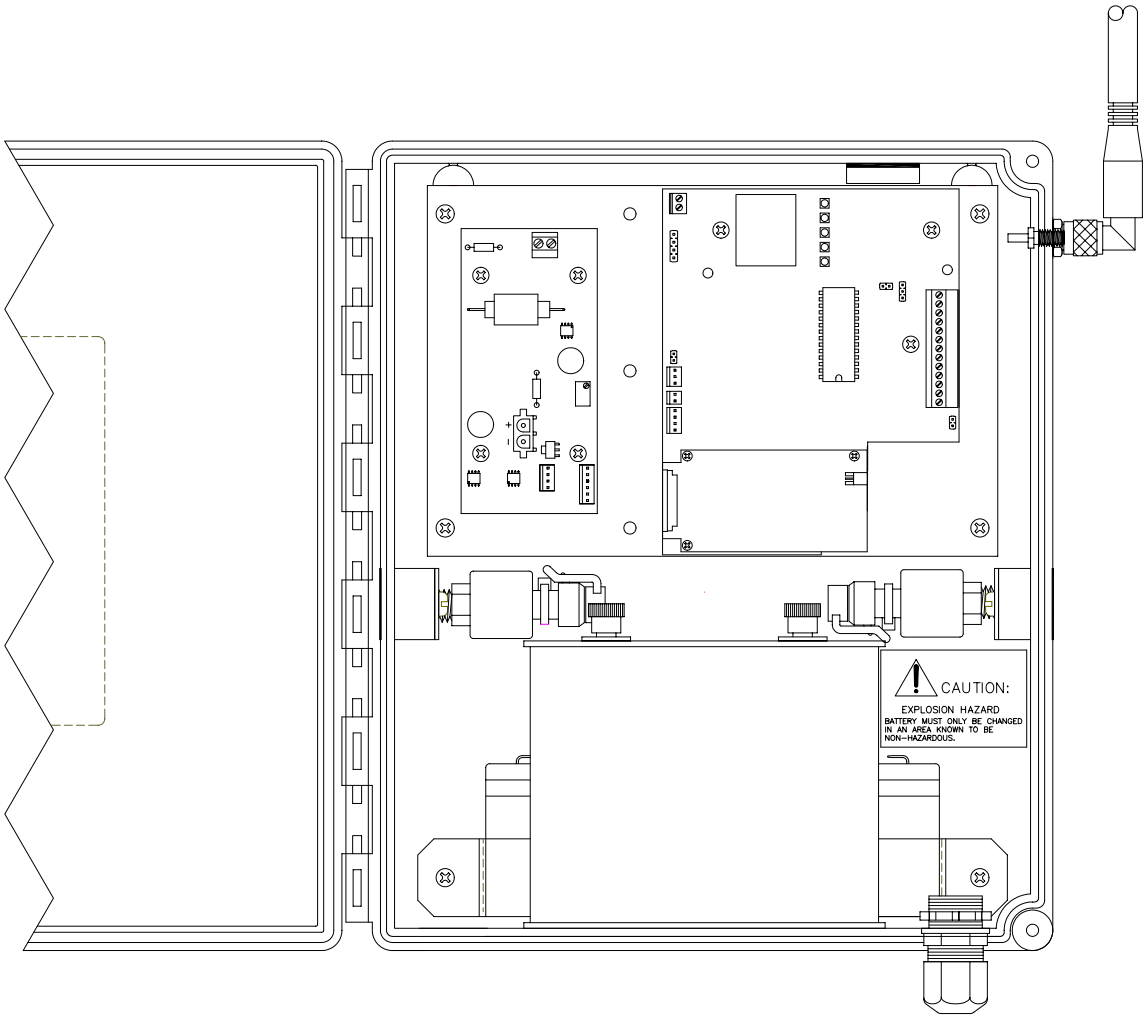
Cellular Network Interface (CNI)
Models GSM18, GSM20 and CDMA18

(Battery-Powered Unit Assemblies with Single- and Dual-Channel Pressure Tracker-II Options)

User's Guide



Document: 900353
Revision: -
September, 2004

WARNING
This product contains a radio-frequency transmitter,
Motorola Model g18, FCC ID # IHDT6AC1,
Motorola Model g20, FCC ID # IHDT56DB1 or
Motorola Model c18, FCC ID # IHDT56CW1.

The combined cable loss and antenna gain must not exceed 6.1dBi gain, and the antenna installation must provide a minimum separation distance of 20cm (8”) from users and nearby persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

See Chapter-7 for more safety information.

WARNING
No hazardous area safety approvals have been received for this product.
It is therefore necessary to ensure that the product is only installed at locations that are classified as ‘safe area’ sites.

See Chapter-7 for more safety information.

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COMMON QUESTIONS

The Cellular Network Interface is simply referred to as the "*CNI*" throughout this document. This unit's operating software allows it to behave as a legacy Metretek data collection device known as a Pressure Tracker-II, or "PTII-DC".

What does this device do?

The CNI measures pressure from one or two built-in pressure sensors over a predetermined period of time and saves the readings in its memory as one record. It then starts over for the next time period and continues this process for hours, days or weeks at a time. Each sensor can be provided in various pressure ranges up to 1000 PSI.

At regular intervals the CNI establishes a radio link with a cellular telephone service provider and transmits this information to a central computer system for processing. This can be accomplished with a circuit-switched data (CSD) connection to an analog modem at the computer site, or via a general packet radio standard (GPRS) connection or a radio transmission technology (1XRTT) connection to an Internet server running on the computer. Metretek provides a powerful application program called "DC-2000" which can process calls from thousands of devices, store their data in a database and present the results in a variety of formats.

The CNI also monitors several internal signals that might indicate alarm conditions, such as device tampering, excessive pressure, loss of power, etc. The CNI can be programmed to place an immediate call when any of these conditions occur.

See Chapter-1 for more information.

How is the CNI powered?

The CNI accepts a 6V dc input from an alkaline lantern battery. Also contained within the unit is a 12V sealed lead-acid battery that is constantly charged by a power supply board. In the event the lantern battery becomes depleted the unit will continue to operate for an extended period of time and can also call in to the central computer system to report that the alkaline battery needs to be replaced. The lead-acid battery provides the brief but heavy current requirements of the cellular radio while the alkaline battery provides charging current for the lead-acid battery.

See Chapter-2 for more information.

Does the CNI use a cell phone?

The cellular radio module is similar to that used in a digital cellular phone, but there is no display, keypad, speaker or microphone. Instead it has a communications port that allows the CNI's processor to control the radio and use it as a wireless modem. Also, the radio is designed for more severe environmental conditions than a commercial cell phone.

There are references within this document to "mobile" devices because the cellular radio system was intended to support portable phones and equipment. Though the CNI is normally installed in a fixed location, it is still classified as a "mobile" device.

How is the CNI packaged?

All circuit boards and batteries are mounted within a fiberglass NEMA 4X rated enclosure. This enclosure has four mounting tabs that allow the unit to be secured to the side of a building. The door is normally secured with two captive screws. Latches are also available that allow the door to be opened without tools and to be secured with a padlock. All exposed fasteners are made of stainless steel. This enclosure is designed for outdoor environments and can withstand wide variations in temperature and humidity.

Does it matter where the CNI is installed?

Since the CNI contains the equivalent of a cellular phone it has the same limitations with respect to metal buildings and sources of radio interference. An optional external antenna kit is available that may overcome some of these problems.

Also, and this is very important, although the equipment that will be attached to the CNI may be allowed to operate in hazardous areas, the CNI itself must not be installed in any area classified as hazardous. The use of safety barriers may be necessary.

Is the CNI ready to use immediately?

No, there are four important steps before the CNI can be put into service:

1) The external pressure lines must be connected to the CNI's pressure sensors (Chapter-2).
2) You must purchase cellular phone service (Chapter-3).
3) You must configure the CNI using a computer and a special program and cable from Metretek (Chapter-4).
4) The data collection software supplied by Metretek (DC-2000) must be supplied with information about the CNI (Chapter-5).

How do I purchase cellular service?

As with any cellular phone, you must purchase cellular service. There are several different digital technologies used today, and the service providers may support one or several of them. When you purchase a personal cell phone, you generally choose a provider that has the best calling plan and coverage in the area you live or work. You then receive a phone that works with their technology.

The CNI is designed to support GSM or CDMA technology. Though all service providers support voice calls, not all of them may support the exchange of data. Therefore it is necessary to locate a service provider that supports circuit-switched data (CSD) connections or Internet connections using the general packet radio standard (GPRS) for GSM service, or single carrier, radio transmission technology (1X or 1XRTT) packet service for CDMA service. Chapter-3 will help with this process.

Why must the CNI be configured?

When the CNI places a cellular call, it must have a phone number to dial or an Internet address to contact, instructions about what to do if the line is busy, what baud rate to use, etc. Each CNI must also be assigned a unique ID number.

The CNI is configured using your computer and a special cable and software supplied by Metretek. This can be done any time before, during or after installation. Chapter-4 has much more information.

What does the DC-2000 data collection software do?

Metretek's data collection software, DC-2000, has the ability to process calls from, or place calls to thousands of units. Each CNI can be scheduled to call in at specific times throughout the day, or once a week or once a month. The data collection software can process the CNI's information in many different ways, depending upon the customer's needs. It can also notify the customer immediately when an alarm condition occurs. To do this properly, each unit must be registered with the software. Chapter-5 has much more information.

What is the difference between CSD and Packet Service?

When the CNI places or receives a CSD (circuit-switched data) call, it will be communicating with an analog modem that is tied to a wired telephone line. The cellular service provider has banks of modems available in its switching centers. When it detects a CSD call, it connects one of its own modems to the wired line. Data is transferred between the CNI and the switching center via the radio link, and then between the switching center and the destination modem via wire. Like a voice call, a CSD call is generally billed by the minute. Some service providers may only support "mobile-originate" calls, meaning the CNI can place a call but cannot be called.

GSM cellular service providers may offer access to the Internet using a service called GPRS (general packet radio service). CDMA cellular service providers may offer access to the Internet using a service called 1X or 1XRTT (single carrier, radio transmission technology). Data is exchanged in small blocks, or packets, to a server running Metretek's DC-2000 software. A packet call is generally billed by the amount of data exchanged rather than by the minute. Service is generally purchased in increments of 1 million bytes (1Mb) per month. Packet service has the advantage of being able to retrieve data from any CNI regardless of how far away the unit is from the central computer, without the expense of long-distance phone calls.

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1 PRODUCT DESCRIPTION

The Cellular Network Interface is simply referred to as the "*CNI*" throughout this document. This unit's operating software allows it to behave as a legacy Metretek data collection device known as a Pressure Tracker-II, or "PTII-DC".

1.1 Product Overview

Metretek's CNI, with Pressure Tracker-II (PTII) option is a precision measurement and data logging instrument that was developed for the purpose of acquiring gas pressure samples. Data is recorded in time tagged format, which can then be used for billing purposes or used to observe or predict trends. Real time pressure readings are also available.

It can also monitor several other electrical signals that might indicate alarm conditions, such as a low-pressure situation on a gas pipeline. In these situations the CNI can contact the central computer system immediately.

At some point the CNI must transmit its records to a central computer system for processing and to make room for more storage. Traditionally data logging devices have used wired telephone lines and modems to communicate with the central computer system. But in some cases the device may have to be located in a remote location and the cost of running phone lines to those locations may be quite high. In some hazardous locations phone lines may not be allowed. In general the monthly cost of wired phone service has greatly increased.

The CNI was specifically designed to address these problems. Operating as a wireless modem, a connection is made using commercial digital cellular GSM or CDMA phone networks. The GSM18 supports 900 / 1800 / 1900 MHz GSM, used throughout most of the world. The GSM20 supports 850 / 1900 MHz or 900 / 1800 MHz GSM. Either can make a circuit-switched data (CSD) connection to another modem, or a general packet radio service (GPRS) connection to an Internet server. The CDMA18 supports 850 & 1900 MHz CDMA service. It can make a circuit-switched data (CSD) connection to another modem, or a single carrier, radio transmission technology (1XRTT) connection to an Internet server.

Pressure alarm limits (high or low) can be used to trigger immediate calls for reporting failure conditions or consumption overloads in the distribution network. In addition to time-tagged interval data the user can obtain actual pressure readings. When the unit is communicating via the Internet it is possible to obtain new pressure readings every 10 seconds.

Primary power for the CNI is obtained from a common alkaline battery pack. This power source then maintains a charge on a lead-acid backup battery pack, as well as distributing power to the various circuit boards within the system. An industrial grade fiberglass enclosure is capable of withstanding the extremes that an outdoor environment can produce. The enclosure's door has a sensor to detect when the door has been opened. This event can trigger an immediate call if desired.

Metretek offers a powerful application program called DC-2000 that can collect information from thousands of devices, store their data in a database and present the results to user in a variety of formats. It can also notify the customer immediately when an alarm condition occurs.

1.2 Communications Options

Selecting a communications network to reliably transfer data is challenging. Economic factors come into play where the initial product cost must be weighed against monthly network service charges.

Some points to consider when selecting a network are:

- Satellite or microwave data links have a high initial cost and a high ongoing cost to maintain the service. Advantages include high reliability and high bandwidth (fast data transfers).

- Wired telephone line connections with a modem circuit are the most common for cost-sensitive applications. Installation and operation costs depend upon how accessible a phone line is at the site, whether the line is dedicated or shared, and whether the calls are local or long distance.

- Analog cellular phone service has been used in areas where phone lines do not exist. While the initial purchase price of the service can be higher than that of a wired line system, it eliminates the expense of running telephone wires over long distances. In some hazardous sites, telephone lines are not permitted. However, the limited capacity of analog cellular technology has led to the development of digital methods to increase capacity and provide new features. Some service providers have discontinued or greatly decreased the availability of analog cellular services. Some providers have abandoned it altogether in favor of digital-only systems.

- Digital cellular networks are rapidly expanding and replacing earlier analog systems. More efficient use of the radio spectrum permits the network to handle many more calls at a given time, and to offer new features including data exchange. In the case of the CNI, a GSM or CDMA cellular phone link is utilized to provide the most economical and reliable solution. Figures 1-1 and 1-2 provide simplified illustrations of the network from end-to-end.

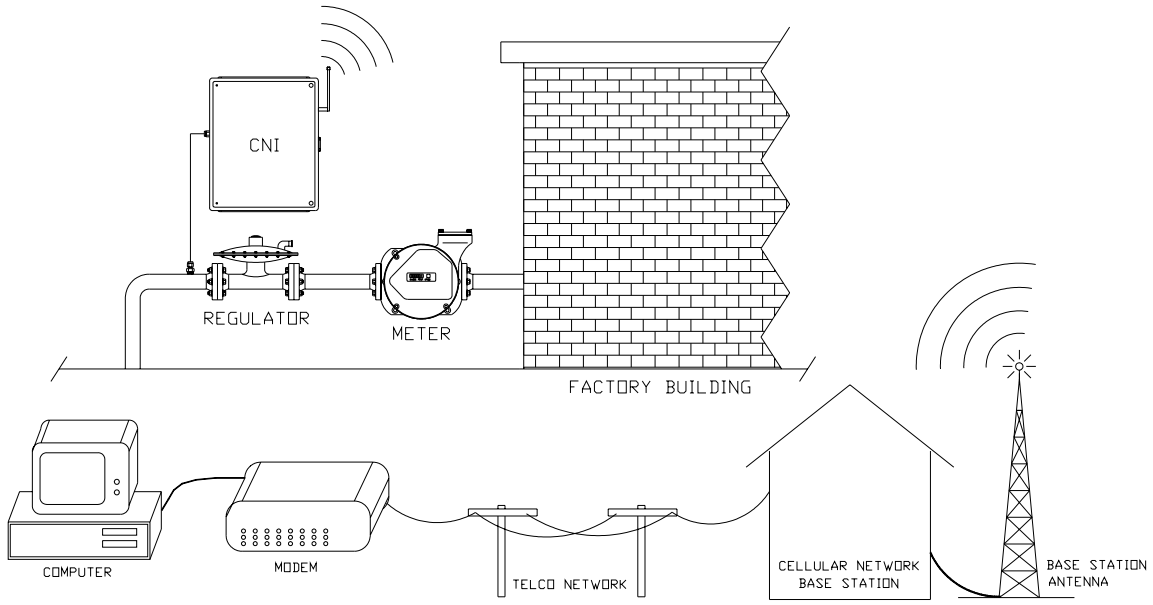

Figure 1-1
Single-Pressure Data Collection System using CSD

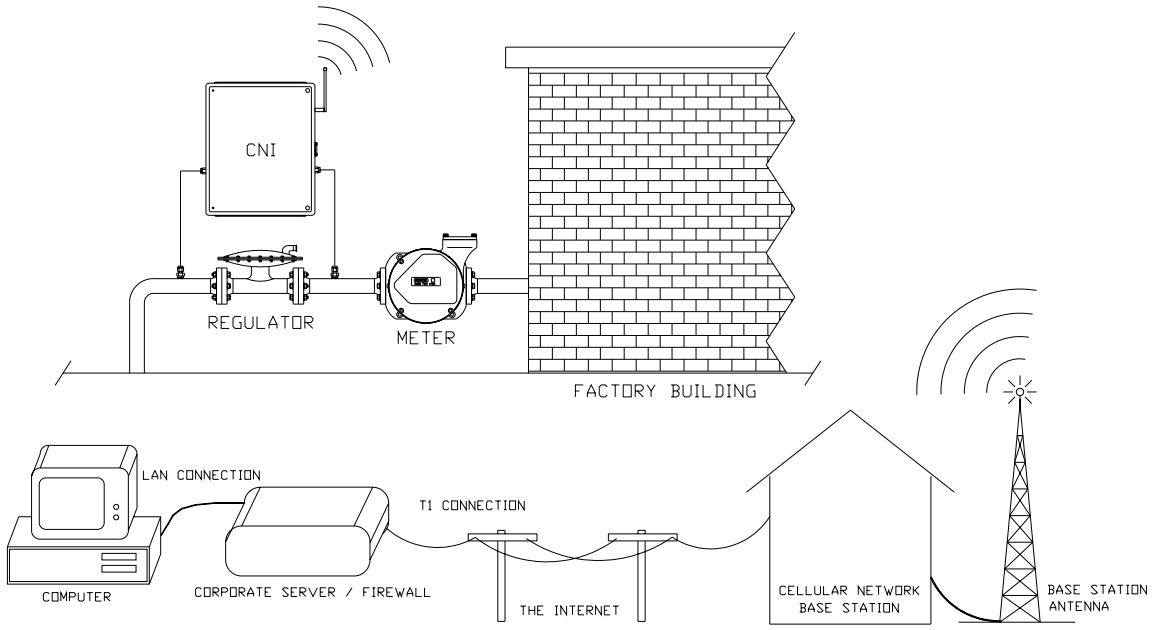

Figure 1-2
Dual-Pressure Data Collection System using the Internet

1.3 Communications Scenarios

Scenario #1: The CNI initiates a call to the central computer

- The CNI determines that a call should be made due to an alarm condition or a regularly scheduled call event.
- The cellular radio on the CNI establishes a connection with the cellular phone network.
- The CNI initiates an outbound data call (CSD mode) or Internet connection (packet mode) to the central computer, which is running Metretek's DC-2000 data collection software.
- The central computer processes the CNI's data and stores it in a database structure format.

Scenario #2: The data collection computer initiates a data call to the CNI (CSD mode only).

- The CNI's cellular radio is registered with the cellular network, and is therefore always 'listening' for an incoming call.
- The central computer dials the radio's "data" number (this is known as a "mobile-terminate" CSD connection). When the radio answers the call, it will establish a link with the computer, which is running Metretek's DC-2000 data collection software.
- The computer processes the meter's data and stores it in a database structure format.

Scenario #3: The data collection computer "pages" the CNI and waits for the CNI to call back.

NOTE: It is not possible to contact the CNI via the Internet because "mobile" devices do not normally have permanent Internet addresses. In CSD mode the cellular service provider may not support "mobile-terminate" connections. In these cases the CNI can be "paged", which will cause the unit to call back immediately.

- The CNI cellular radio is registered with the cellular network, and is therefore always 'listening' for an incoming call or message.
- If the cellular account has been assigned a voice or data phone number, the computer calls that number. The CNI answers the call, hangs up, and will immediately call back as described in Scenario #1.

- If the cellular account includes a feature called SMS (short message service), the computer can send a text message to the CNI. When the CNI receives the message it will immediately call back as described in Scenario #1.

1.4 CSD versus Packet mode

The CNI can communicate with the central computer's modem using a circuit-switched data (CSD) connection, or can exchange information with the central computer over the Internet. There are advantages and limitations to each method.

CSD mode is similar to two modems communicating over a wired telephone line. The cellular service provider has banks of modems available in their switching centers. When it detects a CSD call, it connects one of its own modems to the wired line. Data is transferred between the CNI and the switching center via the radio link, and then between the switching center and the destination modem via wire. Cellular service providers often offer this service as an add-on package to a standard "voice" account, and each call is measured and billed in terms of minutes used. Depending upon the frequency and length of the calls this service can become quite expensive. In situations in which the calls are long distance, it may be possible to purchase plans that include free long distance in order to reduce costs.

GSM cellular service providers may offer access to the Internet using a service called GPRS (general packet radio service). CDMA cellular service providers may offer access to the Internet using a service called 1X or 1XRTT (single carrier, radio transmission technology). Data is exchanged in small blocks, or packets, to a server running Metretek's DC-2000 software. Cellular service providers may offer this service as an add-on package to a standard "voice" account, or may offer it as a stand-alone product. Each connection is usually measured and billed in terms of the amount of data exchanged, usually in increments of 1 million bytes (1 Mb) per month. The amount of information exchanged on each call may range from several hundred bytes to 10's of thousands of bytes, depending upon the information that is requested from the field device. It may be necessary to test the system for several months and then adjust the cellular account for the best cost based on your needs.

1.5 Basic Steps for Operation

1) Decide on communications method, either CSD or Packet mode (Chapter-3).
2) Purchase cellular service (Chapter-3).
3) Install the batteries (Chapter-2).
4) Configure the unit (Chapter-4).
5) Configure the data collection software (Chapter-5).
6) Mount the unit (Chapter-2).
7) Connect the pressure lines (Chapter-2).
8) Power-up the unit and verify first call (Chapter-6).

2 INSTALLATION AND ASSEMBLY INFORMATION

2.1 Unpacking, Damage reports, Item List

Upon receipt, inspect the unit for any potential shipping damage. If any damage is detected that can be attributed to the way the package was handled, then a claim should be filed with the shipping agent as quickly as possible.

A typical unit assembly is provided with the following items:

a) Nema 4X enclosure
b) A Cellular Network Interface (CNI) board.
c) For the model GSM18 a Motorola g18 GSM cellular radio. For the model GSM20 a Motorola g20 GSM cellular radio. For the model CDMA18 a Motorola c18 CDMA cellular radio. The radio is mounted directly to the CNI board.
d) Antenna (mounted to the side of the enclosure)
e) dc power supply board.
f) One or two pressure sensors mounted to the sides of the enclosure.
g) One or two Analog Data Monitor (ADM) boards (for converting the pressure sensor signals to digital information).
h) Dual port multiplexer board mounted to the CNI board (dual-pressure unit only).
i) 12-volt, 2.5 A-hr sealed lead-acid battery
j) 6-volt alkaline lantern battery (for charging the lead-acid battery)
k) Manual 900353 (this document). Normally only one manual is included with each shipment rather than with each unit. Additional manuals can be ordered separately or obtained in PDF file format upon request.

Note: The items listed above may vary depending on what was requested with the original purchase order. Refer to the shipping document or the purchase order for a precise record when inspecting the package contents.

2.2 Additional Items Required for Installation

Several additional tools and items will be required before proceeding with the field site installation. These are:

Equipment available from Metretek:

- PC-to-serial link (Metretek programmer cable) as illustrated in Figure 2-1. This item can be obtained under stock number 1002-0209B-001.

- MP-32 programmer software application program, available under Metretek stock number 100160.

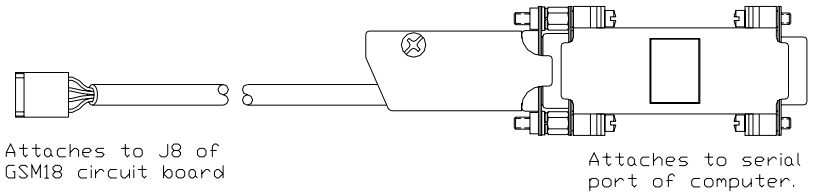

Figure 2-1
Metretek Programmer Cable

Common “off-the-shelf” items required for installation:

- ‘x86 or Pentium class laptop computer for configuration of the CNI. The operating system must be Microsoft Windows-98® or newer. The computer must have an RS-232 serial port available.

- An activated SIM card to enable the GSM cellular radio module. This must be obtained from the cellular service provider. Refer to Chapter-3 for additional details regarding SIM card activation. CDMA does not require a SIM card but an account must be established before the radio can be activated.

- Voltmeter for troubleshooting.

- Hand tools, fasteners, mounting hardware, PVC pipe, etc.

2.3 Site Selection for Best Performance

WARNING
No hazardous area safety approvals have been received for this product.
It is therefore necessary to ensure that the product is only installed at locations that are classified as ‘safe area’ sites.

See Chapter-7 for more safety information.

Field site selection for a cellular communications product requires additional consideration with regard to antenna placement.

- Ensure that the antenna is pointing in a vertical direction.
- Mount the unit away from buildings and structures when possible. Buildings tend to block the rf signal if they lie in the path between the cellular tower and the CNI. Outdoor installations are preferred
- Raise the elevation as high as practical from the ground.
- Avoid mounting the unit to the side of a metal shed or similar structure since metal is a very effective shield against the desired rf signal. Chain link fences are normally not a problem.
- Avoid mounting the product in a location where the antenna is in close proximity to a measurement instrument such as a Rosemont transducer. The strong rf field from the cellular module transmitter could possibly degrade the accuracy of these precision instruments. Conversely, nearby electronic equipment may interfere with the operation of the cellular radio.

Depending on the signal strength for a given location, it may be possible to violate some of these suggestions and still obtain good performance. This will vary from one site to the next, just as the reception quality of a handheld cellular phone will vary.

If the antenna provided does not provide adequate performance, a different antenna can be used as long as it complies with the impedance and frequency range of the cellular radio module. For instance, the CNI may be located in a metal building but a mobile antenna, such as the type that would mount to the roof of a vehicle, may be located outside of the building.

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This product contains a radio-frequency transmitter,
Motorola Model g18, FCC ID # IHDT6AC1,
Motorola Model g20, FCC ID # IHDT56DB1 or
Motorola Model c18, FCC ID # IHDT56CW1.

The combined cable loss and antenna gain must not exceed 6.1dBi gain, and the antenna installation must provide a minimum separation distance of 20cm (8”) from users and nearby persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

See Chapter-7 for more safety information.

2.4 Unit Assembly Layouts

A single-pressure unit consists of one pressure sensor, an Analog Data Monitor (ADM) board (to convert the analog output of the sensor to digital information), a power supply board, the Cellular Network Interface (CNI) board, a cellular radio mounted to the CNI board, antenna and batteries.

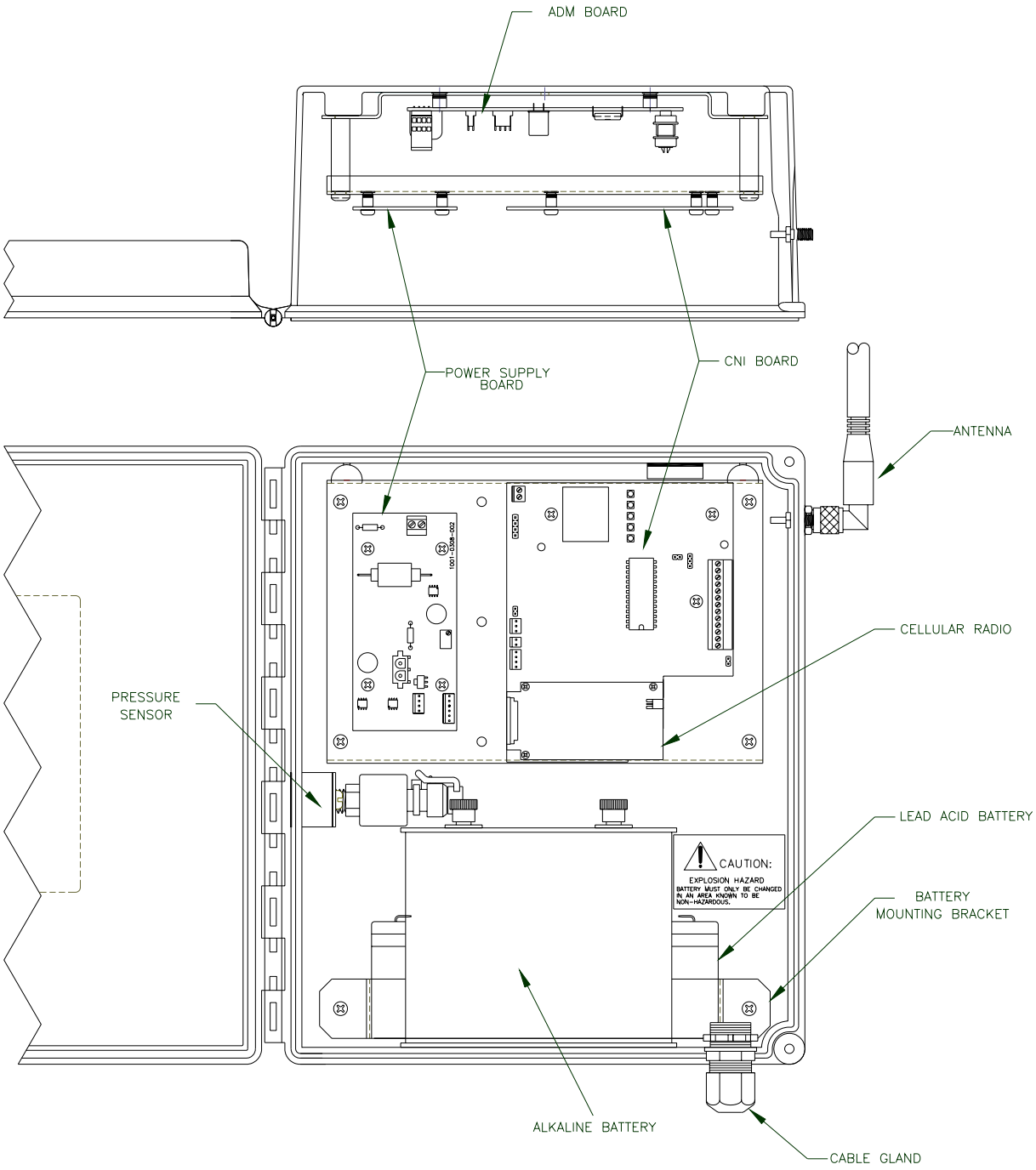

Figure 2-2
Single-Pressure Unit Assembly Layout

A dual-pressure unit consists of two pressure sensors, two Analog Data Monitor (ADM) boards (to convert the analog outputs of the sensor to digital information), a power supply board, the Cellular Network Interface (CNI) board, a dual multiplexer board and cellular radio mounted to the CNI board, antenna and batteries.

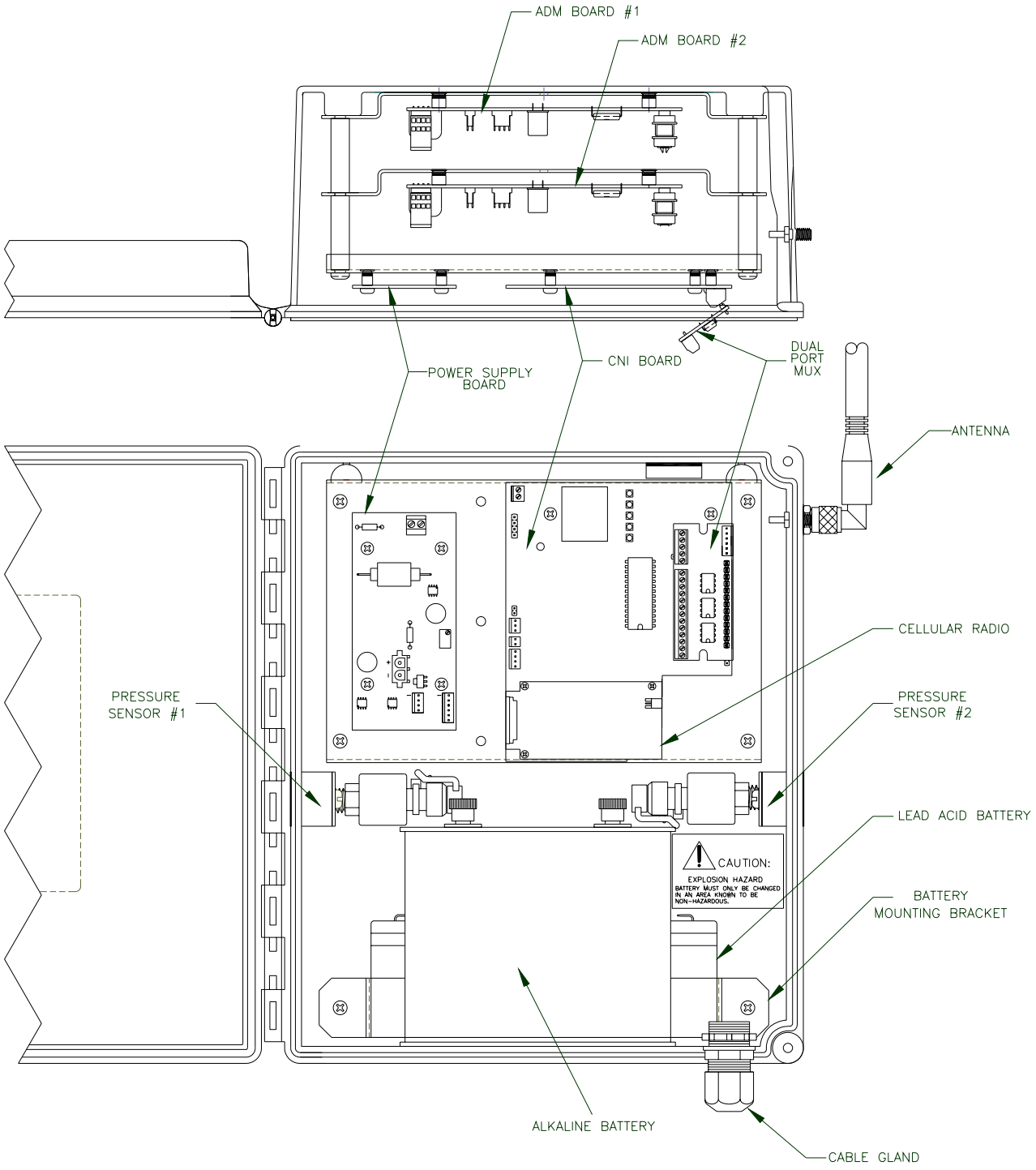

Figure 2-3
Dual-Pressure Unit Assembly Layout

2.5 Enclosure and Mounting Dimensions

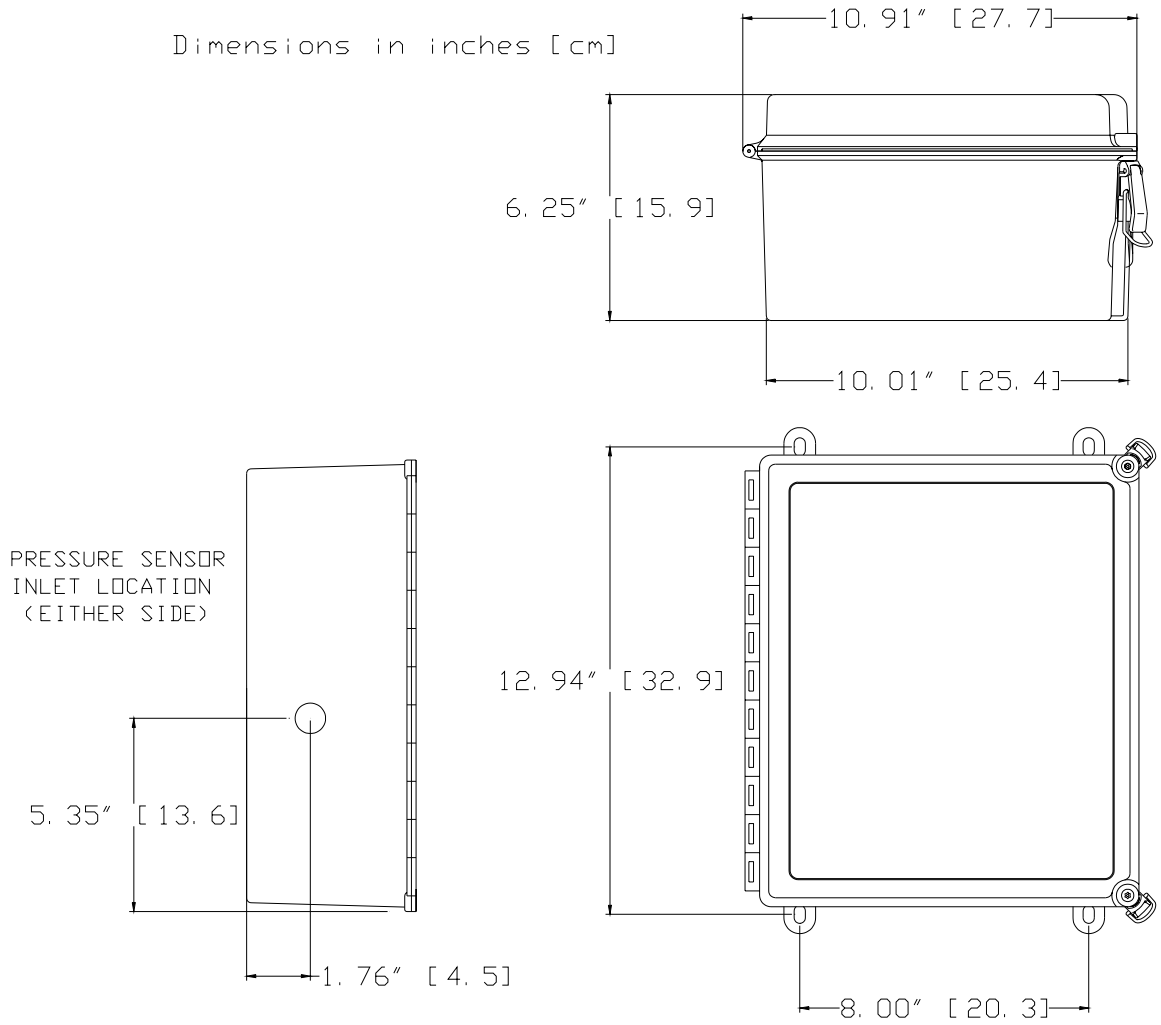

Figure 2-4
Enclosure Dimensions

Mounting of the unit is normally accomplished by bolting the enclosure to a wall or other support structure. The four mounting tabs are capable of accepting bolts of 5/16" (0.312") maximum diameter, although smaller bolts can be used with washers. Figure 2-5 provides an illustration of one of the enclosure mounting tabs.

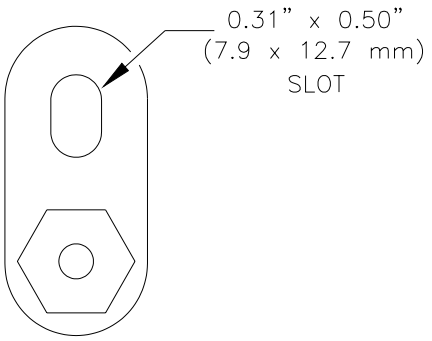

Figure 2-5
Enclosure Mounting Tab (1 of 4)

2.6 Battery Installation

The lead-acid battery is retained with a metal bracket and two screws. The alkaline lantern battery simply rests on the bottom of the enclosure. Be careful not to impact the pressure sensors when removing and installing the batteries.

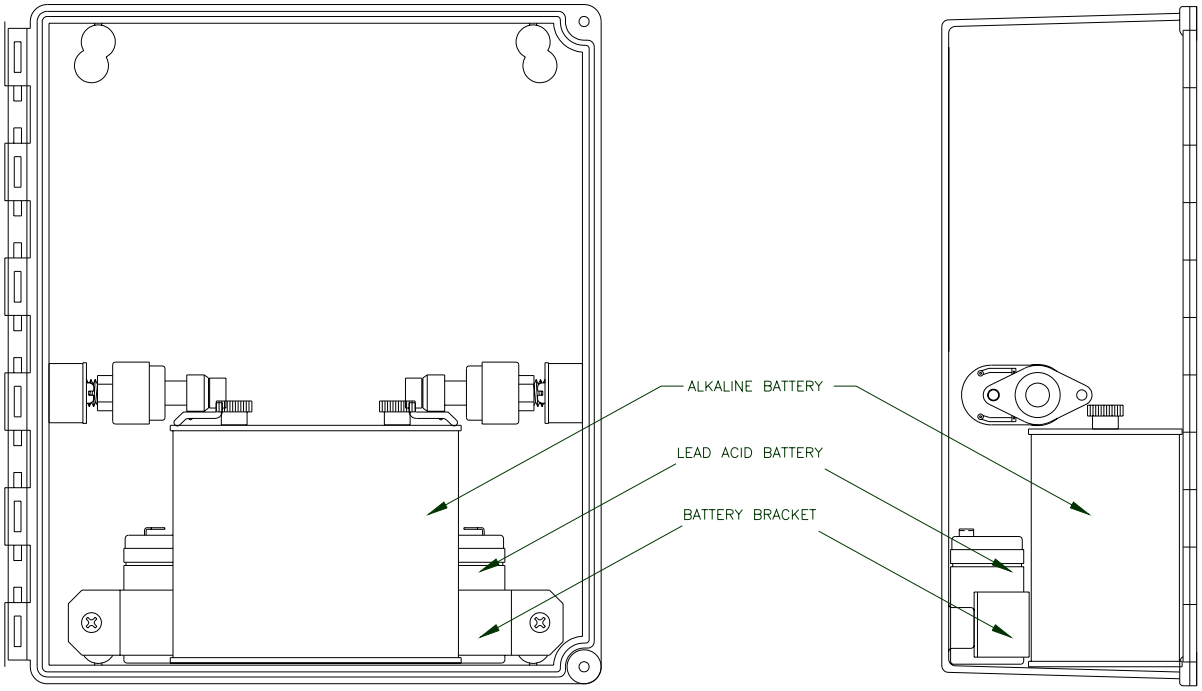

Figure 2-6
Battery Installation

2.7 Pressure Transducer Assembly

See the following illustrations if it becomes necessary to replace a pressure transducer.

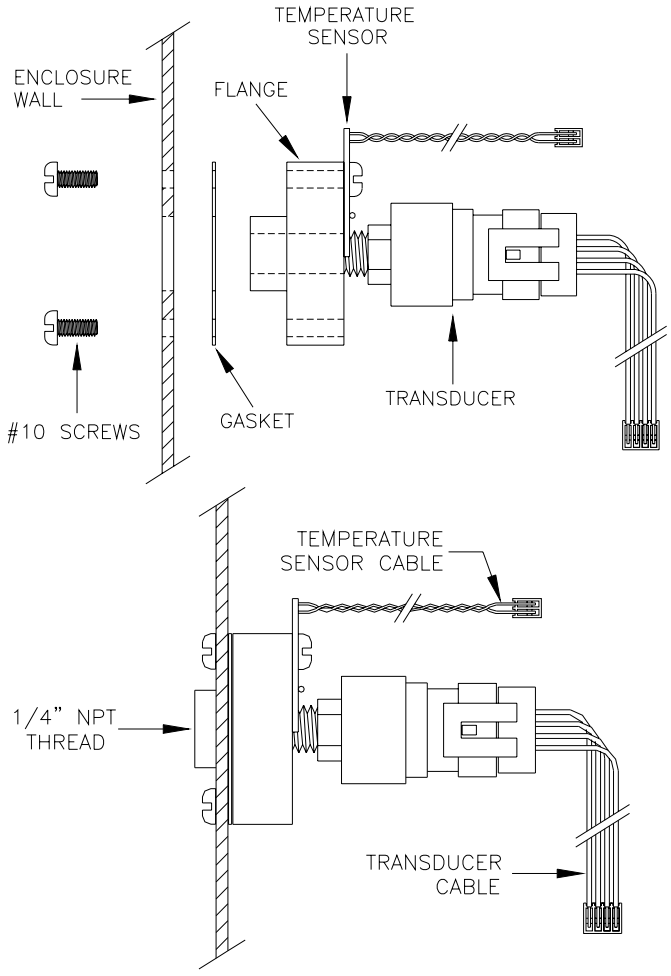

Figure 2-7
Pressure Transducer Assembly

2.8 Electrical Block Diagram – Single-Pressure Configuration

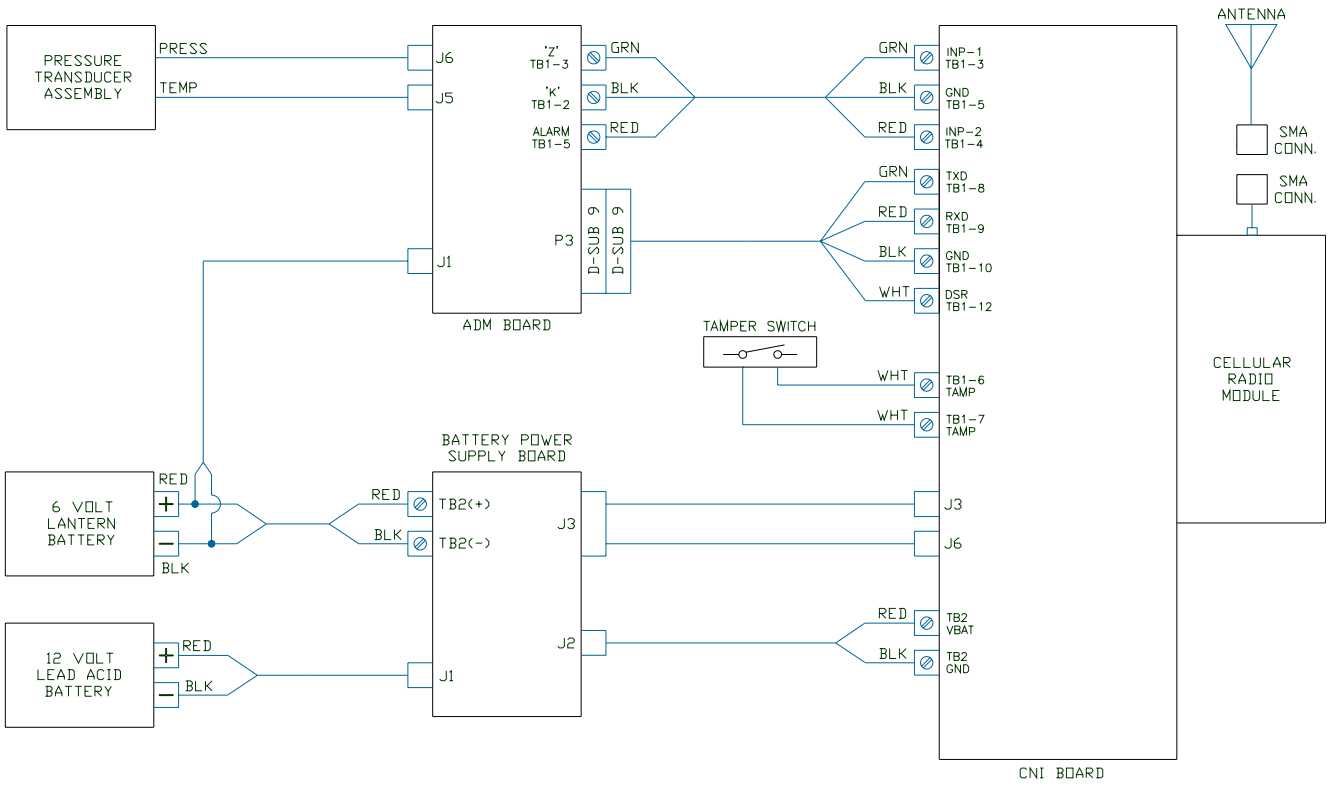

Figure 2-8
Electrical Block Diagram for Single-Pressure Configuration

2.9 Electrical Block Diagram – Dual-Pressure Configuration

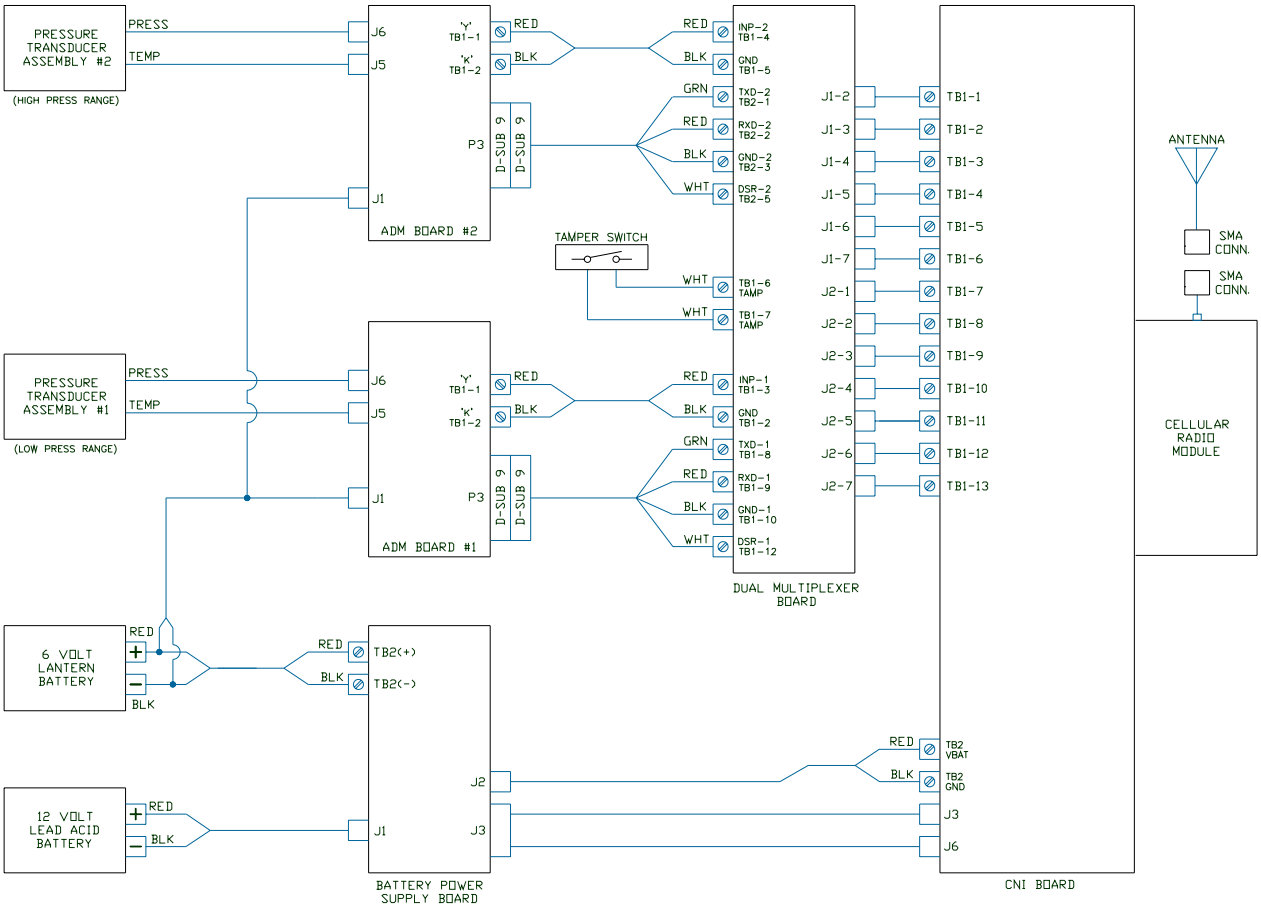

Figure 2-9
Electrical Block Diagram for Dual-Pressure Configuration

2.10 Cellular Network Interface (CNI) Board

The Cellular Network Interface (CNI) circuit board assemblies are shown in Figures 2-10, 2-11 and 2-12. Components that are not related to installation are not shown. The electrical block diagram is shown in Figure 2-13.

The primary difference between the three assemblies is the type of radio used and several different components to support those radios, such as connectors and mounting hardware. The operating software is also different for each model.

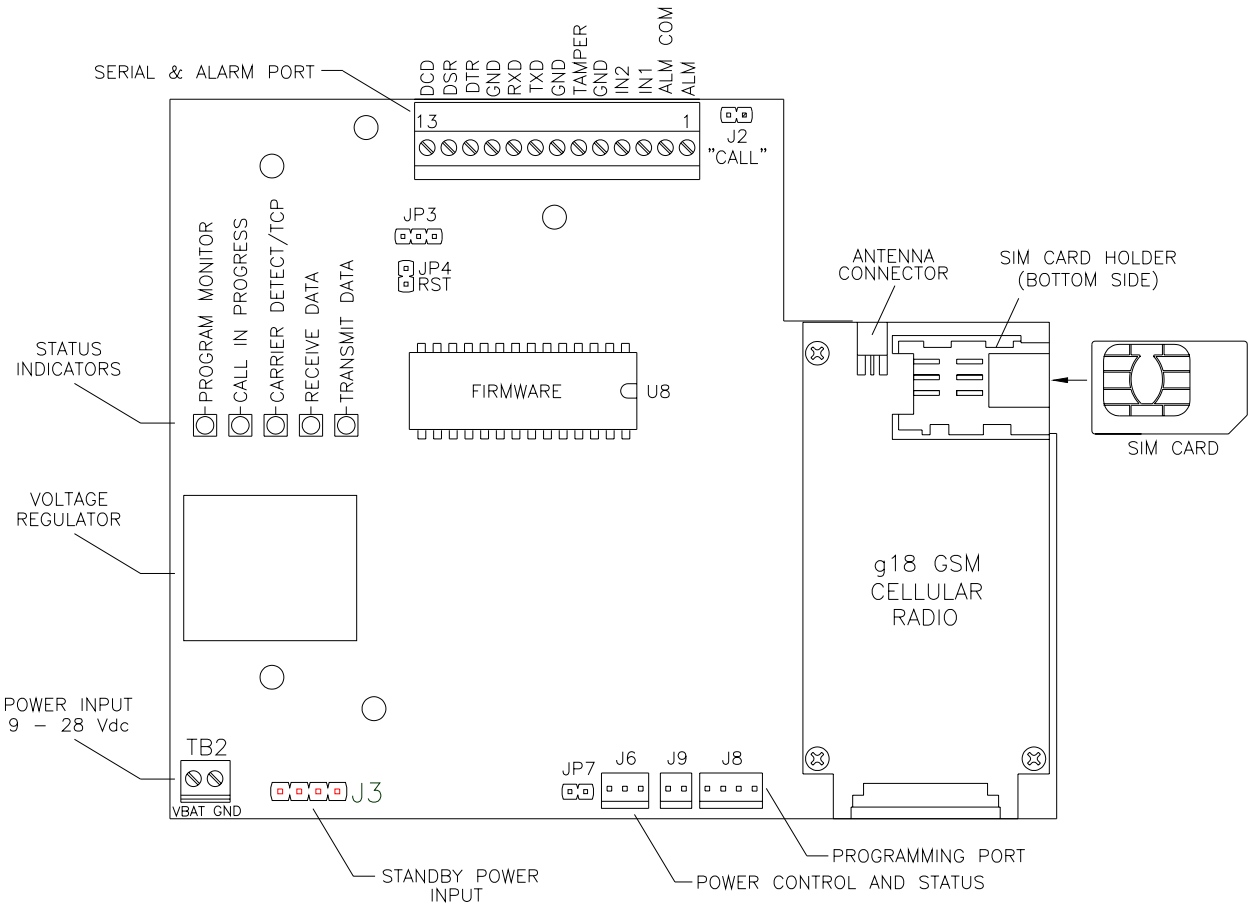

Figure 2-10
CNI / GSM18 Board

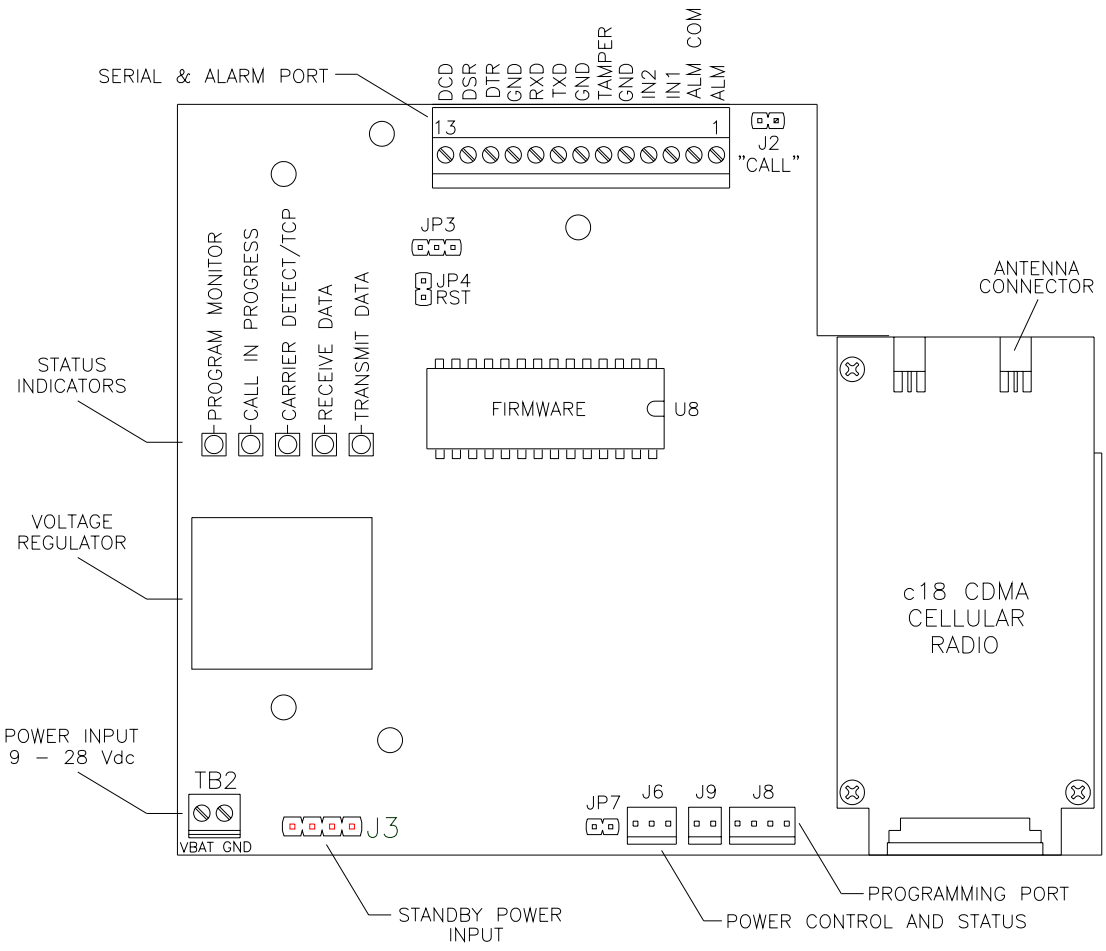

Figure 2-11
CNI / CDMA18 Board

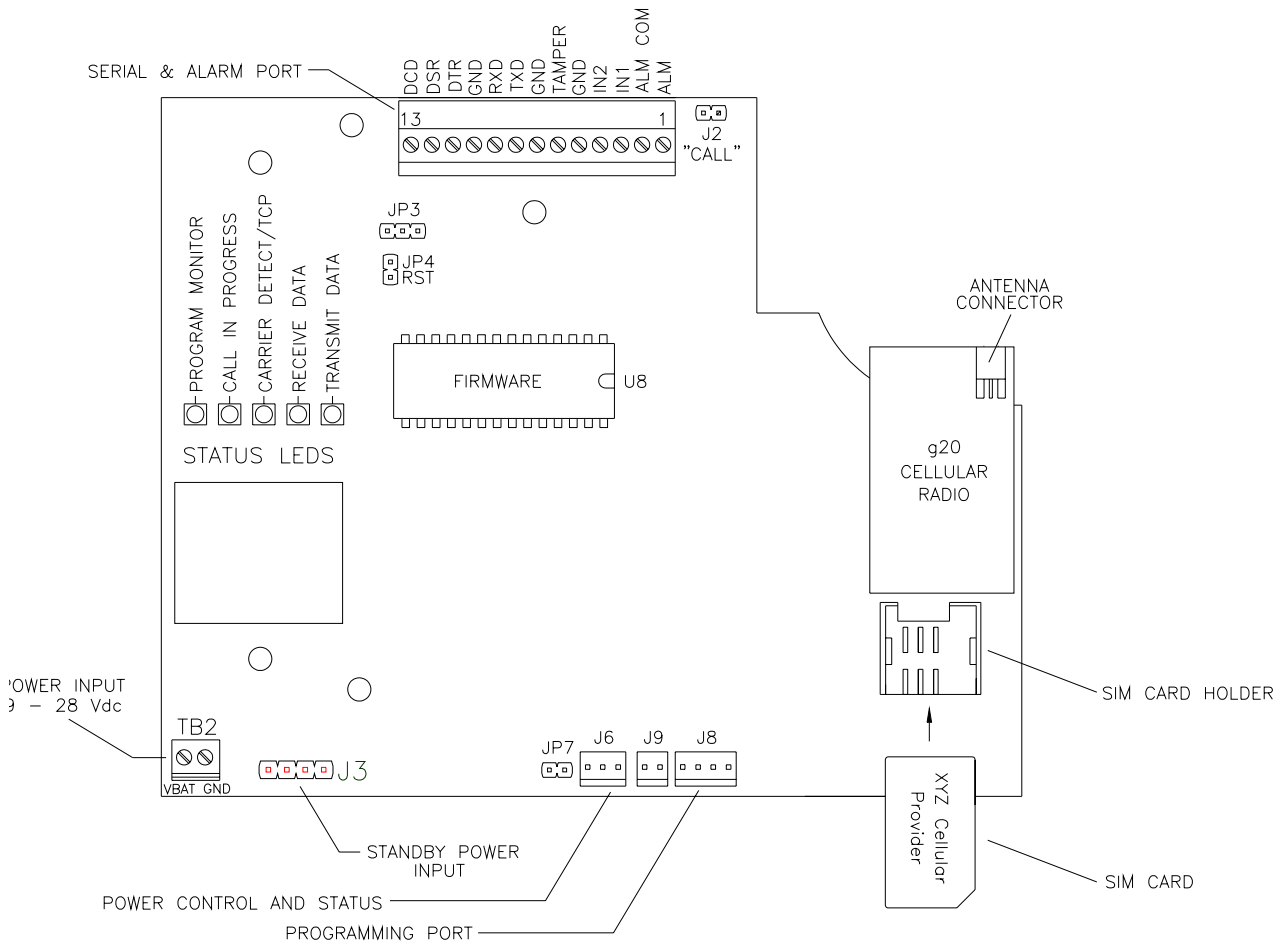

Figure 2-12
CNI / GSM20 Board

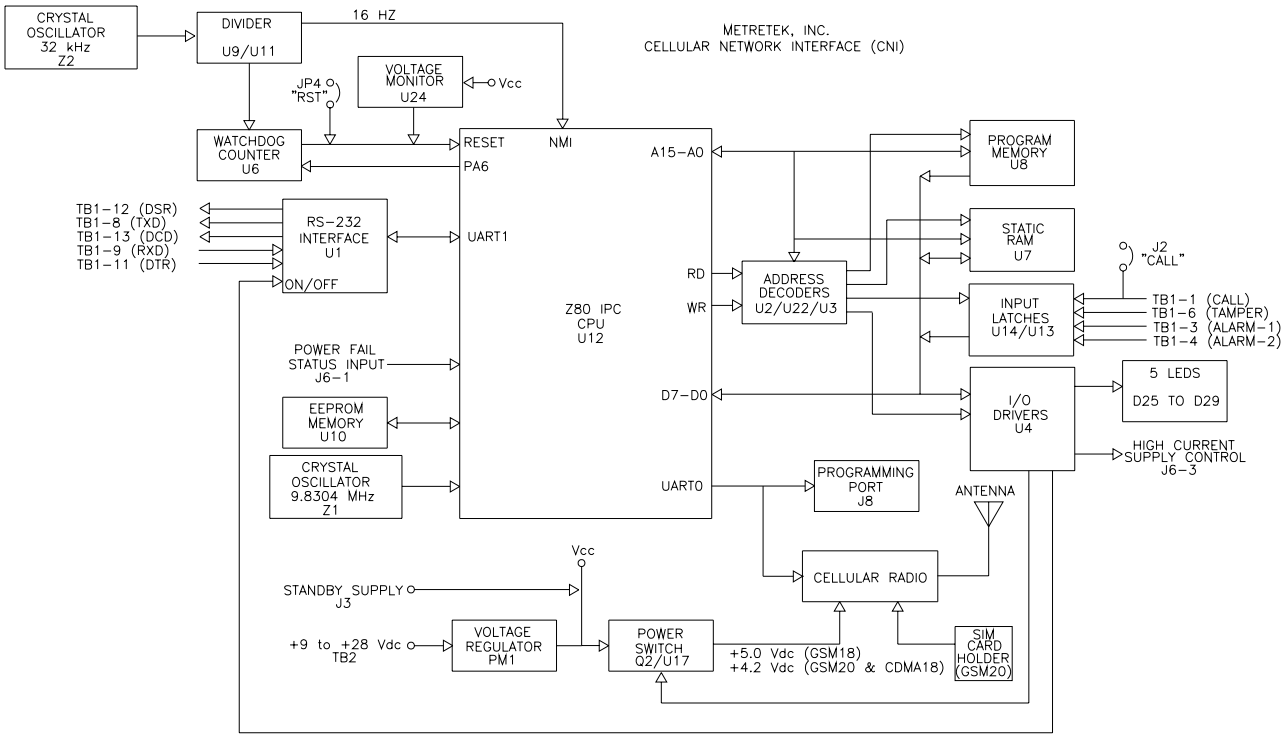

Figure 2-13
Block Diagram of the CNI Board

Various jumpers exist on the CNI board to enable different operating modes and options. Table 2-1 lists these jumpers and their purpose.

JUMPER	POSITION	NOTES
J2	OPEN	Momentary short will force the unit to originate a call
JP3	A-B	For applications that require the DSR control line to have RS-232 voltage levels (± 9V). This is the correct setting for the PTII application.
JP3	B-C	For applications that require the DSR control line to have +5V and 0V voltage levels. This setting is not used in the PTII application.
JP4	OPEN	Momentary short will reset unit and clear data memory
JP7	OPEN	Used for factory testing

Table 2-1
CNI Circuit Board Jumper Configuration

2.11 Power Supply Board

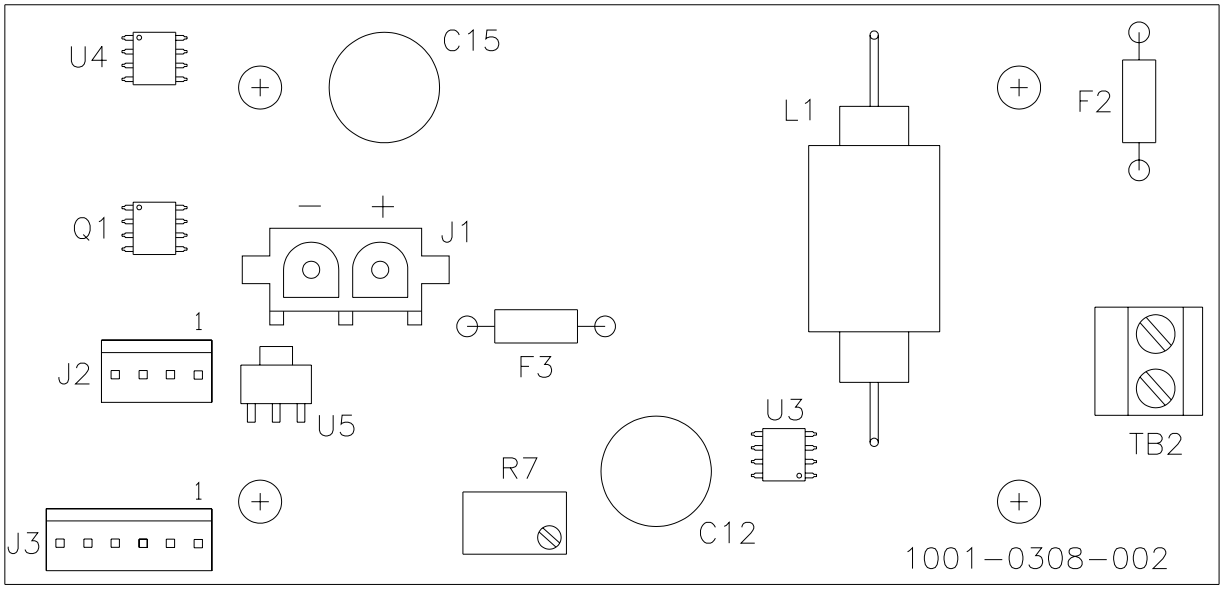

Figure 2-14
Power Supply Board

The primary input source for the power supply board is typically a 6-volt alkaline lantern battery. Any other filtered dc supply can be used as long as the voltage does not exceed 6.5 V. The battery connects to the TB2 connector, Pins-3 (+) and 4 (-).

The power supply board provides four functions. First, the board provides a regulated, low current (100mA) +4.5V supply for the CNI board. This connects to J3 on the CNI board. It is the primary source when the radio is not being used and maintains the processor circuits and memory.

When the radio is powered up the CNI generates a signal on its J6 connector that causes the power supply board to turn on a high-current +9V supply. This supply is connected to the TB2 terminal block on the CNI board. This supply is needed due to the high current demands of the radio.

The third function is to supply a constant 13.0 V charging voltage for the lead acid battery. It is this battery that supplies most of the current for radio operations. The alkaline battery is simply a charging source.

Finally the board monitors the condition of the alkaline battery and reports a low-battery condition to the CNI when the battery voltage reaches approximately 3.6V.

2.12 External Antenna Connection

Each model of the CNI uses a different radio. Although all radios use the same type of MMCX connector, they are located in different positions. Figure 2-17 illustrates this difference. Please note that the c18 CDMA radio has two connectors. It is important to install the cable into the right-hand connector.

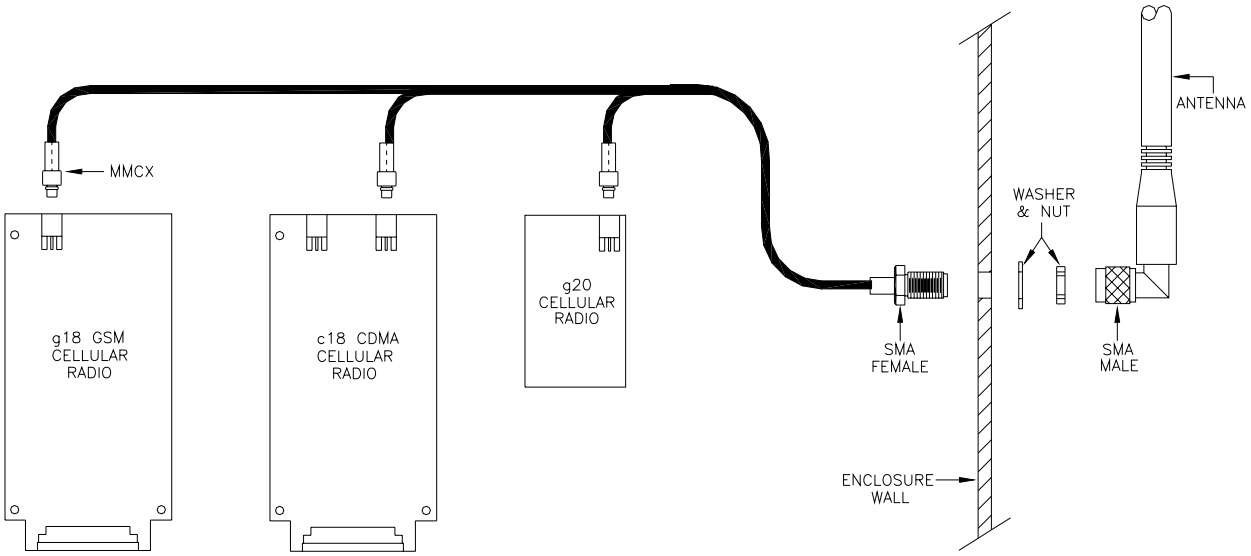

Figure 2-15
External Antenna Connections

Four antenna kits are available depending upon the cellular frequency. One is always installed and will be at the operating frequency that was requested when the unit was purchased. If the unit is moved to another region, or a different cellular provider is chosen at a later time, it may be necessary to change to a different frequency and therefore a different antenna. Use Table-2 to order a different antenna kit.

Metretek Stock #	Frequency	Usage
1014-0042-004	850 MHz	CDMA and GSM
1014-0042-001	900 MHz	GSM
1014-0042-002	1800 MHz	GSM
1014-0042-003	1900 MHz	CDMA and GSM

Table 2-2
External Antenna Kits

2.13 Dual-Port Multiplexer Board

The dual-port multiplexer board (Metretek Stock # 1001-0314-001) is used only in the dual-pressure unit. The CNI board communicates with each ADM board using a serial RS-232 interface. The CNI only has one such interface, but the dual-pressure unit has two ADM boards. The dual-port multiplexer board splits the serial interface into two physical interfaces, one for each ADM board. The multiplexer board is mounted directly to the CNI's terminal block. It also provides connection points for any other signals not associated with the serial port, such as alarm inputs.

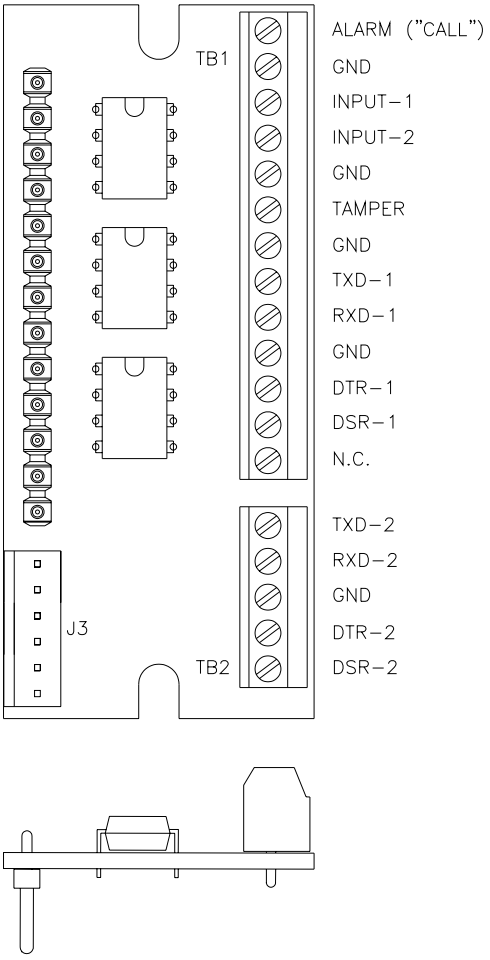

Figure 2-16
Dual Port Multiplexer Board

Figure 2-17 depicts the multiplexer board installed directly on the CNI. The pins of the multiplexer board are inserted into the CNI's terminal block. All screws on the CNI's terminal block must be tightened to ensure proper electrical contact. Connections are then made to the multiplexer board's terminal block for all alarm inputs as well as the serial connections to the two ADM boards.

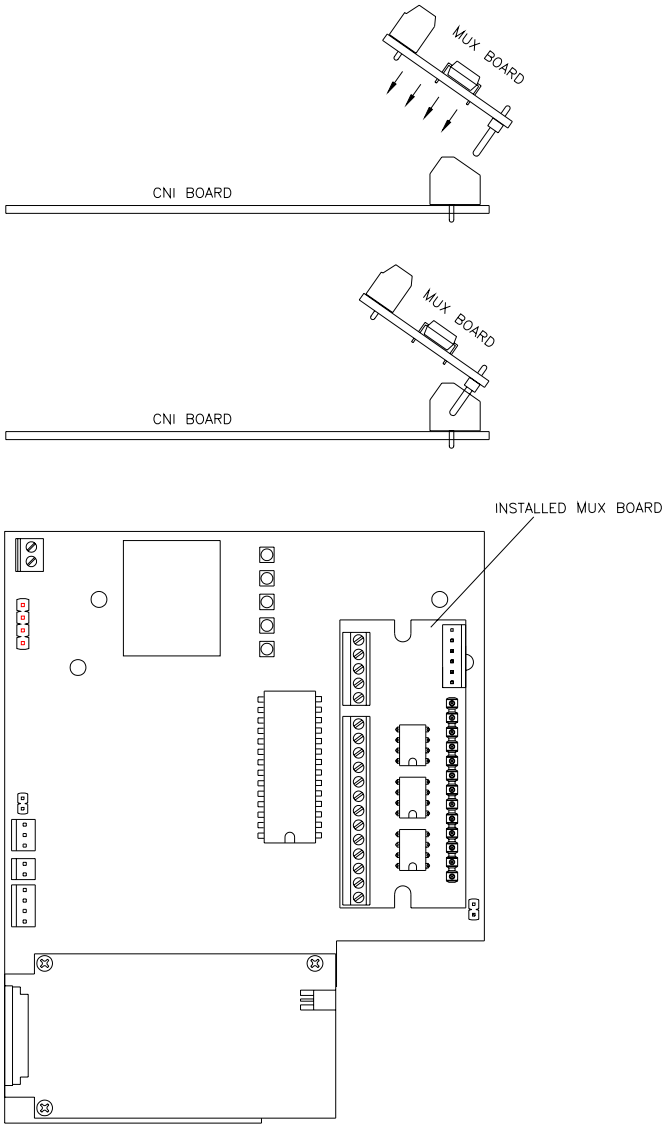

Figure 2-17
Installed Dual Port Multiplexer Board

2.14 Analog Data Monitor (ADM) Board

It is the function of the ADM board (Figure 2-18) to take analog samples from the pressure transducer and its temperature sensor, apply correction factors that compensate for non-linearity and temperature effects related to the transducer and to generate a pulse output for the CNI board. The pulse train is linear with respect to the full-scale range of the pressure transducer: 0 Hz of zero pressure and 8 Hz for full scale.

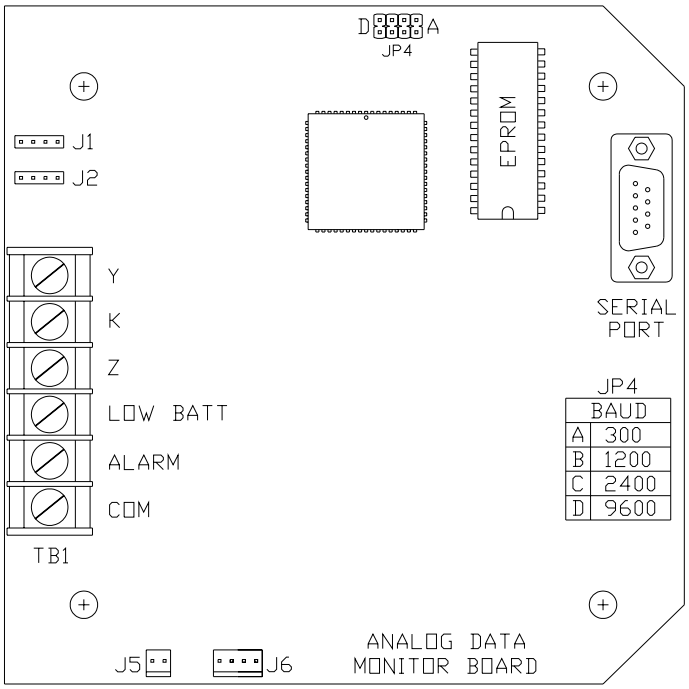

Figure 2-18
Analog Data Monitor (ADM) Board

Connection points are as follows:

J1: This is a power connector on the ADM board, and accepts from 3.6 to 6.0 volts. The power supply board provides this power source. In some cases the power connection may come directly from the alkaline battery.

J2: This is a redundant power connector that serves the same function as J1.

J5: This two-position connector attaches to the temperature sensor board that is part of the pressure transducer assembly.

J6: This four-position connector attaches directly to the pressure sensor.

P3: A 9-pin RS-232 serial port connector is available for observing live pressure readings and for making configuration changes to the ADM. Normally the CNI is wired to this port via the serial port at the terminal block. It is also possible to connect a computer's serial port to this

connector to allow direct communications at the field site.

TB1: Although six connection points are available at TB1, not all of them are utilized. Terminals ‘K’ and ‘Y’ provide the pulse signal outputs representing the current pressure samples. The ‘Alarm’ signal is also tied into the CNI and is intended to trigger an alarm call that will be registered at the central computer site warning of either a high or low pressure event. NOTE: The connection points ‘Z’ and ‘Low Batt Alarm’ on the terminal block do not require any connection for this application.

Jumper JP4 is used to set the bit rate (baud) for the RS-232 link at P3. Four positions exist for selecting either 300, 1200, 2400, or 9600 bps. Default setting is 9600 bps at position ‘D’. NOTE: If this jumper location is changed, power to the ADM board must be removed and reapplied in order for the baud rate to be changed.

2.15 Power-Up / Power Down Procedure

Since there are two power sources, the alkaline battery and the lead-acid battery, it is necessary to remove both sources to completely power down the unit. Failure to disconnect both will shorten the life of the alkaline battery.

It is not necessary to remove any connectors from the CNI or ADM boards. To disconnect the lead-acid battery, unplug the white connector from the J1 connector on the power supply board. To disconnect the alkaline battery disconnect one of the wires from the battery’s screw-on terminals.

When powering up the unit either battery can be connected first, though it is best to connect the lead-acid battery first.

When power is first applied the green “PROGRAM MONITOR” light on the CNI should light solidly. The red “RECEIVE DATA” light should light momentarily, then go out. The green “PROGRAM MONITOR” light should then start flashing once per second. This indicates the CNI is running.

3 CELLULAR SERVICE

3.1 GSM Service

3.1.1 GSM Overview

GSM is an abbreviation for **G**lobal **S**ystem for **M**obile communications. This communications standard is widely used throughout Europe, Africa, Asia and parts of North and South America. Messages are digitized into packets and sent in brief bursts during allocated time slots using a variation of TDMA (Time Division Multiple Access) techniques. Up to 8 cellular phones can thus share the same frequency band, which in turn permits the system to support more users with existing equipment. Efficient utilization of spectrum is an important consideration for service providers since there is only a limited bandwidth space that has been allocated to cellular phone service.

Most GSM systems throughout the world operate on either the 900 MHz or 1800 MHz communications bands. In North America most GSM systems operate on the 1900 MHz band. Also, many older 850 MHz TDMA networks in North America are being converted for GSM service. The GSM20 covers both the 850 and 1900 MHz bands

3.1.2 Establishing Cellular Service for GSM GPRS Packet Service

A cellular account must be activated with a cellular service provider prior to placing a CNI into service. Some GSM service providers may not offer all forms of data transfer. General packet radio service (GPRS) may have to be added to a standard voice plan, or may be a stand-alone service.

GPRS packages are generally priced by the number of bytes to be transferred rather than by the minute. Typically the smallest available package will be 1 megabyte (1 Mb) per month. The amount of data that the CNI will produce depends upon what sort of data is requested from the field device. The amount of information exchanged on each call may range from several hundred bytes to 10's of thousands of bytes. It may be necessary to test the system for several months and then adjust the cellular account for the best cost based on your needs.

In order to connect to the Internet, the cellular service provider has its own computer equipment called a "gateway" server, aptly named, as it is their gateway to the Internet. The server will have an "APN" (access point name), usually in the form of a domain name such as "internetaccess.providername.com" or something as simple as "proxy". Contact your service provider for this information. This APN will be needed when configuring the CNI (Chapter-4).

Service providers may have several different gateways to choose from, depending upon the type of service required. "Web phones" (cellular phones that support Internet access) are generally assigned to a gateway that only connects to WAP services (wireless application protocol). The CNI requires full Internet access because the data collection software could be running on any server located anywhere in the world. Full access gateways are usually assigned to customers who will be connecting a cellular modem to a personal computer.

Another parameter that will be needed is the packet service connection command. In most cases the command will be ATD*99# but you may want to check with your service provider. This command requests a connection to the cellular network's Internet gateway server, which then provides access to the global Internet.

Finally, the service provider may ask the device type, which must be specified as either the Metretek "CNI / GSM18" or "CNI / GSM20".

3.1.3 Establishing Cellular Service for GSM CSD

A cellular account must be activated with the local service provider prior to placing a CNI into service. Many GSM service providers offer some sort of data support, but their marketing focus may be on Internet connectivity or short-message services ("SMS", used to send text messages to and from cellular phones). This does not necessarily mean that they support all forms of data transfers. The service provider must support asynchronous circuit-switched data (CSD) exchange at 4800 or 9600 baud. The baud rate must match the baud rate of the central computer's modem. Sometimes this capability may be included as part of a standard voice package, or it may be an add-on feature at extra cost.

One consideration when ordering service is the frequency of calls to and from the CNI. Each service provider offers different packages that may include a fixed number of minutes per month for a fixed price. However, when this number is exceeded, the cost per each additional minute can be very high. There are also variations in the way "minutes" are measured. For example, a call lasting 1 minute 10 seconds may be considered to be a 2-minute call by some providers. It might be possible to purchase less expensive packages that have additional "weekend" or "evening" minutes, and then schedule the field device to call in at those times. Some plans may offer the 1st minute free. This might be advantageous for short calls.

Another consideration when ordering service is the location of the CNI with respect to the service provider's network. It is best to describe where the units will be located and where they will be calling, otherwise you could be charged "roaming" or long-distance fees. Some providers offer free long distance or no roaming charges as part of their basic plans.

The final consideration is the direction of the calls. If the CNI is to originate calls, then the service must support "mobile-originate" service. If the unit is to receive calls, then "mobile-terminate" service is required.

If the CNI is to receive calls this will require that the cellular radio be powered up at all times. If the primary charging source is the alkaline lantern battery this will quickly drain the battery. It may be necessary to use an alternate dc power source in the range of 5 – 6.5 Vdc.

The service provider will need the following information:

- Type of cellular service desired, which is *circuit-switched data (CSD)*.
- The device type, which must be specified as the Metretek “CNI / GSM18” or “CNI / GSM20”
- Data mode is to support 4800 or 9600-baud operation. This rate must match the speed of central computer’s modem.
- Mobile-originate and/or mobile-terminate service.
- Number of minutes per month.
- Location of the CNI and the location of central computer (to determine if “roaming” or long distance charges apply).
- The service provider may need to know the “IMEI” number printed on the radio.

3.1.4 SIM Card Installation for the GSM18

After the account has been established, the cellular service provider will provide a small memory card known as a SIM card (Subscriber Identity Module). Figure 3-1 illustrates the appearance of a SIM card.

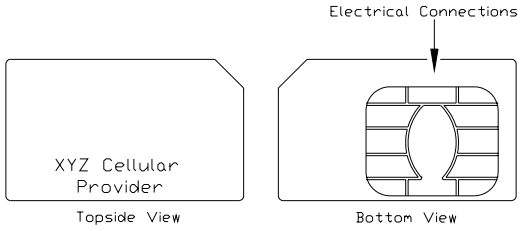

Figure 3-1
SIM Card Profile

For the GSM18 the cellular module has a built-in SIM card holder. Care must be exercised to ensure that the electrical contacts of the SIM card will mate properly with the electrical contacts on the radio module. Figure 3-2 illustrates the location of the holder. Note the location of the notched corner on the SIM card.

Never install a SIM card when power is present.

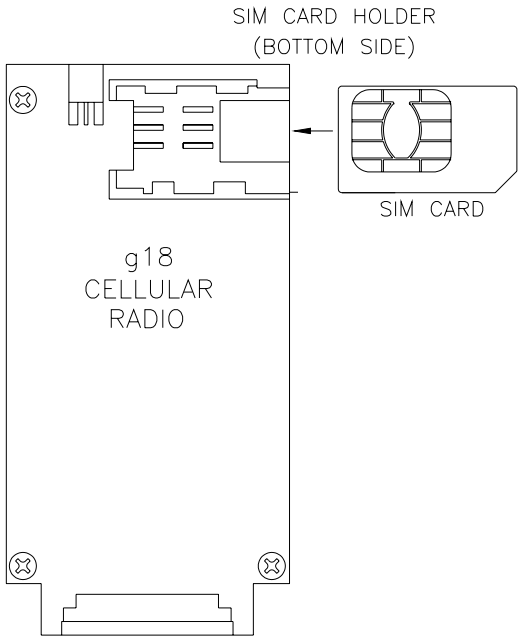

Figure 3-2
g18 SIM Card Holder Location

3.1.5 SIM Card Installation for the GSM20

The SIM card holder for the GSM20 is located on the CNI board, near the radio. See Figure 3-3.

Never install a SIM card when power is present.

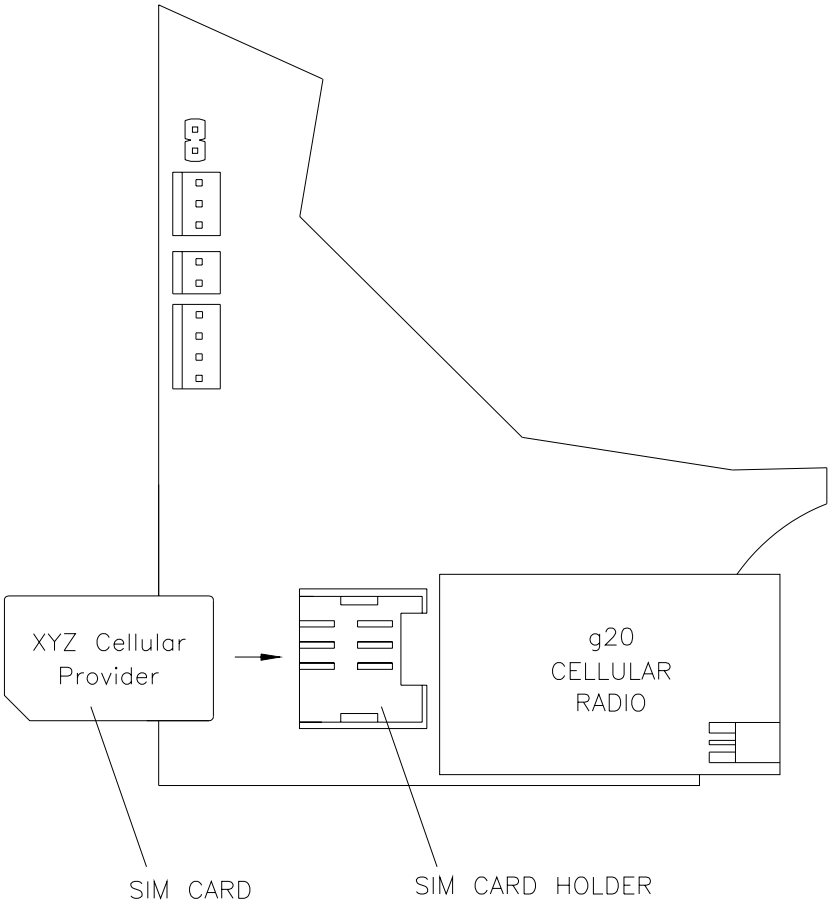

Figure 3-3
GSM20 SIM Card Installation

3.1.6 Requesting a Voice Phone Number or SMS Service

As mentioned earlier some cellular service providers may not support the ability to place a data call to the CNI in CSD mode. This is called “mobile-terminate” service. If purchasing packet service it is important to know that the CNI can only originate an Internet connection. It cannot be contacted via the Internet because mobile devices to not usually have permanent Internet addresses.

Yet there may be times when it is desirable to communicate immediately with the field device rather than wait for it to call in. To overcome these limitations the CNI supports the ability to be "paged". When paged the CNI will immediately call back to the central computer.

There are two ways to page, and these are described in Chapter-6. If the cellular account has been assigned a "voice" or "data" number then the unit can be called using this number. Otherwise most cellular providers can include SMS (short message service) as part of the package. This allows the CNI to be paged with a text message. The SMS address of the unit is often created using the voice or data phone number as part of the address, such as **3215551212@myserviceprovider.net**.

3.2 CDMA Service

3.2.1 CDMA Overview

CDMA is an abbreviation for **C**ode **D**ivision **M**ultiple **A**ccess communications. CDMA technology was originally developed for military applications but was eventually commercialized. This communications standard is widely used in North America and in some parts of Asia and South America.

Rather than dividing calls into time slots like GSM, CDMA allows all users to transmit at the same time. Each call is accompanied by a unique digital code that allows it to be differentiated from the rest. As an analogy suppose you are in a crowded room and many conversations are taking place at the same time. Your brain is able to distinguish the conversation you are having with your friend because it is able to focus on your friend's voice characteristics. As the room grows more crowded each person must talk louder and the size of the conversation "zone" grows smaller. You may have to move closer to your friend to keep the conversation going. Thus the number of conversations is limited by the overall interference and noise in the room.

3.2.2 Establishing Cellular Service for CDMA 1XRTT Packet Service

A cellular account must be activated with a cellular service provider prior to placing a CNI into service. Some CDMA service providers may not offer all forms of data transfer. Single carrier, radio transmission technology (1X or 1XRTT) packet service may have to be added to a standard voice plan, or may be a stand-alone service.

Packet service packages are generally priced by the number of bytes to be transferred rather than by the minute. Typically the smallest available package will be 1 megabyte (1 Mb) per month. The amount of data that the CNI will produce depends upon what sort of data is requested from the field device. The amount of information exchanged on each call may range from several hundred bytes to 10's of thousands of bytes. It may be necessary to test the system for several months and then adjust the cellular account for the best cost based on your needs. The CNI requires full Internet access because the data collection software could be running on any server located anywhere in the world. Full access is usually assigned to customers who will be connecting a cellular modem to a personal computer.

One parameter that will be needed is the packet service connection command. In most cases the command will be ATD#777 but you may want to check with your service provider.

The service provider may ask the device type, which must be specified as the Metretek "CNI / CDMA18".

3.2.3 Establishing Cellular Service for CDMA CSD

A cellular account must be activated with the local service provider prior to placing a CNI into service. Many CDMA service providers offer some sort of data support, but their marketing focus may be on Internet connectivity or short-message services ("SMS", used to send text messages to and from cellular phones). This does not necessarily mean that they support all forms of data transfers. The service provider must support asynchronous circuit-switched data (CSD) exchange at the baud rate of the central computer's modem. Sometimes this capability may be included as part of a standard voice package, or it may be an add-on feature at extra cost.

One consideration when ordering service is the frequency of calls to and from the CNI. Each service provider offers different packages that may include a fixed number of minutes per month for a fixed price. However, when this number is exceeded, the cost per each additional minute can be very high. There are also variations in the way "minutes" are measured. For example, a call lasting 1 minute 10 seconds may be considered to be a 2-minute call by some providers. It might be possible to purchase less expensive packages that have additional "weekend" or "evening" minutes, and then schedule the field device to call in at those times. Some plans may offer the 1st minute free. This might be advantageous for short calls.

Another consideration when ordering service is the location of the CNI with respect to the service provider's network. It is best to describe where the units will be located and where they will be calling, otherwise you could be charged "roaming" or long-distance fees. Some providers offer free long distance or no roaming charges as part of their basic plans.

The final consideration is the direction of the calls. If the CNI is to originate calls, then the service must support "mobile-originate" service. If the unit is to receive calls, then "mobile-terminate" service is required.

The service provider will need the following information:

- Type of cellular service desired, which is *circuit-switched data (CSD)*.
- The device type, which must be specified as the Metretek "CNI / CDMA18".
- Data rate. This rate must match the speed of central computer's modem.
- Mobile-originate and/or mobile-terminate service.
- Number of minutes per month.
- Location of the CNI and the location of central computer (to determine if "roaming" or long distance charges apply).
- The service provider may need to know the "IMEI" number printed on the radio.

3.2.4 Requesting a Voice Phone Number or SMS Service

As mentioned earlier some cellular service providers may not support the ability to place a data call to the CNI in CSD mode. This is called “mobile-terminate” service. If purchasing packet service it is important to know that the CNI can only originate an Internet connection. It cannot be contacted via the Internet because mobile devices to not have permanent Internet addresses.

Yet there may be times when it is desirable to communicate immediately with the field device rather than wait for it to call in. To overcome these limitations the CNI supports the ability to be “paged”. When paged the CNI will immediately call back to the central computer.

There are two ways to page, and these are described in Chapter-6. If the cellular account has been assigned a “voice” or “data” number then the unit can be called using this number. Otherwise most cellular providers can include SMS (short message service) as part of the package. This allows the CNI to be paged with a text message. The SMS address of the unit is often created using the voice or data phone number as part of the address, such as **3215551212@myserviceprovider.net**.

3.2.5 Over-the-Air Activation

Unlike GSM, CDMA technology does not support the use of a SIM card (Subscriber Identity Module) to hold and transport account information. Therefore the account information must be downloaded into the cellular module’s own memory. This is usually accomplished by dialing a special phone number to request “over-the-air activation” (OTAA). The activation phone number is specific to the service provider and must be programmed into the CNI using the MP32 configuration software (Chapter-4).

The OTAA process does two things. First, if this is the very first OTAA call, a new phone number is programmed into the phone. This is the number that can be used to page the unit via a phone or data call, or via an SMS message. It also starts the account billing process. Second, a “preferred roaming list” (PRL) is downloaded into the phone. This instructs the radio which service provider(s) to search for and connect to.

If the CNI sees that the radio’s phone number contains all zeros then the activation number is dialed and over-the-air activation is attempted. This also happens automatically whenever the unit is reset and then every 7 days thereafter. The reason for this is that cellular service providers often make arrangements with other providers to carry calls in areas where their own equipment and towers do not exist. These agreements allow the call to be forwarded at no additional charge. The preferred roaming list says that it is acceptable to connect with these carriers. However at some point your service provider may install new equipment in these areas, and the contract with the partner may be terminated. In this new situation roaming fees will be added to each call if the radio is allowed to connect to the other carriers. This is why it is important to periodically update the PRL.

The OTAA call process is discussed in more detail in Chapter-6.

4 CONFIGURATION USING METRETEK PROGRAMMER

4.1 Metretek Programmer Cable

Before placing a CNI into service, it is necessary to setup certain configuration parameters. Setting up the configuration requires a computer, Metretek programmer (MP32) software and a special programming cable. These items are listed below:

- 80x86 or Pentium-based personal computer with an available 9-pin serial port (COM1, COM2). Minimum operating system is Windows 98®.
- Windows®-based Metretek Programmer software, "MP32", available under Metretek P/N: 100160. The "MP32" software must be version 3.0.6 or later.
- PC-to-Remote Interface cable, Metretek P/N 1002-0209B-001. An illustration of the cable assembly was provided in Chapter-2, Figure 2-1.

The CNI stores configuration information in its non-volatile memory. This information is not lost when power is removed or the unit is reset. Certain parameters are unique to each CNI, such as a phone number to call, cellular service details, etc. These parameters can be programmed prior to, during, or after installation of the device in the field, although it is normally most convenient to setup and test the configuration prior to installation.

4.2 MP32 Software Startup

MP32 can operate as a stand-alone program or can work in conjunction with Metretek's DC-2000 data collection software. When MP32 is started it will require a user name and password. If DC-2000 is present then the password must match one of the passwords from DC-2000's list of authorized users. If this is a standalone application then leave the password blank.

Figure 4-1
MP32 Login Screen

After login a window will appear to allow you to select the type of Metretek device to program (Figure 4-2). Prior to selecting the device, select the *"Communication*

Configuration" button. In the next window (Figure 4-3) select the "*Cable Comm Port*" as the default, and make sure that the selected port matches the port that the cable is plugged into on the computer, such as COM1, COM2, etc. Then select the "*OK"* button.

Figure 4-2
MP32 Start-Up Screen

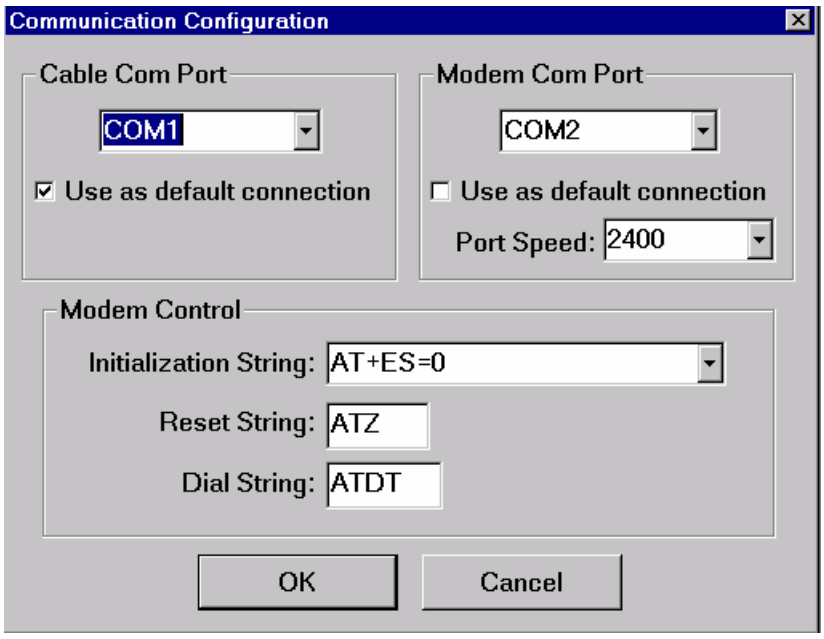

Figure 4-3
Communication Port Configuration Screen

4.3 Main Configuration Screen

The original MP32 screen will now reappear (Figure 4-2). Select the "*GSM18/GSM20/CDMA18 – IMU, PT-II*" button to start the configuration process. The next screen will appear:

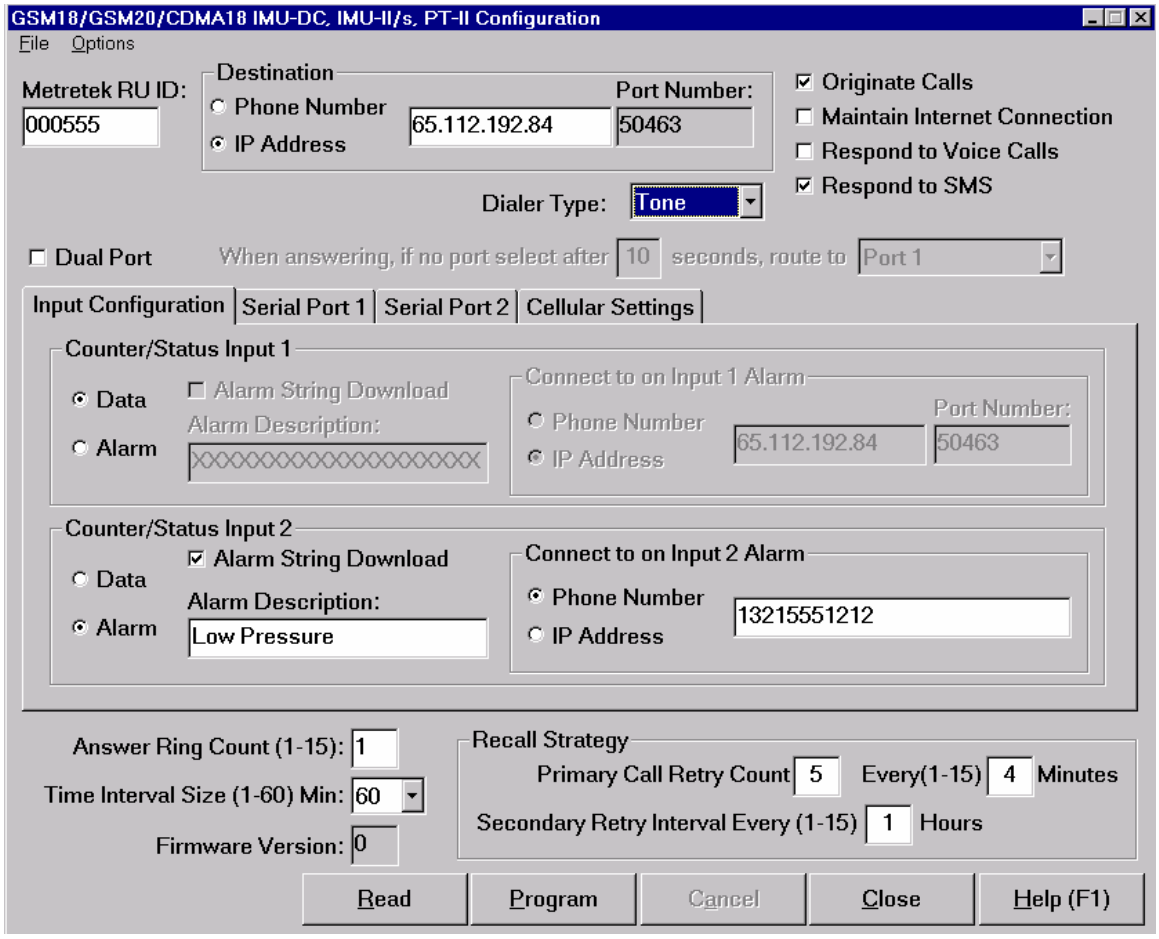

Figure 4-4
Main Configuration Screen

A configuration can be saved for future use by using the *FILE* pull-down menu in the upper left-hand corner of the screen. A previously saved configuration can be opened in the same manner. This is useful when several units are to be programmed with similar information, such as the same destination IP address.

To start a session either *OPEN* a previously saved configuration or perform a *READ* operation with the cable installed and the unit powered up. If the CNI is busy it may take up to 20 seconds to respond, so please be patient. The status of the operation is displayed on the bottom of the screen. The *CANCEL* button will terminate the session in the event there is no response.

4.3.1 Remote Unit ID

Each CNI must have a unique ID number. Legal six-digit values are 000000-FFFFFF (hexadecimal notation). Sequential numbering is not required, nor is it necessary to use any of the hexadecimal digits 'A, B, C, D, E, or F'.

4.3.2 Destination

If the CNI is allowed to originate a data call to another modem (CSD mode), then it will need the phone number of the modem. Select the "*Phone Number*" button and enter up to 32 numeric digits, including the "#" and "*" symbols. As with cellular phones, it is usually necessary to enter the entire phone number, including area code, even if the call is local. For example, in the U.S., a call to 555-1212 within area code 987 may have to be entered as 19875551212.

If the CNI is to communicate via the Internet then it will need the IP address and port number of the data collection server. Your computer system's administrator usually assigns these values. Select the "*IP Address*" button. Then enter the address of the server expressed in "dotted decimal format", such as 198.32.67.101. The IMU data collection server is assigned a default port number of 50463. This value is displayed on the MP32 screen for reference only. This is the port number that will need to be assigned on the server. If the port number needs to be changed hold down the CTRL key on the keyboard, point to the port number box and double click the pointing device (ie – mouse). Then enter a new port number.

4.3.3 Originate Calls

Check this box if the CNI is allowed to originate CSD calls or Internet connections.

The next three options require that the cellular radio be powered up at all times. If the primary charging source is the alkaline lantern battery this will quickly drain the battery. It may be necessary to use an alternate dc power source in the range of 5 – 6.5 Vdc.

4.3.4 Respond to Voice Calls

Check this box if the CNI is allowed to answer CSD calls, or is allowed to be paged using its voice phone number. See Chapter-6 for more information about paging.

4.3.5 Respond to SMS

Check this box if the CNI is allowed to be paged via SMS (short message service). See Chapter-6 for more information about paging.

4.3.6 Maintain Internet Connection

When the CNI originates an Internet connection, it must request access to the cellular provider's packet service, then access to the Internet and finally access to the destination server. All of this negotiation takes a certain amount of time. To reduce this time the CNI can maintain access to the Internet at all times and only needs to request access to the destination server, which only takes a few seconds. This is often referred to as an "always on" connection.

NOTE: To use this feature you must also check the **Originate Calls** checkbox. When maintaining an Internet connection it is not possible to answer incoming phone calls or SMS pages, so those selection boxes are disabled on the screen.

4.3.7 Dual Port

For a single-pressure unit, turn this off. For a dual-pressure unit, turn this on.

For dual-pressure units there are two other selections. The first selection is only used in CSD mode and allows the CNI to wait a certain number of seconds to receive a "port select" command from the central computer, which will be discussed in Chapter-6. If no command is received within this time frame, the CNI will select one of the two pressure sensors based on the second selection.

The second selection is used in both CSD and Internet mode. The choices are *Port-1*, *Port-2*, *Alternate* or *None.* This is the pressure sensor that will be selected for an incoming CSD call or if the unit is paged to call back to the central computer. If *Alternate* is selected then the pressure sensor selection will alternate with every call. The first call will go to pressure sensor #1, the second call to pressure sensor #2, the third to pressure sensor #1 and so on. See Chapter-6 for more information.

4.3.8 Time Interval Size

The ADM board converts the pressure reading to a linear pulse train. The CNI board counts these pulses over a predefined period of time and stores the total count as a record in memory. The counter will be reset to zero and the process will start over for the next period. Possible selections are 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, and 60 minutes. If the CNI runs out of storage memory, it will overwrite the oldest record unless the data collection software retrieves the information before that happens. The CNI will notify the data collection software when 75% of its memory has been used.

A large interval will allow records to be stored over a longer period of time. A short interval will allow trends to be observed with better resolution.

The data collection software DC-2000 (Chapter-5) can convert these time-tagged interval (TTI) readings back into pressure readings using a simple formula. As an example assume that we have a pressure transducer with a full-scale range of 500 PSI. The ADM board will produce 0 pulses for zero pressure and up to 8 pulses per second at 500 PSI. Suppose over a 15-minute (900 second) interval the count is 5760.

$$\text{Pressure} = \frac{(\text{count}) \times (\text{full scale pressure range})}{(\text{interval in seconds}) \times (\text{pulses per second at full scale})}$$

$$\text{Pressure} = \frac{(5760) \times (500\ \text{PSI})}{(900\ \text{seconds}) \times (8\ \text{pulses per second})}$$

Pressure = 400 PSI

4.3.9 Firmware Version

The firmware version is a value that is updated on the screen whenever a *'Read'* operation is performed. This is not a parameter that can be modified by the user.

4.3.10 Primary Call Retry Rate

If the CNI is programmed to originate a call, and the call is unsuccessful for any reason, it will try again at a later time. The CNI can be programmed to wait from 1 to 15 minutes between each attempt.

4.3.11 Primary Call Retry Count

This is the number of times (15 maximum) the CNI will try to repeat a call at the "Primary Call Retry Rate", discussed previously. After this, calls will be attempted at the "Secondary Call Retry Rate", discussed next.

4.3.12 Secondary Call Retry Interval

After the "Primary Call Retry Count" has expired, the "Secondary Call Retry Interval" defines the time between each additional attempt, in 1-hour increments up to a maximum of 15 hours. There is no limit to the number of times the CNI will attempt to place a call at this rate. Once a call is successful, the CNI will return to using the primary retry rate and count.

4.3.13 Counter/Status Input-1

Select *"Data"* for this input.

4.3.14 Counter/Status Input-2

For dual-pressure units select *"Data"* for this input.

For single pressure units select *"Alarm"* for this input. The ADM board can be programmed with high and low pressure values that, when exceeded, will cause the ADM board to trigger an alarm to the CNI board. If the CNI is allowed to originate a call when this alarm condition occurs, you can define a phone number or Internet address to call that is different than the normal primary destination. This secondary destination doesn't necessarily have to be a computer. It might be the phone number of a pager, cell phone or warning device to alert someone of a serious situation.

A special mode called "Transparent Mode" is discussed in detail in Chapter-6. In this mode, the CNI can send readable (ASCII) text strings to the caller or destination to describe the current status, such as "* TAMPER ALARM *". You can define a unique message for Alarm #2, such as "High Pressure !". If this is desired, check the "*Alarm String Download*" box. You can define a custom text string up to 20 characters in length.

4.4 Serial Port-1 Screen

Select the *SERIAL PORT 1* tab to continue the configuration.

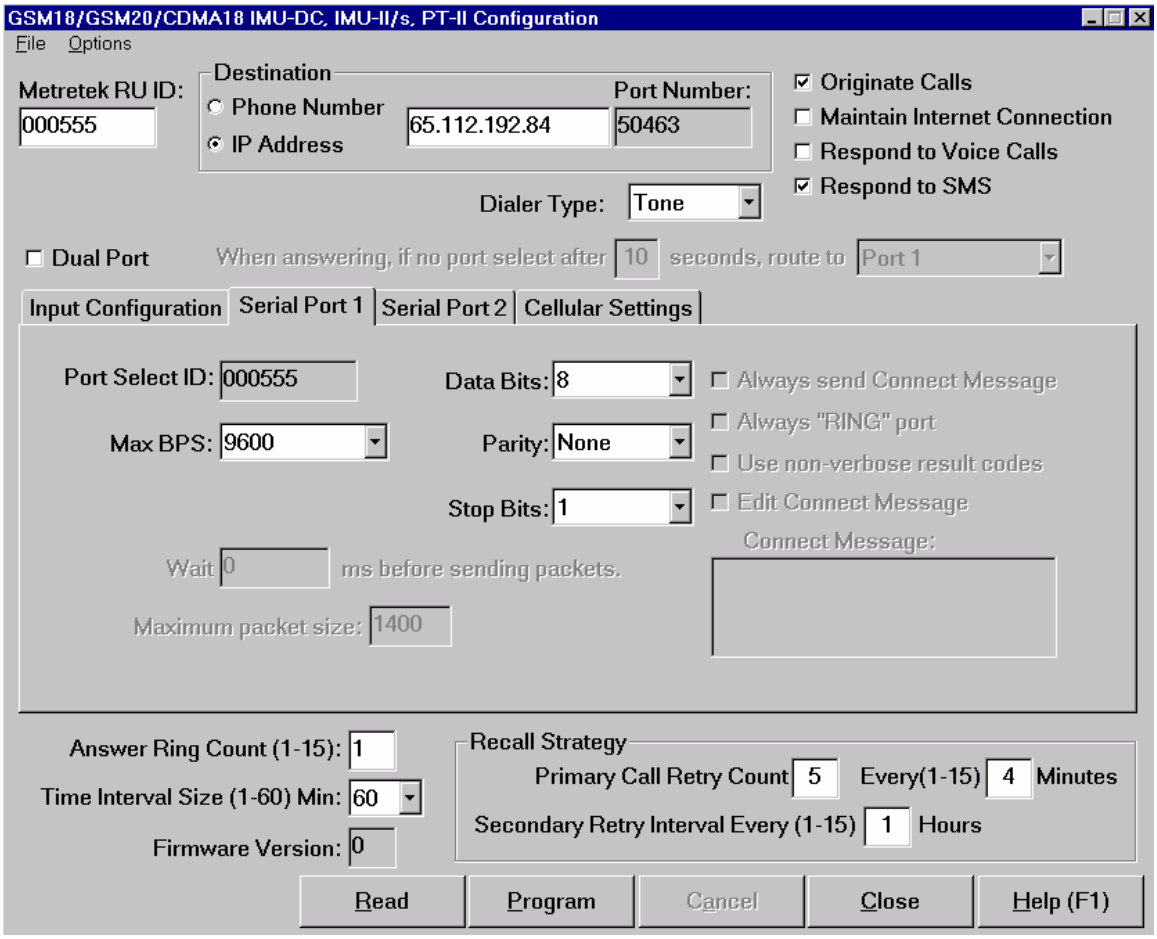

Figure 4-5
Screen Image with “Serial Port 1” Tab Selected

4.4.1 Port Select ID

The *Port Select ID* for Serial Port #1 defaults to the remote unit ID (RUID) that was assigned to the CNI. It is shown on the *SERIAL PORT 1* tab for reference and cannot be changed.

4.4.2 Max BPS

This value must match the baud rate of the ADM board #1, which is 9600 baud.

Important Note: If using circuit-switched data (CSD) service, the *MAX BPS* setting also sets the CSD baud rate. This is often referred to as “bearer service”. If the destination modem is a Metretek MODSMOD modem bank, you will need at least one 9600 baud modem card installed.

4.4.3 Data Bits
Set this value to 8.

4.4.4 Parity Type
Set this value to “None”

4.4.5 Stop Bits
Set this value to 1.

4.5 Serial Port-2 Screen

For dual-pressure units select the *SERIAL PORT 2* tab to continue the configuration. All settings are identical to those for Serial Port 1 except for the *Port Select ID.* You must assign a unique ID number to pressure sensor #2. This will allow the central computer to distinguish between the two devices.

Legal six-digit values are 000000-FFFFFF (hexadecimal notation). Sequential numbering is not required, nor is it necessary to use any of the hexadecimal digits ‘A, B, C, D, E, or F’.

4.6 Cellular Settings Screen

Select the *Cellular Settings* tab to continue the configuration.

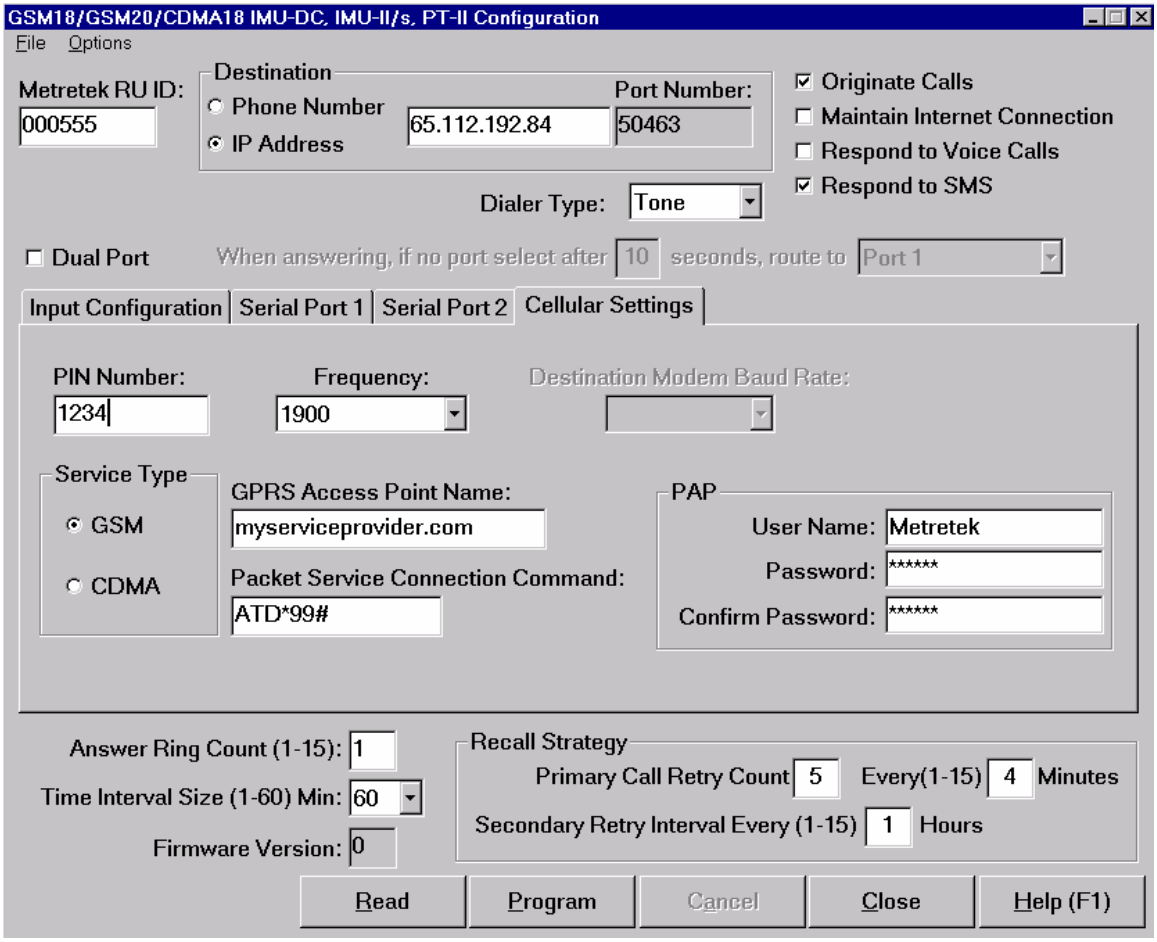

Figure 4-6
Screen Image with the “Cellular Settings” Tab Selected

4.6.1 Service Type

One of two options can be selected, GSM or CDMA. Each type requires a different version of the CNI board, the Model GSM18, GSM20 or CDMA18.

4.6.2 PIN Number (GSM only)

GSM cellular radios require a memory card called a SIM card (Subscriber Identity Module). This is issued to the cellular customer when the cellular service is purchased. A SIM holds information about the account so that certain services are made available to the customer such as Internet access. A SIM card can be moved to a different phone or radio, and the account information moves with it. Though convenient, this may encourage someone to steal the SIM card, insert it into his or her own cellular phone and make hundreds of hours of calls that will be billed to the owner of the card.

A personal identification number (PIN) is an extra security measure to prevent unauthorized use of a SIM card. The PIN number can range from 1 to 8 numeric digits long and can be assigned by the cellular service provider when the card is activated.

NOTE
If a PIN number is not used, leave the *PIN Number* field blank. Do not fill it with 0's, because a "0" is a valid PIN digit.

CDMA does not support the use of a PIN number and this field will be deactivated if CDMA is selected.

4.6.3 Frequency (GSM only)

This field only applies to GSM radios. This field will be deactivated if CDMA is selected.

Depending upon the service provider chosen and the region of the world in which the CNI is located, there will be a specific frequency band used for the cellular service. These are generally 850 and 1900 MHz in North America, and 900 or 1800 MHz elsewhere.

4.6.4 GPRS Access Point Name (GSM only)

This field only applies to GSM radios. This field will be deactivated if CDMA is selected.

If the CNI will be making an Internet connection the cellular service provider will need to provide an Internet APN (access point name). In order to connect to the Internet, the provider has its own computer equipment called a "gateway" server. The server will usually have an APN in the form of a domain name, such as "myserviceprovider.com" or a generic name such as "proxy". Contact your service provider for this information.

Service providers may have several different gateways to choose from, depending upon the type of service required. "Web phones" (cellular phones that support Internet access) are generally assigned to a gateway that only connects to WAP services (wireless application protocol). The CNI requires full Internet access because the data collection software could be running on any server located anywhere in the world. Full access gateways are usually assigned to customers who will be connecting a cellular modem to a personal computer.

4.6.5 Packet Service Connection Command

This command is issued to the cellular radio to request a packet (Internet) connection. For most GSM cellular service providers the phrase "ATD*99#" will work, and this is the default setting for the CNI in GSM mode. For most CDMA service providers the phrase "ATD#777" will work, and this is the default setting for the CNI in CDMA mode.

If you are having problems connecting, this could be the problem. Contact your service provider for more information.

4.6.6 OTAA Programming Number (CDMA only)

Unlike GSM radios, CDMA radios do not use SIM (Subscriber Identity Module) cards to hold account information. After purchasing CDMA service the radio must dial a special phone number to be activated and to have account information downloaded into the phone's memory. This phone number is specific to the carrier and must be entered into

the OTA Programming Number slot in MP32. "OTAA" means over-the-air activation as is discussed in more detail in Chapters 3 and 6.

4.6.7 PAP User Name and Password

As an added security measure some cellular service providers use Password Authentication Protocol, or PAP. In order to gain access to their Internet service you must present a user name and a password that was assigned when the cellular service was purchased. The user name or password can be any combination of printable ASCII characters, including spaces, such as "Joe Smith" or "1234". The total number of characters for both the user name and password cannot exceed 98 characters.

The password is hidden on this screen for added security. You must enter the password twice to verify that it was entered correctly.

NOTE
If PAP is not required then both the user name and password fields must be blank.

4.7 Programming the CNI

1) Attach the 9-pin D-sub end of the PC-to-Remote Interface cable to an available serial communications port on the computer, such as COM1.

2) Attach the opposite end of the interface cable to the 4-position connector (J8) on the CNI board. The connector is keyed and can only insert in one direction.

3) Apply power (see Chapter-2 for the proper power-up procedure). The green "PROGRAM MONITOR" light should light solidly. The red "RECEIVE DATA" light should light momentarily, then go out. The green "PROGRAM MONITOR" light should then start flashing once per second. This indicates the CNI is running.

4) Once the parameters have been entered (or read in from a previously-saved configuration file), select the *PROGRAM* button to start programming the CNI. Status messages will appear in the lower left-hand corner of the screen. If the CNI is busy with radio operations, it could take up to 30 seconds to respond to the program command. If communications cannot be established within several minutes, check your cable and serial port, and try again.

5) When programming has completed, unplug the 4-pin connector of the serial cable from the "J8" connector on the CNI board. The CNI is now ready to be put into service.

5 DC-2000 DATA COLLECTION SYSTEM

The CNI's operating software allows it to behave as a legacy Metretek data collection device known as a Pressure Tracker-II, or "PTII-DC". The PTII is a member of a family of Metretek data loggers known as Industrial Metering Units, or "IMU"s. Therefore this chapter refers to the "IMU" when configuring the DC-2000 data collection software.

5.1 Introduction

This chapter deals with the basic setup parameters needed to start the communications process with the CNI. It does not deal with reports or any sort of database management. Call Metretek for more information and training.

5.2 Setting up the IMU Server for GPRS connections

For GPRS connections the IMU server acts as an Internet server on your computer and thus must be allowed access to the outside world. Most corporate computer systems use firewall technology to prevent unauthorized and potentially damaging access from outside sources. An Internet address and port number must be assigned to the IMU server, and these numbers must be programmed into each CNI. Your computer system's administrator usually assigns this address.

To minimize potential invasion, the IMU server and each CNI exchange private information using the 64-bit data encryption standard. If this exchange fails, the IMU server severs the connection immediately.

Start the DC-2000 Applications Launcher and select "*System Configuration*".

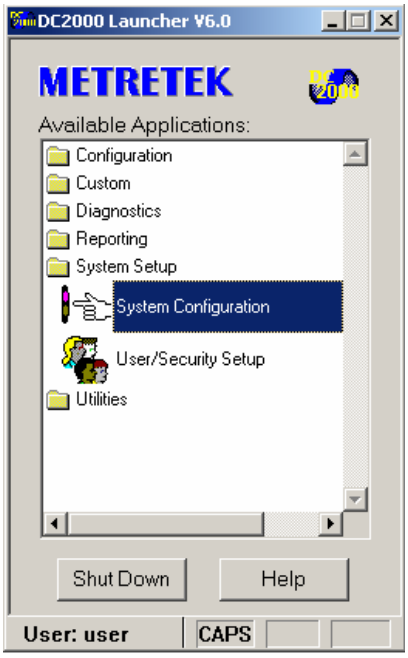

Figure 5-1
Starting the System Configuration

On the next screen select the Data Collection process.

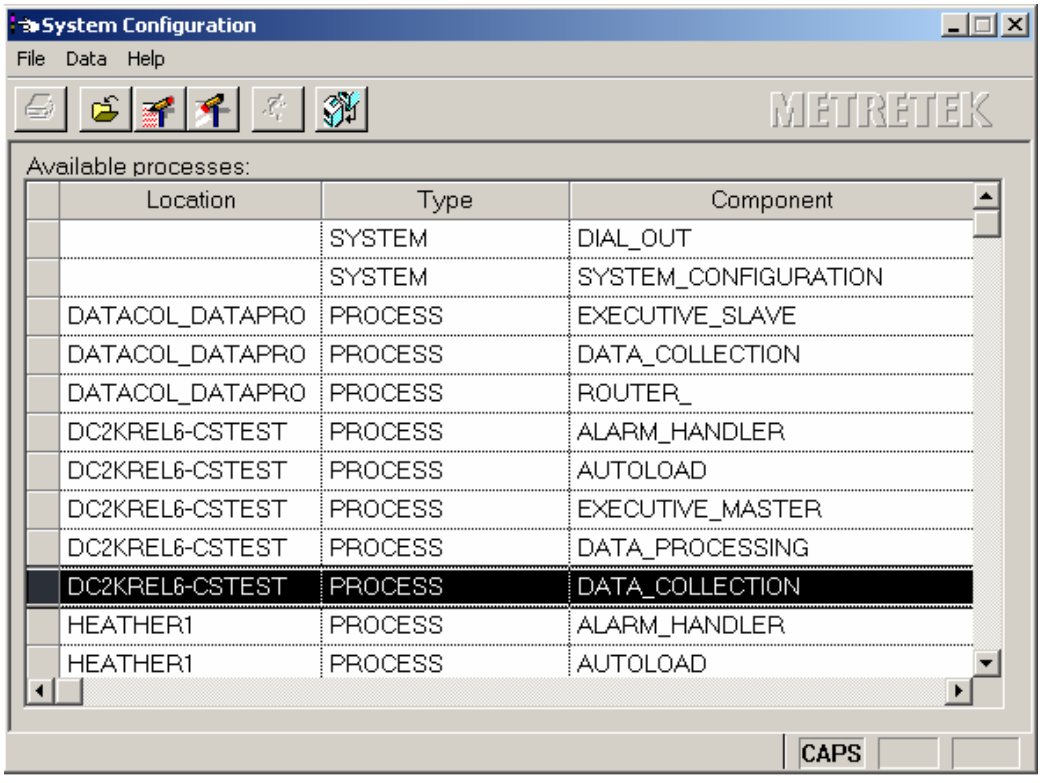

Figure 5-2
Changing the Data Collection Configuration

On the next screen (Figure 5-3) select the "*Internet Ports*" tab and select the "*Add*" button near the bottom of the screen. A smaller selection window will appear. Place a checkmark in the "*Enabled*" checkbox. Select "*IMU Server*" for the port type. The port number will be filled in automatically, and must match the port number that was programmed into the CNI (see Chapter-4). If this needs to be changed hold down the CTRL key on the keyboard, point to the Port Number box and double click the pointing device (ie – mouse). Then enter a new port number. The default is 50463.

Enter the Internet address that was programmed into the CNI. Your computer system's administrator usually assigns this address.

DC-2000 has a number of Internet servers for various Metretek products. A maximum of 255 connections are allowed at the same time for all servers. For instance if there are already 200 connections open for other products, you can only open another 55 connections for the IMU server. If you have 50 devices in the field and only 10 connections open, then only 10 devices will be allowed to connect at any one time. The devices can be scheduled to call in at different times to prevent overloading and to reduce the need for devices to retry calls that couldn't be serviced.

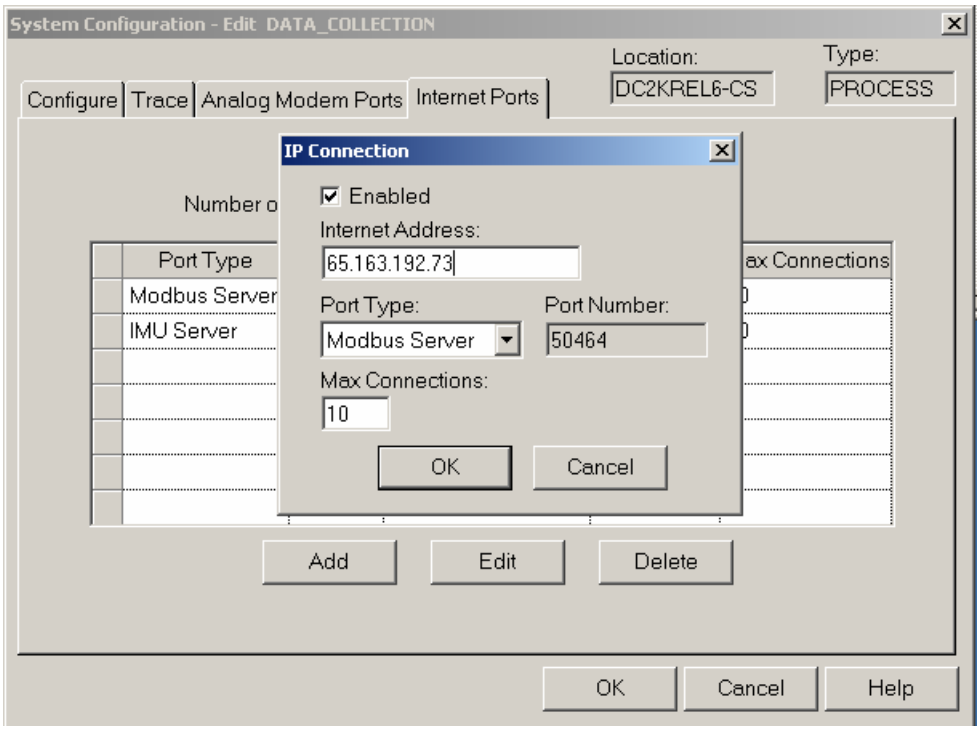

Figure 5-3
Configuring the IMU Server

5.3 Setting up DC-2000 for CSD connections

CSD connections are basically the same as two modems communicating over traditional phone lines. Start the DC-2000 Applications Launcher and select "*System Configuration*" (see Figure 5-1). On the next screen select the Data Collection process (see Figure 5-2).

On the next screen (Figure 5-4) select the "*Analog Modem Ports*" tab. Most cellular providers that support CSD calls may no longer support baud rates below 9600, and the radios used in the GSM18 and GSM20 do not support rates below 4800. Therefore you will need at least one 9600 baud MODSMOD modem card if you are using a Metretek MODSMOD chassis, or at least a 9600 baud AT-compatible modem. For the CDMA18 most common baud rates up to 9600 are supported.

In the example shown in Figure 5-4 we have configured DC-2000 for a 9600-baud MODSMOD card on channel-1 using a Metretek software driver. The *baud rate* selection box near the bottom of the screen is the baud rate between the computer and the MODSMOD card, not between the MODSMOD and the CNI. This baud rate is determined by a set of jumpers on the MODSMOD card. Contact Metretek for more information.

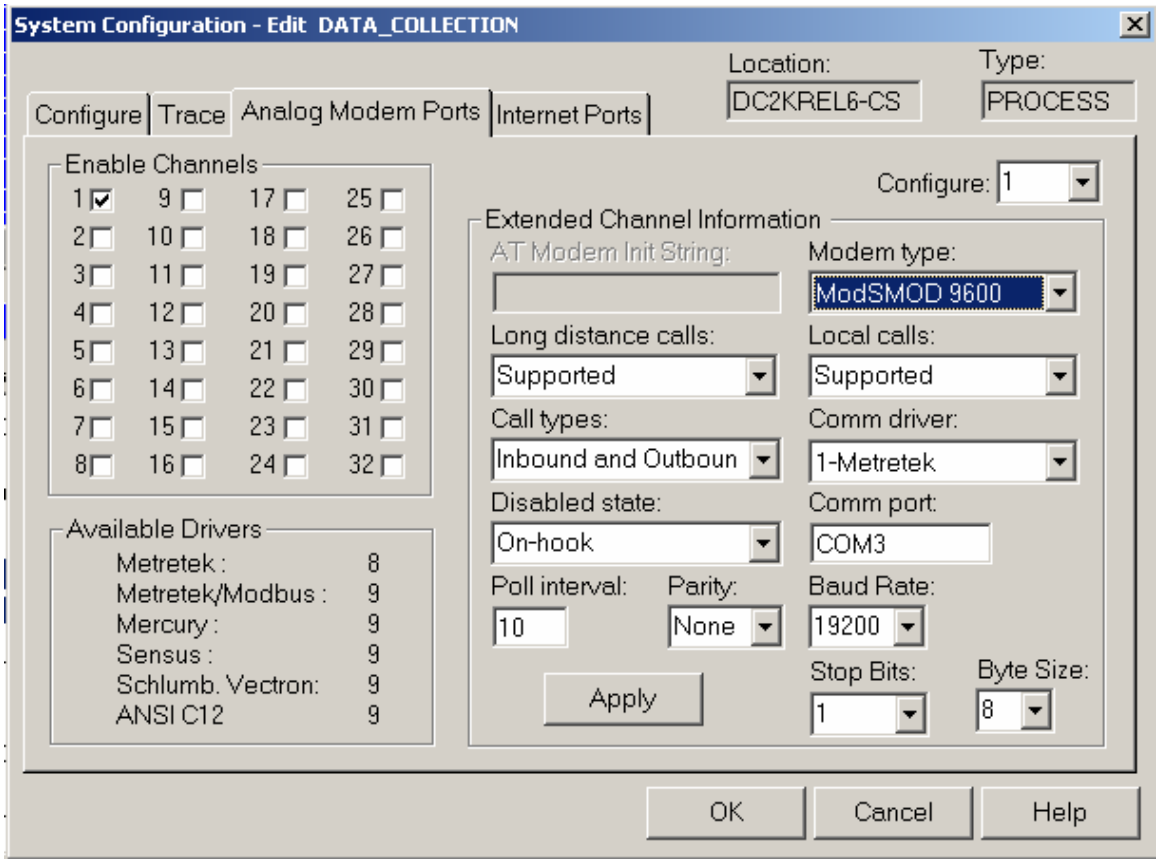

Figure 5-4
Configuring the DC-2000 for CSD Connections

5.4 Setting up a Call Schedule

You can define a call schedule for one CNI or a group of them by selecting "*Call Configuration*" from the Applications Launcher.

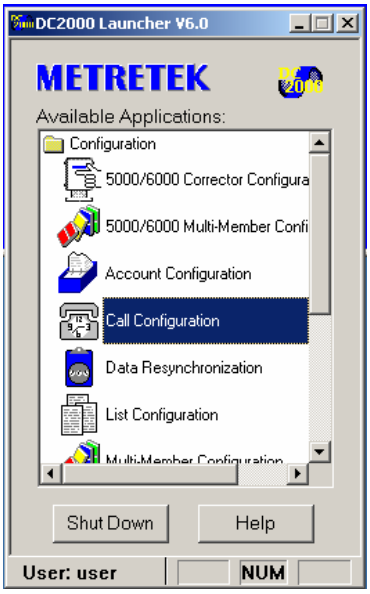

Figure 5-5
Configuring a Call Schedule

On the next screen select the "Add" button and enter in a text name for the profile.

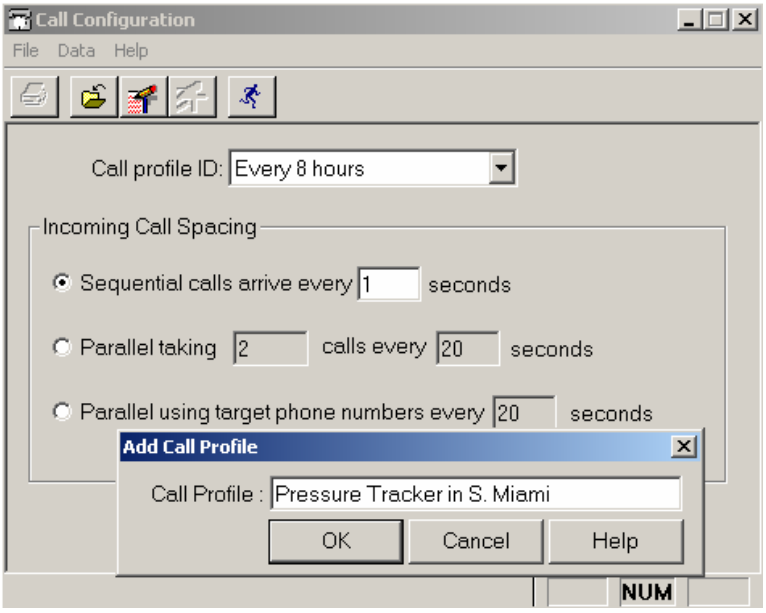

Figure 5-6
Defining a Call Profile Name

On the final screen you can define specifically when the device should call in. In Figure 5-7 the CNI will call in at regular 8-hour intervals starting at 14:00:00.

Select the *Apply* button to make the changes permanent.

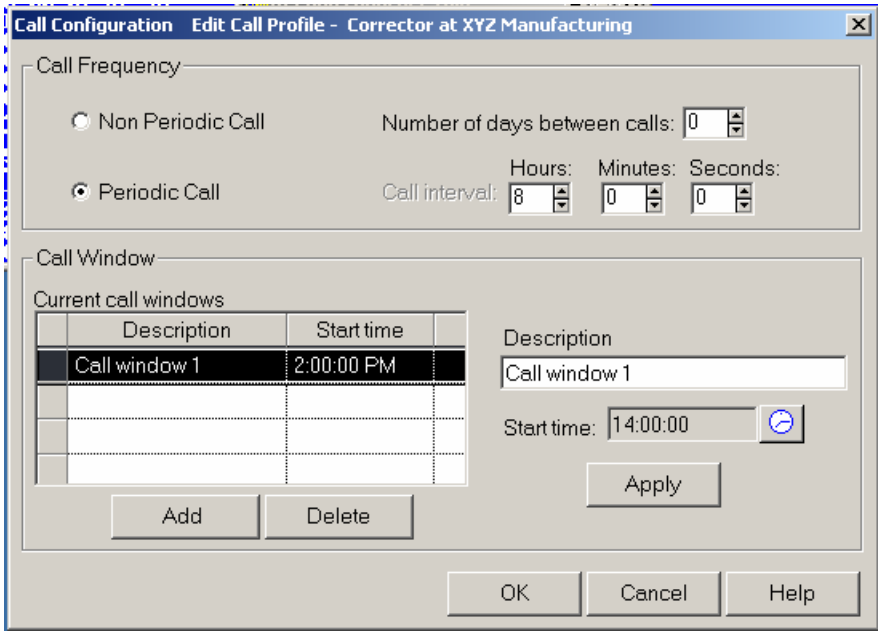

Figure 5-7
Defining the Call Profile Parameters

5.5 Defining the CNI

Account information in the data collection computer must correlate with the hardware configuration of the CNI such that the number of data inputs and the interval sizes match. Start the DC-2000 Applications Launcher and select the '*Remote Unit Configuration'* application as shown in Figure 5-8.

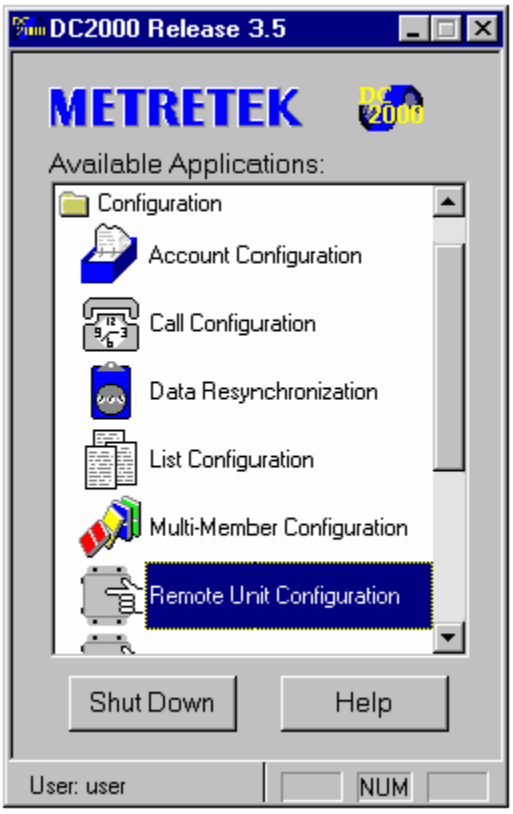

Figure 5-8
Starting the CNI Configuration Process

The process of setting up an account is made easier by starting with a default account to be used as a template. In Figure 5-9, a template for an IMU product has been selected. Double-clicking on this selection will bring the user to another level where the account information is entered.

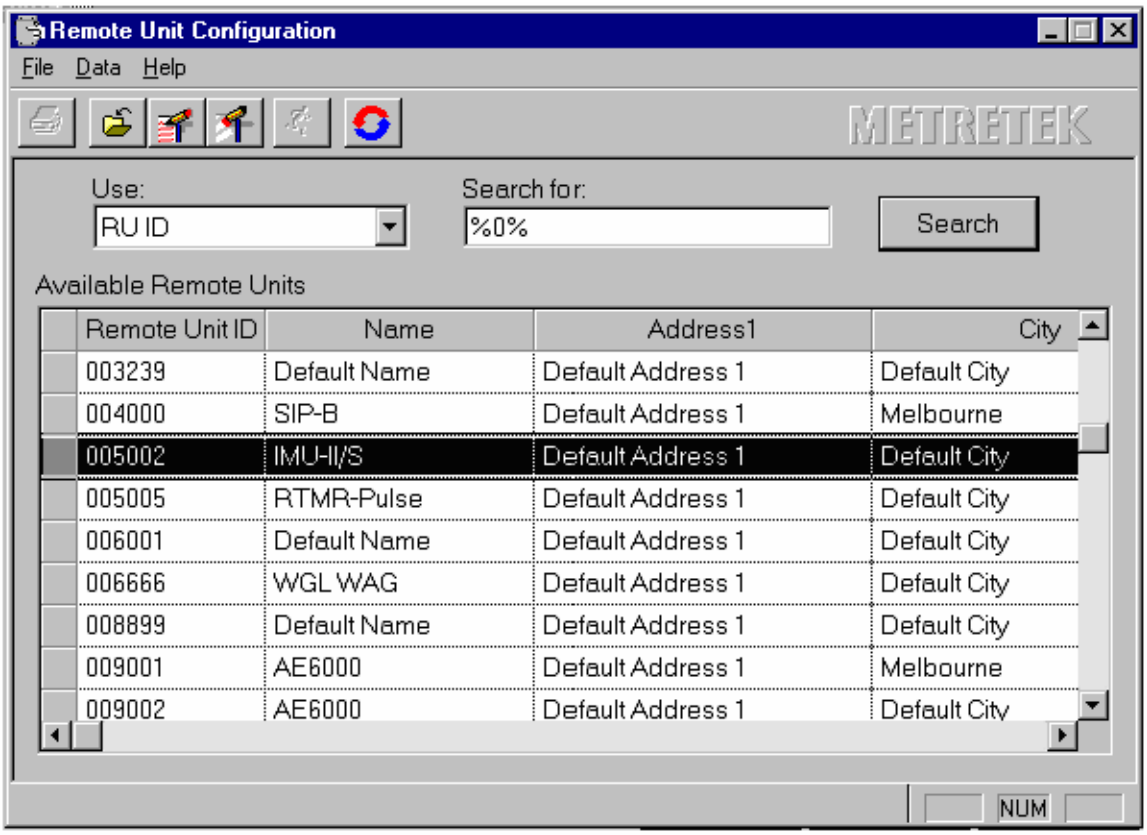

Figure 5-9
Selecting a Default Account

Figure 5-10 illustrates one of the seven ‘tabs’ or ‘folders’ that can be accessed at this level. It is important to select the correct number of data inputs and to instruct the remote device to ‘Send Latest’ data only. Some of the fields (i.e.—Battery Information) are not critical since they exist primarily as a convenience for the system operator.

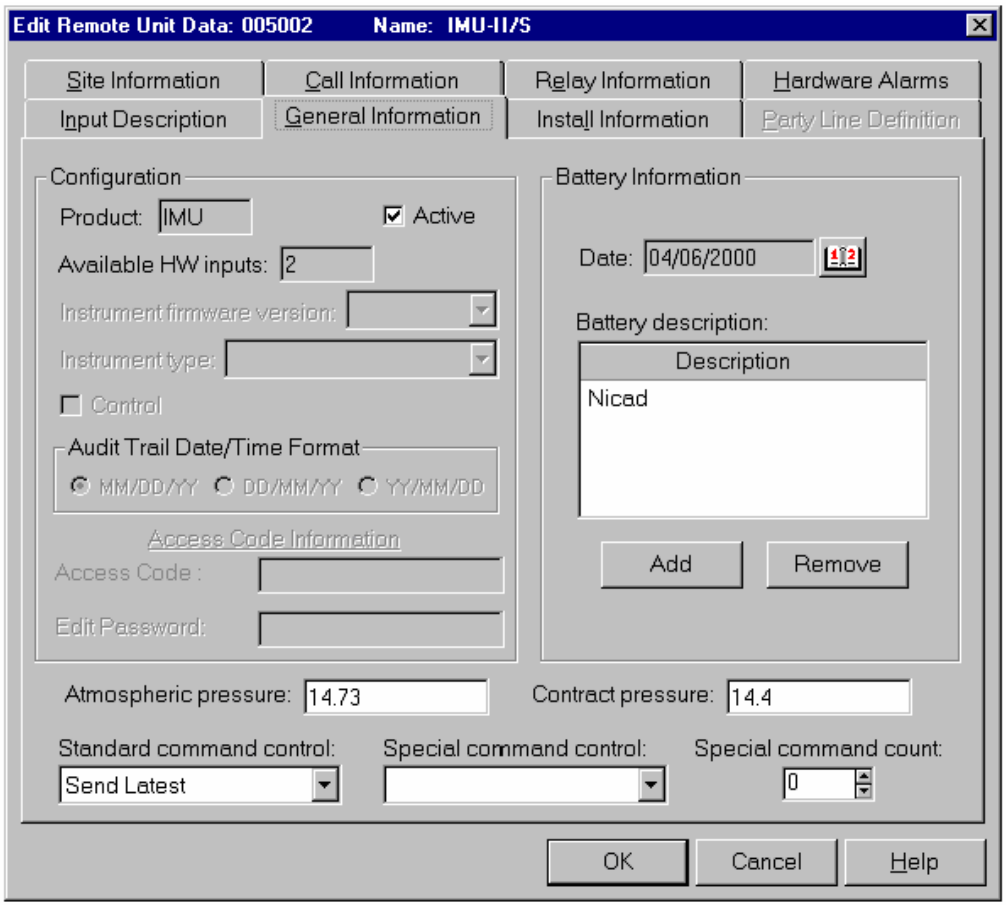

Figure 5-10
Configuration Setup Screen

Select the *Input Description* tab. A single-pressure unit only counts pulses on Input #1, so we need to tell the system that Input #2 is not a data input by deleting that input from the list. Highlight *Input 2 Description* and then select the *Delete* button.

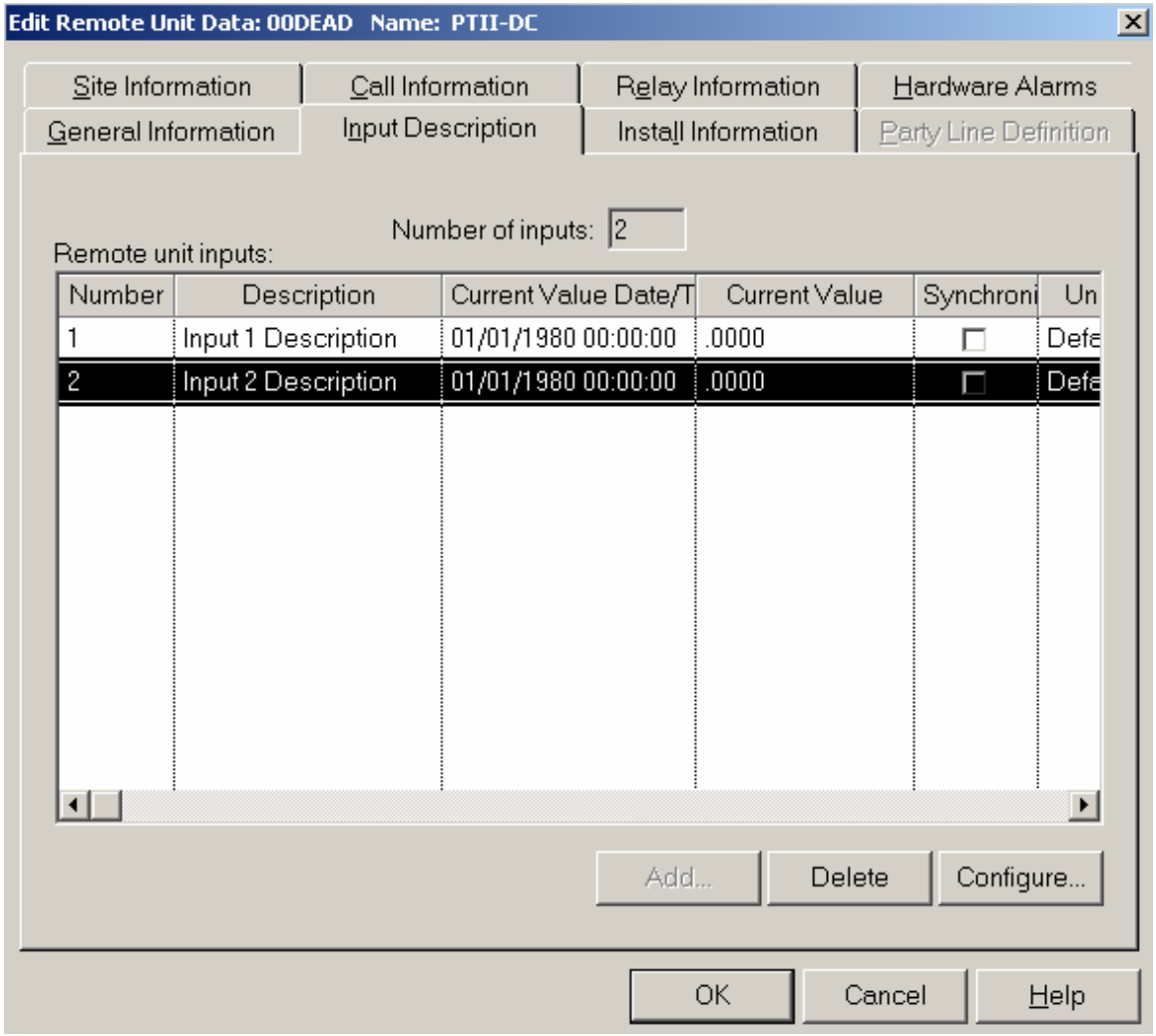

Figure 5-11
Input Description Screen

Figure 5-12 illustrates the configuration for the data inputs. It is critical that the interval size setup in DC-2000 matches the interval size that was programmed into the memory of the CNI (Chapter-4). It is possible to assign various names to the data input. In the example below, it has been called “Gas Pressure”.

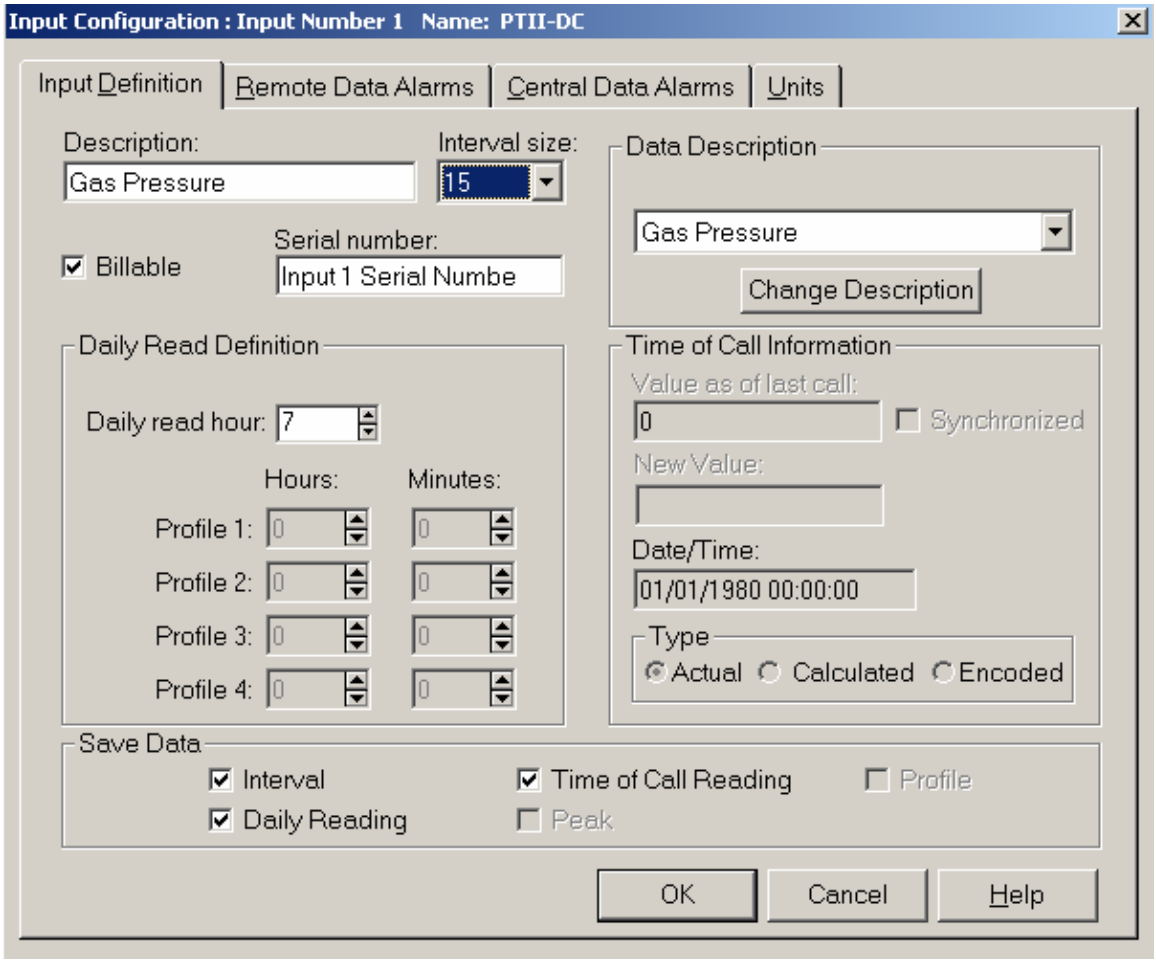

Figure 5-12
Data Input Configuration Screen

Now select the *Units* tab.

The ADM board converts the pressure reading to a linear pulse train. The CNI board counts these pulses over a predefined period of time and stores the total count as a record in memory. The counter will be reset to zero and the process will start over for the next period. A large interval will allow records to be stored over a longer period of time. A short interval will allow trends to be observed with better resolution but may result in longer communications sessions because there are more records to report. Longer sessions may result in higher cellular service cost.

DC-2000 can convert these interval readings back into pressure readings using a simple

multiplier entered into the *Units* screen.

The multiplier is calculated as follows:

$$\text{Multiplier} = \frac{\text{(full scale pressure range)}}{\text{(interval in seconds) x (8)}}$$

As an example assume that we have a pressure transducer with a full-scale range of 500 PSI. The CNI has been programmed for 15-minute (900 second) intervals.

$$\text{Multiplier} = \frac{\text{(full scale pressure range)}}{\text{(interval in seconds) x (8)}} = \frac{500\ \text{PSI}}{\text{(900 seconds) x 8}} = 0.0694$$

Suppose over a 15-minute interval the count is 5760.

Pressure = (count) x (multiplier) = 5760 x 0.0694 = 400 PSI.

On the *Units* screen highlight the unit input and select the *Edit* button.

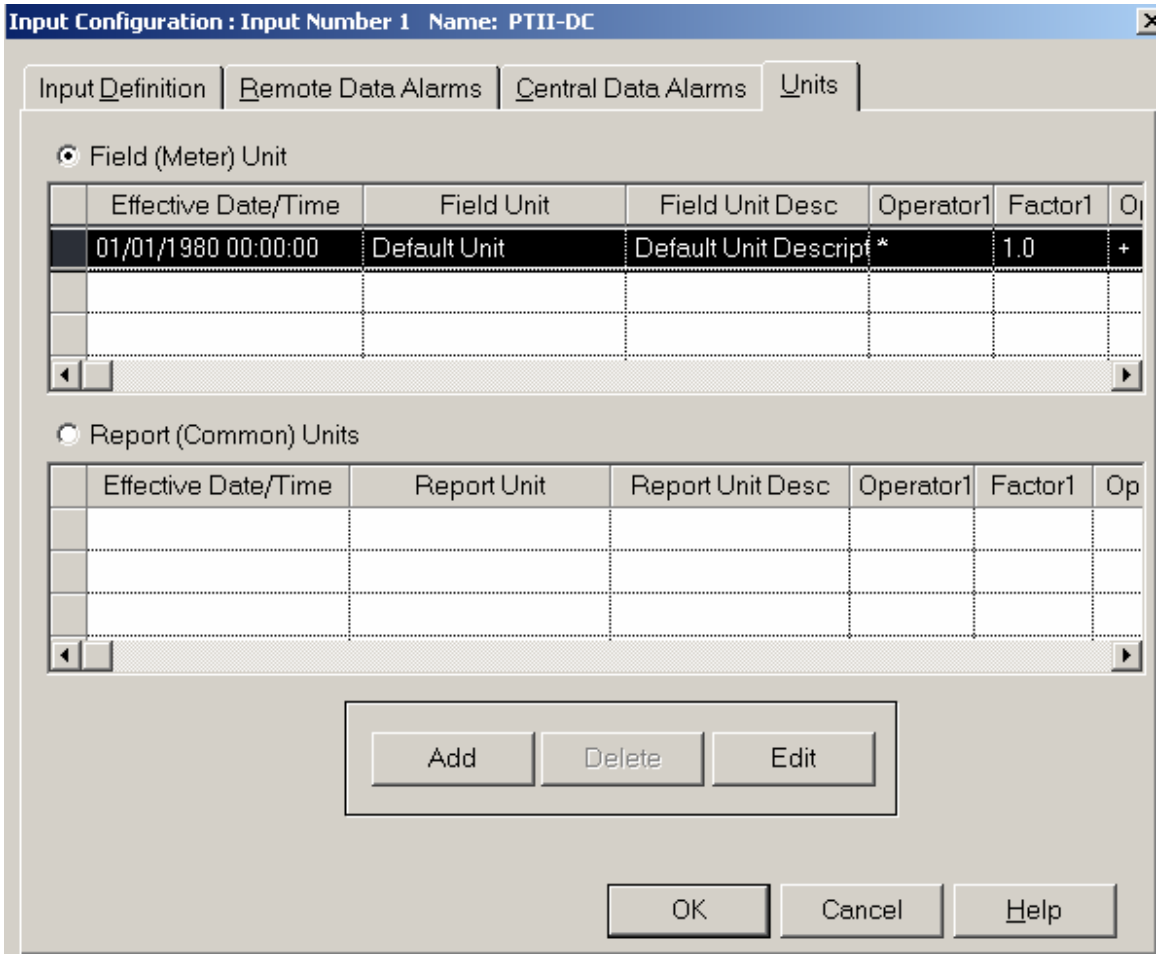

Figure 5-13
Units Configuration Screen

The next screen to appear will allow you to enter the multiplier and select a unit-of-measure description for the input. As seen in Figure 5-14 we've entered our multiplier of 0.0694.

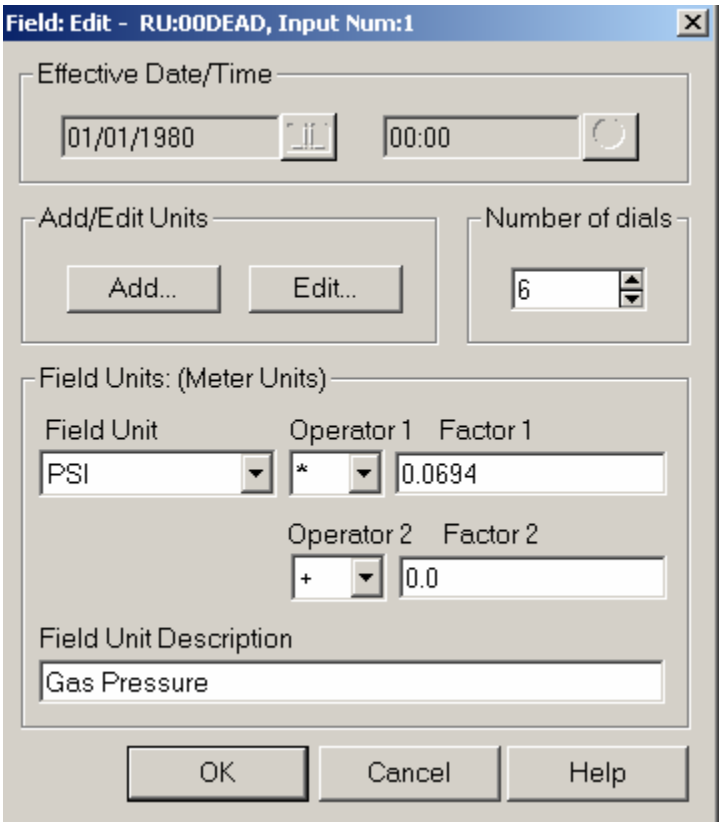

Figure 5-14
Entering a Multiplier in the Units Screen

Proper configuration of the call information fields is essential to ensure that data will be collected and available for processing when expected. If the CNI is programmed to originate calls only, then it will not be possible to initiate outbound calls since the cellular radio is not powered up to receive incoming calls or pages.

Back in Section 5.4 we defined a call schedule called "Pressure Tracker in S.Miami". You can now select this for use with the CNI using the Call Information screen shown in Figure 5-15.

If you are going to be calling or paging the CNI you can enter the phone number of the unit on this screen. This screen also provides information about the time the last call occurred and the time of the next scheduled call.

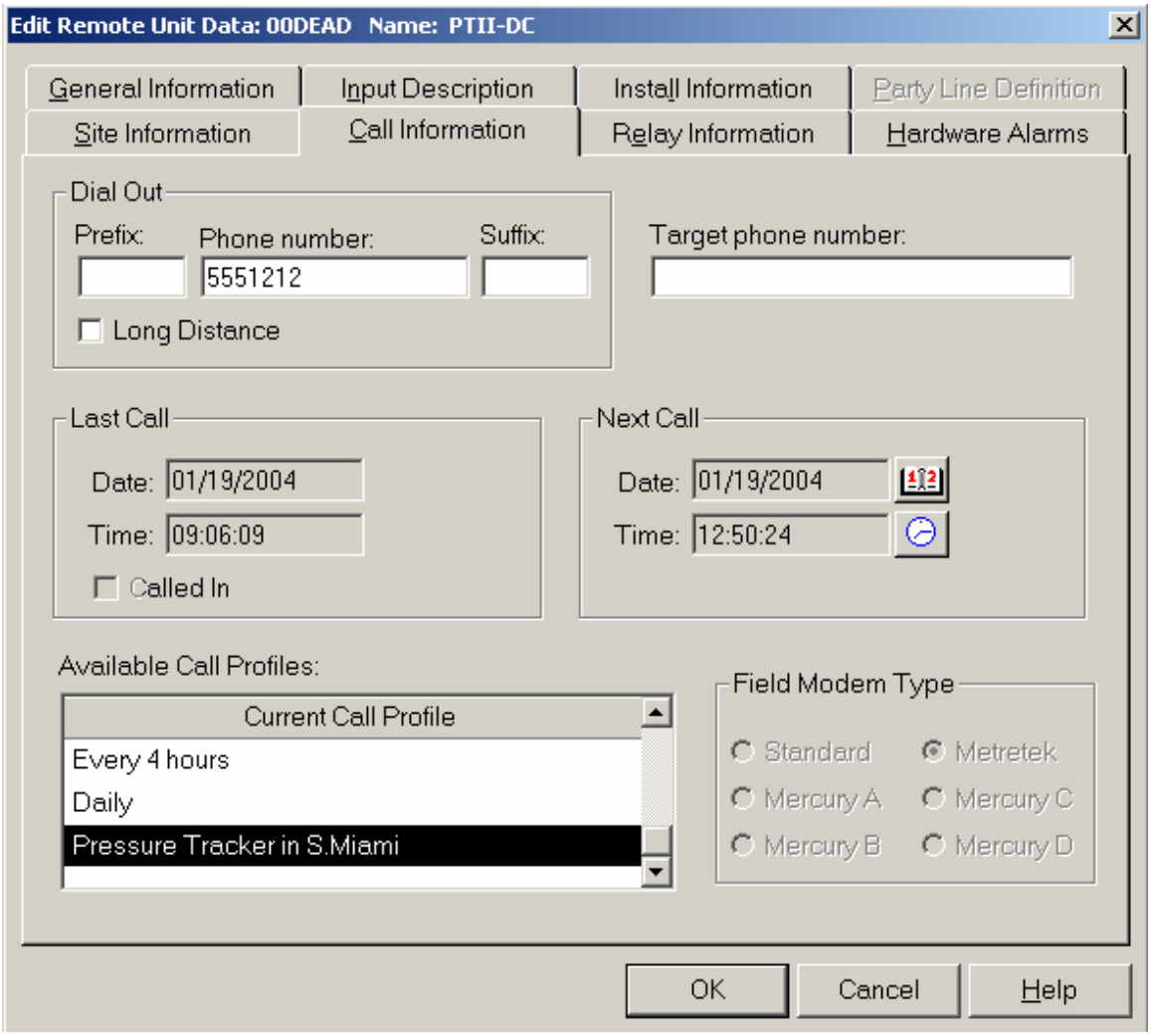

Figure 5-15
Call Information Screen

Alarms are of benefit to the user since they can be used to report unusual events that might require immediate attention. Alarms that are available for the CNI are:

Magnetic Switch Alarm: On the CNI board is a jumper block J2 labeled “CALL”. This is wired in parallel with positions 1 & 2 on the terminal block. Momentarily shorting either connection will cause the unit to place an immediate call to report a “CALL” switch alarm or “MAG” switch alarm. (The phrase “MAG” originates from other Metretek products in which a magnetic reed switch is mounted against an inside wall of a non-metallic enclosure. The field technician can trigger a call without opening the enclosure by simply by holding a magnet to the outside wall of the enclosure.) The alarm description can be changed to more accurately reflect the exact nature of the alarm, such as “Open Valve” or “Call”.

On single-pressure units this input is not used and can therefore be used by other equipment to trigger an alarm condition. The equipment must provide a Form-A switch (normally open) contact. You can still manually trigger a call by momentarily shorting the J2 connector near the terminal block.

On dual-pressure units the ADM boards report high / low pressure alarms on this input. You can still manually trigger a call by momentarily shorting the J2 connector near the terminal block.

Tamper Detect Alarm: Reports when the enclosure door has been opened. The magnetic “tamper” switch has been wired at the factory. If needed, this switch can be disconnected and the inputs used for another purpose. The alternate switch should be a Form-B switch (normally closed).

Customer Alarm 1: Not used.

Customer Alarm 2: For single-pressure units the ADM board reports high / low pressure alarms on this input. The alarm description can be changed to more accurately reflect the exact nature of the alarm, such as “High Pressure”.

Unit Reset Alarm: Reports if the CNI has been reset, indicating that all previously collected data has been lost.

Call Retry Alarm: Reports if the previous call attempt was not successfully completed.

KYZ-1 Input Failure: Not used.

KYZ-2 Input Failure: Not used.

Queue 75% Full Alarm: Reported if the CNI data memory is 75% or more full.

Clock Resync Alarm: Reported if the CNI’s time-of-day clock has been corrected.

Remote Daily Volume Low Input-1,2: Reports if daily volume use is below limits.

Remote Daily Volume High Input-1,2: Reports if daily volume use is above limits.

Remote TTI Consumption Low Input-1,2: Reports if interval volume use is below limits.

Remote TTI Consumption High Input-1,2: Reports if interval volume use is above limits.

AC-Off Alarm: This indicates that the lantern battery has been below 3.6V for more than three minutes. This alarm can be renamed to something more meaningful such as “Low Battery”.

AC-On Alarm: This indicates that the lantern battery has returned to above 3.6V for more than three minutes after having been low for over three minutes. This alarm can be renamed to something more meaningful such as “Battery OK”.

Low Battery Alarm: Not used.

Figure 5-14 depicts the Hardware Alarm configuration screen. For each alarm condition that occurs you can elect to save that event in a trace file by checking the “*Save*” checkbox. The event can also be immediately displayed on DC-2000’s alarm handler screen by checking the “*Log*” checkbox.

As each alarm condition is detected the CNI will decide whether to place an immediate call or to report the condition on the next scheduled call. If you wish to have an immediate call for an alarm then check the “*Immediate Alarm Notification*” checkbox. Note that there are some alarms that always result in an immediate call such as a unit reset.

Once a particular alarm is configured, select the “*Apply*” button to make the changes permanent. You must do this for each alarm.

Note: Changes made to any alarm configuration will not go into effect until the next communication with the CNI.

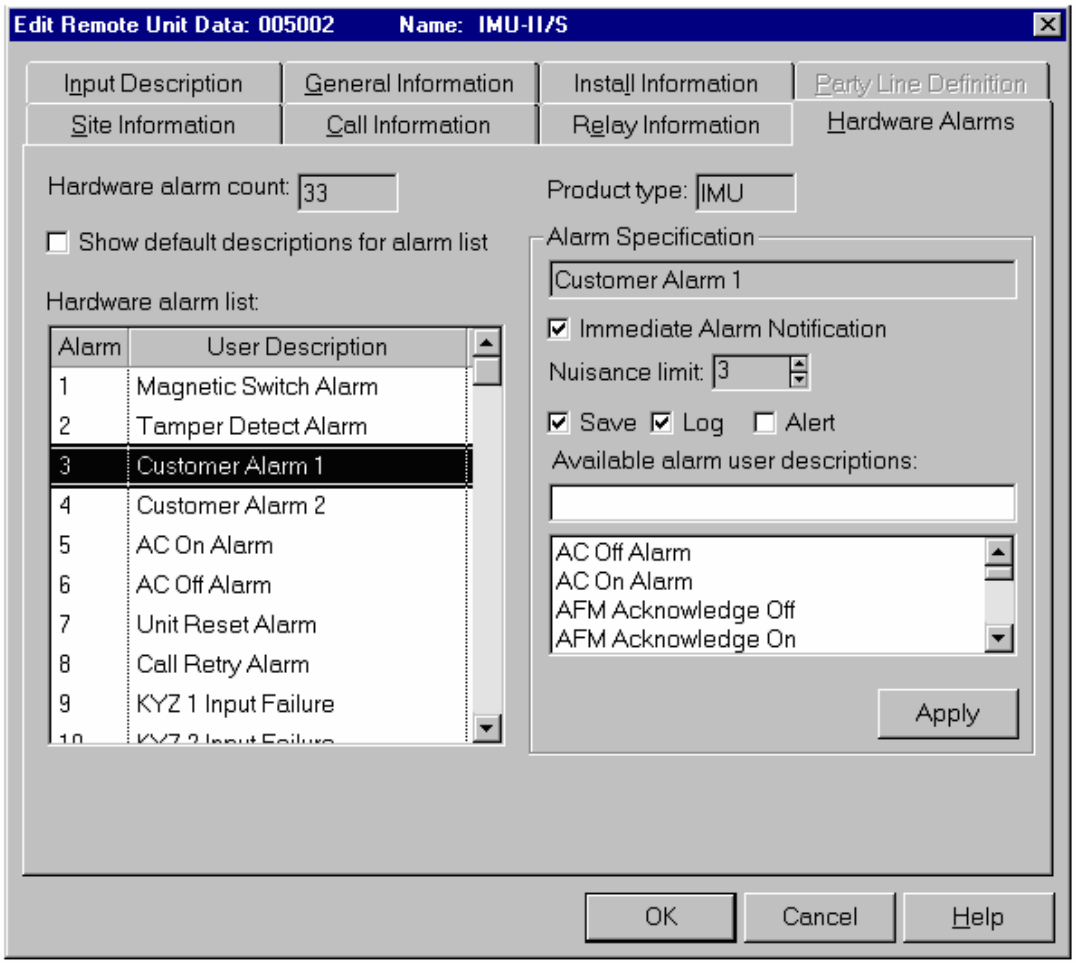

Figure 5-14
Hardware Alarm Configuration Screen

5.6 Starting the data collection process

Once all CNI's have been defined you can start DC-2000. For CSD connections the appropriate modem channels will be initialized. For GPRS connections the IMU server will be started and will begin listening on the number of channels that were selected.

6 MODES OF OPERATION

6.1 Call Retry Strategy

If the CNI is configured to originate calls or Internet connections, and a call fails due to a data error or a network problem, the following retry strategy is followed:

1) The first retry will occur from 1 to 15 minutes after the original call, as defined by the *Primary Call Retry Rate*.

2) Subsequent calls will be made at the *Primary Call Retry Rate* until the *Primary Call Retry Count* is exhausted.

3) Once the *Primary Call Retry Count* is exhausted, subsequent calls will be made at the *Secondary Call Retry Interval*, which is defined in hours (1-15). There is no limit to the number of retries that can occur at the secondary rate.

6.2 Paging via Voice Call

In CSD mode some cellular service providers allow a mobile device to originate a data call ("mobile-originate") or to receive one ("mobile-terminate"). For the GSM18 or GSM20 to receive a data call the cellular account must be assigned a "data" phone number. However, some providers do not support mobile-terminate connections or the user may not wish to pay the additional cost of having a separate data number. The CDMA18 does not require a separate data phone number. It uses the same number that is assigned as a voice number.

Every device connected to the Internet has an Internet protocol ("IP") address. Devices with "static" IP addresses are typically servers that are always on and always ready to accept a request for communications. Their addresses are well known. Other devices, typically called "clients", are assigned temporary or "dynamic" addresses that are only valid during the connection. At the present time a mobile device, including the CNI, is considered a client and therefore can only originate a request for an Internet connection. Therefore it cannot be contacted directly via the Internet.

Many cellular accounts are (or can be) assigned a "voice" phone number. If the CNI is configured to answer incoming phone calls it is possible to use this as a paging number which will then trigger the CNI to immediately call back to the central computer.

> The use of paging requires that the cellular radio be powered up at all times. If the primary power source is the alkaline lantern battery this will quickly drain the battery. It may be necessary to use a constant dc power source in the range of 5 – 6.5 Vdc.

In CSD mode the unit will answer the call and will attempt to communicate with the remote modem if there is one. The call will be terminated if 30 seconds pass without a successful modem exchange or if the other end hangs up. This will trigger the unit to

immediately call back to the primary phone number.

In packet (Internet) mode the unit will answer the call and will immediately hang up. It will then originate an Internet connection to the primary IP address and port number.

6.3 Paging via SMS Message

SMS (short message service) was developed to allow short text messages to be sent to cellular phones. These messages are not sent via the Internet but over a radio channel designated to carry Unstructured Supplementary Services Data (USSD). When the CNI receives an SMS message it will immediately call back to the primary IP address and port number that has been programmed into the unit.

The cellular service provider will give you instructions on how to send text messages to the mobile device. Often the SMS address includes the account's phone number, such as **3215551212@myserviceprovider.net** or something similar.

It is worth noting that SMS is a low-priority feature on some networks and they may not be delivered immediately.

The use of paging requires that the cellular radio be powered up at all times. If the primary power source is the alkaline lantern battery this will quickly drain the battery. It may be necessary to use a constant dc power source in the range of 5 – 6.5 Vdc.

6.4 What Causes the CNI to Call In?

First, the CNI must be configured to originate calls. See Chapter-4 for programming instructions. Second, most alarms conditions can be configured to generate an immediate call. See Chepter-5 for this information. All calls are made to the primary phone number or IP address, except for Alarm Input #2, which can be assigned a different phone number or Internet address.

6.4.1 Alarm Condition
For any alarm condition described in Chapter-5 the CNI can be programmed to place an immediate call into DC-2000.

6.4.2 Paging
The CNI can be paged by calling its voice number or by sending it an SMS message. The unit will call in but does not report an alarm condition for a page.

6.4.3 Scheduled Call
Each time the CNI communicates with DC-2000 it will be given a new time to call in. This schedule is defined by the user using the Call Profile Configuration Screen in DC-2000 (see Chapter-5).

6.5 Behavior when Originating a Call in CSD Mode

Figure 6-1 depicts the status LEDs on the CNI board.

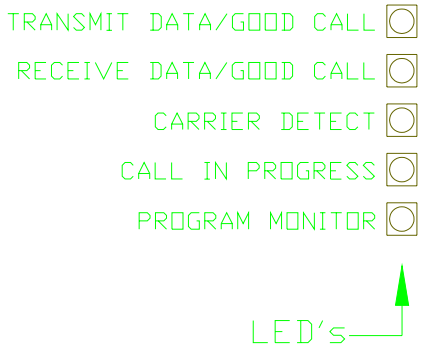

Figure 6-1
CNI's LED Indicators

When power is first applied to the CNI or when the unit is reset the green "program monitor" LED will light steadily for several seconds then should start flashing slowly. If the CNI has been configured to originate a CSD call, it will attempt to make a call to the primary phone number that was programmed into the CNI. The reason for the call is to report a "unit reset" alarm.

- First, the CNI applies power to the cellular radio and will initialize the radio for data communications. During this time the "program monitor" LED will flash very slowly. When the radio is ready, the "program monitor" LED will flash twice as fast.

- The cellular radio will attempt to "register" with the cellular network. If the radio is able to register with the network, the signal strength is checked. If the signal strength is very good the "program monitor" LED will flash very rapidly. If the signal strength is weak but usable the LED will flash at a somewhat slower rate. Good signal strength is equivalent to 3 or more "bars" on a typical cellular phone.

  NOTE: If the radio cannot register with the network within several minutes, the CNI will attempt to call again at a later time. That time is defined as either the "*Primary Call Retry Rate*" or "*Secondary Call Retry Rate*" depending upon how many attempts have been made so far.

- The "call in progress" LED will light solid red. The phone number is dialed. If a connection is established with the central computer's modem the "carrier detect" LED will light solid red. If a link cannot be established the CNI will power down the radio and try again at a later time.

- If a modem connection is established the "transmit data" and "receive data" lights will blink momentarily, indicating that data is being exchanged with the central computer.

- At the end of the call the “call in progress” and “carrier detect” LEDs will turn off. If the call was successful both of the “good call” LEDs will light solid red. If the call was not successful due to data errors or the loss of a connection the CNI will attempt to call again at a later time.

  A CSD connection will be terminated if:
  - The central computer terminates its connection
  - No data has been received from either the computer or an ADM board for one minute
  - The cellular connection has been lost

- 4 – 5 minutes after the initial power-up or reset, if the CNI is only allowed to originate calls and not respond to pages or incoming calls, all LEDs will turn off and the CNI will go into a low-power standby mode to conserve power.

Additional calls can now be made. For each additional successful call both of the “good call” LEDs will light solid red for about 3 seconds before the unit returns to a low-power standby mode.

6.6 Behavior when Answering a Call or Page in CSD Mode

If the CNI has been configured to answer a CSD call the cellular radio module is powered up at all times in order to detect the incoming calls. Therefore it is normally always registered with the cellular network, unless the signal strength is poor.

- Every 20 seconds the signal strength is checked. If the signal strength is very good the “program monitor” LED will flash very rapidly. If the signal strength is weak but usable the LED will flash at a somewhat slower rate. Good signal strength is equivalent to 3 or more “bars” on a typical cellular phone.

- When an incoming call is detected the CNI answers the call, usually on the first ring. The “call in progress” LED will light solid red.

- The CNI will attempt to establish communications with the central computer’s modem. If this is successful the “carrier detect” LED will light solid red. If a link cannot be established within 30 seconds the CNI will terminate the call. At this point the failed call is considered to be a “page” and, if the CNI has been configured to originate calls, will call back to the primary phone number that was programmed into the unit.

- If a modem connection is established the “transmit data” and “receive data” lights will blink randomly to indicate that data is being exchanged.

- At the end of the call the “call in progress” and “carrier detect” LEDs will turn off. If the call was successful both of the “good call” LEDs will light solid red. The CNI will go back to listening for more incoming calls.

A CSD connection will be terminated if:

- The remote computer terminates its connection
- No character has been received from either the computer or an ADM board for one minute
- The cellular connection has been lost

6.7 Behavior in Packet Mode

When power is first applied to the CNI board or when the unit is reset the green "program monitor" LED will light steadily for several seconds then should start flashing slowly. If the CNI has been configured for packet (Internet) mode it will attempt to make a connection to the primary IP address that was programmed into the CNI. The reason for the call is to report a "unit reset" alarm.

- First, the CNI applies power to the cellular radio and will initialize the radio for Internet communications. During this time the "program monitor" LED will flash very slowly. When the radio is ready the "program monitor" LED will twice as fast.

- The cellular radio will attempt to "register" with the cellular network. If the radio is able to register with the network the signal strength is checked. If the signal strength is very good the "program monitor" LED will flash very rapidly. If the signal strength is weak but usable the LED will flash at a somewhat slower rate. Good signal strength is equivalent to 3 or more "bars" on a typical cellular phone.

  NOTE: If the radio cannot register with the network within several minutes the CNI will attempt to call again at a later time. That time is defined as either the "*Primary Call Retry Rate*" or "*Secondary Call Retry Rate*" depending upon how many attempts have been made so far.

- The CNI will request a packet service connection with the cellular provider. If granted the "call in progress" LED will light solid red. Otherwise the CNI will try again at a later time.

- A request is made for an Internet connection to the server whose IP address was programmed into the CNI. During this time the "transmit data" and "receive data" lights will blink randomly, indicating that data is being exchanged between the CNI and the cellular provider.

- If a connection is established to the server the "carrier detect" LED will light solid red. If a link cannot be established, the CNI will try again at a later time.

- The "transmit data" and "receive data" lights will blink randomly indicating that data is being exchanged between the CNI and the destination server.

- At the end of the call the "call in progress" and "carrier detect" LEDs will turn off. If the call was successful both of the "good call" LEDs will light solid red. If the call was not successful due to data errors or the loss of a connection the CNI will

attempt to call again at a later time.

- 4 – 5 minutes after the initial power-up or reset, if the CNI is only allowed to originate calls and not respond to pages or maintain a permanent Internet connection, all LEDs will turn off and the CNI will go into a low-power standby mode to conserve power.

Additional calls can now be made. For each additional successful call both of the "good call" LEDs will light solid red for about 3 seconds before the unit returns to a low-power standby mode.

6.8 Permanent ("Always On") Internet Connection

When the CNI is programmed to only originate calls it returns to a low-power standby mode after the completion of a call. This means the radio is turned off and the connection to the cellular network is terminated.

When it's time to place the next call the radio must be powered up, the registration must be reestablished, a packet service connection requested and granted, and an Internet connection requested and granted to the data collection server. Of course all of this takes time, sometimes several minutes if the network is busy.

A feature that is available from most cellular providers is an "always on" Internet connection. By staying connected to their system it is only necessary to request a connection to the destination server. This normally requires just a few seconds.

To enable this feature program the CNI for originate mode and check the *"Maintain Internet Connection"* checkbox in MP32 (see Chapter-4). In this mode the CNI will not be able to answer incoming calls or respond to SMS messages.

In this mode the "call in progress" LED will remain on to indicate a permanent connection to the Internet. The remaining LED indicators will behave as they do during a normal Internet connection.

> The use of a permanent Internet requires that the cellular radio be powered up at all times. If the primary power source is the alkaline lantern battery this will quickly drain the battery. It may be necessary to use a constant dc power source in the range of 5 – 6.5 Vdc.

6.9 Transparent mode for alarm status and maintenance

When placing or receiving a CSD call, the CNI will always attempt to communicate with a Metretek system first (DC-2000). After the modem connection is established the CNI will send a special ASCII string and wait several seconds for a valid Metretek response. It will repeat this sequence several more times. If a valid response is still not received the CNI switches to "Transparent Mode".

Transparent mode allows a non-Metretek system (such as a modem and a computer running a terminal emulation program such as HyperTerminal) to use the CNI as an alarm-monitoring device. Pulse counting information is not available in this mode. It also allows the computer to communicate with a serial device connected to the CNI's serial port. This is discussed in the next sections.

If either of the CNI's inputs has been configured as an alarm input, and the "*Alarm String Download*" function has been enabled, the CNI will immediately send one or more ASCII text strings relating to its status and alarm conditions. A single carriage-return character (13 decimal or 0d hex) terminates each string.

The first string sent is:

UID# xxxxxx

where "xxxxxx" is the 6-digit remote unit ID that was programmed into the CNI (see Chapter-4). If there are no alarm conditions, this is the only string sent. Otherwise any of the following strings may be sent relating to status and alarm conditions (see Chapter-5 for a description of the various alarm conditions):

*** CALL RETRY ALARM ***
*** UNIT RESET ALARM ***
*** TAMPER ALARM ***
*** CUSTOMER ALARM ***
*** AC OFF ALARM ***
*** AC ON ALARM ***
*** CUSTOMER ALARM 1 ***
*** CUSTOMER ALARM 2 ***

Note: "* Customer Alarm 1 *" and "* Customer Alarm 2 *" are default strings for Input #1 and #2, respectively. These strings can be changed when configuring the device. See Chapter-4.

The CNI can also respond to several short command strings from the computer, shown in the next table. A single carriage-return character (13 decimal or 0d hex) must terminate all strings. Upper or lower case characters are accepted.

COMMAND	DESCRIPTION
+-+SA	**Send Alarms**. The CNI will return the unit ID string followed by other strings describing any alarm or status conditions. See the previous discussion about these messages.
+-+CA +-+CLRALMS	**Clear Alarms**. All alarm conditions that were present at the time of the call are cleared. If the CNI originated a call due to an alarm condition, this command will prevent the CNI from calling again. The CNI will respond with an "OK" string after the alarms are cleared.
+-+AA +-+AUTALMS	**Auto Alarm Clear**. When this command is received, alarm conditions will be automatically cleared after each call (including this call). Therefore it is not necessary to issue the +-+CA or +-+CLRALMS command with each call. This command only needs to be issued once. The CNI will respond with an "OK" string after this command is accepted.
+-+MA +-+MANALMS	**Manual Alarm Clear**. When this command is received, alarm conditions can only be cleared using the +-+CA or +-+CLRALMS command. The CNI will respond with an "OK" string after this command is accepted.
+-+PAxxxxxx	**Port Address**, where "xxxxxx" is the 6-digit remote unit ID that was programmed into the CNI for the pressure sensors (see Chapter-4). This is used only for dual-pressure units.

Table 6-1
CSD Transparent Mode Status Commands

6.10 ADM Board Configuration

Some users may want to change the factory default settings of the ADM (Analog Data Monitor) board in order to provide a better fit for their application. Settings that fall into this category include Sample Rate, Pressure Alarm Set Points, Entry Password, etc. Two methods for performing this task are presented here.

6.10.1 Configuration using a Direct Serial Link

A direct serial cable link between a personal computer (PC) and the Analog Data Monitor will be necessary when a cellular connection is not available. This will most often be the case when performing a pressure calibration in the field. Equipment requirements are:

- Serial cable assembly as shown in Figure 6-2. The serial port extension cable is an item that can be purchased at a local computer store, while the adapter will either need to be constructed or purchased from Metretek.

- Personal Computer with terminal emulation software such as Procomm™, Hyperterminal™, or equivalent.

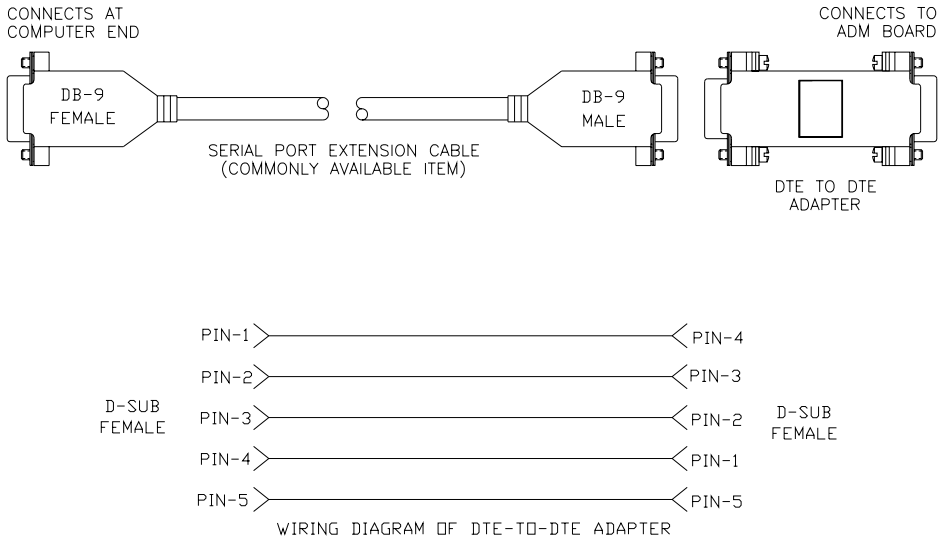

Figure 6-2
Direct Serial Link Cable

The following process steps will establish the communications link:

a) Note the setting of JP4 on the Analog Data Monitor board. The terminal emulation software on the computer will need to be setup for the same baud rate as the ADM board. In addition, the following parameters must also be setup as follows:

Data Bits = 8, Stop Bits = 1, Parity = None.

b) Remove the existing cable from the P3 connector on the ADM board.

c) Ensure that the ADM board has power applied to it.

d) On the computer run the terminal emulation software. Attach one end of the DTE to DTE adaptor cable to an available serial port connector on the computer (such as COM1), and the opposite end to the ADM board.

At this point, a menu should appear on the display of the PC as shown in Figure 6-3. If no menu appears, or if the characters are scrambled, then it is likely that the bit rate parameters are not set properly. The bit rate of the computer should match the bit rate of the ADM board, while the other configuration settings must always be 8 data bits, 1 stop bit, no parity.

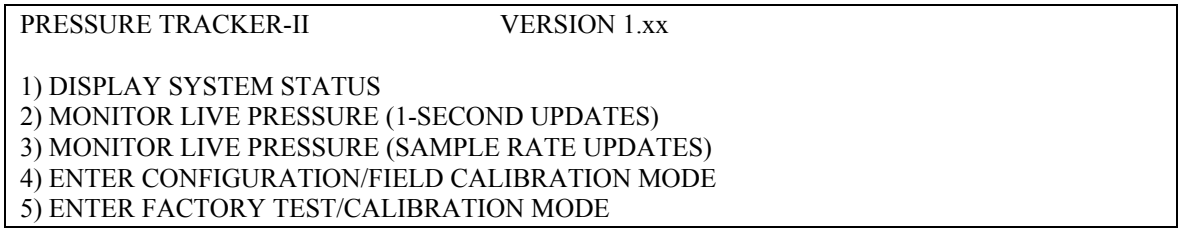

Figure 6-3
ADM Board Main Menu

6.10.2 Configuration using a Cellular (CSD) Connection

A cellular phone link connection between the CNI and a computer is normally made when units are already installed in the field at remote locations. This method of configuration avoids the necessity of sending a service technician into the field to make the changes. This feature requires a circuit-switched data (CSD) connection, a service that may have to be purchased as an add-on feature from the cellular service provider.

Equipment requirements are:

- Personal Computer with terminal emulation software such as Procomm™, Hyperterminal™, or equivalent.

- Hayes compatible modem (attached to the above PC) capable of supporting 9600bps connection speeds. The modem may need to have error correction protocol disabled by issuing the AT&Q0 command. Most terminal emulation software programs have a method available for disabling error correction.

If the CNI has been programmed to answer calls, and the cellular service provider supports “mobile-terminate” CSD service, then dial out to the CNI to establish a data connection. It may take 20-60 seconds to establish a connection. The CNI must have been originally configured for CSD calls for this to work.

If the cellular service provider does not support “mobile-terminate” CSD service, but the cellular account has been assigned a voice number, then dial that number and hang up after the CNI answers the call. The CNI will then hang up and call back to the phone number that was originally programmed into the CNI board. This should be the number of your modem. Alternately you can send an SMS message to page the unit to call back. In either case the CNI must have been originally configured for CSD calls for this to work.

When placing or receiving a CSD call, the CNI will always attempt to communicate with a Metretek system first (DC-2000). After the modem connection is established the CNI will send a special ASCII string and wait several seconds for a valid Metretek response. It will repeat this sequence several more times. If a valid response is still not received the CNI switches to “Transparent Mode”.

For dual-pressure units it will be necessary to select one of the two ADM boards before configuration begins. The +-+PAxxxxxx command allows the computer to select one of

the two ADM boards. See Chapter-4 for more information about dual port mode. For example, if the primary unit ID for ADM Board #1 is 123456 (which is also the ID for Serial Port-1), and the ID for ADM Board #2 is 987654, then the command to select #2 would be

+-+PA987654

The CNI will respond with the string

CONNECTION WITH PORT 987654 NOW TRANSPARENT

Initially a few erroneous characters might appear as the connection is established. Ultimately, a menu screen similar to Figure 6-3 should appear. If not, try pressing the 'Enter' key to make the menu redraw.

6.10.3 Using the Configuration Menus

Figure 6-3 shows the five options that are available in the main menu.

Selection '1' generates a display that provides a summary of the operating status. Figure 6-4 illustrates a typical status screen report. It is a good idea to review the status screen after making configuration changes. This provides verification that any of the desired configuration changes have indeed been applied as expected.

```
PRESSURE TRACKER-II SYSTEM STATUS

PRESSURE: 0.0 PSIG
TEMPERATURE: 22.8 DEG. C
KYZ FREQUENCY: 0.00 HERTZ
BATTERY: 3.610 VOLTS
SAMPLE RATE: 30 SECONDS
LOW PRESSURE ALARM SETPOINT: 45 PSIG
HIGH PRESSURE ALARM SETPOINT: DISABLED
SETPOINT VIOLATION TIMER: 45 SECONDS
PRESSURE RANGE: 0-100 PSIG
```

Figure 6-4
System Status Screen

Selection '2' generates a continuous pressure sample display that is updated every second (see Figure 6-5). Pressure readings are taken and updated every second when in this mode, regardless of the stored setting for the sample rate. Applications for this menu include the monitoring of live pressure while equipment adjustments are made within the distribution network.

```
PRESSURE TRACKER-II LIVE SAMPLE DISPLAY (UPDATED EACH SECOND).
TYPE  'Q'  TO RETURN TO MENU.

PRESS = 0.0 PSIG
PRESS = 0.0 PSIG
PRESS = 0.0 PSIG
PRESS = 0.0 PSIG
```

Figure 6-5
Monitoring of Live Pressure

Selection '3' generates a pressure sample display that is updated at the programmed sample rate (see Figure 6-6). This sample rate can be set for a value in the range of 1 to 60 seconds under a configuration menu described later. A less frequent sample rate is useful when the data is being downloaded to a file for analysis by a spreadsheet program. Spreadsheet programs are capable of filtering out the non-numeric text and analyzing the numbers to produce a pressure profile chart.

```
PRESSURE TRACKER-II LIVE SAMPLE DISPLAY (UPDATED AT SAMPLE RATE).
CURRENT SAMPLE RATE = 30 SECONDS.
TYPE 'Q' TO RETURN TO MENU.

PRESS = 0.0 PSIG
PRESS = 0.0 PSIG
PRESS = 0.0 PSIG
PRESS = 0.0 PSIG
```

Figure 6-6
Live Pressure Display, 30 Second Update Rate

Selection '4' requires password entry to gain access to the configuration / calibration menu as shown in Figure 6-7. Factory default password is "PASSWORD" until changed by the user.

```
PASSWORD ENTRY IS REQUIRED BEFORE PROCEEDING TO NEXT LEVEL

NOTES:  a) PASSWORD ENTRY IS NOT CASE SENSITIVE
        b) DEFAULT PASSWORD IS "PASSWORD" UNLESS CHANGED BY USER
        c) TYPE 'QUIT' TO RETURN TO MAIN MENU

< . . . . . >
```

Figure 6-7
Password Entry Screen

CAUTION
Failure to change the default password will leave the system vulnerable to unauthorized access.

After entry of the appropriate password the Configuration / Calibration sub-menu will appear as shown in Figure 6-8. Menu items 6, 7, and 8 are marked with '--USE CAUTION--' as a warning to the user that the ADM configuration and/or calibration could be corrupted unless due care is exercised.

```
CONFIGURATION / FIELD CALIBRATION MENU

1) CHANGE LOW PRESSURE ALARM LIMIT
2) CHANGE HIGH PRESSURE ALARM LIMIT
3) CHANGE ALARM VIOLATION TIMER VALUE
4) CHANGE PRESSURE SAMPLE RATE
5) DISPLAY EEPROM MEMORY CONTENTS
6) MODIFY EEPROM MEMORY CONTENTS      -USE CAUTION-
7) CHANGE ENTRY PASSWORD              -USE CAUTION-
8) CALIBRATE PRESSURE SENSOR          -USE CAUTION-

Q) RETURN TO MAIN MENU
```

Figure 6-8
Configuration / Calibration Menu

6.10.3.1 Change low pressure alarm limit

Permits the user to assign a low-pressure alarm set point with values in the range of zero to the full-scale rated pressure. Entries are made as a numeric value in PSI units. Typing ‘X’ at the prompt will disable this alarm.

6.10.3.2 Change high pressure alarm limit

Permits the user to assign a high-pressure alarm set point with values in the range of zero to the full-scale rated pressure. Entries are made as a numeric value in PSI units. Typing ‘X’ at the prompt will disable this alarm.

6.10.3.3 Change alarm violation timer value

Allows changing of the value contained in the countdown timer that is used to trigger the alarm signal on the terminal block. A pressure violation (either high or low) must exist continuously for the specified time interval before the alarm is triggered. This can be used to prevent spurious alarms from being triggered based on only a few samples. Legal values are from 1 to 255 seconds, but the number must be equal to or greater than the value used for the sample rate.

To illustrate the point, a system with a sample rate of once every 30 seconds may be configured to use an alarm violation timer value of 120 seconds. It will then be necessary for the pressure to be out of range for 4 continuous samples before the alarm will be triggered (which in turn can cause the CNI to call the central computer site).

6.10.3.4 Change pressure sample rate

Permits changing of the frequency with which the ADM board takes a pressure sample with the transducer. Permitted entry values are limited to once every 1, 2, 3, 4, 5, 6, 10, 15, 30, or 60 seconds. Factory default value is once every 15 seconds, and a value of once every 30 or 60 seconds will likely satisfy the requirements for most applications.

6.10.3.5 Display EEPROM memory contents

This diagnostic tool displays the contents of EEPROM memory in hexadecimal number format. Normally this would not be invoked except at the request of a Metretek service technician. Numerous operating parameters are stored in this memory, some of which include the pressure scale, unit of measure, user selectable parameters and calibration coefficients for the transducer.

6.10.3.6 Modify EEPROM memory contents

Permits the user to directly change the contents of EEPROM memory. This can be useful in special cases where the user is receiving guidance from a Metretek service technician. In situations where it is desired to change the unit of measure (from 'psi' to 'inches H20' for example), one of the EEPROM registers would require modification. Normally it is advised not to change the contents of EEPROM memory to prevent accidental accuracy degradation or total failure.

6.10.3.7 Change entry password

Allows the user to assign a new password to the configuration / calibration entry menu, and is highly recommended for preventing unauthorized access. Special care should be taken however to ensure that the new password is not lost or forgotten. Passwords are

not case sensitive (caps lock state can be ignored), and are permitted to be any combination of characters/symbols available on the keyboard.

6.10.3.8 Calibrate pressure sensor

Permits field calibration of the pressure transducer used in the CNI. When this option is selected, a new menu will appear as shown in Figure 6-9.

```
SELECT ONE OF THE FOLLOWING CALIBRATION OPTIONS:

1) OFFSET CALIBRATION (ZERO PRESSURE)
2) SPAN CALIBRATION (FULL SCALE PRESSURE)
Q) QUIT
```

Figure 6-9
Pressure Calibration Menu

Select option '1' to calibrate the zero pressure point or option '2' to calibrate the full-scale pressure point. Calibration of the pressure sensor requires that the Technician be able to apply zero pressure for the offset calibration and full-scale pressure to calibrate the span. A typical menu for calibrating the zero point is shown in Figure 6-10.

```
APPLY ZERO PRESSURE AND ADJUST THE OUTPUT TO REPORT ZERO

PRESS 'I' TO INCREMENT THE VALUE
PRESS 'D' TO DECREMENT THE VALUE
PRESS 'ENTER' TO SAVE THE CALIBRATION PARAMETERS

PRESSURE = 0.0 PSIG
```

Figure 6-10
Zero Point (offset) Calibration Menu

Pressure readings are updated at a rapid rate at the bottom of the menu to provide feedback during the adjustment process. Pressing the 'I' or 'D' key will cause a small increment or decrement to the reported pressure reading. Each time a key is pressed a beep sound will be made on the computer to signal an acknowledgement.

Since a precisely controlled temperature is not possible in the field, it should be expected that a field calibration would not be as accurate as a factory calibration. The original factory calibration was performed in an environmental chamber at six temperature points and with a high precision pressure source.

> NOTE:
> When possible, full-scale pressure should be used to execute the span calibration. In cases where this is not possible, line pressure can be utilized instead with the understanding that this method is less precise.

6.10.4 Overall Menu Summary

```
----------------1) VIEW SYSTEM STATUS
|  ------------2) VIEW LIVE PRESSURE (1-SEC UPDATES)
|  |  ---------3) VIEW LIVE PRESSURE (SAMPLE RATE UPDATES)
|  |  |  ------4) ENTER CONFIGURATION/FIELD CALIBRATION MODE
|  |  |  |  ---5) ENTER FACTORY TEST/CALIBRATION MODE
|  |  |  |  |
|  |  |  |  --- (Factory test menu, not accessible to user.)
|  |  |  |
|  |  |  --1) CHANGE LOW PRESSURE ALARM LIMIT SETPOINT
|  |  |    2) CHANGE HIGH PRESSURE ALARM LIMIT SETPOINT
|  |  |    3) CHANGE ALARM VIOLATION TIMER SETTING
|  |  |    4) CHANGE SAMPLE RATE
|  |  |    5) DISPLAY EEPROM MEMORY CONTENTS
|  |  |    6) MODIFY EEPROM MEMORY CONTENTS    -CAUTION-
|  |  |    7) CHANGE ENTRY PASSWORD            -CAUTION-
|  |  |    8) CALIBRATE PRESSURE SENSOR        -CAUTION-
|  |  |    Q) RETURN TO MAIN MENU
|  |  |
|  |   --- PRESSURE TRACKER LIVE SAMPLE DISPLAY (UPDATED AT SAMPLE RATE).
|  |       CURRENT SAMPLE RATE = 15 SECONDS.
|  |       TYPE 'Q' TO RETURN TO MENU.
|  |       PRESS = 0.0 PSIG
|  |       PRESS = 0.0 PSIG
|  |       PRESS = 0.0 PSIG
| |
|  --- PRESSURE TRACKER-II LIVE SAMPLE DISPLAY (UPDATED EACH SECOND).
|      TYPE  'Q'  TO RETURN TO MENU.
|      PRESS = 0.0 PSIG
|      PRESS = 0.0 PSIG
|      PRESS = 0.0 PSIG
|
---PRESSURE TRACKER-II SYSTEM STATUS
   PRESSURE: 0.0 PSIG
   TEMPERATURE: 22.8 DEG. C
   KYZ FREQUENCY: 0.00 HERTZ
   BATTERY: 3.610 VOLTS
   SAMPLE RATE: 15 SECONDS
   LOW PRESSURE ALARM SETPOINT: DISABLED
   HIGH PRESSURE ALARM SETPOINT: DISABLED
   SETPOINT VIOLATION TIMER: 45 SECONDS
   PRESSURE RANGE: 0-100 PSIG
```

Figure 6-11
ADM Menu Tree

6.11 Power Failure Standby Mode

Here is how the CNI behaves before, during and after a low battery condition. This is the condition of the alkaline charging battery, not the lead-acid battery. A low battery condition is considered to be around 3.6V.

It is not unusual for battery voltage to vary as temperature varies. Generally battery voltage drops as temperature decreases but will recover once the unit warms up. However, repeated reports of low battery conditions should be acted upon as soon as possible. If the charging battery is depleted then the lead-acid battery will eventually discharge. At some point the CNI will lose its accumulated pressure readings and that information cannot be recovered.

- If the alkaline battery voltage has fallen below 3.6V for longer than 5 minutes the CNI will log an "AC-OFF" alarm. If the unit has been configured to originate calls it will attempt to report it to the central computer. If the call fails it will try again at a later time. That time is defined as either the "*Primary Call Retry Rate*" or "*Secondary Call Retry Rate*" depending upon how many attempts have been made so far.

  Note: In DC-2000 you can change the phrase "AC-OFF" to something more meaningful, such as "Low Battery".

- If the unit has been configured to answer phone calls, receive SMS messages or maintain a permanent IP connection, those modes are temporarily cancelled.

- The radio will be powered down and the CNI will enter a low-power sleep mode. During this time all LEDs are turned off.

- The CNI will still count pulses and respond to alarm conditions, and will wake up and place calls under alarm conditions. It will return to sleep mode after each call is placed. However, the unit will <u>not</u> retry calls that are unsuccessful except for the call to report the "AC-OFF" alarm.

- When the alkaline battery voltage has remained at 3.6V or higher for longer than 5 minutes the CNI will log an "AC-ON" alarm. If the unit has been configured to originate calls it will attempt to report it to the central computer.

  Note: In DC-2000 you can change the phrase "AC-ON" to something more meaningful, such as "Battery Restored".

- The CNI will restore itself to the conditions that existed prior to the low battery condition.

6.12 Over-the-Air Activation (CDMA18 only)

CDMA technology does not support the use of a SIM card (Subscriber Identity Module) to hold and transport account information. Therefore the account information must be downloaded into the cellular module's own memory. This is usually accomplished by dialing a special phone number to request that the radio be activated "over-the-air" (OTAA). The activation phone number is specific to the service provider and must be programmed into the CNI using the MP32 configuration software (Chapter-4).

The OTAA process does two things. First, if this is the very first OTAA call, a new phone number is programmed into the phone. This is the number that can be used to page the unit via a phone or data call, or via an SMS message. It also starts the account billing process. Second, a "preferred roaming list" (PRL) is downloaded into the phone. This instructs the radio which service provider(s) to search for and connect to.

If the CNI sees that the radio's phone number contains all zeros then the activation number is dialed and over-the-air activation is attempted. This also happens automatically whenever the unit is reset and then every 7 days thereafter. The reason for this is that cellular service providers often make arrangements with other providers to carry calls in areas where their own equipment and towers do not exist. These agreements allow the call to be forwarded at no additional charge. The preferred roaming list says that it is acceptable to connect with these carriers. However at some point your service provider may install new equipment in these areas, and the contract with the partner may be terminated. In this new situation roaming fees will be added to each call if the radio is allowed to connect to the other carriers. This is why it is important to periodically update the PRL.

Here is how the CNI behaves during an OTAA call:

- First, the CNI applies power to the cellular radio and will initialize the radio for data communications. During this time the green "program monitor" LED will flash very slowly. When the radio is ready, the "program monitor" LED will flash twice as fast.

- The cellular radio will attempt to "register" with the cellular network. If the radio is able to register with the network, the signal strength is checked. If the signal strength is very good the green "program monitor" LED will flash very rapidly. If the signal strength is weak but usable the LED will flash at a somewhat slower rate. Good signal strength is equivalent to 3 or more "bars" on a typical cellular phone.

  NOTE: If the radio cannot register with the network within a few minutes, the CNI will attempt to call again at a later time. That time is defined as either the "*Primary Call Retry Rate*" or "*Secondary Call Retry Rate*" depending upon how many attempts have been made so far.

- The "call in progress" LED will light solid red. The OTAA phone number is dialed (this was programmed into the CNI using MP32). If a connection is established with the cellular provider both the "call in progress" and the "carrier detect" LEDs

will flash slowly.

- For the next 1 –2 minutes the cellular provider should download a new phone number if needed and a new PRL. When the call has finished both the “call in progress” and the “carrier detect” LED will turn off, and the “transmit data” and “receive data” LEDs will light solidly for at least several seconds.

IMPORTANT NOTE

If the OTAA call occurs more than two times in a row, this indicates that the download process is failing. Remember, a cellular account must be purchased prior to activating the CNI. You usually have to provide the cellular provider with the “ESN” number that is printed on the label of the radio. Make sure this number is correct.

Also check the OTAA phone number that was programmed using MP32 (see Chapter-4). Some service providers may have different OTAA phone numbers to use depending upon geographical location. If you continue to have problems you may have to contact your service provider directly.

7 SAFETY, HAZARDOUS AREAS, ESD PRECAUTIONS

Safety

WARNING
This product contains a radio-frequency transmitter, Motorola Model g18, FCC ID # IHDT6AC1, Motorola Model g20, FCC ID # IHDT56DB1 or Motorola Model c18, FCC ID # IHDT56CW1.

The combined cable loss and antenna gain must not exceed 6.1dBi gain, and the antenna installation must provide a minimum separation distance of 20cm (8") from users and nearby persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

Hazardous Area Classification

At the time of this publication no hazardous area safety approvals have been received for the CNI product. It is therefore necessary to ensure that the product is only installed at locations that are classified as 'safe area' sites. Safety barriers must be utilized if it becomes necessary to route any cables into a hazardous area boundary.

Refer to the U.S. National Electrical Code (NEC) book, article 510, as well as any relevant local ordnance for guidance with hazardous area wiring. It is the responsibility of the user to ensure compliance with regulations regarding hazardous area locations. This may require the site to be inspected by a certified electrician to maintain full compliance.

ESD Handling Precautions

Any electronics device contains components sensitive to ESD (electrostatic discharge). For example people experience up to 35kV ESD, typically while walking on a carpet in low humidity environments. In the same manner many electronic components can be damaged by less than 1000 volts of ESD. For this reason you must observe the following handling precautions when servicing this equipment:

- Always wear a conductive wrist strap.
- Eliminate static generators (plastics, styrofoam, and so on) in the work area.
- Remove nylon or polyester jackets, roll up long sleeves, and remove or tie back loose hanging neckties, jewelry, and long hair.

- Store and transport all static sensitive components in ESD protective containers.
- Disconnect all power from the unit before ESD sensitive components are removed or inserted, unless noted.
- Use a static safeguarded workstation, which can be set up by using an anti-static kit (Motorola part number 0180386A82). This kit includes a writes strap, two ground cords, a static control tablemat, and a static control floor mat. The Motorola part number for a replacement wrist strap that connects to the tablemat is 4280385A59.
- When anti-static facilities are unavailable, use the following technique to minimize the chance of damaging the equipment:
    - Let the static sensitive component rest on a conductive surface when you are not holding it.
    - When setting down or picking up the static sensitive component, make skin contact with a conductive work surface first and maintain this contact while handling the component.
    - If possible, maintain relative humidity of 70-75% in development labs and service shops.

8 TECHNICAL SPECIFICATIONS

Model:	CNI - GSM18, GSM20 or CDMA18, battery-powered with PTII-DC option.	
Battery Types:	Lead acid: 12V, 2.5 AHr, (Metretek 6135-0049) Lantern battery: 6V, Energizer brand 521 or equivalent.	
Sleep current :	< 1500 uA, originate mode only.	
Main crystal frequency:	9.8304 MHz.	
Number of inputs:	4 Form-A inputs	
Wetting current per input:	175uA nominal.	
Serial Port:	Output levels on TX, DCD and DSR: ±9V max. Input levels on RX and DTR: ±15V max. Baud rate: 300 to 38400 (user-selectable)	
Antenna (external kit):	1850 – 1990 MHz, Metretek Stock #1014-0044-003 1710 – 1880 MHz, Metretek Stock # 1014-0044-002 890 – 960 MHz, Metretek Stock # 1014-0044-001 824 – 894 MHz, Metretek Stock # 1014-0044-004	
Cellular Radio (GSM18):	Motorola Model g18 Tri-Band GSM GPRS FCC ID# IHDT6AC1 Metretek Stock Number 1015-0184-001	
Cellular Radio (GSM20):	Motorola Model g20 Dual-Band GSM GPRS FCC ID# IHDT56DB1 Metretek Stock Number 1015-0199-001 (850 / 1900 MHz) Metretek Stock Number 1015-0201-001 (900 / 1800 MHz)	
Cellular Radio (CDMA18):	Motorola Model c18 Dual-Band CDMA 1XRTT FCC ID# IHDT56CW1 Metretek Stock Number 1015-0198-001	
Antenna Connector:	MMCX Jack (female), 50 ohm impedance.	
Receive Frequencies:	GSM, CDMA GSM GSM GSM, CDMA	824-849 MHz 935-960 MHz 1805-1880 MHz 1930-1990 MHz
Transmit Frequencies:	GSM, CDMA GSM GSM GSM, CDMA	869-894 MHz 890-915 MHz 1710-1785 MHz 1850-1910 MHz
ADM Board High/Low		

Pressure Alarm:	Active low output for 1-second duration indicates that either the high or the low-pressure limit threshold has been violated. For single-pressure units this is sensed on the CNI board's Input #2. For dual-pressure units the outputs from both ADM boards are wired together and sensed on the CNI's "CALL" alarm input.
ADM Board KYZ Output Signal:	Form-C transistor output, open collector, capable of sinking 2mA minimum. Frequency of switching is 0-8 Hertz linearly related to the applied input pressure. This is sensed on the CNI board's Input #1 (and Input #2 for dual-pressure units).
ADM Board RS-232 Connector Pinout:	1 - Carrier Detect Signal (input, awakens board to initiate communications) 2 - Receive Data (RXD, input) 3 - Transmit Data (TXD, output) 4 - DTR (wired to DSR) 5 - Signal Common 6 - DSR (wired to DTR) 7 - No connection 8 - No connection 9 - No connection
Input Pressure Connection:	1/4" NPT (National Pipe Thread) female connection at the flange inlet.
Maximum Overpressure:	2 times full scale.
Burst Pressure:	3 times full scale.
Electrical Isolation of Transducer:	Up to 5000Vdc between electrical circuit and threaded metal fitting with no appreciable leakage. Systems with cathodic protection do not require additional isolation measures.
Measurement Error:	Maximum error when combining all sources (linearity, repeatability, temperature drift, etc.) is 1% of full scale. This translates to ± 1psi for a 100psi rated transducer and ± 3psi for a 300psi transducer.
Weight:	Without batteries: x.x pounds (x.x Kg) With batteries: x.x pounds (x.x Kg)
Dimensions:	See Figure 2-4

Operating temperature range: -22° to +140° Fahrenheit (-30° to +60° Celsius)

9 WARRANTY INFORMATION

The seller warrants its hardware to be free from defects in material and workmanship under normal and proper use for a period of 12 months from the date the hardware is shipped from Metretek, Incorporated. The seller's sole liability and the buyer's sole remedy for any breach of the foregoing provision is, at the seller's option, the timely no-charge repair or replacement of any defective hardware or part that Metretek inspects and finds reasonable evidence that a defect in material or workmanship exists. The buyer shall provide the labor required to remove the defective hardware and install its replacement at no charge to the seller. The equipment will be shipped to the seller at the buyer's expense. The replacement or repaired equipment will be shipped to the buyer at the seller's expense.

Warranty claims to be honored under this warranty must be made promptly. Such claims shall specify the nature and details of the claim, the date that the cause of the claim was first observed, and the affected equipment's unit serial number. Defective equipment shall not be returned to the seller's factory without prior authorization from the seller. A copy of the claim's documentation must be attached to the defective equipment and sent to the seller's manufacturing facility. Defective components replaced under this warranty shall become the property of the seller.

The seller makes no representation or warranty other than those set forth in this agreement. THE WARRANTY STATED HEREIN IS EXPRESSLY IN LIEU OF ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY EXPRESSED OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SUCH WARRANTY CONSTITUTES THE ONLY WARRANTY MADE BY THE SELLER WITH RESPECT TO THIS AGREEMENT, THE EQUIPMENT UNITS, OR THE SERVICES TO BE SUPPLIED HEREBY. THE SELLER SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND.

This warranty will not extend to equipment subjected to accident, to misuse, or to alterations/repair not made and documented in writing by Metretek.

Returns Procedure

If it has been determined through troubleshooting that the problem cannot be resolved without returning the equipment for repair, then a return authorization (RA) number will need to be obtained. Please call **1-800-327-8559** or **1-321-259-9700** to contact the repairs department for obtaining the RA number as well as the return form document that should be filled out. When filling out the repair return form, it is beneficial to provide a description of the problem with as much detail as is necessary to fully characterize the symptom(s). This will assist our technicians in being able to narrow in on the problem, and reduces the possibility that a unit will be returned to the customer with "no problem found". Intermittent type problems can be especially difficult to troubleshoot without a detailed description of the symptoms.