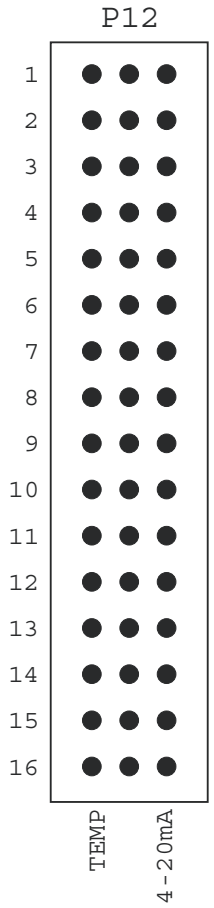
CHAPTER 4

INPUTS

ISACC comes with 16 user definable inputs that can sense the following: temperature, analog voltage, analog current, dry contact and pulse count.

HOW THE INPUTS WORK

ISACC reads the value of each input by measuring the voltage across the input terminal and common. ISACC can read the voltage between 0 Volts and 5 Volts, in increments of .00489 Volts. The inputs are configured by positioning the shunts at location P12 on the ISACC circuit board. (P12 is located under the acrylic safety panel directly above the input terminal block. Refer to Appendix B for a diagram of the ISACC board layout.) P12 has 16 sets of pins, one set for each input. See diagram of P12 below:

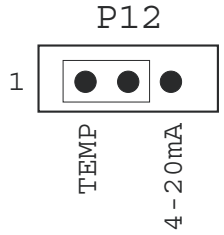


The input configuration pins at P12

When the shunts are positioned for a specific type of sensor, ISACC uses a different circuit to measure the appropriate reading for that sensor. The three configurations are single ended 4-20mA; thermistor/digital/pulse; and 0-5V. To configure an input channel, you must first

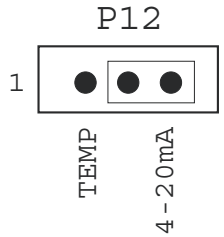
remove the acrylic panel. Using needlenose pliers, move the shunt to the appropriate position. See diagrams below. Replace the acrylic panel when finished.

TEMP position - The default configuration connects the input signal to a 5V reference through a 6.34K pull-up resistor. This configuration allows a thermistor, dry contact (N.C. or N.O.), or pulse counting sensor to be wired to the input. You may use either a 2.8K thermistor or a 10K thermistor with ISACC.



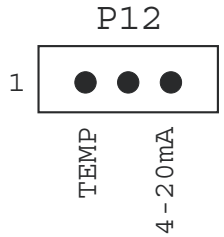
Thermistor, dry contact or pulse count configuration

4-20mA position - This configuration connects the input signal to a 249 Ohm load resistor. This allows ISACC to measure the current at the input. Any sensor that puts out 4-20mA can be wired to this input.



4-20mA configuration

0-5V (NO SHUNT) position - This configuration connects the input signal directly to ISACC's analog to digital converter for measuring the output of 0 to 5 volt transducers. Any sensor that puts out 0-5V can be wired to this input.

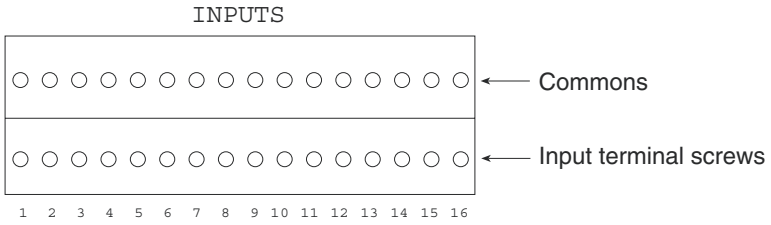


0-5 Volt configuration

CAUTION: Wiring sensors with shunts in the incorrect position could result in damage to the unit.

INPUT TERMINAL BLOCK

On the circuit board, each input terminal is located on the double row terminal block labeled INPUTS. The bottom row is the positive input terminal and the top row is the common terminal. All commons are the same and are internally connected. See diagram below:

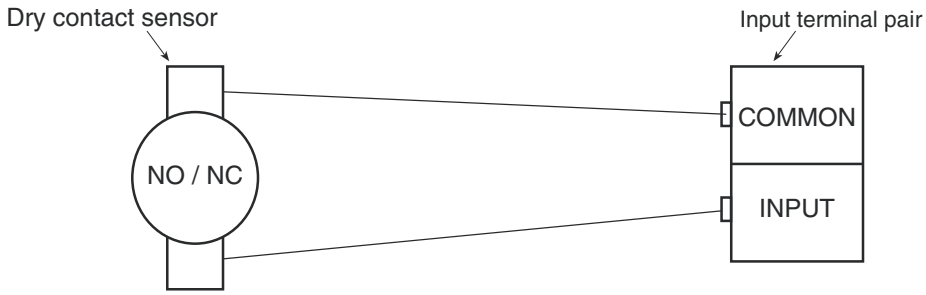


Input terminal block

NOTE: If you are using the ABS plastic enclosure, you must remove the top cover to access the circuit board. After wiring is completed, reinstall the top cover. All wiring should be properly fitted through the strain relief clamps. Strain relief is provided in the ISACC enclosure to prevent wiring from being pulled from the circuit board or damaged while passing through the enclosure. To use, thread wires through the clamp and clear rubber bushing. Position the bushing in the clamp and tighten the screws on either side so that the wiring does not move.

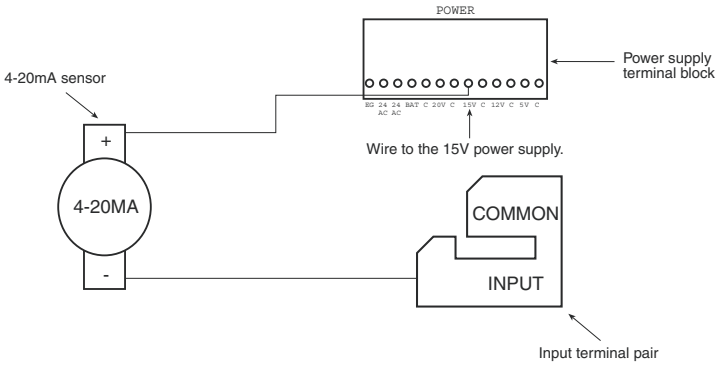
WIRING SENSORS TO THE INPUTS

Dry contact/Thermistor/Pulse count - To use a dry contact sensor, thermistor, or pulse counter on an input, wire one lead to the numbered screw of an input terminal and the other lead to the corresponding common screw. See diagram below:



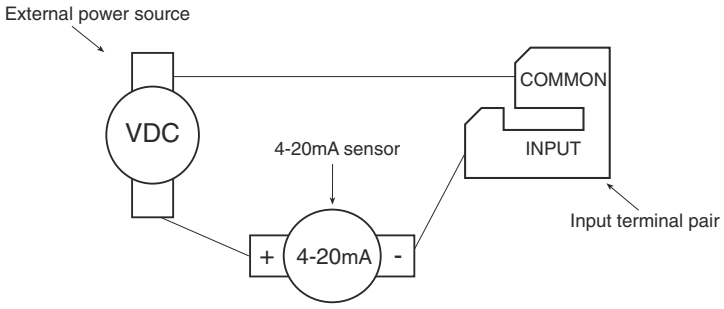
Dry contact/ Thermistor/Pulse count sensor

4-20mA (internally powered) - To use a 4-20mA sensor on an input, you must supply power to it. You may power a 4-20mA sensor using ISACC's internal power supply, or you may wire the sensor to an external power supply. NOTE: The number of internally powered sensors will affect battery backup time during a power failure. To use the internal power supply, wire the positive lead from the sensor to ISACC's 15V power supply (located on the POWER terminal block). Wire the negative lead to a numbered input terminal screw. See following diagram:



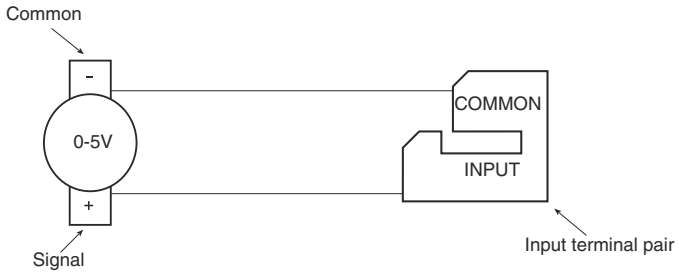
4-20mA sensor using internal power supply

4-20mA (externally powered) - To use an external power supply, wire the positive lead from the sensor to the positive terminal on the external power source. Wire the negative lead from the sensor to a numbered input screw on ISACC. Next, connect the power supply to ISACC by wiring the negative terminal on the power supply to a common screw on ISACC. See diagram below:



4-20mA sensor using external power source

0-5V sensor - To use a 0-5V sensor with ISACC, wire the sensor signal lead to a numbered input terminal screw on the unit. Then, wire the sensor common to the corresponding common screw on ISACC. See diagram below:



0-5V sensor

SHIELDED WIRE

ISACC is designed to work in most installations without the need of shielded wire. This does not apply to wire run in conduit that has other noise-generating conductors such as 60Hz AC.

It is strongly recommended that input wiring be run in a conduit separated from AC power or output wiring. When wire runs are long or are in close proximity to large power consuming, power generating or power switching equipment, it is recommended that SHIELDED WIRE be used. Not doing so may cause erroneous input readings.

LENGTH OF WIRE

Temperature - It is recommended that long wire runs be **avoided** when using a thermistor as a sensor. A long run of wire could alter the resistance of the circuit therefore providing an inaccurate temperature reading of the input. Below is a chart of recommended gauges and wire lengths:

MINIMUM WIRE GAUGE	MAXIMUM WIRE LENGTH	LOOP RESISTANCE
#26	250 feet	10.2 Ohms
#24	700 feet	18 Ohms
#22	1500 feet	24.15 Ohms
#20	2500 feet	25.5 Ohms

Dry contact - The total resistance of the loop cannot exceed 50 Ohms. Use the table above to determine the appropriate GAUGE wire for your application.

Analog Current - Long wire runs will not affect the accuracy of the input because there is constant current being driven through the sensor wire.

Analog Voltage - Wire runs should be kept as short as possible to avoid voltage drops and noise susceptibility. Use the chart above as a guideline.

NOTE: All wiring should comply with section 17 of the UL requirements.

INPUT MODULES

Solid state input modules may also be used with ISACC. Input modules provide a reliable means of interfacing between ISACC and an outside device. Input modules come in AC and DC versions and are used to measure the presence or absence of AC or DC voltage, respectively.

The ISACC enclosure comes predrilled to mount a 4-module rack using four #6-32 1" machine screws. If you are using input modules, you must hardwire the rack to ISACC. If your application requires the use of many input modules, you may want to consider using a 16-module rack. See end of this section.

NOTE: With the 4-module racks, you may use a combination of input and output modules in the same rack. For information on output modules, See *Chapter 5: Outputs*.

To use the 4-module rack with ISACC:

1. Insert solid state modules into the 4-module rack.
2. Place the rack in front of you so that **2IO-4A** is at the top and the LEDs are on your right.
3. The right side of the 4-module rack is the *logic I/O* that is wired to ISACC. The left side of the board is the *field I/O* that is wired to the I/O devices.

To wire the logic I/O (right side) to ISACC:

1. Attach terminal 1 (on the right side) to 5 VDC on the ISACC power supply terminal block. Attach terminal 2 to one of the C (common) terminals on the ISACC power supply terminal block.
2. Connect an odd-numbered terminal (3, 5, 7, or 9) to one of the ISACC input terminals (1-16) on the bottom row terminal block. The shunt for this input must be in the TEMP position.

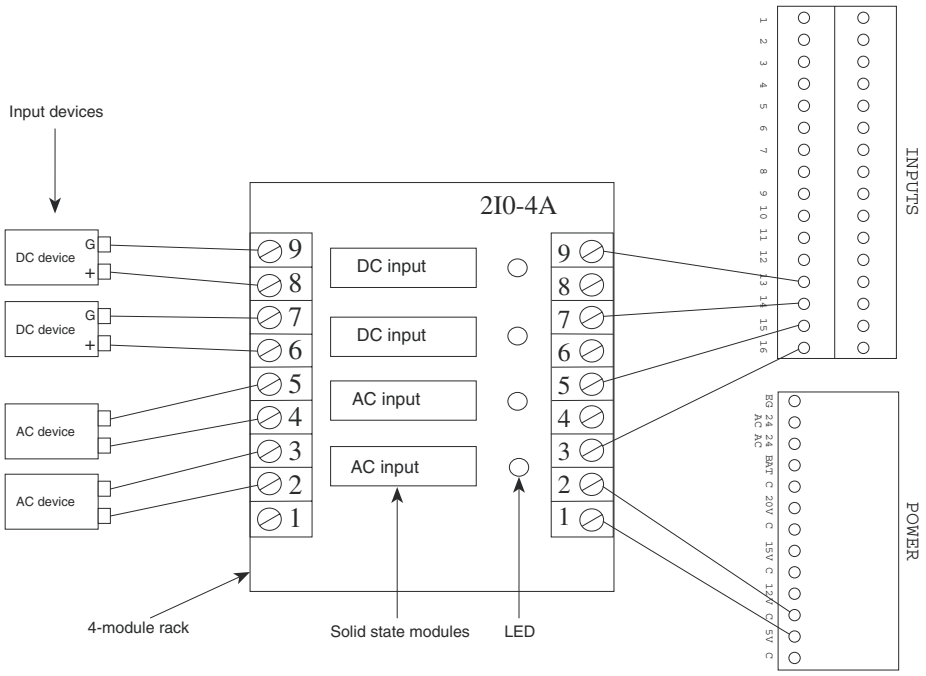
To wire the field I/O (left side) to the input device:

If the input device is DC:

1. Connect ground from the outside device to the odd-numbered terminal (3, 5, 7, or 9) on the rack.
2. Connect the positive voltage from the outside device to the even-numbered terminal (2, 4, 6, or 8) on the rack.

If the input device is AC, polarity does not matter and either wire can be connected to a terminal pair on the rack.

See sample diagram below:



Wiring AC and DC input modules using a 4-module rack

DIP CONNECTOR FOR A 16-MODULE RACK

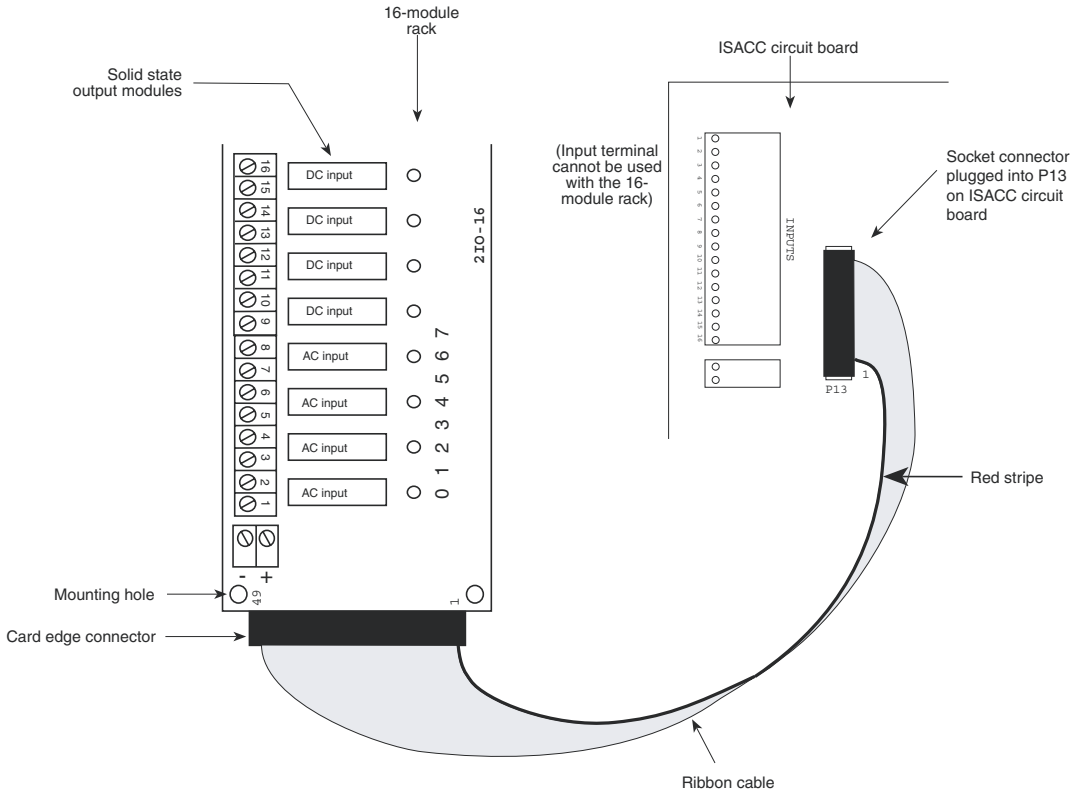
If you need to use all 16 inputs for monitoring AC or DC voltage, you may simplify your wiring by using a 16-module rack (Potter & Brumfield 2IO16), with a 50-pin ribbon cable with a card edge connector on one end and a 50-pin socket connector on the other end. The socket connector connects to the ISACC unit and the card edge connector connects to the

16-module rack. On the ISACC circuit board is a 50-pin DIP connector at location P13 (located adjacent to the input terminal block). The signals at the DIP header are internally connected to the input terminal block. Configure all input shunts to the TEMP position.

IMPORTANT: The 16-module rack is used in lieu of the input terminal block, both cannot be used at the same time. When using a 16-module I/O rack, all 16 inputs are dedicated to using input modules. If a smaller number of input modules are needed, use a smaller rack and hardwire the rack to the input block.

To use the 16-module rack:

1. Connect the ribbon cable between the 16-module rack and the DIP connector on ISACC. Make sure that pin 1 on the rack connects to pin 1 on the DIP header.
2. Install the jumper wire at the card edge pad 49 on the rack, or connect the positive terminal on the rack's 2-position terminal strip to 5V on the ISACC POWER terminal block.



16-module rack connection

ISACC INPUT SPECIFICATIONS

Voltage Range:	0 to +5 VDC
Minimum/Maximum Input Voltage:	-0.5VDC to +5.5VDC
Input Resolution:	10 Bit or 0.004888V
A/D Converter Typical Total Unadjusted Error:	±1 LSB
Accuracy (TEMP POSITION):	±1° F typical using Phonetics 2.8K temperature sensor
Accuracy (4-20mA POSITION):	±1.25%
Maximum Pulse Frequency:	1.0Hz
Minumum Pulse Width:	400ms
Noise Filtering:	2300Hz low pass filter -20dB/Decade

INPUT MODULE SPECIFICATIONS

AC INPUT MODULE (FGD-0018):

Input Voltage:	90 - 140 VAC/VDC
Input Current:	8 - 12 mA
Output Current:	100 mA DC max.
Output Leakage:	100 µA DC max.
Logic Supply Voltage:	5 VDC
Logic Supply Current:	10 mA DC typical

DC INPUT MODULE (FGD-0017):

Input Voltage:	3-32 VDC
Input Current:	10-15 mA
Output Current:	100 mA DC
Output Leakage:	100 µA DC
Logic Supply:	5 VDC
Logic Supply Current:	10 mA DC

CHAPTER 5

OUTPUTS

ISACC comes with 8 digital outputs, one mechanical relay, one on-board buzzer, and four analog outputs.

NOTE: All wiring should comply with section 17 of the UL requirements.

HOW THE OUTPUTS WORK

On-board buzzer - is considered an output that acts as a local audible indicator. Its function is controlled by programming. No wiring required. It is referred to as output 9 in the programming parameters. It may be controlled manually, or automatically by C program.

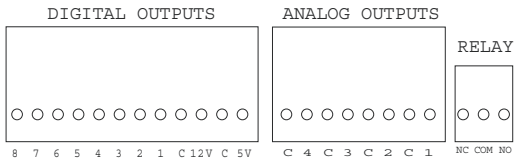
Mechanical SPDT Relay - used for simple on/off switching of up to 5 Amps. If your application requires the use of only one output, the on-board relay may be appropriate. It is referred to as output 10 in the programming parameters. It may be controlled manually, or automatically by C program.

Digital Outputs - used to control equipment such as heating, air conditioning, ventilation, lighting, power, etc. The outputs are low level 5 volt TTL signals capable of sinking or sourcing about 20mA. The logical operation of the outputs is OFF = 5 volts and ON = 0 volts. The digital outputs require an interface such as solid state relays to be used. The digital outputs are referred to as outputs 1-8 in the programming parameters. They may be controlled manually, or automatically by C program.

Analog Outputs - provide proportional control of equipment and do not require an interface to be used. The analog outputs are 0 to 10 Volts, specified by a number from 0 to 255. They are controlled automatically by C program and are referred to as outputs 11 through 14 in the programming parameters. They may be controlled manually, or automatically by C program.

OUTPUT TERMINAL BLOCKS

On the circuit board, the outputs are available on three different terminal blocks labelled DIGITAL OUTPUTS, ANALOG OUTPUTS, and RELAY. See diagram below:



Output terminal blocks

NOTE: If you are using the ABS plastic enclosure, you must remove the top cover to access the circuit board. After wiring is completed, reinstall the top cover. All wiring should be properly fitted through the strain relief clamps. Strain relief is provided in the ISACC enclosure to prevent wiring from being pulled from the circuit board or damaged while

passing through the enclosure. To use, thread wires through the clamp and clear rubber bushing. Position the bushing in the clamp and tighten the screws on either side so that the wiring does not move.

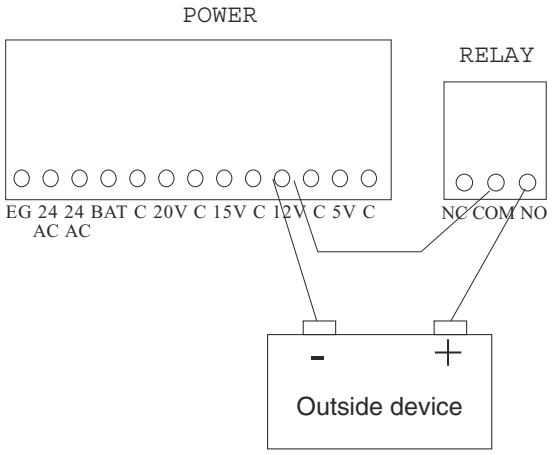
WIRING THE MECHANICAL RELAY

To wire a device to the mechanical relay using an ISACC power supply:

1. Wire one lead from the device to the terminal marked NO on the relay terminal block.
2. Wire the other lead from the device to a common on ISACC's POWER supply terminal block.
3. Wire the terminal marked COM on the relay terminal block to a power terminal (5V, 12V, 15V, or 20V) on ISACC's POWER supply terminal block.

NOTE: If the unit powers off, the relay will revert to "normal" condition. It is not Latching!

See diagram below:

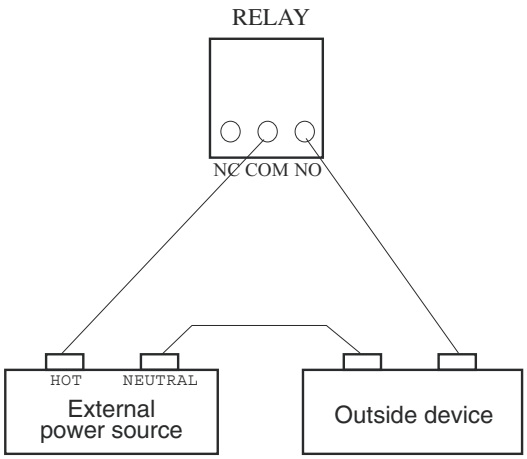


Wiring a device to mechanical relay using an ISACC power supply

To wire a device to the mechanical relay using an external power source:

1. Wire one lead from the device to the terminal marked NO on the relay terminal block.
2. Wire the other lead from the device to the NEUTRAL terminal on the external power source.
3. Wire the terminal marked COM on the relay terminal block to the HOT terminal on the external power supply.

See diagram next page.



Wiring a device to mechanical relay using an external power source

NOTE: The NO/NC status is only valid while the unit is on. Should the unit lose power, the relay will invert position.

WIRING THE DIGITAL OUTPUTS

In order to use the digital outputs to control other equipment, an appropriate interface is required. Optically isolated solid state relays provide the optimum interface to be driven by the digital outputs. These are preferred because they isolate ISACC from the equipment being switched. The two types that can be used with ISACC are:

- Solid state output modules
- High power solid state relays (FGD-0020)

If the equipment that needs to be switched requires less than 3 Amps, use solid state output modules mounted in a 4- or 8-module rack. If the equipment requires more than 3 Amps, individual high power solid state relays must be used.

Solid State Output Modules – The solid state output modules come in AC and DC versions and are typically limited to 3 Amp switching. They are designed to be plugged into output mounting boards (racks). The ISACC enclosure is predrilled to mount either one 4-module rack or one 8-module rack using four #6-32 1" machine screws. See *Appendix C* for mounting diagrams.

AC and DC output modules (FGD-0015 and FGD-0016), the 4-module rack (FGD-0021), and the 8-module rack (FGD-0039) are available from Phonetics. See Appendix D for accessory information. Other output modules from different manufactures may be used with ISACC. Contact Phonetics for more information.

If you use an 8-module rack, you must use a ribbon cable to connect AC/DC output modules to ISACC. The ribbon cable attaches to the rack and plugs into a 26-pin DIP header at location P14 on ISACC. The output signals at the DIP header are internally connected to those at the terminal block. This is only for the digital outputs, there is no DIP connector for the analog outputs. See the 8-module rack installation diagram.

NOTE: With the 4-module rack, you may use a combination of input and output modules. For more information on using and wiring input modules, see *Chapter 4: Inputs*.

To wire the 4-module rack logic I/O to ISACC:

1. Insert solid state modules into the 4-module rack.
2. Mount the rack in the ISACC enclosure so that it is parallel to the ISACC circuit board, with the LED side closest to the circuit board. The LED side is called the logic I/O and is wired to ISACC. The other side is called the field I/O and is wired to the AC and DC devices.
3. Wire terminal 1 on the rack to 5 VDC on the ISACC digital output terminal block. Attach terminal 2 to one of the C (common) terminals on the ISACC digital output terminal block.
4. Connect an odd-numbered terminal (3, 5, 7, or 9) on the rack to a digital output terminal (1-8) on ISACC.

To wire the 4-module rack field I/O to DC devices using an ISACC power supply:

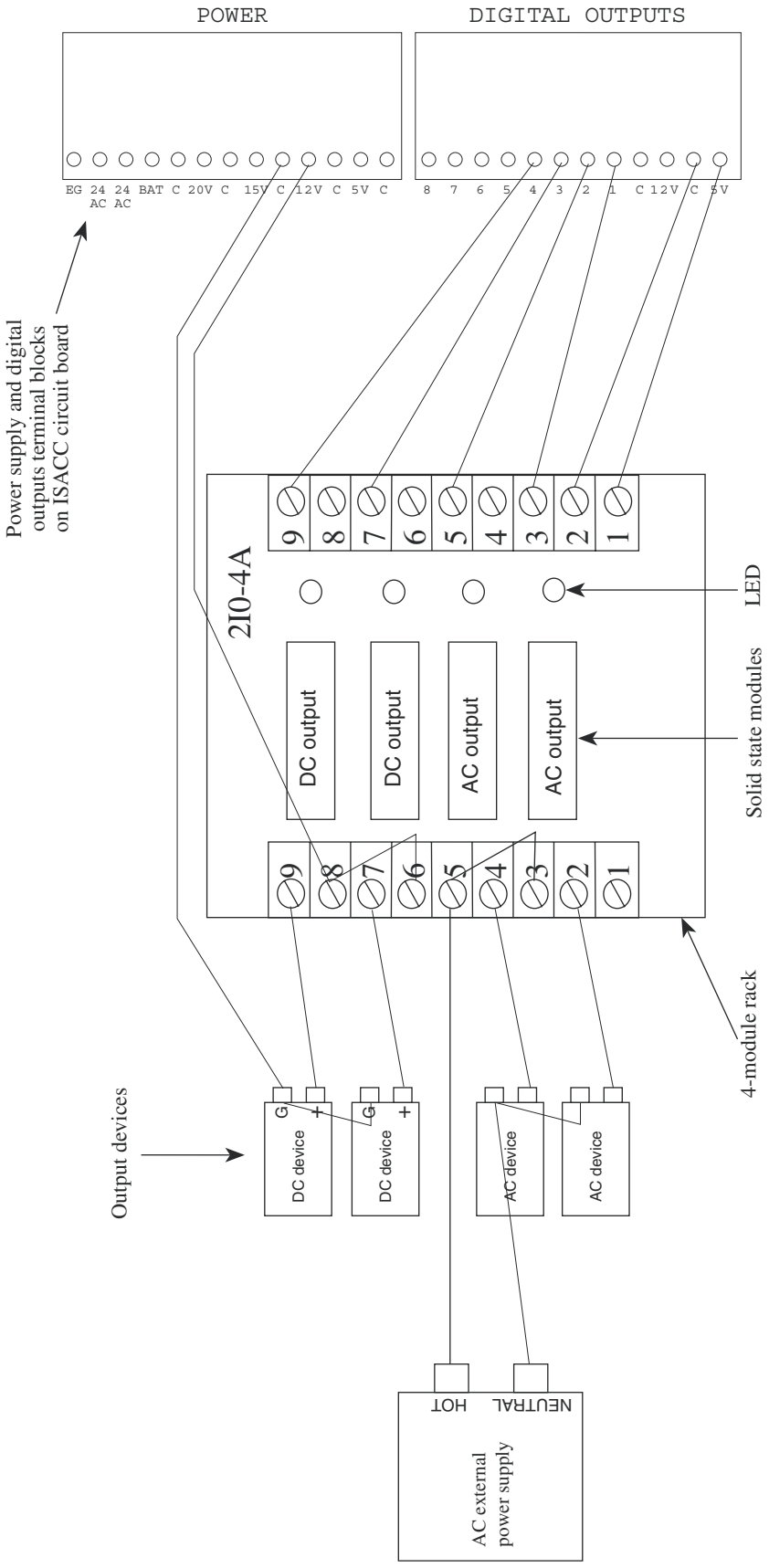
1. Connect ground from the DC device to a common on ISACC's power supply terminal block.
2. Connect an even-numbered terminal on the 4-module rack to a power terminal (20V, 15V, 12V, or 5V) on ISACC's power supply terminal block.
3. Connect the positive terminal from the DC device to the odd-numbered terminal (2, 4, 6, or 8) on the rack.
4. If you use more than one DC module, you may wire the even-numbered terminals on the rack together (if they require the same voltage) to supply power, and the ground terminals on the DC devices together to ground.

To wire the 4-module rack field I/O to AC devices using an external power supply:

1. Wire the HOT terminal from the external power supply to an odd-numbered terminal on the 4-module rack.
2. Wire the NEUTRAL terminal from the external power supply to a terminal on the AC device.
3. Wire the other terminal on the AC device to an even-numbered terminal on the 4-module rack.
4. When using more than one AC module, you may wire the odd numbered-terminals on the rack together, and the neutral terminals on the AC devices together.

See diagram on next page.

NOTE: If you are using the ABS plastic enclosure, any external wiring must go through the strain relief clamps in the wall of the enclosure. Replace the top cover after installation. Terminal 1 on the field I/O side of the 4-module rack is unused.

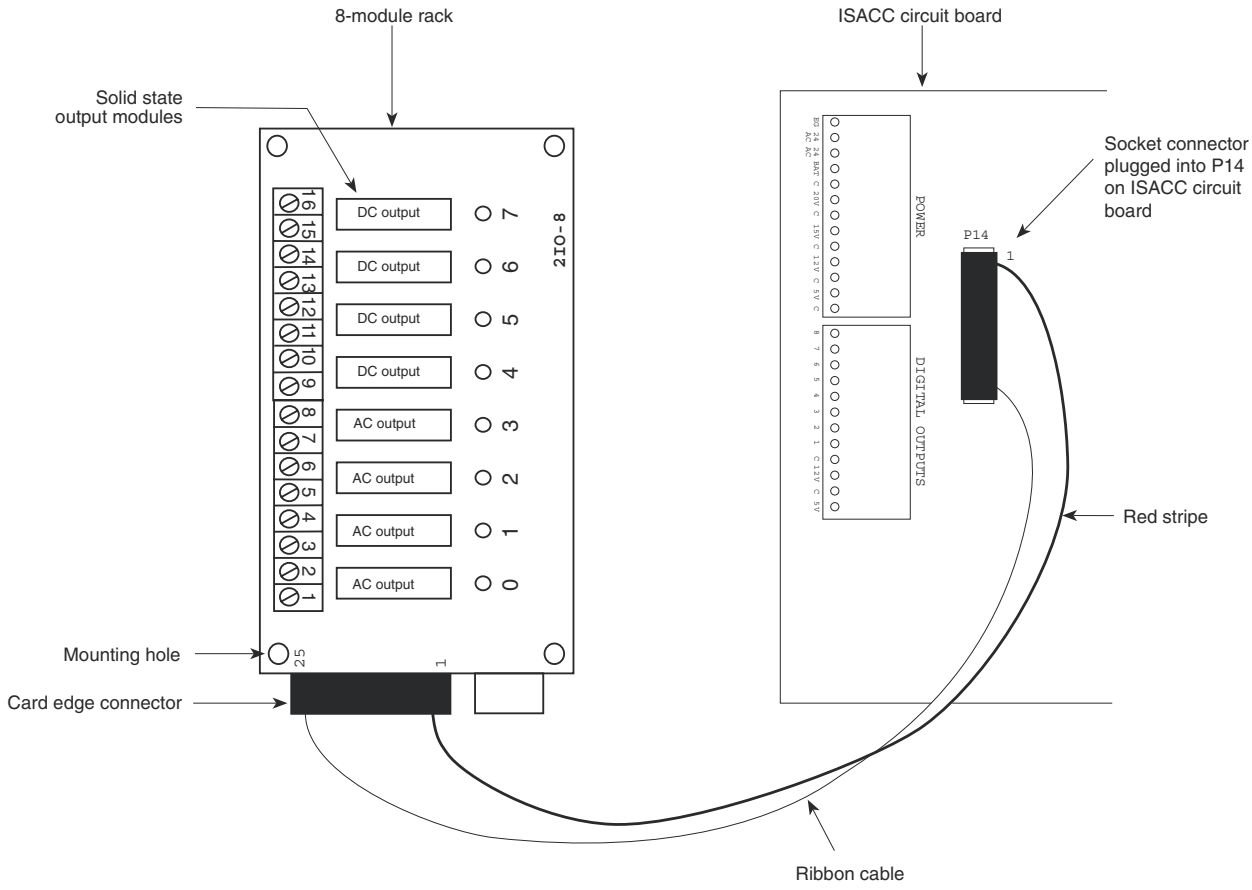


Using 4-module rack with ISACC

To install the 8-module rack with ISACC:

1. Insert the solid state modules into the 8-module rack.
2. Mount the rack in the ISACC enclosure so that it is parallel to the ISACC circuit board, with the LED side closest to the circuit board.
3. Plug the ribbon cable card edge connector to the rack with the red stripe at pin 1.
4. Insert the socket connector into the 26-pin DIP header at location P14 on the ISACC circuit board with the red stripe at pin 1.

See diagram below:



Installing the 8-module rack with ISACC

To wire a DC device to the 8-module rack using an ISACC power supply:

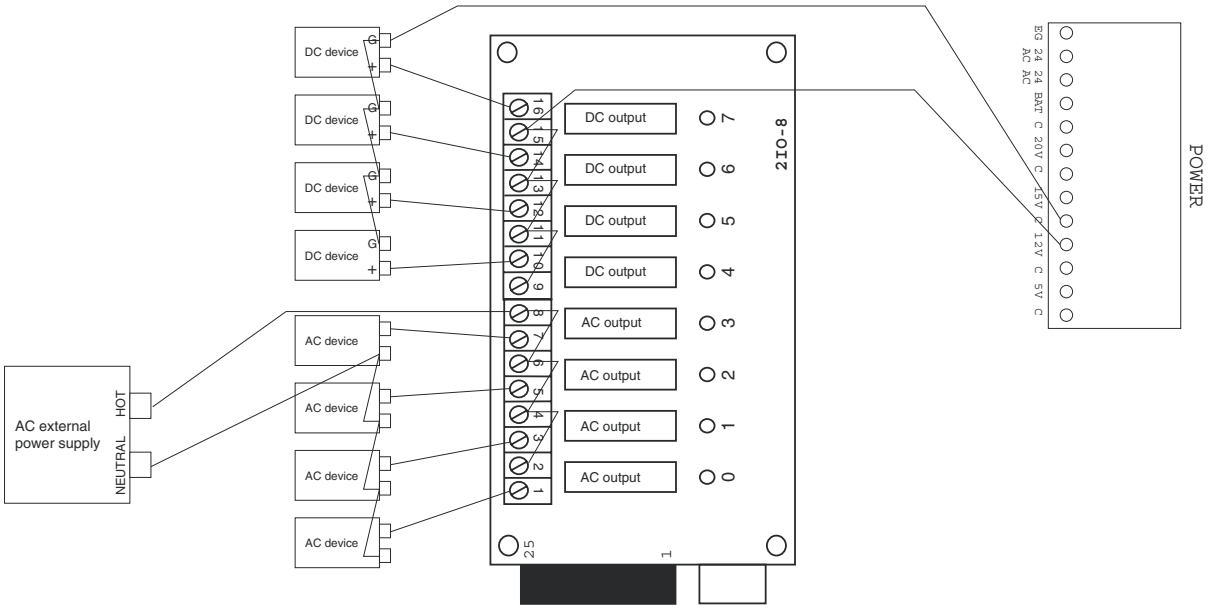
1. Wire the ground terminal on the DC device to a common on the ISACC POWER supply terminal block.
2. Wire the positive terminal on the DC device to an even-numbered terminal on the 8-module rack.
3. Wire an odd-numbered terminal on the 8-module rack to a power terminal (5V, 12V, 15V, or 20V depending on your application) on the ISACC POWER supply terminal block.

4. When using more than one DC device, you may wire all the device ground terminals together, and wire the odd-numbered terminals on the 8-module rack together if all the DC devices require the same voltage.

To wire an AC device to the 8-module rack using external AC power source:

1. Wire the HOT terminal on the external AC power source to an even-numbered terminal on the 8-module rack.
2. Wire the NEUTRAL terminal on the external power source to one of the AC device terminals.
3. Wire the other AC device terminal to an odd-numbered terminal on the 8-module rack.
4. When using more than one AC device, you may wire the even-numbered terminals on the rack together, and wire the neutral terminals on the AC devices together.

See diagram below:



Wiring the AC and DC devices to the 8-module rack

Below is a pin-out of the digital outputs DIP connector:

Common	26	••	25	+5V
Common	24	••	23	Output 1
Common	22	••	21	Output 2
Common	20	••	19	Output 3
Common	18	••	17	Output 4
Common	16	••	15	Output 5
Common	14	••	13	Output 6
Common	12	••	11	Output 7
Common	10	••	9	Output 8
Common	8	••	7	N.C.
Common	6	••	5	N.C.
Common	4	••	3	N.C.
Common	2	••	1	+12V

P14

26-pin DIP header at P14

High Power Solid State Relay - The 25 Amp high power solid state relay (FGD-0020) is available from Phonetics. See Appendix D for accessory information. The ISACC enclosure is predrilled to mount as many as 8 high power solid state relays using two #6-32 ˘" machine screws. See Appendix C for mounting diagrams.

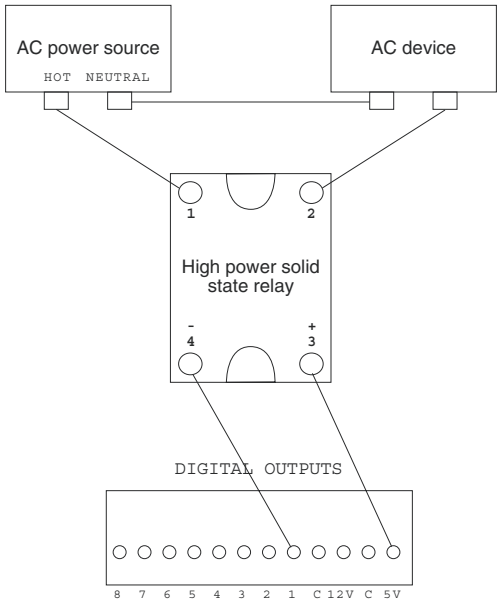
NOTE: Do not use a high power solid state relay when a lower power relay will be sufficient. Solid state relays require a certain minimum current to switch (see page 54 for solid state relay specifications). If a lower power relay is sufficient to switch the required current, but you have a high power relay wired, the output may not switch. Likewise, a certain amount of leakage current also occurs. With a high power relay, this could be sufficient to cause unintended switching of an output.

To use a high power solid state relay:

1. Mount the relay in the ISACC enclosure so that terminals 3 and 4 are closest to the ISACC circuit board.
2. Wire terminal 3 on the relay to the 5V terminal on the DIGITAL OUTPUTS terminal block.
3. Wire terminal 4 on the relay to one of the digital output terminals (1-8).
4. Wire terminal 2 on the relay to one of the terminals on the AC device.
5. Wire the other terminal on the AC device to the NEUTRAL terminal on the AC external power source.
6. Wire the HOT terminal on the AC external power source to terminal 1 on the relay.

See diagram below:

CAUTION: Exercise care when handling high voltage, high current circuits. Failure to do so may result in electrical shock, fire, and/or serious bodily harm.



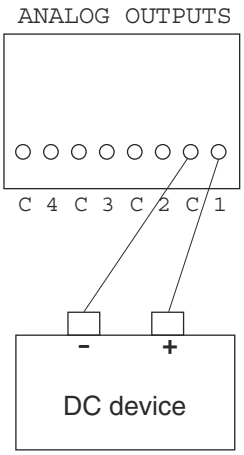
Wiring a high power solid state relay

WIRING THE ANALOG OUTPUTS

To wire the analog outputs:

1. Wire the positive terminal on the DC device to a numbered terminal on the analog outputs terminal block.
2. Wire the negative terminal on the DC device to a common on the analog outputs terminal block.

See diagram below:



Wiring an analog device

OUTPUT SPECIFICATIONS

DIGITAL:

Output Voltage	0 to 5V
Output Source Current (V = 0V)	-30mA Max
Output Sink Current (V = 5V)	20mA Max

ANALOG:

Output Voltage	0 to 10V
Resolution	8 bits or .03137V
Maximum Total Unadjusted Error	±2 LSB
Voltage Output Slew Rate	3V/µs
Voltage Output Settling Time	4µs
Minimum Output Load Resistance (V = 10V)	2K

RELAY:

Type:	SPDT
Rated Load	5A at 120VAC
	5A at 30VDC
Carry Current	5A

Maximum Operating Voltage	250VAC 125VDC
Maximum Operating Current	5A (AC/DC)
Maximum Switching Capacity	1,250VA, 150W

BUZZER:

Sound Output	80dB at 30cm
Frequency	400Hz ±50Hz

SOLID STATE RELAY SPECIFICATIONS

AC Output Module (FGD-0015):

Voltage range:	24 - 140 Vrms
Max current:	3 Arms
Min current:	20 mArms
Typical leakage current:	2 mArms at 120 Vrms

DC Output Module (FGD-0016):

Voltage range:	5 - 60 V DC
Max current:	3 A DC
Min current:	20 mA DC
Typical leakage:	.5 mA at 32 V DC

High Power Solid State Relay (FGD-0020):

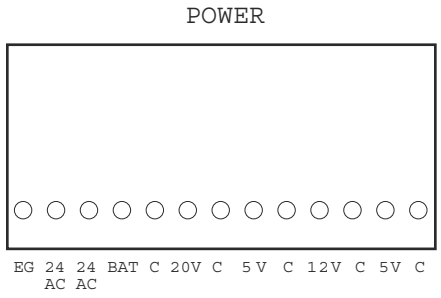
Voltage range:	24 - 140 Vrms
Max current:	25 Arms
Min current:	50 mArms
Typical leakage:	7.5 mArms at 140 Vrms

CHAPTER 6

POWER SUPPLIES

ISACC has four power supplies available from the PC board. They are there to power your external sensors, solid state relays or output devices. Below are the specifications for these power supplies:

Maximum Available Current	
5V Supply	200mA
12V Supply	200mA
15V Supply	100mA
20V Supply	100mA



Power supply terminal block

The 5 Volt, 12 Volt, 15 Volt, and 20 Volt supplies are battery backed, but usage affects battery backup time. The charge voltage at the BAT terminal is 20.4 Volts. Main power (24VAC) is supplied through the two terminals labelled **24** and **24**. The Earth Ground Terminal is labelled **EG**.

> **NOTE:** If you are using the ABS plastic enclosure, you must remove the top cover to access the circuit board. After wiring is completed, reinstall the top cover. All wiring should be properly fitted through the strain relief clamps. Strain relief is provided in the ISACC enclosure to prevent wiring from being pulled from the circuit board or damaged while passing through the enclosure. To use, thread wires through the clamp and clear rubber bushing. Position the bushing in the clamp and tighten the screws on either side so that the wiring does not move.

All wiring should comply with section 17 of the UL requirements.

CHAPTER 7

PROGRAMMING

The standard parameter programming and system setup of ISACC is accomplished through using short command words called KEYWORDS and STAND ALONE commands. To use either type of command, you simply type the letters after an ISACC prompt (ISACC>) and then press the ENTER (or RETURN) key.

Note About Programming Examples: Commands and example information in this chapter that are typed in by the user are represented in bold type. This is so that you can easily see what has been changed.

KEYWORDS

There are two main components of a keyword command: the command prefix words SET or SHOW followed by the KEYWORD. SET allows you to make a change in a parameter. SHOW lists the current values of the parameter. The KEYWORDS represent all the system and programming parameters. They are:

SYSTEM	RECOGNITION	SELECTION
CLOCK	ALARMS	VOICE
INPUTS	DIALOUT	LOGGING
ITYPE	OUTPUTS	NETWORK
TABLE	ONAME	VARIABLES
LIMITS	PHONE	

The format for using a keyword command is the following:

```
ISACC>SET (KEYWORD)
ISACC>SHOW (KEYWORD)
```

You may abbreviate the prefix and the keyword by using only the first three letters of each word. For example, the command "**show system**" may also be typed as "**sho sys**". The command "**set system**" may be typed as "**set sys**". This applies for all the keyword commands.

You may specify which item you want to program or interrogate for certain input, output and phone parameters. To do this, type set or show followed by the keyword and the number of the input, output or phone. For example, to show the programming for phone number 3, type:

```
ISACC>show phone 3

DIALOUT PHONE NUMBER, DIALING MODE, AND LABEL NAME
PH03, Num =
Dialing mode = (Voice      ) >   Name = "Phone #3       "
```

SYSTEM

This keyword allows you access to the global system parameters, including:

Unit identification - You may assign a name to the ISACC unit for identification. The name may be up to 31 numbers or characters long.

Phone number of unit - The ISACC unit may be reached at this number. This number is used in voice mode identification. The phone number may be up to 31 digits long and can be typed plain, using hyphens and parentheses. Example:

```
Phone number of unit = >16105551234
Phone number of unit = >1-610-555-1234
Phone number of unit = >1(610)555-1234
```

Data password - The data password can be any combination of numbers or letters up to 30 characters long. The password is **case sensitive**. You MUST enter the password exactly as it was originally programmed, with capitals, small letters, punctuation, etc. If the password is forgotten, the only way to access ISACC is to turn the unit off and remove the lithium battery. **All programming will be deleted** and reset back to the default settings.

Network node number - Up to 16 ISACC units may be networked together in series via the RS485 port. The network node number identifies the ISACC unit in the network. This number may be from 0 to 15, the default is 1. If ISACC is not part of a network, its network node number should be set to 1.

Rings until answer - This parameter is the number of rings ISACC will wait before answering the phone line when the unit is being called. The rings may be programmed from 1 to 15, the default is 1.

Phone dialing - This parameter allows you to determine whether ISACC will dial out using pulse or tone dialing. The unit will prompt you to enter 0 for pulse or 1 for tone, the default is tone.

Time between calls - This parameter is the length of time that ISACC will wait between phone calls before dialing the next phone number on the list. The time between calls may be programmed from 5 seconds to 270 minutes, the default is 30 seconds.

Wait time between rounds - This parameter allows you to program the time ISACC will wait before it resumes calling from the top of the phone list after it finishes a round. The wait time may be programmed from 1 minute to 270 minutes, the default is 5 minutes..

Maximum number of calls - This parameter determines the maximum number of calls ISACC will make if the unit does not receive acknowledgment. The maximum number of calls may be programmed from 0 to 9999, the default is 16. If ISACC reaches the maximum number, it will self-acknowledge the alarm(s) and cease the dialout. **NOTE**: If you program the maximum number of calls to 0 (zero), ISACC WILL NOT DIAL OUT. If only one phone number is programmed ISACC will dialout a maximum of 15 times to report an alarm.

Voice alarm repetitions - This parameter allows you to program how many times ISACC will repeat the alarm message during an alarm dialout phone call before requesting acknowledgment. The number of repetitions of the alarm message may be from 1 to 255 for each phone call, the default is 3 repetitions.

> **NOTE:** If the voice alarm repetitions is programmed to 0 (zero), ISACC will not recite the alarm message.

Online time out - When you are online with ISACC locally or remotely, the unit looks for inactivity. This parameter allows you to set the amount of time, 1 - 255 minutes, that ISACC will wait during inactivity before it terminates the online session, the default is 4 minutes. If there is inactivity that meets this parameter, ISACC will disconnect and display the message TIME OUT on your screen.

Acknowledge on carrier - When ISACC dials out in data mode, the unit will wait to receive a carrier signal from a modem. This tells ISACC that a telephone connection has been made. The acknowledge on carrier parameter allows you to program ISACC to self-acknowledge an alarm when it receives the carrier signal. To acknowledge on carrier, type Y for yes. If you do not want ISACC to acknowledge on carrier, type N for no. The default is Yes.

When used with the SHOW command, the SYSTEM keyword also displays the following information in addition to the current values of the above parameters:

Alarm acknowledgment status - This parameter tells you if any alarms exist and, if so, whether they have been acknowledged or not. To see which inputs are in alarm, type SHOW ALARMS.

C program run status - This parameter will indicate if there is a C program running or not.

Data log status - This line will indicate if the data logger is currently running.

Current temperature - ISACC has a temperature sensor on its circuit board. This parameter will display the current board temperature, not air temperature, in degrees Fahrenheit and degrees Celsius.

Battery level - This parameter displays the present voltage of the backup battery, rounded to the nearest whole number.

AC power status - This parameter displays the status of the AC power. NOTE: You may use power outage as a system alarm by controlling it through a C program. See Chapter 8.

To display the current system information and global parameter values, type **show system** at an ISACC prompt:

```
ISACC>show system

SYSTEM INFORMATION

No unacknowledged alarms exist
C program not running
Data logger not running
The temperature is 78 Deg F, 25 Deg C
Battery level is 21 V
AC power is OFF

Unit identification = Snow
Phone number of unit = 555-4592
Data password = 23B79Q4
Network node = 1
Rings until answer = 3
Phone dialing (0=pulse, 1=tone) = 1
Time between calls = 0 Min 30 Sec
Wait time between rounds = 5 Min
Maximum number of calls = 3
```

```
Voice alarm repetitions = 4
On line time out (minutes) = 4
Acknowledge on carrier = YES
```

To change the global parameters, type **set system** after an ISACC prompt. Enter new information after the prompt (>). Press ENTER to go to the next parameter:

```
ISACC>set system

SYSTEM INFORMATION

Unit identification = Snow >Sun
Phone number of unit = 555-4592 >555-5674
Data password = 23B79Q4 >123999
Network node = 1 >
Rings until answer = 3 >5
Phone dialing (0=pulse, 1=tone) = 1 >
Time between calls = 0 Min 30 Sec, New minutes > New seconds >
Wait time between rounds = 5 Min >3
Maximum number of calls = 3 >
Voice alarm repetitions = 4 >
On line time out (minutes) = 4 >
Acknowledge on carrier = YES (Y or N) >N
```

CLOCK

ISACC has a battery-backed real time clock that stores the time and date. This is a separate battery, not the 18V battery. This KEYWORD will provide the current time and date and the allow you to enter new settings.

To display the current time and date, type **show clock** after an ISACC prompt:

```
ISACC>show clock

The time is 08:47:27 AM
The date is 12/15/93
```

To change the time and/or date, type **set clock** after an ISACC prompt. Enter the new information after the prompt (>). Time must be entered in 24 hour format, i.e. 0 = midnight. Press ENTER to go to the next parameter:

```
ISACC>set clock

The time is 08:48:37 AM
The date is 12/15/93

Enter new time (hh:mm) >22:00
Enter new date (mm/dd/yy) >12/17/93
```

INPUTS

ISACC has 16 universal inputs. The command SHOW INPUTS will display all 16 inputs with their names, values, status and limits. The command prefix SET is not valid with this keyword. Refer to ITYPE, LIMITS, and RESET to change this information.

To display the current input names, values, and status, type **show inputs** after an ISACC prompt:

```
ISACC>show inputs

INPUT  NAME                  VALUE      STATUS  LOW LIMIT  HIGH LIMIT  MIN   MAX
IN01 = "Input #1        " =  Open        OK
IN02 = "Input #2        " =  Open        OK
IN03 = "Input #3        " =  Open        OK
IN04 = "Input #4        " =  Open        OK
IN05 = "Input #5        " =  Open        OK
IN06 = "Input #6        " =  Open        OK
IN07 = "Input #7        " =  Open        OK
IN08 = "Input #8        " =  Open        OK
IN09 = "Input #9        " =  Open        OK
IN10 = "Input #10       " =  Open        OK
IN11 = "Input #11       " =  Open        OK
IN12 = "Input #12       " =  Open        OK
IN13 = "Input #13       " =  Open        OK
IN14 = "Input #14       " =  Open        OK
IN15 = "Input #15       " =  Open        OK
IN16 = "Input #16       " =  Open        OK
```

ITYPE

This command allows you to program the input type for each of the 16 inputs and assign a descriptive name. NOTE: The input type programmed must correspond with the shunt configuration on the ISACC circuit board. See Chapter 4: Inputs. The input types are:

```
00=Digital:  Normally Closed  07=Analog:  10K F
01=Digital:  Normally Open    08=Analog:  10K C
02=Digital:  Pulse Count      09=Analog:  Table 1
03=Analog:  4-20mA            10=Analog:  Table 2
04=Analog:  0-5 Volts         11=Analog:  Table 3
05=Analog:  2.8K F            12=Analog:  Table 4
06=Analog:  2.8K C            13=User Defined
```

Input type 13 - User defined. The value for an input defined as type 13 is not received from a physical input but is generated from a C program. See SET_INPUT, Chapter 8.

To display the current input type and name, type **show itype** after an ISACC prompt. You may also display a specific itype by typing **show itype** followed by the number of the input.

```
ISACC>show itype

INPUT TYPE
IN01 is now Digital: N.O.     Name = "Input #1    "
IN02 is now Digital: N.O.     Name = "Input #2    "
IN03 is now Digital: N.O.     Name = "Input #3    "
IN04 is now Digital: N.O.     Name = "Input #4    "
IN05 is now Digital: N.O.     Name = "Input #5    "
IN06 is now Digital: N.O.     Name = "Input #6    "
IN07 is now Digital: N.O.     Name = "Input #7    "
IN08 is now Digital: N.O.     Name = "Input #8    "
IN09 is now Digital: N.O.     Name = "Input #9    "
IN10 is now Digital: N.O.     Name = "Input #10   "
IN11 is now Digital: N.O.     Name = "Input #11   "
IN12 is now Digital: N.O.     Name = "Input #12   "
IN13 is now Digital: N.O.     Name = "Input #13   "
```

```
IN14 is now Digital: N.O.     Name = "Input #14   "
IN15 is now Digital: N.O.     Name = "Input #15   "
IN16 is now Digital: N.O.     Name = "Input #16   "
```

To configure the input type and assign a descriptive name, type **set itype** after an ISACC prompt. Enter the type number to change the input type and press ENTER to get to the name parameter. Enter an input name. The name may be up to 16 characters. Press ENTER to go to the next input. You may program a specific itype by typing **set itype** followed by the input number.

```
ISACC>set itype

INPUT TYPE
00 = Digital: N.C.  01 = Digital: N.O.  02 = Digital: P.C.
03 = Analog: 4-20mA 04 = Analog: 0-5 Volts     05 = Analog: 2.8K F
06 = Analog: 2.8K C 07 = Analog: 10K F  08 = Analog: 10K C
09 = Analog: Table 1       10 = Analog: Table 2       11 = Analog: Table 3
12 = Analog: Table 4       13 = User Defined
IN01 is now Digital: N.O.  >00    Name = "Input #1    " >LOW WELL FLOAT
IN02 is now Digital: N.O.  >      Name = "Input #2    " >HI SUMP FLOAT
IN03 is now Digital: N.O.  >      Name = "Input #3    " >
IN04 is now Digital: N.O.  >09    Name = "Input #4    " >FLOW RATE(GPM)
IN05 is now Digital: N.O.  >10    Name = "Input #5    " >WELL LEVEL(FT)
IN06 is now Digital: N.O.  >      Name = "Input #6    " >RESET
IN07 is now Digital: N.O.  >      Name = "Input #7    " >
IN08 is now Digital: N.O.  >09    Name = "Input #8    " >VOLTAGE
IN09 is now Digital: N.O.  >      Name = "Input #9    " >
IN10 is now Digital: N.O.  >      Name = "Input #10   " >
IN11 is now Digital: N.O.  >      Name = "Input #11   " >
IN12 is now Digital: N.O.  >      Name = "Input #12   " >
IN13 is now Digital: N.O.  >      Name = "Input #13   " >
IN14 is now Digital: N.O.  >      Name = "Input #14   " >
IN15 is now Digital: N.O.  >      Name = "Input #15   " >
IN16 is now Digital: N.O.  >      Name = "Input #16   " >
```

NOTE: The unit will not speak the input name when in voice mode.

TABLE

ISACC allows you to create up to four custom linear analog tables to be used with 4-20mA or 0-5V analog sensors. This allows you to translate a 4-20mA or 0-5V signal into a more meaningful number. For example, if your transducer is calibrated for 0-10' of water depth, an ITYPE of #3 (4-20mA) will express the water level as a percentage. However, using a table with a low of 0 and a high of 10, the water level will be expressed in feet. When you type SET TABLE, ISACC prompts you to enter the high and low values that ISACC will use to calculate the table. NOTE: To use a table, the input type must be programmed as Analog Table 1, 2, 3, or 4.

To display the current input table configuration and range, type **show table** after an ISACC prompt. You may also display a specific table by typing show table followed by the table number.

```
ISACC>show table

LOOK UP TABLE

0 = 0-5 Volt input
1 = 4-20mA input

Table #1 low number  =  0000
Table #1 high number =  1023  input =  0-5 V

Table #2 low number  =  0000
Table #2 high number =  1023  input =  0-5 V

Table #3 low number  =  0000
Table #3 high number =  1023  input =  0-5 V

Table #4 low number  =  0000
Table #4 high number =  1023  input =  0-5 V
```

To configure the tables and set high and low values, type **set table** after an ISACC prompt. Enter a value and press ENTER to go to the next parameter. You may also program a specific table by typing set table followed by the table number.

```
ISACC>set table

LOOK UP TABLE

0 = 0-5 Volt input
1 = 4-20mA input

Table #1 low number  =  0000 >
Table #1 high number =  1023 >0800   input =  0-5 V      >

Table #2 low number  =  0000 >
Table #2 high number =  1023 >2300   input =  0-5 V      >1

Table #3 low number  =  0000 >
Table #3 high number =  1023 >       input =  0-5 V      >

Table #4 low number  =  0000 >
Table #4 high number =  1023 >0768   input =  0-5 V      >
```

LIMITS

ISACC allows you to set high and low limits for inputs defined as 4-20mA analog, 0-5V analog, pulse count, temperature, table, or user defined. The limits are used to determine when an input is in alarm. The command SET LIMITS prompts you to enter these values. NOTE: An input defined as N.O. or N.C. does not have a high or low limit. ISACC will display N/A for that input. An input defined as pulse count can only have a high limit.

To display the current programmed limits, type **show limits** after an ISACC prompt. You may display a specific limit by typing **show limits** followed by the input number.

```
ISACC>show limits

HIGH AND LOW ANALOG LIMITS
IN01 = "LOW WELL FLOAT  " =   N/A
IN02 = "HI SUMP FLOAT   " =   N/A
IN03 = "Input #3        " =   N/A
IN04 = "FLOW RATE (GPM) " =   LOW = -9999   HIGH =  9999
IN05 = "WELL LEVEL (FT) " =   LOW = -9999   HIGH =  9999
IN06 = "RESET           " =   N/A
IN07 = "Input #7        " =   N/A
IN08 = "VOLTAGE         " =   LOW = -9999   HIGH =  9999
IN09 = "Input #9        " =   N/A
IN10 = "Input #10       " =   N/A
IN11 = "Input #11       " =   N/A
IN12 = "Input #12       " =   N/A
IN13 = "Input #13       " =   N/A
IN14 = "Input #14       " =   N/A
IN15 = "Input #15       " =   N/A
IN16 = "Input #16       " =   N/A
```

To program the low and high limits for analog or pulse count inputs, type **set limits** after an ISACC prompt. Type a value and press ENTER to go to the next parameter. You may program a specific limit by typing **set limits** followed by the input number.

```
ISACC>set limits

HIGH AND LOW ANALOG LIMITS
IN01 = "LOW WELL FLOAT  " =   N/A
IN02 = "HI SUMP FLOAT   " =   N/A
IN03 = "Input #3        " =   N/A
IN04 = "FLOW RATE (GPM) " =   LOW = -9999 >0001  HIGH =  9999 >0025
IN05 = "WELL LEVEL (FT) " =   LOW = -9999 >0010  HIGH =  9999 >0150
IN06 = "RESET           " =   N/A
IN07 = "Input #7        " =   N/A
IN08 = "VOLTAGE         " =   LOW = -9999 >0000  HIGH =  9999 >0110
IN09 = "Input #9        " =   N/A
IN10 = "Input #10       " =   N/A
IN11 = "Input #11       " =   N/A
IN12 = "Input #12       " =   N/A
IN13 = "Input #13       " =   N/A
IN14 = "Input #14       " =   N/A
IN15 = "Input #15       " =   N/A
IN16 = "Input #16       " =   N/A
```

RECOGNITION

The recognition time is the length of time that an alarm condition must exist continuously before ISACC will consider it a valid alarm and initiate a response. This keyword allows you to program the recognition time for each input.

To display the currently programmed recognition times, type **show recognition** after an ISACC prompt. You may also display the recognition time for a specific input by typing **show recognition** followed by the input number.

```
ISACC>show recognition

INPUT RECOGNITION TIME
IN01 = "LOW WELL FLOAT  " = 000 Min 003 Sec
IN02 = "HI SUMP FLOAT   " = 000 Min 003 Sec
IN03 = "Input #3        " = 000 Min 003 Sec
IN04 = "FLOW RATE (GPM) " = 000 Min 003 Sec
IN05 = "WELL LEVEL (FT) " = 000 Min 003 Sec
IN06 = "RESET           " = 000 Min 003 Sec
IN07 = "Input #7        " = 000 Min 003 Sec
IN08 = "VOLTAGE         " = 000 Min 003 Sec
IN09 = "Input #9        " = 000 Min 003 Sec
IN10 = "Input #10       " = 000 Min 003 Sec
IN11 = "Input #11       " = 000 Min 003 Sec
IN12 = "Input #12       " = 000 Min 003 Sec
IN13 = "Input #13       " = 000 Min 003 Sec
IN14 = "Input #14       " = 000 Min 003 Sec
IN15 = "Input #15       " = 000 Min 003 Sec
IN16 = "Input #16       " = 000 Min 003 Sec
```

To program the recognition times, type **set recognition** after an ISACC prompt. Enter a new value for the minutes and press ENTER. Enter a new value for the seconds and press ENTER to go to the next parameter. You may also program the recognition time of a specific input by typing **set recognition** followed by the input number.

```
ISACC>set recognition

INPUT RECOGNITION TIME
IN01 = "LOW WELL FLOAT  " = 000 Min 003 Sec  New minutes >   New seconds >001
IN02 = "HI SUMP FLOAT   " = 000 Min 003 Sec  New minutes >   New seconds >001
IN03 = "Input #3        " = 000 Min 003 Sec  New minutes >  New seconds >001
IN04 = "FLOW RATE (GPM) " = 000 Min 003 Sec  New minutes >001  New seconds >030
IN05 = "WELL LEVEL (FT) " = 000 Min 003 Sec  New minutes >005  New seconds >000
IN06 = "RESET           " = 000 Min 003 Sec  New minutes >   New seconds >
IN07 = "Input #7        " = 000 Min 003 Sec  New minutes >010  New seconds >000
IN08 = "VOLTAGE         " = 000 Min 003 Sec  New minutes >001  New seconds >030
IN09 = "Input #9        " = 000 Min 003 Sec  New minutes >  New seconds >
IN10 = "Input #10       " = 000 Min 003 Sec  New minutes >  New seconds >
IN11 = "Input #11       " = 000 Min 003 Sec  New minutes >  New seconds >
IN12 = "Input #12       " = 000 Min 003 Sec  New minutes >  New seconds >
IN13 = "Input #13       " = 000 Min 003 Sec  New minutes >  New seconds >
IN14 = "Input #14       " = 000 Min 003 Sec  New minutes >  New seconds >
IN15 = "Input #15       " = 000 Min 003 Sec  New minutes >  New seconds >
IN16 = "Input #16       " = 000 Min 003 Sec  New minutes >  New seconds >
```

ALARMS

The keyword command SHOW ALARMS will display the present status of the inputs in alarm, if any alarms exist. The prefix SET is not valid with this keyword.

To display the current input alarm status, type **show alarms** at an ISACC prompt:

```
ISACC>show alarms
DIALOUT ALARM STATUS
No alarms
```

DIALOUT

This command allows you to enable or disable an input's ability to cause a dialout during an alarm on that input. If the input is enabled, an alarm on that input will initiate a dialout. If the input is disabled, ISACC will not dialout if an alarm occurs on that input.

To display the input dialout programming, type **show dialout** after an ISACC prompt. You may also display the dialout programming for a specific input by typing show dialout followed by the input number.

```
ISACC>show dialout

DIALOUT ENABLING
IN01 = "LOW WELL FLOAT  " = Yes
IN02 = "HI SUMP FLOAT   " = Yes
IN03 = "Input #3        " = Yes
IN04 = "FLOW RATE (GPM) " = Yes
IN05 = "WELL LEVEL (FT) " = Yes
IN06 = "RESET           " = Yes
IN07 = "Input #7        " = Yes
IN08 = "VOLTAGE         " = Yes
IN09 = "Input #9        " = Yes
IN10 = "Input #10       " = Yes
IN11 = "Input #11       " = Yes
IN12 = "Input #12       " = Yes
IN13 = "Input #13       " = Yes
IN14 = "Input #14       " = Yes
IN15 = "Input #15       " = Yes
IN16 = "Input #16       " = Yes
```

To program the dialout for an input, type **set dialout** after ISACC prompt. To enable the input for dialout, type Y after prompt. To disable the input for dialout, type N at the prompt. You may also program the dialout for a specific input by typing set dialout followed by the input number.

```
ISACC>set dialout

DIALOUT ENABLING
IN01 = "LOW WELL FLOAT  " = Yes  (Y or N) >
IN02 = "HI SUMP FLOAT   " = Yes  (Y or N) >
IN03 = "Input #3        " = Yes  (Y or N) >N
IN04 = "FLOW RATE (GPM) " = Yes  (Y or N) >
IN05 = "WELL LEVEL (FT) " = Yes  (Y or N) >
IN06 = "RESET           " = Yes  (Y or N) >
IN07 = "Input #7        " = Yes  (Y or N) >N
IN08 = "VOLTAGE         " = Yes  (Y or N) >
IN09 = "Input #9        " = Yes  (Y or N) >N
```

```
IN10 = "Input #10       " = Yes  (Y or N) >N
IN11 = "Input #11       " = Yes  (Y or N) >
IN12 = "Input #12       " = Yes  (Y or N) >N
IN13 = "Input #13       " = Yes  (Y or N) >
IN14 = "Input #14       " = Yes  (Y or N) >
IN15 = "Input #15       " = Yes  (Y or N) >
IN16 = "Input #16       " = Yes  (Y or N) >
```

OUTPUTS

ISACC has 8 digital outputs, 1 on-board relay, 1 on-board buzzer, 4 analog outputs. The outputs can be controlled manually, or can be controlled automatically by a C program. This keyword command allows you to manually turn the output on or off, or to set the output to be automatically controlled by C program. For the analog outputs, you may enter a value from 0 to 255 to manually set the output level, or set the output to be controlled automatically by C program.

To display the output name, configuration and status, type **show outputs** after an ISACC prompt. You may also display the information for a specific output by typing **show outputs** followed by the output number.

```
ISACC>show outputs
OUTPUTS
OUT01 = "WATER PUMP RELAY" = MAN,  OFF
OUT02 = "LOW WELL LIGHT  " = MAN,  OFF
OUT03 = "HI SUMP LIGHT   " = MAN,  OFF
OUT04 = "Output #4       " = MAN,  OFF
OUT05 = "Output #5       " = MAN,  OFF
OUT06 = "Output #6       " = MAN,  OFF
OUT07 = "Output #7       " = MAN,  OFF
OUT08 = "Output #8       " = MAN,  OFF
OUT09 = "On board buzzer " = MAN,  OFF
OUT10 = "On board relay  " = MAN,  OFF
OUT11 = "CONTROL VALVE   " = MAN,  000
OUT12 = "Analog output #2" = MAN,  000
OUT13 = "Analog output #3" = MAN,  000
OUT14 = "Analog output #4" = MAN,  000
```

To program or switch the outputs, type **set outputs** after an ISACC prompt. Enter a value and press ENTER to go to the next parameter. You may also program or switch a specific output by typing **set outputs** followed by the output number.

```
ISACC>set outputs
OUTPUTS
0 = OFF, 1 = ON, A = AUTO
OUT01 = "WATER PUMP RELAY" = MAN,  OFF >A
OUT02 = "LOW WELL LIGHT  " = MAN,  OFF >A
OUT03 = "HI SUMP LIGHT   " = MAN,  OFF >A
OUT04 = "Output #4       " = MAN,  OFF >1
OUT05 = "Output #5       " = MAN,  OFF >
OUT06 = "Output #6       " = MAN,  OFF >1
OUT07 = "Output #7       " = MAN,  OFF >
OUT08 = "Output #8       " = MAN,  OFF >
OUT09 = "On board buzzer " = MAN,  OFF >
OUT10 = "On board relay  " = MAN,  OFF >
OUT11 = "CONTROL VALVE   " = MAN,  000 >
```

```
OUT12 = "Analog output #2" = MAN,  000 >
OUT13 = "Analog output #3" = MAN,  000 >
OUT14 = "Analog output #4" = MAN,  000 >
```

ONAME

This keyword command allows you to assign a descriptive name to an output.

To display the label name for each output, type the command **show oname** at an ISACC prompt. You may also display a specific output name by typing **show oname** followed by the output number.

```
ISACC>show oname

OUTPUT LABEL NAMES

OUT01 = "Output #1       "
OUT02 = "Output #2       "
OUT03 = "Output #3       "
OUT04 = "Output #4       "
OUT05 = "Output #5       "
OUT06 = "Output #6       "
OUT07 = "Output #7       "
OUT08 = "Output #8       "
OUT09 = "On board buzzer "
OUT10 = "On board relay  "
OUT11 = "Analog output #1"
OUT12 = "Analog output #2"
OUT13 = "Analog output #3"
OUT14 = "Analog output #4"
```

To assign a descriptive name to an output, type set output after an ISACC prompt. Press ENTER to go to the next parameter. You may also program a specific output name by typing **set oname** followed by the output number.

```
ISACC>set oname

OUTPUT LABEL NAMES

OUT01 = "Output #1       " >WATER PUMP RELAY
OUT02 = "Output #2       " >LOW WELL LIGHT
OUT03 = "Output #3       " >HI SUMP LIGHT
OUT04 = "Output #4       " >
OUT05 = "Output #5       " >
OUT06 = "Output #6       " >
OUT07 = "Output #7       " >
OUT08 = "Output #8       " >
OUT09 = "On board buzzer " >
OUT10 = "On board relay  " >
OUT11 = "Analog output #1" >CONTROL VALVE
OUT12 = "Analog output #2" >
OUT13 = "Analog output #3" >
OUT14 = "Analog output #4" >
```

PHONE

ISACC is capable of dialing to up to 8 phone numbers, 32 digits each, during an alarm. ISACC can dial to a modem, to a standard touch-tone or pulse telephone (VOICE mode), to a beeper, or through an external modem. The command SET PHONE prompts you to program the phone number, the dialing mode (modem, voice, beeper, external modem), and a descriptive label name, a maximum of 16 characters, for each phone number.

DIALING MODES: ISACC is capable of dialing out to a 300 bps modem, 1200 bps modem, to a pulse or touch-tone telephone, to a beeper, or through an external modem. The dialing modes tell ISACC whether it will be dialing to or through a modem (and its speed), to a pulse telephone, or to a tone telephone. The dialing modes are:

Dialing mode 0 - dial out in data mode through the internal modem at 300bps

Dialing mode 1 - dial out in data mode through the internal modem at 1200bps

Dialing mode 3 - dial out in voice mode and give message in digitized voice

Dialing mode 4 - dial out to a beeper, leaves no voice message

Dialing mode 5 - dial out through an external modem. See Chapter 9.

To display the current phone number, dialing mode and label names, type **show phone** after an ISACC prompt. You may also display information for a specific phone number by typing **show phone** followed by the entry number, (01-08).

```
ISACC>show phone

DIALOUT PHONE NUMBER, DIALING MODE, AND LABEL NAME
PH01, Num =
Dialing mode = (Voice          ) >   Name = "Phone #1        "
PH02, Num =
Dialing mode = (Voice          ) >   Name = "Phone #2        "
PH03, Num =
Dialing mode = (Voice          ) >   Name = "Phone #3        "
PH04, Num =
Dialing mode = (Voice          ) >   Name = "Phone #4        "
PH05, Num =
Dialing mode = (Voice          ) >   Name = "Phone #5        "
PH06, Num =
Dialing mode = (Voice          ) >   Name = "Phone #6        "
PH07, Num =
Dialing mode = (Voice          ) >   Name = "Phone #7        "
PH08, Num =
Dialing mode = (Voice          ) >   Name = "Phone #8        "
```

To program the phone numbers, dialing modes and assign label names, type **set phone** after an ISACC prompt. Enter values at the prompt and press ENTER to go to the next parameter. You may also program information for a specific phone number by typing **set phone** followed by the entry number, (01-08).

```
ISACC>set phone
DIALOUT PHONE NUMBER, DIALING MODE, AND LABEL NAME
Dialing codes:
  P = 2 second pause,  W = wait for dial tone,  B = wait for beeper tone,
  A = wait for beeper service to answer,  I = send input numbers in alarm
    Dialing modes
    0 for 300 bps data
    1 for 1200 bps data
```

```
3 for Voice
4 for Beeper
5 for External Modem

PH01, Num =               >14078546142b123456789**I
Dialing mode = (Voice     ) >4    Name = "Phone #1       " >Engineer Beeper
PH02, Num =               >16105551290
Dialing mode = (Voice     ) >     Name = "Phone #2       " >DIF phone
PH03, Num =               >12035554044
Dialing mode = (Voice     ) >     Name = "Phone #3       " >Office
PH04, Num =               >12155559854
Dialing mode = (Voice     ) >1    Name = "Phone #4       " >Manager
PH05, Num =               >5554538
Dialing mode = (Voice     ) >1    Name = "Phone #5       " >M. Weaver
PH06, Num =                                >5559605
Dialing mode = (Voice     ) >1    Name = "Phone #6       " >J. Hogan
PH07, Num =                                >17175556886
Dialing mode = (Voice     ) >1    Name = "Phone #7       " >A. Daniels
PH08, Num =                                >16035556453
Dialing mode = (Voice   ) >0   Name = "Phone #8     " >M. Otto
```

DIALING CODES: Sometimes ISACC may need special instructions when dialing out on certain phone systems, long distance phone services, to access an outside phone line, or to beepers. The dialout codes give ISACC instructions on how to set the phone digits when dialing the phone number. Each code is counted as one digit toward the total of 32 digits. The dialout codes are:

P = two second pause
W = wait for dial tone
B = wait for beeper tone
A = wait for phone to be answered
I = send alarm input digits

P = two second pause: A two second pause can be placed anywhere within the phone number by typing the letter P (upper or lower case). The pause takes up one digit and may be used more than once.

W = wait for dial tone: This code instructs ISACC to wait until a dial tone is detected on the phone line before it continues dialing. This is needed when a second dial tone, such as for an outside line, is present. ISACC automatically waits for the first dial tone. If the second dial tone is not detected after 10 seconds, ISACC will dial automatically.

```
Example:  9 W 5555674
```

B = wait for beeper tone: This code instructs ISACC to wait for a tone from the beeper company before it sends the remaining digits.

```
Example: 16105552376 B 123456
```

A = wait for a phone to be answered: This code instructs ISACC to wait for the phone to stop ringing before it continues sending digits when dialing to a beeper. This allows you to essentially force call progress in the middle of the phone dialing when the beeper service does not produce a tone when ready.

```
Example:  16105554593 A 234567
```

I = send alarm input digits: This code is used only when dialing to a beeper. After the call is received by the beeper company, the code I instructs ISACC to send a two-digit number(s) indicating which input(s) is in alarm.

```
Example:  16025553487 B 1235679 I
```

POUND OR ASTERISK: When dialing to a beeper, a pound sign (#) or an asterisk (*) may be used within the phone number. When using pulse dialing, the # or * will instruct ISACC to switch to tones for the remaining digits.

```
Example:  1 # 6105554591 A P 986033 #
```

NOTE: When dialing to a beeper it is sometimes necessary to combine codes. Certain beeper systems vary and you must adjust accordingly. To test your beeper system, use an extension telephone on the same line as the ISACC unit and listen in during ISACC's dial out to confirm that your beeper service is reached without a problem. If you must add a pause, use the letter P to insert a two second pause wherever necessary. See your beeper service for specifics.

SELECTION

This keyword command allows you to program ISACC to dial only specific phone numbers depending on which input is in alarm.

To display the current dialing selection, type **show selection** after an ISACC prompt. You may also display the selection for a specific phone number by typing **show selection** followed by the entry number (01-08).

```
ISACC>show selection

DIALOUT ALARM SELECTION
            Input source    = 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16
PH01 =  "Engineer Beeper   " = 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
PH02 =  "DIF phone         " = 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
PH03 =  "Office            " = 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
PH04 =  "Manager           " = 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
PH05 =  "M.Weaver          " = 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
PH06 =  "J. Hogan          " = 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
PH07 =  "A. Daniels        " = 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
PH08 =  "M. Otto           " = 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

To change the dialing selection for each phone number, type **set selection** after an ISACC prompt. Enter 1 to enable or 0 (zero) to disable the alarm dialing for the corresponding phone number and input. Press the spacebar to advance to the next entry. Press ENTER to jump to the next phone number. You may also program the selection of a specific phone number by typing **set selection** followed by the entry number(01-08).

```
ISACC>set selection

DIALOUT ALARM SELECTION
            Input source    = 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16
PH01 =  "Engineer Beeper   " = 1  1  0  0  0  1  0  1  0  0  0  0  0  0  0  0

PH02 =  "DIF phone         " = 1  1  0  0  0  1  0  1  0  0  0  0  0  0  0  0

PH03 =  "Office            " = 1  1  0  0  0  1  0  1  0  0  0  0  0  0  0  0

PH04 =  "Manager           " = 0  0  1  1  1  0  1  0  1  1  1  1  1  1  1  1

PH05 =  "M. Weaver         " = 0  0  1  1  1  0  1  0  1  1  1  1  1  1  1  1

PH06 =  "J. Hogan          " = 0  0  1  1  1  0  1  0  1  1  1  1  1  1  1  1

PH07 =  "A. Daniels        " = 0  0  1  1  1  0  1  0  1  1  1  1  1  1  1  1

PH08 =  "M. Otto           " = 0  0  1  1  1  0  1  0  1  1  1  1  1  1  1  1
```

VOICE

This keyword command allows you to select the input and output status information to be recited when you call into the unit for a status report using a standard telephone.

To display the information to be recited during a voice status report, type **show voice** after an ISACC prompt:

```
ISACC>show voice

VOICE STATUS SELECTION
IN01 = "LOW WELL FLOAT  "     = Yes
IN02 = "HI SUMP FLOAT   "     = Yes
IN03 = "Input #3        "     = Yes
IN04 = "FLOW RATE (GPM) "     = Yes
IN05 = "WELL LEVEL (FT) "     = Yes
IN06 = "RESET           "     = Yes
IN07 = "Input #7        "     = Yes
IN08 = "VOLTAGE         "     = Yes
IN09 = "Input #9        "     = Yes
IN10 = "Input #10       "     = Yes
IN11 = "Input #11       "     = Yes
IN12 = "Input #12       "     = Yes
IN13 = "Input #13       "     = Yes
IN14 = "Input #14       "     = Yes
IN15 = "Input #15       "     = Yes
IN16 = "Input #16       "     = Yes
OUT01 = "WATER PUMP RELAY"    = Yes
OUT02 = "LOW WELL LIGHT  "    = Yes
OUT03 = "HI SUMP LIGHT   "    = Yes
OUT04 = "Output #4       "    = Yes
OUT05 = "Output #5       "    = Yes
OUT06 = "Output #6       "    = Yes
OUT07 = "Output #7       "    = Yes
OUT08 = "Output #8       "    = Yes
OUT09 = "On board buzzer "    = Yes
OUT10 = "On board relay  "    = Yes
OUT11 = "CONTROL VALVE   "    = Yes
OUT12 = "Analog output #2"    = Yes
OUT13 = "Analog output #3"    = Yes
OUT14 = "Analog output #4"    = Yes
```

To program the information to be provided in the voice status report, type **set voice** after an ISACC prompt. At the prompt, enter Y to include the information, or N to exclude. Press ENTER to go to the next parameter:

```
ISACC>set voice

VOICE STATUS SELECTION
IN01 = "LOW WELL FLOAT  " = Yes  (Y or N) >
IN02 = "HI SUMP FLOAT   " = Yes  (Y or N) >
IN03 = "Input #3        " = Yes  (Y or N) >
IN04 = "FLOW RATE (GPM) " = Yes  (Y or N) >
IN05 = "WELL LEVEL (FT) " = Yes  (Y or N) >
IN06 = "RESET           " = Yes  (Y or N) >
IN07 = "Input #7        " = Yes  (Y or N) >N
IN08 = "VOLTAGE         " = Yes  (Y or N) >
IN09 = "Input #9        " = Yes  (Y or N) >N
IN10 = "Input #10       "     = Yes  (Y or N) >N
IN11 = "Input #11       "     = Yes  (Y or N) >N
```

```
IN12 = "Input #12       "     = Yes  (Y or N) >N
IN13 = "Input #13       "     = Yes  (Y or N) >N
IN14 = "Input #14       "     = Yes  (Y or N) >N
IN15 = "Input #15       "     = Yes  (Y or N) >N
IN16 = "Input #16       "     = Yes  (Y or N) >N
OUT01 = "WATER PUMP RELAY"    = Yes  (Y or N) >
OUT02 = "LOW WELL LIGHT  "    = Yes  (Y or N) >
OUT03 = "HI SUMP LIGHT   "    = Yes  (Y or N) >
OUT04 = "Output #4       "    = Yes  (Y or N) >N
OUT05 = "Output #5       "    = Yes  (Y or N) >N
OUT06 = "Output #6       "    = Yes  (Y or N) >N
OUT07 = "Output #7       "    = Yes  (Y or N) >N
OUT08 = "Output #8       "    = Yes  (Y or N) >N
OUT09 = "On board buzzer "    = Yes  (Y or N) >
OUT10 = "On board relay  "    = Yes  (Y or N) >N
OUT11 = "CONTROL VALVE   "    = Yes  (Y or N) >
OUT12 = "Analog output #2"    = Yes  (Y or N) >N
OUT13 = "Analog output #3"    = Yes  (Y or N) >N
OUT14 = "Analog output #4"    = Yes  (Y or N) >N
```

LOGGING

ISACC's data logging feature gives you the ability to log and store up to 512 records. Each record contains the present value of all 16 inputs with a time stamp. The keyword command SET LOGGING prompts you to determine the time between logs, whether to enable or disable the data logger, and whether to reset the data logger. This command also informs you of how many records have been used and how many are available.

To display the current log programming and data log status, type **show logging** after an ISACC prompt:

```
ISACC>show logging

DATA LOGGING
Time between logs = 0 Hrs 0 Min 00 Sec
Enable data logger = NO
0 records used
512 records available
```

To program and enable the data logger, type **set logging** after an ISACC prompt. Enter values after the prompt (>) and press ENTER to go to the next parameter:

```
ISACC>set logging

DATA LOGGING
Time between logs = 0 Hrs 0 Min 00 Sec, New hrs >1 New min >30 New sec >45
Enable data logger = YES (Y or N) >Y
Reset data logger (Y or N) >Y
0 records used
512 records available
```

NETWORK

ISACC can communicate with other ISACC units without telephone lines through a network. After the network is set up, you must tell each ISACC unit the information it will have access to from another unit. See Chapter 3, for information on setting up the network. This predetermined information exchange is called an Information Network Request. The keyword command SET NETWORK allows you to program an Information Network Request.

Each ISACC unit can make a total of 60 requests for input/output information. However, all units cannot request information at the same time. Therefore, the Master unit controls all information exchange. An ISACC unit is identified as the Master by programming its network node number as 0 (zero). See keyword SYSTEM. Note: Each piece of information takes one second to transfer to another unit. The more requests you have programmed, the longer it will take for each round through the units.

To program an information request, type **set network** after an ISACC prompt. Press ENTER to go to the next parameter:

```
ISACC>set network

NETWORK REQUESTS
Request #01: Node >1, Input or Output (I/O) >i, I/O number >4
Request #02: Node >1, Input or Output (I/O) >o, I/O number >3
Request #03: Node >2, Input or Output (I/O) >i, I/O number >14
Request #04: Node >
```

To display the network request values, type **show network** after an ISACC prompt:

```
ISACC>show network

NETWORK REQUESTS
Request #01: Node = 01, Input  #04 =  0018
Request #02: Node = 01, Output #03 =  0001
Request #03: Node = 02, Input  #14 =  0001
```

VARIABLES

ISACC allows you control over the information calculated in your C program. With the keyword command SET VARIABLES, you can set or alter the present value of any variable in your program.

To display values of variables in your C program, type **show variables** after an ISACC prompt:

```
ISACC>show variables
PROGRAM VARIABLES
rset              =  00000
gal1ta            =  00000
gal1tb            =  00000
rate              =  00000
temp              =  00000
in                =  00000
```

To change the values of your C program variables, type **set variables** after an ISACC prompt. Press ENTER to go to the next parameter:

```
ISACC>set variables
PROGRAM VARIABLES
rset              =  00000 >00001
gal1ta            =  00000 >00008
gal1tb            =  00000 >00990
rate              =  00000 >00001
temp              =  00000 >00038
in                =  00000 >00794
```

STAND ALONE COMMANDS

The STAND ALONE commands are used without the command prefix SET or SHOW to execute an action. The STAND ALONE commands are:

RESET	EXIT
CLEAR	DATA
PATCH	123
HELP	DIAG

The format for using a STAND ALONE command is the following:

```
ISACC>(COMMAND)
```

RESET

ISACC keeps track of all the highest and lowest events for each analog input. These are labelled MIN and MAX values. The RESET command allows you to reset the MIN and MAX values for all the analog inputs, or for one specific input.

If an input is defined as a pulse counting input, then the RESET command will clear the pulse count to zero.

To reset all minimum and maximum values, type **reset** after an ISACC prompt. To reset a specific input's minimum and maximum values, type **reset** followed by the input number.

```
ISACC>reset
Minimum/maximum and pulse count values reset
```

CLEAR

This command is used to stop a dialout in progress for all inputs, or for one specific input, by clearing the alarms.

To clear all alarms, type **clear** after an ISACC prompt. To clear a specific alarm, type **clear** followed by the input number.

```
ISACC>clear

CLEAR DIALOUT ALARMS
Input #01 cleared
Input #02 cleared
Input #03 cleared
Input #04 cleared
Input #05 cleared
Input #06 cleared
Input #07 cleared
Input #08 cleared
Input #09 cleared
Input #10 cleared
Input #11 cleared
Input #12 cleared
Input #13 cleared
Input #14 cleared
Input #15 cleared
Input #16 cleared
```

PATCH

This command enables you to communicate directly with an external device connected to the RS232 port when you call ISACC using a modem. This command also allows you to establish an online session with an ISACC unit not connected to your PC, but through the Master unit. This is called network patching.

To communicate with an external device connected to ISACC's RS232 port, type **patch** after an ISACC prompt:

```
ISACC>patch
```

To communicate with ISACC units in a network through the master, the patch command is followed by the node number. This can be used remotely or locally. The following example patches to the ISACC unit with node number 2:

```
ISACC>patch 2
```

Using the above example, you will receive the message "Connecting to network 2." Type the command SHOW SYSTEM. The system parameters of the network unit #2 will now be listed. You are online with that unit and may now program it. To return to the Master unit, type the command EXIT, press ENTER and then press CTRL Z. If you type the command SHOW SYSTEM, you should see the Master's system parameters.

HELP

The HELP command provides a list of all valid KEYWORDS and STAND ALONE commands.

To display the command list, type **help** after an ISACC prompt:

```
ISACC>help

COMMANDS        SET/SHOW KEYWORDS
--------        -----------------
SHOW              INPUTS*
SET               OUTPUTS
PATCH             CLOCK
HELP              SYSTEM
RESET             ITYPE
CLEAR             ONAME
LIST              LIMITS
INSERT            PHONE
DELETE            ALARMS*
ERASE             RECOGNITION
COMPILE           NETWORK
START             SELECTION
STOP              TABLE
RUN               VARIABLES
DATA              DIALOUT
123               LOGGING
DIAG              VOICE
EXIT
```

EXIT

This command "logs" you off from an online data programming or status inquiry session with ISACC. If you do not log off the unit cannot communicate until the online timeout expires. **It will block alarm dialout!**

To log off ISACC, type **exit** after an ISACC prompt.

```
ISACC>exit
```

DATA

This command displays input values from data log records for all or specified inputs. There are three parts to the DATA command. The first is the command itself. The second indicates how many of the 16 inputs you want to display records for. The third indicates how many records you want to display. (Note: If you request the records for all 16 inputs, the values may wrap to the next line, depending on the width of your text line.) The following example requests the last 10 records for inputs 1 through 9.

```
ISACC>data 9 16
12/17/93 10:02:24, 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
12/17/93 10:03:54, 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
12/17/93 10:05:24, 0001, 0001, 0001, 0798, 2300, 0001, 0001, 0794, 0001
12/17/93 10:06:54, 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
12/17/93 10:08:24, 0001, 0001, 0001, 0798, 2300, 0001, 0001, 0794, 0001
12/17/93 10:09:54, 0001, 0001, 0001, 0798, 2300, 0001, 0001, 0794, 0001
12/17/93 10:11:24, 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
12/17/93 10:12:54, 0001, 0001, 0001, 0798, 2300, 0001, 0001, 0794, 0001
12/17/93 10:14:24, 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
12/17/93 10:15:54, 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
```

123

This command displays input values for data log records for specified inputs so that they can be imported into a spreadsheet program like Quattro or Lotus. It is used the same as the DATA command. Refer to your communication software manual on how to capture the data to a disk and then import the information into your spreadsheet software. Using the above example, ISACC would display the following:

```
ISACC>123 9 10

"12/17/93","10:02:24", 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
"12/17/93","10:03:54", 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
"12/17/93","10:05:24", 0001, 0001, 0001, 0798, 2300, 0001, 0001, 0794, 0001
"12/17/93","10:06:54", 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
"12/17/93","10:08:24", 0001, 0001, 0001, 0798, 2300, 0001, 0001, 0794, 0001
"12/17/93","10:09:54", 0001, 0001, 0001, 0798, 2300, 0001, 0001, 0794, 0001
"12/17/93","10:11:24", 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
"12/17/93","10:12:54", 0001, 0001, 0001, 0798, 2300, 0001, 0001, 0794, 0001
"12/17/93","10:14:24", 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
"12/17/93","10:15:54", 0001, 0001, 0001, 0799, 2300, 0001, 0001, 0794, 0001
```

DIAG

This command runs a diagnostics test to verify system functioning and pinpoint errors.

To run the diagnostics test, type **diag** following an ISACC prompt.

```
ISACC>diag
Crystal = 14.7456Mhz
Board rev = C/D/E
Software version = 3.37
Max int stack = 151
Min ext stack = 24539
Max int time = 5734
Min int time = 4166
Avg int time = 4188
C run time = 0 mS
Start ups = 1

ROM test:PASS
Internal RAM test:PASS
External RAM test:PASS, PASS
Analog input test:PASS
Phone test:NO DIAL TONE

Reset ?

ISACC>
```

Crystal speed, board revision, and software revision - used for factory identification.

Max internal stack, min internal stack, max interrupt time, min interrupt time, and avg interrupt time - refer to memory usage and processing times. These are internal monitoring elements that are important for factory referral.

C execution time - indicates the duration time of the C program, if one is running.

Start ups - indicates the number of times the unit has been powered up or reset.

ROM test, internal RAM test, and external RAM test - these tests evaluate different sections of memory. Each are either PASS or FAIL

Analog input test - determines ISACC's ability to read analog information from the inputs. It is either PASS or FAIL.

Phone test - determines if there is a dial tone or not.

Reset? - (y/n) This is the remote equivalent of turning ISACC off then on again. There is no loss of programming information.

CHAPTER 8

C PROGRAMMING

Resident within ISACC is a C compiler . The purpose of putting a C compiler within ISACC is to offer remote programmability and flexibility. With a C program running, ISACC can perform logical input and output control and computation.

SPECIFICATIONS

The maximum size of your program can be 2K of compiled space, 8191 characters, or 500 lines, whichever comes first . You can define up to 127 variables, in addition to those built in, and the names of the variables can be up to 15 characters. A C program may be executed a maximum of once per second. It will continue to run until you halt it.

ABOUT THE C LANGUAGE

C is a structured programming language that is similar to other structured languages like Pascal (for those of you who are familiar with it). For those who aren't, do not be frightened off by the following list of structural elements. The most important part of C is the structure, not remembering all the names for its elements.

The **structure** of C is like asking a question or posing a problem, and then going through the simple steps of information gathering and action to solve the problem. For example, if your alarm clock is ringing and you want it to stop ringing, you must hit the OFF button to turn it off, otherwise nothing will happen. If you want ISACC to turn off the alarm clock, you must first tell the unit how to recognize that it is ringing, give it the command to turn it off when it recognizes that it is ringing, otherwise do nothing.

To give ISACC this information, you must translate English commands into C commands. ISACC's built-in compiler then translates the C commands into ISACC's language.

The C language structure is fairly simple. Each program must have a beginning and an end. Each individual statement within the program must open, provide its information, and then close. Think of it as writing sentences—without the proper sentence structure and punctuation, you will get syntax errors. The reader (ISACC) will then not be able to receive the message or understand what to do.

The ISACC C facility is comprised of the following elements:

STRUCTURE: To write a valid C program, regardless of length, you must follow its simple structural elements.

EDITING COMMANDS: These commands allow you to begin writing, edit, list, or delete a C program.

STAND ALONE COMMANDS: These are one word commands that are basic to the execution of a C program. These commands allow you to compile, test, start and stop a C program.

KEYWORDS: These are short words or symbols that define variables or execute specific actions within a C program. They include operators, assignment, comparators, and comments.

PREDEFINED VARIABLES: These are variables that have specific predefined values that are automatically updated and cannot be changed by the user.

FUNCTIONS: These are word commands that perform a predefined function within a C program.

ARRAYS: This is a more advanced programming type that significantly shortens and simplifies long programs.

ERROR HANDLING: When a program is compiled, it is scanned for language related errors. An error message including the type of error is displayed.

This chapter provides basic instruction in the C language and gives all the commands that are valid for use with ISACC. Sample programs are included. If you have questions or problems, please call for technical support at (610)558-2700.

STRUCTURE

Below are some examples that will help demonstrate the C language structure. Refer to following pages for explanation of the keywords, functions, and commands used within the sample programs.

1. All programs must begin with the main() function. It must be followed by an open brace { and closed with an end brace }.

This program is valid, but will do nothing.

```
main()
  {
  }
```

2. A statement is a line of programming code. All statements are placed inside the braces {} and end with a semicolon (;). For example:

```
main()
  {
  puts("Hello there\n");
  puts("I am ISACC.");
  }
```

This program will print the words "Hello there" and "I am ISACC." The \n following "Hello there" means start a new line. When this program is run, the screen would look like this:

```
Hello there
I am ISACC.
```

3. In the C language, numbers are stored in what are called variables. A variable must be defined before the main() function.

```
int x;
main()
  {
  x=12;
  }
```

In this program we defined a variable called "x" and set its value equal to 12. Here, x is defined as an integer. ISACC's C language can define variables as integers or characters. An integer can hold a value from -32768 to 32767, but a character can only hold a value from -128 to 127. Both characters and integers must be whole numbers. **NOTE:** If a value exceeds these limits, the variable will still contain a number, but it will not be the correct number. For example, **var x** contains the value **32767**. Adding one to **x** will cause **x** to equal **-32768**.

The following program will set y to 47 and x equal to 57:

```
char y;
int x;
main()
  {
  y=47;
  x=y+10;
  }
```

In many of the examples in this chapter, we use x and y as variable names. The variable name can be up to 15 characters long. Numbers can also be used as long as the name does not begin with a number. In addition to letters and numbers, the underscore character may be used in a variable name, but it cannot be the first character of the variable name.

The following are valid variable names:

```
int average;
int outside_temp;
int condition1;
int contact12;
```

The following are NOT valid variable names:

```
int 3temp;
int average_result_per_day;
int inside room;
int _timer;
```

4. The ISACC C language has other tools available to construct your program. One of the most important tools is the "if" statement. The "if" statement is used to make a decision whether or not to execute a sequence of statements.

Example: The following program will print "X is big" only if x if greater than 10, which in this case is true. When the condition in the "if" statement is true, the program continues through the statements inside the "if" braces. If the condition was not true, the program skips the block of statements.

```
int x;
main()
  {
  x=14;
  if (x>10)
    {
    puts("X is big\n");
    }
  }
```

The "else" statement can be used with the "if" statement and gives instructions on what to do when the "if" statement is false.

Example: In the following program, if x is greater than 30, the words "X is big" will print. If x is not greater than 30, the words "X is small" will print. In either case, "All done" will always print.

```
int x;
main()
  {
  x=23;
  if (x>30)
    {
    puts("X is big\n");
    }
  else
    {
    puts("X is small\n");
    }
  puts("All done\n");
  }
```

There are C commands other than "if" and "else", and built in variables to access ISACC's inputs and outputs. Details for these will be covered later.

EDITING COMMANDS

The commands used to edit your program are INSERT, DELETE, ERASE and LIST. These commands allow you to insert and delete lines within a new or already existing program. When an existing line needs to be modified, the DELETE command is used to erase that line and the INSERT command is used to retype the line. The ERASE command eliminates an entire C program at once. The LIST command allows you to view the program on the screen. ISACC's editor is a line editor. You can only make changes to the current line.

INSERT

To begin your program, enter INSERT at a prompt. ISACC will prompt you to type in the first line of your program by displaying the following:

```
ISACC>insert
INSERT LINES
#001  >
```

After you are done typing the text for each line, press <RETURN> and the cursor will move to the next line. If a <RETURN> is pressed on a line with no text, ISACC will return you to a prompt, outside of the text editor.

Example:

```
ISACC>insert

INSERT LINES

#001  >this is a c program        <RETURN>
#002  >                           <RETURN>

ISACC>
```

To add a line at a particular line number within your already existing program, type INSERT, spacebar, line number. Using the example above, if you want to add a line at line #2, type INSERT 2. ISACC will display the following, prompting you to type in the text for that line and as many more as you want. To stop inserting lines, press <RETURN> on a line with no text:

```
ISACC>insert 2

INSERT LINES

#002   >new line                  <RETURN>
#003   >                          <RETURN>

ISACC>
```

If line #002 already has text, that text will be moved to line #003.

DELETE

The DELETE command will let you delete a specific line or number of lines of your program. To delete a specific line of your program, type DELETE followed by the line number. For example:

```
ISACC>delete 3

DELETE LINES

ISACC>
```

The text on line 4, if any, will be moved up to line 3.

If you would like to delete a section of program, for instance lines 12 through 35, type DELETE, spacebar, 12, spacebar, 35.

```
ISACC>delete 12 35

DELETE LINES

ISACC>
```

ERASE

The ERASE command is used to delete an entire C program at once. Using this command eliminates having to delete a program by specifying line numbers when the whole program is to be erased. To use this command, type the word ERASE at the prompt. For example:

```
ISACC>erase
```

LIST

The command LIST allows you to view your program on the screen. If you want to view all of your program enter LIST at a prompt. To view a particular line within a program, enter LIST, spacebar, line number. For example:

```
ISACC>list 4
```

To view a particular section of lines, enter LIST, spacebar, starting line number, spacebar, ending line number.

```
ISACC>list 14 35
```

At the bottom of your listed program, ISACC will give you an update on bytes used and bytes remaining. Remember, there are 8191 bytes available

```
ISACC>list
#01   main()
#02     {
#03     }

36 bytes used
8155 bytes remaining
```

STAND ALONE COMMANDS

Stand alone commands are one word commands that are typed at an ISACC prompt. They are instructions for the physical execution of a C program. They allow you translate the C program into ISACC's language, run the program once to test, start and stop the continuous execution of the program within ISACC. The four commands are COMPILE, RUN, START and STOP.

COMPILE

This command must be typed in before the program is executed. All programs that are written must be translated into a language that ISACC will understand and this is done with the COMPILE command.

When you type the command COMPILE, ISACC scans your program, looks for errors and makes another copy in its memory in a coded format. The coded format is another language so ISACC will run more efficiently. When you type COMPILE, the following will appear:

```
ISACC>compile
Starting prescan
Found main
Finished scanning
Prescan completed
0 global variables found
ISACC>
```

The new program is checked for syntax errors. If a problem is found, an error code will be displayed. The type of error code depends on where the code is found and what kind it is. Multiple errors must be corrected one at a time before ISACC will continue to scan the program. Please refer to the ERROR HANDLING section in this chapter.

> **IMPORTANT: Any time the program is changed or corrected, it must be recompiled.** If it is not, ISACC will continue using the old version of the program. When the program is recompiled, all variables are reset to zero.

RUN

After the program has been compiled, you may enter RUN at a prompt. The RUN command allows you to see your new program executed once. It is wise to check the new program before continuing. When you type RUN, ISACC will display a "Run time" which is the amount of time it takes to execute. This is required when starting the program, so it is wise to make a note of it. It will also display any Run time errors it finds.

```
ISACC>run
Run time 0.140 seconds
```

START & STOP

After the program has been compiled and run once, you may start your program by entering START. Your screen will display the following:

```
ISACC>start
Reload time (seconds) = 2 >
```

The reload time is how much time ISACC will wait between running the program. This is programmable so you can make the unit most efficient by telling ISACC to execute the C program only when necessary. For instance, if you require the program to run every half hour, it is not necessary to waste ISACC's time and have the program run every 10 seconds.

The reload time must be at least double the Run time and can be given in whole numbers only. The Run time is provided when you RUN your program. So if your Run time is 1.5 seconds, the Reload time must be at least 3 seconds. The maximum number of seconds is 255. For example:

```
ISACC>run
Run time was 0.760 seconds
```

For this example, the recommended reload time is 2 seconds:

```
ISACC>start
Reload time (seconds) = 2 > 2
Program now running
```

The default Reload time is 2 seconds.

After the program is started, ISACC will run the program depending on your programmed Reload time. If you want to stop the program enter STOP at a prompt. ISACC will display the following:

```
ISACC>stop
Program now halted
```

If a Run time error is encountered ISACC will display the following: (See Error Handling section for description of error number)

```
Error (error number)
```

Whenever a modification is made to your program, you should enter STOP. If STOP is not entered before recompiling your new program, ISACC will stop the program automatically.

The actual mechanics of working with the C programming within ISACC is fairly simple. To edit your program, the commands INSERT, DELETE, and LIST are used. To compile and test your program the commands COMPILE and RUN are used. When you actually put your program to use or discontinue your program from running, the commands START and STOP are used.

The contents of your C program is what tells ISACC what to do. The next section will teach you the basics so that you can program in C.

C LANGUAGE KEYWORDS

The following is a list of all valid components of the C language within ISACC.

```
char
int
if
else
for
do
while

operators
assignment
comparators
comments
functions
```

CHAR - used to define a variable as a character. A character can hold a value from -128 to +127 and must be a whole number. Exceeding this range will cause incorrect results.

Example:

```
char x;
main()
  {
  x = 12;
  }
```

INT - used to define a variable as an integer. An integer can hold a value from -32,768 to +32,767 and must be a whole number. Exceeding this range will cause incorrect results.

Example:

```
int result;
main()
  {
  result = 17;
  }
```

IF - Used to make decisions.

Example:

```
main()
{
if (input(1)>7)
  {
  puts("One is bigger\n");
  }
}
```

ELSE - Used with IF to execute a statement when the IF condition is false.

Example:

```
main()
  {
  if (input(2)>100)
    {
    puts("It is hot\n");
    }
  else
    {
    puts("It is cold\n");
    }
  }
```

FOR - Used to execute a statement (or statements) multiple times. Contains a start condition, a stop condition, and a control statement. The following example starts a counter at one, checks that it is less than nine, and executes the output statement. Then it adds one to the counter, and checks that it is still less than nine. When the counter equals nine, the for loop is finished. This program example sets outputs 1 through 8 off.

Example:

```
int counter;
main()
  {
  for (counter=1;counter<9;counter=counter+1)
    {
    output(counter,0);
    }
  }
```

DO - Used to execute a list of statements while a condition is true. The statements are always executed at least once. The following example always sets output 1 on and keeps it on as long as input 1 is greater than 100.

Example:

```
main()
  {
  do{
    output(1,1);
    }while(input(1)>100);
  }
```

WHILE - Used to execute a list of statements while a condition is true. The statements are only executed if the condition is already true. The following example only sets output 1 on when input 1 is greater than 100, and keeps it on until input 1 is less than or equal to 100.

Example:

```
main()
  {
  while(input(1)>100)
    {
    output(1,1);
    }
  }
```

OPERATORS - Symbols used to execute mathematical operations and determine whether a particular condition exists.

+	Adds two values.
-	Subtracts two values.
*	Multiplies two values.
/	Divides two values. Produces a whole number result.
%	Finds the remainder of a division.
||	Checks if one condition or another exists.
&&	Checks if one condition and another exists.

ASSIGNMENT - Symbol used to assign a numeric value.

=	Assigns a new value to a variable.

COMPARATORS - Symbols used to compare numeric values to each other.

<	Less than
>	Greater than
==	Is equal to
!=	Is not equal to
<=	Less than or equal to
>=	Greater than or equal to

COMMENTS - Provide a format for you to make English notations within a program.

/*	Begin comment
*/	End comment

PREDEFINED VARIABLES

ISACC's C language has a number of variables that are predefined. These variables are automatically updated with the proper information outside of the C program and cannot be user-changed. They include:

```
MONTH          EXISTS
DAY            UPTIME
YEAR
HOURS
MINUTES
SECONDS
```

MONTH, DAY, YEAR, HOURS, MINUTES & SECONDS

These variables represent the values from the real time clock. They are defined as integer type. Their internal definitions look like the following:

```
int month;
int day;
int year;
int hours;
int minutes;
int seconds;
```

Note: You do not need to define these at the beginning of your program to use them.

Description:

MONTH - Holds the present value from 1 to 12.
DAY - Holds the present value from 1 to 31.
YEAR - Holds the present value from 0 to 99, representing only the last two digits of the year.
HOURS - Holds the present value in 24 hour time from 0 to 23.
MINUTES and SECONDS - Hold the present values from 0 to 59.

EXAMPLE: This program will reset the minimum and maximum values for input 12 at midnight.

```
main()
  {
  if ((hours==23)&&(minutes==59))
    {
    reset(12);
    }
  }
```

EXISTS & UPTIME

These are predefined variables specifically for use with ISACC.

EXISTS - The alarm status of ISACC is represented by this variable. When any alarm exists that has not been acknowledged, the EXISTS variable is equal to one. When there are no unacknowledged alarms, it is equal to zero.

Example: This program will turn on the buzzer (output 9) whenever any alarm occurs. It will turn the buzzer off when the alarm is acknowledged.

```
main()
  {
  if (exists==1)
     {
     output(9,1);
     }
  else
     {
     output(9,0);
     }
  }
```

UPTIME - This variable contains the number of seconds since the last power up or reset. This value starts at zero when the unit is powered up or reset, and will increase in increments of one up to 3600 seconds. After 3600 seconds (1 hour), it will continue to have a value of 3600.

EXAMPLE - This program will keep output 2 off for the first 30 seconds of power up, and controlled by input 1 after that.

```
main()
  {
  if ((input(1)>88)&&(uptime>30))
    {
    output(2,1);
    }
  else
    {
    output(2,0);
    }
  }
```

FUNCTION LIBRARY

In ISACC's C language, there are a number of functions that are predefined. These functions allow you to retrieve certain values and incorporate them into your C program. A function can be a statement by itself or it can be used to retrieve a value and return it.

This function is turning output one on and is an example of a function acting alone:

```
output(1,1);
```

This function retrieves the value of input 3:

```
x=input(3);
```

The format for how these functions work is in a reference format. First the function is stated, then a summary is given. The summary is how the function is internally defined. The return value is the value of the function after performing what has been programmed. Some of the functions do not have a return value that would apply. In these cases the return value will be zero.

The functions for use with ISACC are:

ALARM
DATA
ENABLE
INPUT
IS_ALARM
NETWORK
OUTPUT
OUT_SPEC
PUTNUM
PUTS
RESET
RELOAD
SET_INPUT

ALARM

Summary:

```
int alarm(n);
int n;          Input Number
```

Description:

The alarm function generates an alarm condition for the input specified by n.

Return value:

The alarm function always returns a zero.

Example:

This program will initiate an alarm 3 condition if input 3 is greater than 100 and input 2 is greater than 90.

```
main()
  {
  if ((input(3)>100)&&(input(2)>90))
    {
    alarm(3);
    }
  }
```

NOTE: The Phone numbers, Selection and Dialout in the standard programming parameters must be set up properly to generate an alarm, or nothing will happen.

DATA

Summary:

```
int data(n1,n2,n3,n4);
int n1;          Number of hours
int n2;          Number of minutes
int n3;          Number of seconds
int n4;          Start or stop, 0=stop, 1=start
```

Description:

The data function enables or disables the data logger, and specifies how often the data logger executes.

Return value:

The data function always returns a zero.

Example:

This program will run the data logger every 2 minutes from 7:00am to 5:00pm, and disables it at all other hours.

```
main()
  {
  if ((hours >= 7) && (hours <= 17))
    {
    data(0,2,0,1);
    }
  else
    {
    data(0,2,0,0);
    }
  }
```

ENABLE

Summary:

```
int enable(n1,n2);
int n1;          Input number
int n2;          Command, 0=disable, 1=enable, 2=return status
```

Description:

The enable function enables, disables, or reads the dialout ability for an input specified by n1.

Return value:

The enable function returns 0 if the input is disabled, or a 1 if the input is enabled for dialout.

Example:

This program will disable dialout for input 4 from 12 noon to 12:59, and enable dialout for all other hours. This program will also turn on output 1 when input 1 dialout is enabled.

```
main()
  {
  if (hours == 12)
    {
    enable(4,0);
    }
  else
    {
    enable(4,1);
    }
  if (enable(1,2) == 1)
    {
    output(1,1);
    }
  else
    {
    output(1,0);
    }
  }
```

INPUT

Summary:

```
int input(n);
int n;          Input number
```

Description:

The input function will return the present value of an input specified by n1. When n1 is a number from 1 to 16, the return value is from the corresponding input. For n1 equals 17 to 20, the return values are the following:

```
17 The built in temperature sensor in degrees F.
18 The built in temperature sensor in degrees C.
19 Battery backup level in volts DC.
20 AC power, 1 = on, 0 = off.
```

Return value:

The input function returns the present value of an input specified by n1. This will be the appropriate look up table value if the input is analog. If the input is a dry contact, an open condition will return a 1, and a closed condition will return a zero.

Example:

This program will generate an alarm condition if input 12 is greater than 100. It will also generate alarm condition 13 if AC power fails. Please note that for input 13 to alarm as power failure, the ITYPE must be set to USER DEFINED (see ITYPE section), and the low alarm limit set to 90.

```
main()
  {
  if (input(12) > 100)
    {
    alarm(12);
    }
  set_input(13,(input(20)*110));
  }
```

IS_ALARM

Summary:

```
int is_alarm(n);
int n;          Input number
```

Description:

The is_alarm function checks if there is an active dialout alarm on the input specified by n. This follows the unacknowledged status on the alarm, so after the alarm is acknowledged by someone, it is no longer considered an alarm even if the physical condition is still there.

Return value:

The is_alarm function returns a zero if there in no alarm on input n, or a 1 if there is an alarm.

Example:

This program will set output number 3 on if input 3 is alarming. Otherwise it sets output 3 off. When input 3 goes into alarm status, the output will be turned on. As soon as that alarm is acknowledged by someone, the output will be turned off.

```
main()
  {
  if (is_alarm(3) == 1)
    {
    output(3,1);
    }
  else
    {
    output(3,0);
    }
  }
```

NETWORK

Summary:

```
int network(n1,n2);
int n1;        Request number
int n2;        Command, 0=turn off, 1=turn on, 2=return status
```

Description:

The network function will read a value or write a value to one of the predetermined network requests (specified by n1). If the network request is an output function, then the value of n2 is the value sent to that output. If the network request is an input function, then n2 should have the value 2. For more information on the network requests see NETWORK command - Chapter 7, page 72.

Return value:

If n2 is 2, then the network function returns the present value of that network request. Otherwise it will return the value of n2.

Example:

This program will set network request number 2 (for output 7) to 1 (on) if network request 1 (value of input 4) if greater than 85. Otherwise it sets request 2 to 0 (off). In other words, if input number 4 on node 2 is greater then 85, then output 7 on node 3 is turned on. Otherwise output 7 on node 3 is turned off.

This program assumes these network requests:

```
NETWORK REQUESTS
Request #01: Node = 02, Input  #04 =  0082
Request #02: Node = 03, Output #07 =  0000

main()
  {
  if (network(1,2) > 85)
    {
    network(2,1);
    }
  else
    {
    network(2,0);
    }
  }
```

PROGRAMMING NOTE: When using the NETWORK command, be sure to program n1 as the network request number, NOT the input or output number that you want to manipulate.

For analog outputs, if n2 is 0 or 1, the output will be set to that value. Note that analog outputs use incremental values. Therefore, the value 1 for an analog output is not the same as "on" for a digital output.

OUTPUT

Summary:

```
int output(n1,n2);
int n1;          Output number
int n2;          Command, 0=turn off;1=turn on;2=return status
```

Description:

The output function will turn a digital output specified by n1 on or off, or will just read the present state of the output. It will also set the value of an analog output. The analog outputs, referred to as outputs 11 through 14, are 0 to 10V. They are specified by 8 bit data from 0 to 255. If n1 is from 1 to 8, it refers to the corresponding digital outputs. When n1 is 9, it refers to the built in buzzer, and when n1 is 10, it refers to the built in relay. **This function will not change an output unless that output is set for automatic control.** See OUTPUT command, Chapter 7.

Return value:

The output function returns the state of the digital output, 0 for off, 1 for on. IMPORTANT: If the output function is used on an analog output, with n2=2, it will return status, and set the output to a value of 2. There is no way to query an analog output without changing its value. The C program must remember what it set it to. The value of n2 is assigned to the analog output.

Example:

This program will turn output 8 on between the hours of 8:00am and 5:00pm. This program will also set analog output 1 to full scale if the buzzer is on, and sets analog output 1 to bottom scale when it is off.

```
main()
  {
  if ((hours >= 8) && (hours <= 17))
    {
    output(8,1);
    }
  else
    {
    output(8,0);
    }
  if (output(9,2) == 1)
    {
    output(11,255);
    }
  else
    {
    output(11,0);
    }
  }
```

OUT_SPEC

Summary:

```
int out_spec(n);
int n;          Input number
```

Description:

The out_spec function checks if the value of input n is outside of the high and low alarm limits. This is without regard to alarm processing, recognition time, acknowledged status, dialout selection, and dialout enabling.

Return value:

The out_spec function will return a zero if the input is within limits, and will return a nonzero result if it is outside of the limits.

Example:

This program will set output 9, the onboard buzzer, on if input 5 is closed. It will set output 9 off when input 5 opens again. Input 5 is defined as a normally open input.

```
main()
  {
  if (out_spec(5)!=0)
    {
    output(9,1);
    }
  }
```

PUTNUM

Summary:

```
int putnum(n);
int n;          Value
```

Description:

The putnum function will write the value of n to the local RS232 port.

Return value:

The putnum function always returns a zero.

Example:

This program will send the value of input 9 to the RS232 port when it is greater than 100.

```
main()
  {
  if (input(9) > 100)
    {
    putnum(input(9));
    }
  }
```

NOTE: PUTNUM does not send data to the modem port.

PUTS

Summary:

```
int puts(s);
char * s;        String
```

Description:

The puts function will write a string to the local RS232 port.

Return value:

The puts function always returns a zero.

Example:

This program will send the string "SHUTDOWN" followed by a carriage return, and send the string "Input 11 is 96" followed by a carriage return to the RS232 port when input 11 is equal to 96. A carriage return is created by typing \n.

```
main()
  {
  if (input(11) == 96)
    {
    puts("SHUTDOWN\n");
    puts("Input 11 is ");
    putnum(input(11));
    puts("\n");
    }
  }
```

Your output will look like the following:

```
SHUTDOWN
Input 11 is 96
_                (final cursor placement)
```

NOTE: The PUTS function does not send data to the modem port. The PUTS function will not accept variables or formatted data. You must use a combination of PUTS and PUTNUM.

RESET

Summary:

```
int reset(n);
int n;          Input number
```

Description:

The reset function resets the values automatically maintained by the system for an input specified by n. If the input is analog, reset resets the max and min values. If the input is a pulse counter, reset sets the pulse count to zero. If the input is a dry contact, reset has no effect.

Return value:

The reset function always returns a zero.

Example:

If input 7 is a pulse counting input, this program will initiate an alarm 7 condition if input 7 is greater than 100, and reset the counter to zero.

```
main()
  {
  if (input(7) > 100)
    {
    reset(7);
    alarm(7);
    }
  }
```

RELOAD

Summary:

```
int reload();
```

Description:

The reload function returns the reload rate in seconds of the C program. There are no parameters.

Return value:

The reload rate in seconds of the C program.

Example:

This program will use the reload rate to update a seconds down-timer. When the timer hits zero, it will turn output number 1 on.

```
main()
  {
  rate=reload();
  if (timer>0)
      {
      timer=timer-rate;
      }
  if (timer<=0)
      {
      output(1,1);
      }
  else
      {
      output(1,0);
      }
  }
```

SET_INPUT

Summary:

```
int set_input(n1,n2);
int n1;          Input number
int n2;          New value of input
```

Description:

The set_input function will allow you to manually set the input value for any of the 16 input channels. This is useful to get a average or some other calculated value to appear on an input channel. That value is then treated as any other analog input for alarm functionality and also appears in the data logger. **To do this, you must first set the input type for that input to USER DEFINED.** See ITYPE command, Chapter 7.

Return value:

The set_input function returns n2.

Example:

This program will set the value of input number 3 equal to the average values of inputs 1 and 2.

```
int x;
main()
  {
  x = (input(1) + input(2))/2;
  set_input(3,x);
  }
```

ARRAYS

Arrays allow you to store a lot of related information in a convenient, organized fashion. An array lets you use one line of code to create a series of variables. These variables share the same basic name and are distinguished from one another by a numerical tag.

Example:

```
int count[10];
```

This means that an array named count has 10 members or "elements," with each element having its own value, starting with 0 and ending with 9. The first element is count[0], the second element is count[1], and so on up to count[9]. The type int means that the actual numerical value of each element is an integer.

Example:

```
count[2] = 7

count[4] = 131

count[9] = 26
```

SAMPLE PROGRAM:

This program calculates a one-hour average temperature. The array named "numbers" sets up a series of variables from 0 to 60 to hold a value for input 1 for each minute in an hour. The 60 values are totalled, then averaged. The value of input 2 is then set to this average.

By using an array, the code becomes substantially more concise. The program is first listed, then followed by a section by section explanation of how it works.

```
int numbers[60];  /* array: input 1 value for each minute */
int x;            /* index to the array */
int total;        /* total of the input 1 values */
int average;      /* total/60 */
int oldminute;    /* minute counter */
main()
  {
  if (oldminute != minutes)
    {
    oldminute = minutes;
    numbers[minutes] = input(1);
    total = 0;
    for (x=0;x<60;x=x+1)
      {
      total = total + numbers[x];
      }
    average = total/60;
    if ((total % 60) >= 30)
      {
      average = average + 1;
      }
    set_input(2,average);
    }
  }
```

The following is a step by step explanation of the program.

1.
```
if (oldminute != minutes)
  {
  oldminute = minutes;
```

This checks the value of minutes to see if a minute has passed. If a minute has passed, the value of oldminute is reset to the value of the new minute.

2. `numbers[minutes] = input(1);`

This line sets the value of numbers for a particular minute to the current value of input 1. For example:

It is 3 minutes into the hour.

The value of input 1 is 72°.

Therefore:

```
numbers[minutes] = input(1)
```

is equal to:

```
numbers[3] = 72
```

3.
```
total = 0;
```

This line initializes the variable total to zero.

4.
```
for (x=0;x<60;x=x+1)
```

This line initializes the index variable (x) to zero, checks if it is less than 60, runs the next line, and then increments x by one. This line creates a loop that runs the following line until x reaches 60.

5.
```
total = total + numbers[x];
```

This line of code is very important. It eliminates having 60 lines of code to get a total of all the minute readings. The x serves to automatically read in the next value for each element in the array. For example:

The value of x is 6 (meaning it is minute 6, incremented in step 4). The value of input 1 for minute 6 will be read into the array and added to the total of the other 5 minutes.

The value of input 1 at minute 6 is 70. Therefore:

```
numbers[6] = 70
```

The previous total was, say, 351.

```
total = 351 + 70
```

The new total is 421.

```
total = 421
```

6. When x reaches 60, the For loop is finished, and the average is calculated.

```
average = total/60;
```

7. ISACC automatically rounds numbers down. This section of code rounds the value of average up to the next whole number according to the remainder left over during division. If the remainder is greater than 30, average is rounded up.

```
if ((total % 60) >= 30)
   {
   average = average + 1;
```

8. This line sets the value of input 2 to the hourly average just calculated.

```
set_input(2,average);
```

ERROR HANDLING

When a program is compiled, it is scanned for language related errors. When an error is encountered, the word ERROR is displayed followed by the error type, and line number. The line number may not be the exact line that contains the error. Sometimes an error is detected a line or two after the actual mistake. If an error occurs while compiling, the compiler aborts. It is possible to pass the compiler with no errors, but receive an error when the program is running. A run time error occurs when the syntax of a built-in function is incorrect. When a run time error occurs, the type of error is displayed, but not a line number.

Below is a list of compiling errors:

ERROR TYPE	DESCRIPTION
0	Syntax
1	Semicolon expected
2	Unbalanced braces
3	Parentheses Expected
4	While expected
5	Quote expected
6	Variable not found
7	Too many variables defined (limit is 127)
8	Bracket expected
9	Compiled file too big

DIFFERENCES BETWEEN STANDARD C AND ISACC C

For those of you who are familiar with C programming, note that there are some differences between standard C and ISACC's C compiler. The following items will be helpful to be aware of:

1. With ISACC C, every IF, ELSE, FOR, DO, and WHILE **must** have a set of brackets {} after it.

2. Condition clauses must be grouped together into pairs.

   Standard C will allow:

```
IF ((condition1) && (condition2) && (condition3))
```

   ISACC C requires:

```
IF (((condition1) && (condition2)) && (condition3))
```

3. There are no shortcut statements such as:

```
i++;
red+=5;  or
bits&=5;
```

   However, statements such as the following are allowed if placed inside parentheses:

```
IF ( (x=input(5)) ==0)
```

4. Bitwise operators are not implemented. There are no:

```
bitmask = bitmask & 4;
```

5. ISACC C only works with base ten integers. No floating point or hexadecimal numbers can be used unless you implement them in your C program. However, doing so takes up the limited code space. Remember, you only have 8k of listing space, and 2k of compiled space.

6. Variables declared before the main statement retain their values after the program has been executed. This provides the programmer with nonvolatile memory between runs of the program. This is useful for accumulating, timing, and most ISACC applications.

7. There are no user defined functions or procedures.

8. The run through, don't loop if you can avoid it philosophy.

   Avoid the use of WHILE loops. This will lengthen the execution and response time of your C program, and serves no advantage. Write your programs such that they run straight through and exit. If your program is checking for a certain condition to occur, using a WHILE loop will cause your program to concentrate on that one condition unnecessarily. Since the program will execute at regular time intervals, you can use an IF statement and achieve the same or even better results. For example, we need a program to perform two independent tasks. The first task is to set output 9 on for 60 seconds whenever input 1 closes. The second task is to change the datalogger rate to once per second upon closure of input 2.

The first program fragment uses a WHILE loop for the timing.

```
if (input(1)==0) {
       output(9,1);
       start_time=minutes;
       while ((start_time+1)>minutes) {
           }
       output(9,0);
       }
if (input(2)==0) {
       data (0,0,1,1);
       }
```

In this code fragment, when input 1 closes, the program will turn output 9 on, and then wait for 60 seconds without doing anything else. Input 2 may close during this time period, and critical data may be lost. After this time period, output 9 is turned off, and then input 2 is checked.

The next program fragment is a 'straight-through' approach using only IF statements.

```
if (input(1)==0) {
       output(9,1);
       start_time=minutes;
       }
if ((start_time+1)<=minutes) {
       output(9,0);
       }
if (input(2)==0) {
       data(0,0,1,1);
       }
```

In this code fragment, when input 1 closes, the program will turn output 9 on, and then continue with the rest of the program. It will then check for the output 9 off condition (time expired) and for the input 2 closure condition. It will not be held up in a WHILE loop. Please note that these examples are greatly simplified for this discussion, they do not account for the minutes variable rolling over from 59 to 0.

PROGRAMMING EXAMPLES

1. This example demonstrates: TIME DELAY and OUTPUT DISABLING

```
int delay, timer, timergo, relay, temp, rate;
main ()
    {
    if (temp<seconds)
        {
        rate=seconds-temp;            /* Calculate reload rate */
        }
    temp=seconds;                     /* Save seconds for next run of program */
    if (timer!=0)
        {
        timer=timer-rate;             /* Update countdown timer */
        if (timer<=0)
            {
            timer=0;                  /* Don't count past zero */
            }
        }
    if ((input(3)==1)&&(timergo==0))  /* If input 3 opens and we aren't already timing it */
        {
        timer=delay; timergo=1;       /* Start timer, set flag */
        }
    if ((timer==0)&&(timergo==1))     /* If timer reaches zero, and flag is set */
        {
        relay=1;                      /* Set relay flag to ON */
        }
    if (input(3)==0)                  /* If input closes */
        {
        timer=0; timergo=0; relay=0;  /* Clear timer, flag, and turn relay OFF */
        }
    if ((input(5)==0)&&(relay!=0))    /* If input 5 (relay disable switch) is closed(not active) */
        {                             /* and relay accumulator is not zero */
        output(10,1);                 /* Turn relay ON */
        }
    else
        {
        output(10,0);                 /* Turn relay OFF */
        }
    }
```

2. This example toggles output 1 on and off, based on the output's previous state.

```
main ()
    {
    output(1,(1-output(1,2)));
    }
```

3. This example demonstrates: RESETTING VARIABLES and SINGLE TIME EVENTS

```
int rset, average, total, recent, prvhrs;
main()
    {
    if (rset==0)                  /* Using the ISACC command SET VAR RSET, and setting RSET = 0 */
        {                         /* causes these variables to be cleared */
        average = 0;
        total = 0;
        recent = 0;
        prvhrs = 0;
        rset = 1;                 /* RSET = 1 prevents variables from being cleared every time */
        }                         /* the program runs */
```

```
    recent = input(1);            /* Get the value from input 1 */
    if ((hours==6)&&(prvhrs!=6))  /* This segment of code runs only when the hours change to */
        {                         /* 6 o'clock */
        total = total + recent;
        average = total / 24;
        prvhrs=hours;             /* This prevents the previous IF statement from executing */
    }          /* more than once during the hour of 6 o'clock */
    }
```

4. This example shows: PUSH BUTTON RESET and SINGLE ALARM FOR POWER OUTAGE. Note that the push button is an open/close button attached to input 14.

```
int i,was_alm,step,cncl,ocncl;
main()
    {
    if ((input(20)==0)&&(was_alm==0))     /* Only if new power outage*/
        {
        was_alm=1;  alarm(15);
        }
    if (input(20)==1)                     /* Power back on */
        {
        was_alm=0;
        }
    cncl=input(14);
    if (cncl!=ocncl)                      /* If push button changed state */
        {
        ocncl=cncl;
        if (cncl==0)
            {
            step=1;                       /* Push button reset */
            }
        }
    if (step==2)
        {
        for (i=1;i<17;i=i+1)
            {
            enable(i,1);                  /* Enable all alarms */
            }
        step=0;
        }
    if (step==1)
        {
        for (i=1;i<17;i=i+1)
            {
            enable(i,0);                  /* Disable all alarms */
            }
        step=2;
        }
    }
```

5. This example demonstrates usage of the DATA LOGGER from within a C program. This program will run the data logger when an input is alarmed.

```
int loggin;
main()
    {
    if (exists==1)              /* Checks for an active alarm */
        {
        if (loggin==0)          /* Checks to see if data logger already running */
            {
            data(0,0,30,1);     /* If not, start the data logger */
            loggin = 1;         /* Do not restart the logger until it has been turned off*/
            }
        }
    else
        {                       /* No active alarms */
        if (loggin==1)
            {
            data(0,0,30,0);     /* If no alarms exist, turn off data logger */
            loggin = 0;         /* So that it can be restarted next time */
            }
        }
    }
```

COMMON ISACC PROGRAMMING ERRORS

As you develop ISACC programs, you may find that your programs do not work as you intended. The following programs show common programming errors.

1. Program does not turn on the buzzer

```
main()
    {
    output(9,1);
    }
```

Usually, this is because the output needs to be set on AUTO. Use keyword command SET OUTPUT 9, and set it for AUTO in the standard programming parameters.

2. The following program causes ISACC to continue calling out for power outage even after the alarm has been acknowledged:

```
main()
    {
    if (input(20)==0)
        {
        alarm(1);
        }
    }
```

This is because the ALARM function will generate a new alarm regardless of whether it has been acknowledged. A flag is needed to determine if there is a new power outage:

```
int was_alm;
main()
    {
    if ((input(20)==0)&&(was_alm==0)) /*Only if new power outage*/
        {
        was_alm=1;
        alarm(1);
        }
    if (input(20)==1)                 /*Power back on*/
        {
        was_alm=0;                    /*Allow alarming*/
        }
    }
```

If you have unused inputs available, a more straight forward method would be to use the SET_INPUT function (see Function Library section). Assume input 16 is unused. First set its ITYPE to USER DEFINED (see ITYPE section). Then set its HIGH and LOW limits to 120 and 90, respectively. Next, set the Dialout Selection for this input. Finally, enter the following program:

```
main()
    {
    set_input(16,(110*input(20)));
    }
```

3. This program simply does not do what it should:

```
int x;
main()
    {
    x=input(5);
    if (x=10)
        {
        output(9,1);
        }
    else
        {
        output(9,0);
        }
    }
```

The problem is that the statement: if (x=10) actually assigns the value of 10 to x. The key is that it uses a single equals sign '='. To test a condition, use the double equals sign, '=='. See below:

```
int x;
main()
    {
    x=input(5);
    if (x==10)            /* Notice the == */
        {
        output(9,1);
        }
    else
        {
        output(9,0);
        }
    }
```

CHAPTER 9

OPERATION

HOW THE UNIT WORKS

ISACC monitors up to 16 universal inputs. When the status of an input changes or exceeds user-programmed limits, it causes an alarm. If the alarm condition lasts long enough to meet its programmed recognition time, ISACC will consider the alarm valid and begin a dialout to the programmed telephone numbers from a list associated with that particular alarm condition. ISACC can dial out to a standard touch-tone or pulse telephone (VOICE mode), to a PC or terminal (DATA mode), or to a beeper. The unit will continue dialing telephone numbers in succession until a positive acknowledgment is received.

NOTE: ISACC will not dial out if you are online with the unit locally through the RS232 port.

ALARM DIALOUT - VOICE MODE

When dialing to a standard telephone, ISACC recites an alarm message in voice-synthesized English to identify the input in alarm using its internally resident vocabulary. To acknowledge the alarm, you must use a touch-tone telephone to enter the acknowledgment code at the end of the alarm call. You may also call the unit back using a touch-tone telephone to enter the acknowledgment code.

Example: An alarm occurs on input 2 and meets the recognition time. ISACC begins the dialout sequence. Phone 1 is programmed as voice. When the phone is answered, ISACC will identify itself by reciting its programmed phone number. It will then state the input in alarm. This message is repeated the 3 times (programmed number of voice repetitions). ISACC will then request the touch-tone acknowledgment code 555. When the touch-tones are received, ISACC will respond by saying OK and then disconnect from the line. **NOTE:** The alarm is acknowledged but not cleared. The condition will continue to exist until some action is taken to correct the situation. Below is what ISACC says in the above example:

```
"Hello, this is telephone number 555-1234
Number 2 exists

Hello, this is telephone number 555-1234
Number 2 exists

Hello, this is telephone number 555-1234
Number 2 exists

Indicate you have received warning message."
```

You have 15 seconds to enter the acknowledgment code: 555 on the touch-tone phone. When the touch-tones are received, ISACC will respond by saying:

```
"OK."
```

The alarm has been acknowledged and the unit will then disconnect from the telephone line.

If the touch-tone code is not received, ISACC will respond by saying:

```
"Have a good day."
```

The alarm is not acknowledged. ISACC will continue calling the next phone number. You may call the unit back using a touch-tone telephone, PC or terminal to acknowledge the alarm. An alarm cannot be acknowledged using a pulse (rotary) telephone.

ALARM DIALOUT - DATA MODE

When ISACC dials to a PC or terminal using its internal modem, it sends data information indicating the alarm condition. Acknowledgment is requested at the end of the report. You may also program ISACC to acknowledge on carrier when dialing out in data mode.

Example: If acknowledge on carrier is selected as NO, ISACC will display the following during a data mode alarm dialout:

```
ALARM DIALOUT

The time is 11:52:25 PM
the date is 12/29/93
Unit identification = Sun
Phone number of unit = 555-5674

Reason for dialout
IN02 = "HI SUMP FLOAT    " = EXISTS

Acknowledge alarms (Y or N) ?
```

Type Y to acknowledge the alarm. Type N to leave the alarm unacknowledged. Enter your answer. The following will then be displayed:

```
Stay online (Y or N)?
```

If you wish to stay online with ISACC to access programming and interrogate the unit, type Y. If you do not want to stay online with ISACC, type N for NO. If you left the alarm unacknowledged, ISACC will then resume dialing the next phone number.

Example: If acknowledge on carrier is selected as YES, ISACC will display the following during a data mode alarm dialout:

```
ALARM DIALOUT

The time is 11:52:25 PM
the date is 12/29/93
Unit identification = Sun
Phone number of unit = 555-5674

Reason for dialout
IN02 = "HI SUMP FLOAT    " = EXISTS

Stay online (Y or N)?
```

If you type Y for YES, ISACC will allow you to stay online to program and interrogate.

If you type N for NO, ISACC will hang up and your PC or terminal will lose the carrier. In either case, the alarm is acknowledged.

ALARM DIALOUT - BEEPER

When dialing to a beeper, you can program ISACC to send digits that identify itself and the input in alarm. See Chapter 7, Dialing Codes. You must acknowledge the alarm by calling the unit back using a touch-tone telephone, PC or terminal.

CALL PROGRESS

VOICE OR BEEPER MODE: ISACC monitors call progress when dialing out in voice or beeper mode. If ISACC encounters a busy signal or no answer, the unit hangs up, waits the programmed intercall wait time, and then dials the next phone number.

DATA MODE: When ISACC dials out in data mode, it does not monitor call progress, but waits 30 seconds for a carrier. The timer starts when it dials the last digit of the phone number. If ISACC does not receive a carrier within 30 seconds of dialing, it will hang up, wait the programmed intercall wait time, and then dial the next phone number.

STATUS REPORT - VOICE MODE

You can call into ISACC using a touch-tone telephone to obtain a status report. After answering, ISACC will attempt to make a data connection. If none is made, ISACC will recite a status report in voice-synthesized English. The information recited in the status report is user selected. Following the voice status report, ISACC allows you to turn on or off an output remotely. See below.

Example: Using the sample information programmed in Chapter 7, ISACC would recite the following during a voice status report:

```
"Hello, this is telephone number 555-5674
The electricity is ON

INPUTS
Number one: 1
Number two:  1
Number three:  1
Number four:  799
Number five:  2300
Number six:  1
Number eight:  794

OUTPUTS
Number one: Off
Number two:  Off
Number three:  On
Number nine:  Off
Number eleven:  20"
```

VOICE MODE OUTPUT CONTROL

Following the voice status report, ISACC allows you to turn on or off one of the digital outputs (1-10) using a touch-tone telephone. At the end of the report, you have 5 seconds to enter a touch-tone command. To switch an output:

1. Using the touch-tone phone keypad, enter the number of the output you want to manipulate (1, 2, 3, 4 ,5, 6, 7, 8, 9, or 0 for 10) within 5 seconds.
2. To turn the output on, press 1.
3. To turn the output off, press 0.
4. ISACC will say "OK."
5. ISACC will wait 5 seconds for another command. To manipulate another output, repeat above steps.
6. If ISACC does not receive a command within 5 seconds, the unit will say "Have a good day," and then hang up.

STATUS REPORT - DATA MODE

At any time the unit is idle (not dialing out or communicating locally), you can call into it for a status report. If you call using a modem, ISACC will answer after its programmed rings until answer and allow you to go online. At this point you have entered an online session identical to the local programming session and may program or interrogate as long as needed.

DATA LOGGER

ISACC is capable of logging and storing up to 512 data log records. Each record contains the present value of all 16 inputs with a time stamp. The time between logs is user programmable. At any time, you may access the system to display log information on a terminal or PC monitor, or print the log information to a printer hooked up to the built-in RS232 serial port (requires a C program). You may retrieve the data log remotely by terminal or PC.

When 512 records have been logged, ISACC will overwrite the oldest records with new records. The data log records can also be formatted to be imported into a spreadsheet software program.

The data log is a separate function within the ISACC programming that runs independently of other operating features.

EXTERNAL MODEM

ISACC provides you with the option to use an external modem with the unit. There are two reasons to use an external modem. One is to gain a faster transmission rate. The fastest available internal modem speed with ISACC is 1200 bps. Modems that transmit at 9600 bps can be used through the serial port.

The second is that you may need to use a modem with error-checking capability. If you have poor phone service or are using a cellular phone service, considerable noise may be generated over the phone line that may prevent data from being transferred. An external modem with error-checking capability will solve this problem. NOTE: If you use an error-checking modem for this purpose, you must

also have an error-checking modem for your PC or terminal.

To install the external modem:

1. Power up and set the modem according to the manufacturer's instructions.
2. Connect the external modem to ISACC's RS232 serial port.
3. Connect the phone line. This can be done one of two ways:

    a. Hook up the phone line directly to the external modem. If you do this, you cannot use dialing modes 0-4 *(see Chapter 7)*. Also, you cannot call into ISACC for a voice mode status report. ISACC will only have access to the phone line through the external modem.

    b. Split the phone line. Hook one wire to the external modem. Hook the other wire to ISACC. This set up will allow you to use all dialing modes. **NOTE**: When calling in to ISACC with the split phone line, the external modem will answer first. To bypass the external modem, hang up and call back. On the second call you will access ISACC's phone interface.

4. Program one or more of ISACC's dialout phone numbers to **dialing mode 5**. See *Chapter 7*, Phone programming.
5. Reset ISACC. This initializes ISACC so that it knows that an external modem exists.

CHAPTER 10

GLOSSARY

STAND-ALONE COMMANDS

Clear - Used alone or with an input number to stop the dial out for a specific alarm.

Compile - Instructs ISACC to compile your C program.

Data - Instructs ISACC to display the records of the data logging function.

Delete - Allows deletion of one or more lines of your C program.

Diag - Runs a diagnostics test to help pinpoint functioning errors.

Disable - Used alone or with a specific input number to disable dial out for that input or all inputs if used alone.

Erase - Used to delete an entire C program at once.

Exit - Used to exit out of ISACC.

Help - Used alone to list commands and set/show key words.

Insert - Allows insertion of one or more lines into your C program. Note: to modify an already existing line, the line must to be deleted (see below) and then be inserted as a new line at that point.

List - Used to list the C program. If used alone, ISACC will list the whole program. If used with one number after, it will list that line number. If used with two numbers, it will list from one line to the other.

Patch - Used alone to allow communication from a modem/phone line to devices connected to the RS232 port, turning ISACC into a transparent modem. This command is used only when communicating via modem.

Reset - Used alone or with a specific input number to reset minimum and maximum values and pulse count values.

Run - Executes the C program once.

Start - Initiates the C program.

Stop - Halts the C program.

123 - Instructs ISACC to display the records of the data logging function in a format that allows exporting into a spreadsheet.

SET/SHOW KEYWORDS

Alarms - Used with show to display any outstanding alarms.

Clock - Battery-backed clock that allows the time and date to be displayed or programmed.

Dialout - Used to display or instruct ISACC to enable or disable the dialout for each alarm.

Inputs - Used with show to display the present values of the inputs. If an input number is followed, the command only displays that specific input.

Itype - Used with set or show to program or display the input type and name.

Limits - Used with set or show to program or display the high and low limits of the inputs.

Logging - Used to display or instruct ISACC on the data logging parameters.

Network - Used with set or show to program or display the networking requests.

Oname - Used with set or show to program or display the output names.

Outputs - Used with set or show to program or display the state of the outputs. If an output number follows, the command only effects that specific output.

Phone - Used with set or show to program or display the dial out phone numbers, communication modes, and their names.

Recognition - Used with set or show to program or display the recognition time for each input.

Selection - Used with set or show to program or display the configuration of the dial out numbers for each input.

System - Used with set or show to program or display ISACC's system parameters.

Table - Used with set or show to program or display the custom look-up tables.

Variables - Used to instruct ISACC to display the values derived from the C program.

Voice - Used to display or program the input and output voice choices on a voice call-in.

APPENDIX A

CHECKING YOUR SENSAPHONE FOR PROPER OPERATION

We recommend that you test your Sensaphone weekly to be sure it is functioning properly. This will ensure that when a problem arises the Sensaphone will be ready to alert the appropriate personnel.

There are several tests that can be performed:

1) Call the unit and listen to the Status Report. This will test the unit's ability to answer the phone and speak a message. It will also verify that the inputs are reading properly, the alarm conditions are OK, the electricity is on, and that the batteries are OK.

2) Create a test alarm on an input and allow the unit to contact all programmed telephone numbers. This will make sure that the Sensaphone is programmed properly. It will also prepare personnel to respond appropriately when they receive a call from the Sensaphone.

3) Test the batteries by unplugging the AC power cord and making sure that the Sensaphone continues to function. Check the battery voltage with a DC voltmeter at the terminal screws or go online and check it on the System menu, to make sure it is at least 13V. Reconnect the power supply when finished.

4) Test the internal modem by calling the Sensaphone from a computer and logging on.

APPENDIX B

ENGINEERING SPECIFICATIONS

I. General

The Automatic dialer shall be a self-contained microprocessor controlled system capable of monitoring and controlling up to 16 alarm channels. The system shall be integrated in construction and shall be installed and configured for operation by the user via keyword command programming on a data terminal or PC. Characteristics of Input and Output channels include Universal Input, Digital Output, Digital Relay Output, and Analog Output.

The system shall have an internally resident compiler to interpret the C programming language to allow users sophisticated control capabilities. C programming shall not be necessary for standard operation of the system.

Upon detection of any alarm or status change, the system shall commence dialing telephone numbers from a list associated with the particular alarm condition(s) and deliver a voice message identifying and describing the alarm condition(s). The system shall be capable of dialing out in voice mode, data mode, or to a beeper. When dialing out to a telephone number programmed as voice, the alarm message shall be delivered in voice-synthesized English using the internally resident vocabulary. When dialing in data mode, the system shall expect a data connection and shall send information to print to a PC or terminal monitor. When dialing to a beeper, the system shall send digits that identify the input in alarm. The system will continue to call telephone numbers in succession until a positive acknowledgment of the alarm message is received. Acknowledgment is accomplished from a touch-tone telephone, by PC, or by terminal. In addition, the system shall be able to receive incoming telephone calls from a standard telephone or modem. Upon answering, the system shall attempt a data connection. If a connection is made, the system shall allow remote access to programming and operation. If a data connection is not made, the system shall recite a voice-synthesized status report with information that is pre-selected by the user.

The system shall be FCC and DOC registered for direct connection to the telephone network. The system shall have a one year warranty from the manufacturer. The system shall be a Sensaphone® ISACC by Phonetics, Inc.

II. I/O Channel Attributes and Features

A. Inputs

The system shall come standard with 16 universal input channels. All input channels shall be user-configurable as:

1. NO or NC digital dry contact, using 1mA loop current
2. 4-20mA analog, using custom look up table
3. 0-5V analog, using custom look up table
4. Pulse count
5. Thermistor

The system shall also allow monitoring of AC power failure through an input channel using built-in circuitry and controlled by C program.

All monitored channels, including built-in monitoring features, shall allow local and remote data programming of pertinent operational data including, but not limited to:

1. Input type (NO/NC dry contact, 4-20mA and 0-5V analog, pulse count, thermistor)
2. High and Low limits (-9999 to +9999)
3. Input recognition time (0 seconds to 270 minutes)
5. Dialout Alarm Selection for each channel
6. Enable/disable for each channel to dialout for alarm

B. Outputs

The system shall have 8 digital 5 Volt TTL logic level outputs capable of sinking or sourcing 20 mA. The system shall also have one built-in SPDT form C 5A 250VAC mechanical relay output that may be programmed to switch automatically or manually. In addition, four 0 - 10VDC analog outputs are also included. The analog outputs shall be 0 to 10 Volts, 8 bit data from 0 to 255.

III. Communications Features

A. Telephone Specifications

The system shall connect to a standard 2-wire telephone line using pulse or tone, with loop start only. The system shall recognize ringer frequencies from 16 to 60 Hz. Call progress detection shall ensure that the alarm dialout is not hindered by no answers or busy signals.

B. Communication Interface

The system shall have a built-in 1200 bps modem to allow remote data communication and programming via PC or terminal. The system shall have a built-in RS232 serial port for the purpose of local communication and programming via PC or terminal. The system shall also have a built-in RS485 port for networking up to 16 ISACC systems.

C. Telephone Numbers

The system shall be capable of dialing up to 8 telephone numbers, 32 digits each. Individual Dialout Alarm Selection may be programmed for each input channel to instruct the system to dial specific telephone numbers for certain alarms.

The system shall allow local or remote data programming of the following telephone dialing information:

1. Dialing mode (voice, data, beeper)
2. Message repetitions (0 to 255)
3. Rings until answer (1 to 15)
4. Maximum number of calls (0 to 9999)
5. Intercall delay time (5 seconds to 270 minutes)
6. Wait time between rounds (0 to 270 minutes)
7. On-line time out (1 minute to 255 minutes)
8. Acknowledge on carrier (Y/N)

IV. Programming

A. Local Programming

The System shall have a built-in RS232 port for the purpose of locally programming all system data using a PC or dumb terminal. Programming is accomplished by keyword and stand-alone commands. All operational data, system setup and configuration data, and all information regarding the status of monitored I/O channels shall be accessible. In addition, C programming using the resident C compiler may also be accomplished locally.

B. Remote Programming

The system shall have a built-in 1200 bps modem for the purpose of remotely programming and communicating all system, configuration and input data using a PC or dumb terminal that has a modem. C programming may also be accomplished remotely. User-programmable security password shall protect the system from unauthorized tampering.

V. System Features

A. Power

The system shall be provided with a UL listed 20V AC power transformer that the user may plug into a 117V AC outlet, $\pm$20%, 60HZ. Typical power consumption shall be 12 Watts.

B. Data Log

The system shall be capable of logging and storing up to 512 records. Each record shall contain the present value of all 16 inputs with a time stamp. The time between logs shall be user-programmable. The system shall be able to display log information on a terminal or PC monitor, or print the log information to a printer hooked up to its built-in RS232 serial port. The data log shall also be retrievable

remotely by terminal or PC.

C. Diagnostics and Testing

The system shall have built-in diagnostic tests to pinpoint system problems.

D. Security

The system shall allow the user to program a data password to prevent unauthorized local or remote access to programming.

VI. Remote Operation Features

A. Voice Status Report

The system shall allow the user to call into the unit at any time using any standard telephone to obtain a status report of user-selectable monitoring information. The status report shall be articulated using the resident voice-synthesized English vocabulary.

B. Data Status Report

The system shall allow the user to call into the unit with any PC or terminal using a modem. The system shall allow interrogation and programming access to system parameters and status after the appropriate data password is entered.

C. Voice Acknowledgment

An alarm on any monitored channel may be acknowledged remotely by pressing tones on a touch-tone telephone keypad.

D. Data Acknowledgment

An alarm on any monitored channel may be acknowledged remotely by the user by PC or terminal. The system shall provide a visual status report on a terminal or PC monitor indicating the alarm(s) in progress and then shall request acknowledgment. When dialing out in data mode, the system may be programmed to self-acknowledge on carrier.

VII. Enclosure and Environmental

A. Enclosure

The system shall be housed in a NEMA-4 ABS plastic enclosure with a removable clear cover and shall be internally constructed to facilitate field upgrades, repair, and maintenance.

B. Power Supply

The unit shall provide battery backed 5 Volts DC, 12 Volts DC, 15 Volts DC, and 20 Volts DC to power external sensors, solid state relays, or output devices.

C. Battery Backup

The system shall have built-in 18 VDC Gel Cell rechargeable battery backup. The backup shall support a maximum of 14 hours of continued system operation in the absence of AC power. (Actual battery backup performance is dependent upon the number of external devices being powered by the system.)

D. Electrical Protection

Power and telephone connection shall have internal spike and surge protection using metal oxide varistors. All input channels shall have spike protection and noise filter circuits.

E. Additional Electrical Surge Protection

Additional Power and Telephone line surge protection shall be available from the manufacturer. When so installed, the system shall be fully warranted against any damage caused by transient surges entering the system through Power or Telephone lines.

F. Environmental

The system shall function over an operating range of 32° F - 120° F at up to 0 - 90% RH, non-condensing.

G. Maintenance

The system manufacturer shall have in-house service facilities and technical assistance available during normal business hours (EST).

Specifications subject to change without notice.

Phonetics, Inc.

901 Tryens Road

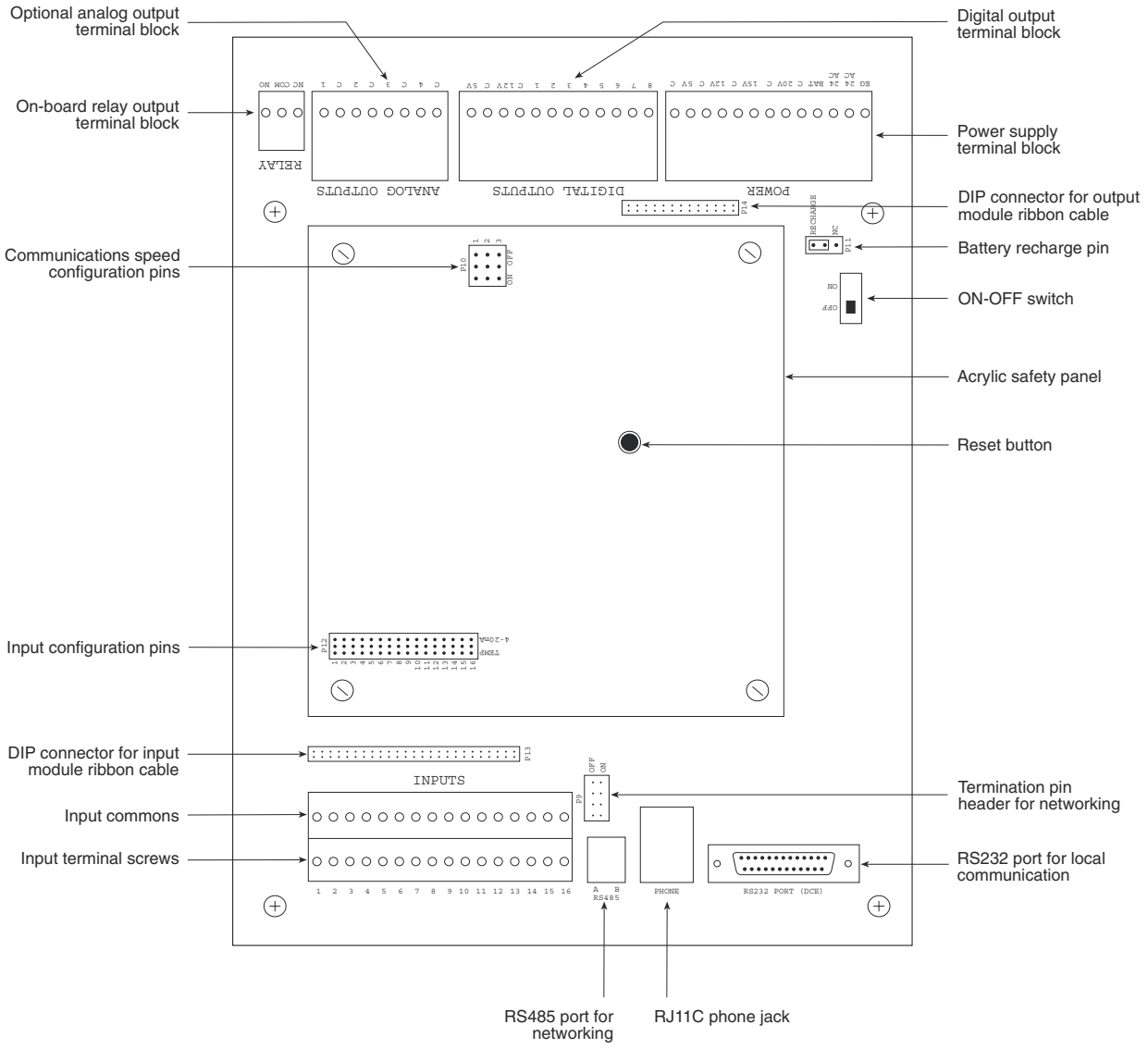
Aston, PA 19014

Phone: (610)558-2700 FAX: (610)558-0222

http://www.sensaphone.com

APPENDIX C

BOARD LAYOUT

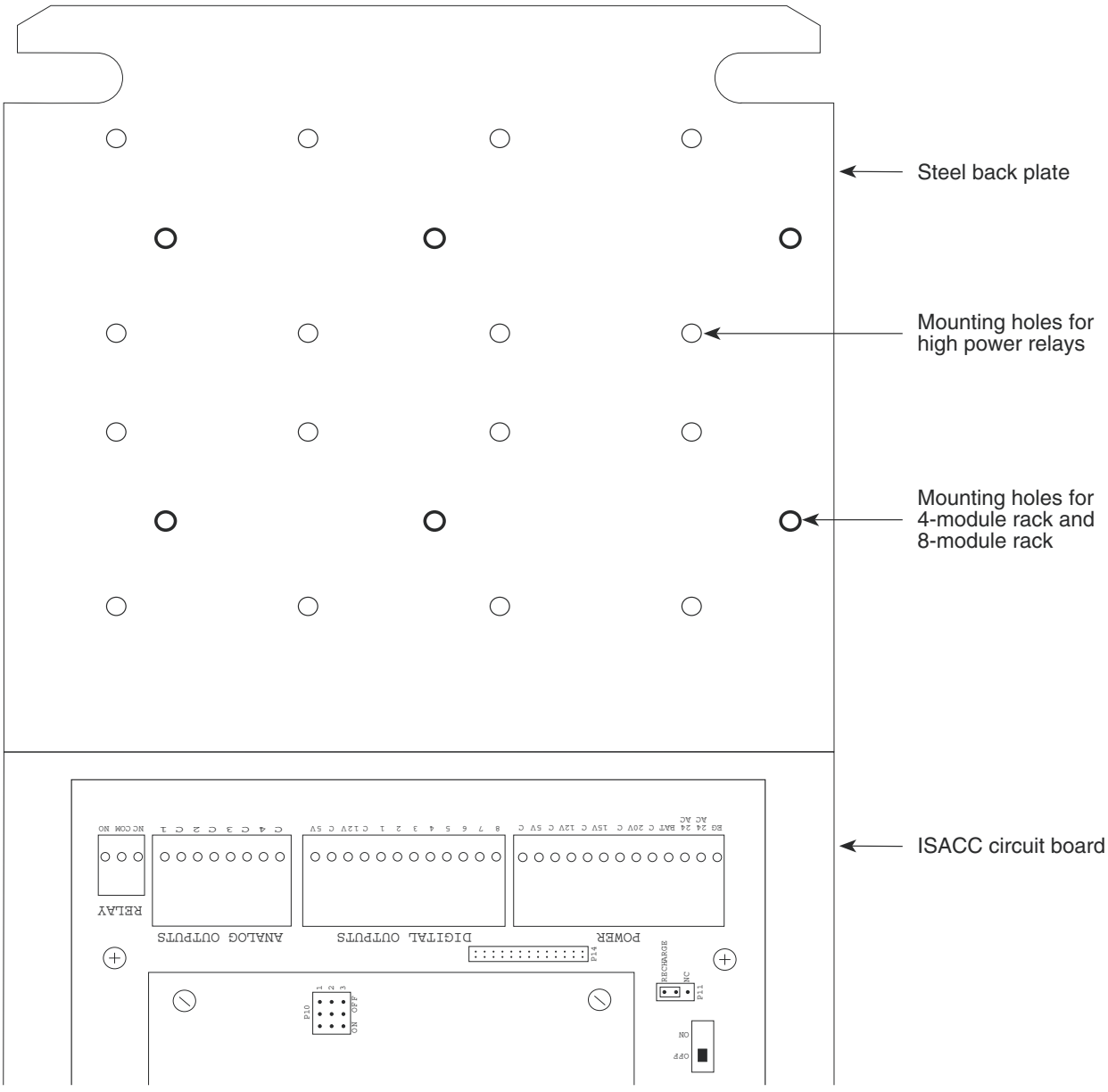


APPENDIX D

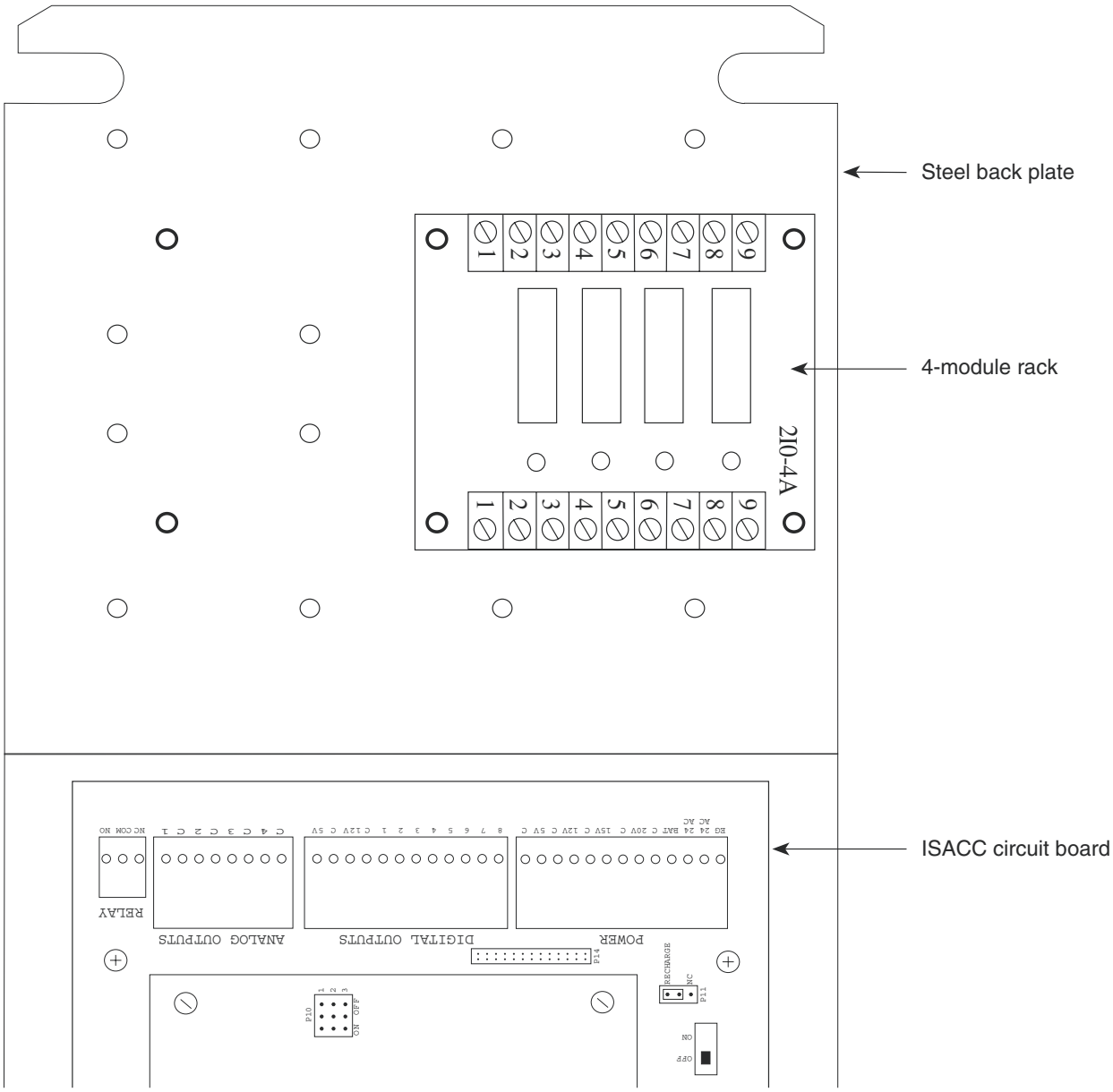
MOUNTING I/O DEVICES

This appendix includes diagrams to show you how various combinations of I/O racks and relays mount into the ISACC enclosure. ISACC's enclosure will accept:

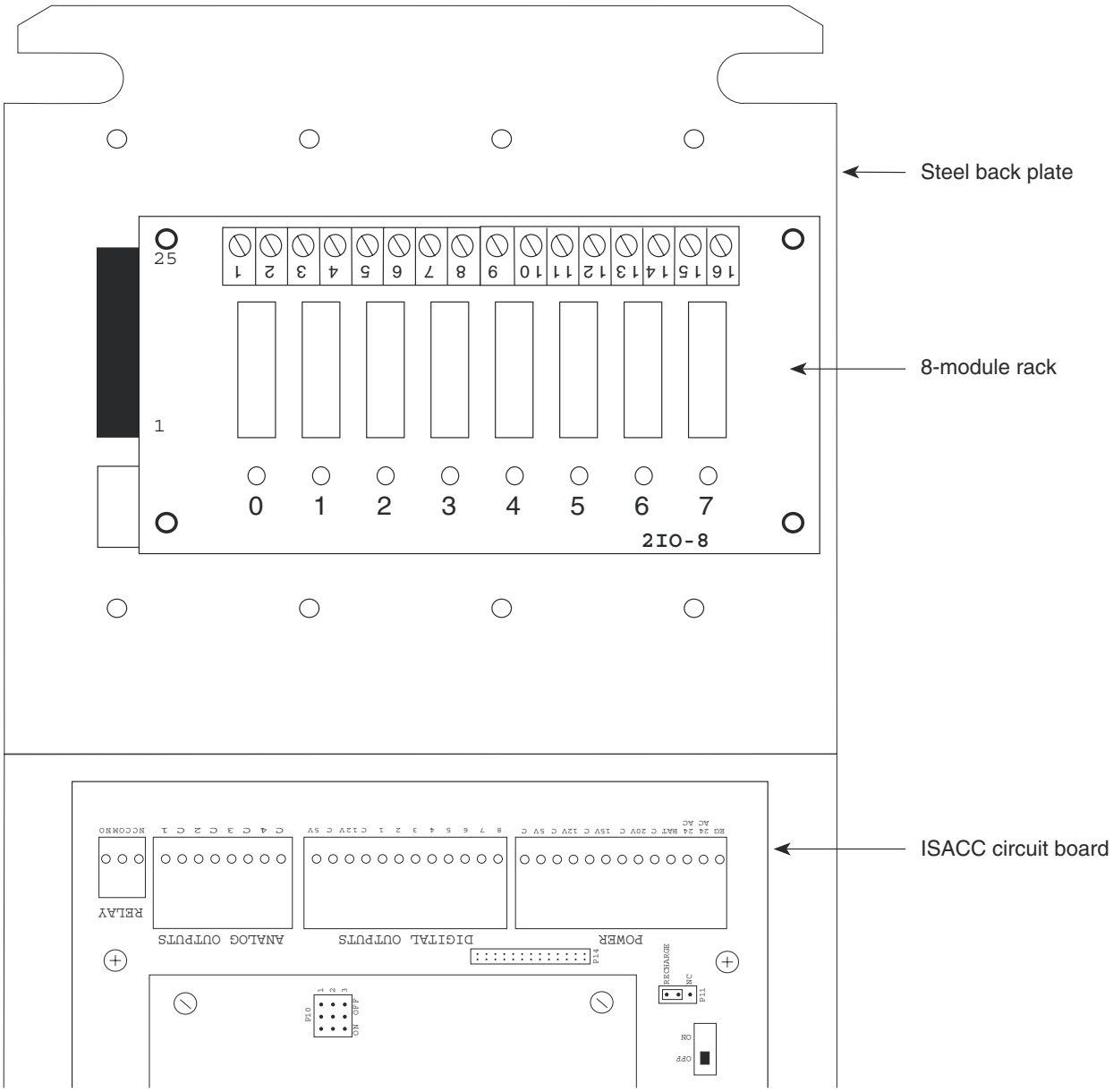
- One 4-module rack, or
- One 8-module rack, or
- 8 high power solid state relays, or
- 4 high power solid state relays and one 4-module rack



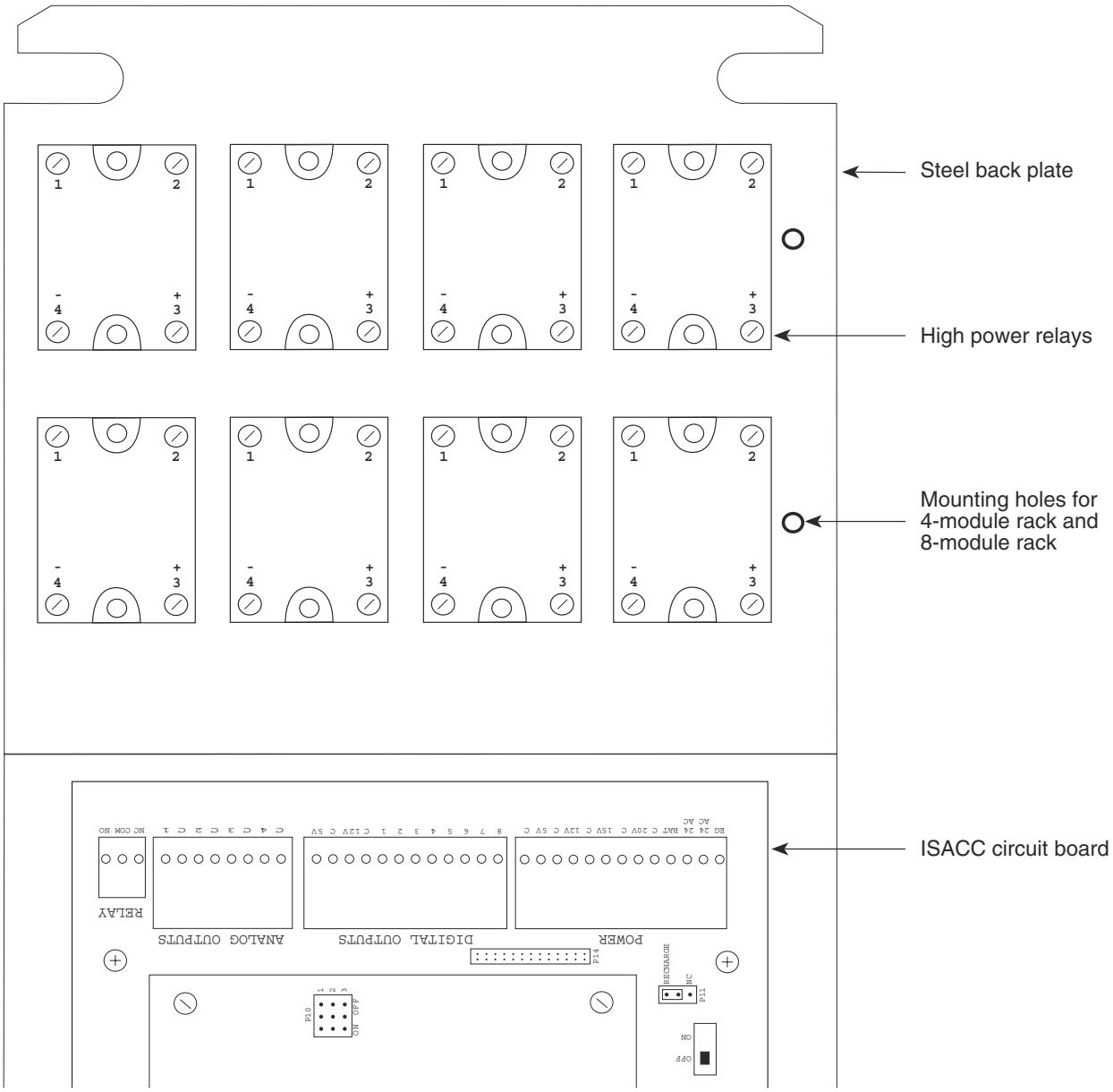
Pre-drilled holes in ISACC steel panel



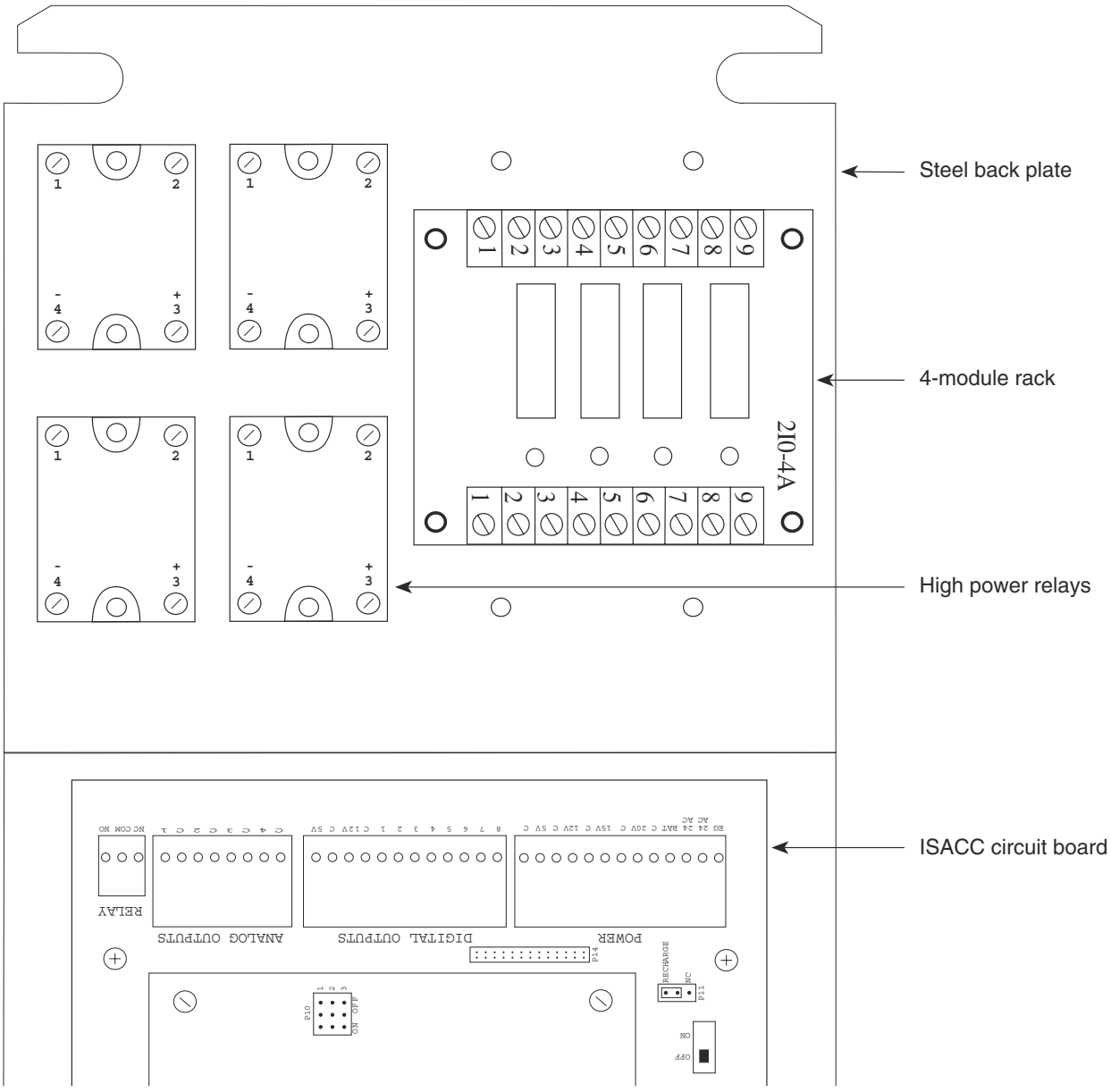
One 4-module rack mounted to steel panel



One 8-module rack mounted to steel panel



8 high power solid state relays mounted to steel panel



4 high power solid state relays and one 4-module rack mounted to steel panel

APPENDIX E

ACCESSORIES

The sensors and accessories listed below are the most commonly used with ISACC. In addition, there are a virtually unlimited variety of sensor/switch input devices available at commercial or industrial electrical supply houses. They can provide a device to monitor virtually any condition that might be required for your business, industrial or residential needs. Contact Phonetics, Inc. at (610)558-2700 for more information.

ACCESSORIES (available through Phonetics)	MODEL NUMBER
Magnetic Reed Switch	FGD-0006
Passive Infra-Red Motion Detector	FGD-0007
Output Controller (CM-001)	FGD-0012
Water Detection Sensor	FGD-0013
AC Output Module	FGD-0015
DC Output Module	FGD-0016
DC Input Module	FGD-0017
AC Input Module	FGD-0018
High Power Solid State Module	FGD-0020
4-Module I/O Rack	FGD-0021
Temp° Alert	FGD-0022
ISOTEL Surge Protector	FGD-0023
Humidistat	FGD-0027
8-Module I/O Rack	FGD-0039
Smoke Detector w/built-in Relay	FGD-0049
Humidity Transmitter	FGD-0052
Remote Temperature Sensor	FGD-0100
2.8K Weatherproof Temperature Sensor	FGD-0101
10K Weatherproof Temperature Sensor	FGD-0102
10K Outdoor Temperature Sensor	FGD-0104
10K Immersion Temperature Sensor	FGD-0105
Phonecell SX3e Cellular Phone	FGD-0200

APPENDIX F

RETURN FOR REPAIR

In the event that ISACC does not function properly and you cannot reprogram it, we suggest that you do the following:

1) Carefully write down your observations of ISACC's malfunctioning.

2) Call Phonetics' Technical Service at (610) 558-2700 if any instructions are not clear or if you have any question.

If the unit must be sent to us for servicing, do the following:

1) Turn the unit off, unplug the AC power supply from the wall outlet, and disconnect all input and output wiring.

2) Carefully pack the unit into its original container or a sturdy shipping box. Be certain to use sufficient cushioning material to avoid damage in transit.

3) To avoid processing delays, be sure to include the following:

   a) Your name, address, and phone number

   b) The unit Model and Serial Numbers

   c) A letter explaining ISACC's problem

4) Address package to

SERVICE DEPARTMENT

PHONETICS, INC.

901 TRYENS ROAD

ASTON, PA 19014

5) Ship prepaid and insured via UPS or US Mail to ensure a traceable shipment with recourse for damage or replacement.

WARRANTY

1 YEAR LIMITED WARRANTY

1. **WARRANTOR:** Dealer, Distributor, Manufacturer

2. **ELEMENTS OF WARRANTY:** This Product is warranted to be free from defects in materials and craftsmanship with only the limitations and exclusions set out below.

3. **WARRANTY AND REMEDY:**

One-Year Warranty — In the event that the Product does not conform to this warranty at any time during the time of one year from original purchase, warrantor will repair the defect and return it to you at no charge

This warranty shall terminate and be of no further effect at the time the Product is (1) damaged by extraneous cause such as fire, water, lightning, etc. or not maintained as reasonable and necessary; (2) modified; (3) improperly installed; (4) repaired by someone other than warrantor; (5) used in a manner or purpose for which the Product was not intended; or (6) sold by original purchaser.

WARRANTORS' OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT. THIS WARRANTY DOES NOT COVER PAYMENT OR PROVIDE FOR THE REIMBURSEMENT OF PAYMENT OF INCIDENTAL OR CONSEQUENTIAL DAMAGES.

It must be clear that the warrantors are not insuring your premises or guaranteeing that there will not be damage to your person or property if you use this Product. The warrantors shall not be liable under any circumstances for damage to your person or property or some other person or that person's property by reason of the sale of this product or its failure to operate in the manner in which it is designed. The warrantors' liability, if any, shall be limited to the original cost of the Product. The warrantors assume no liability for installation of the Product and/or interruptions of the service due to strikes, riots, floods, fire, and/or any cause beyond Seller's control.

4. **PROCEDURE FOR OBTAINING PERFORMANCE OF WARRANTY:** In the event that the Product does not conform to this warranty, the Product should be shipped or delivered freight prepaid to a warrantor with evidence of original purchase.

5. **LEGAL REMEDIES:** This warranty gives you specific legal rights, and you may also have other rights which vary from state to state to the extent allowed by law expressly in lieu of any other express or implied warranty, condition, or guarantee.

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Fax: (610) 558-0222
www.sensaphone.com