

# Remote Facilities Controller

*Model RFC-1/B*

•

# Relay Panel

*Model RP-8*

**– INSTALLATION AND OPERATION –**

*RFC-1/B firmware version 5.12  
RFC-1/B hardware revision 14  
RP-8 hardware revision 10*



*Nashville, Tennessee • 615-228-3500*

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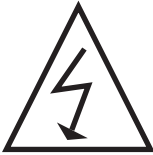
## Section I — Safety Information



### **WARNING!**

***The RFC-1 Remote Facilities Controller and the RP-8 Relay Panels should be installed only by qualified technical personnel. An attempt to install this device by a person who is not technically qualified could result in a hazardous condition to the installer or other personnel, and/or damage to the RFC-1/RP-8 or other equipment. Please ensure that proper safety precautions have been made before installing this device.***

The RFC-1 Remote Facilities Controller is registered with the Federal Communications Commission and certified to meet specific safety requirements. It is extremely important that the RFC-1 not be modified in any way. Modification of this equipment will void the FCC certification, void the warranty, and perhaps pose a hazard to the user of this equipment or to maintenance personnel of your local telephone company. Service of the RFC-1 Remote Facilities Controller should be performed only by qualified technical personnel who are familiar with the implications of FCC Part 68 registration. The RFC-1 Remote Facilities Controller and the RP-8 Relay Panels are designed for indoor use in a dry location. Installation and operation in other locations could be hazardous.



### **High Voltage!**

***Extreme caution should be used if the RFC-1 Remote Facilities Controller case is opened without first being disconnected from the telephone line and the RP-8 Relay Panels. High voltages may be present on telephone lines, and although the RFC-1 is powered by 12 volts AC from a "wall plug" transformer, failure of this transformer could cause dangerous and potentially lethal voltages to become present. Only the supplied transformer should be used.***

Depending on the installation, the RP-8 Relay Panels may be connected to 120 volts AC. If this is the case, use extreme care when working in the vicinity of these panels. Disconnect all sources of high voltage AC before contacting these panels.

The RFC-1 contains self-resetting "fuses" that protect it from excessive current. If these are replaced, the replacement devices should be of the same type and rating.

The RFC-1, as any electronic device, can fail in unexpected ways and without warning. Do not use the RFC-1 in applications where a life-threatening condition could result if it were to fail.

## Section 2 — FCC Information

### 2.1 Part 68 Compliance

The RFC-1 complies with Part 68 of the FCC rules. On the rear panel of the RFC-1 is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN) for this equipment. If requested, this information must be provided to the telephone company.

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

The RFC-1 is designed for use with standard modular (RJ11C) telephone jacks.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the RFC-1. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications to maintain uninterrupted service.

If the RFC-1 causes harm to the telephone network, the telephone company will notify you in advance of service disconnection. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

Please contact Sine Systems, Inc., for repair and/or warranty information if you suspect that the RFC-1 has malfunctioned. If a defective device is causing harm to the telephone network, the telephone company may request you remove that device from the network until the problem is resolved.

The RFC-1 cannot be used on public coin service lines provided by the telephone company. Connection to Party Line Service is subject to state tariffs. Contact your state public utility commission, public service commission, or corporation commission for information.

The RFC-1 is registered with the Federal Communications Commission and is certified to meet specific safety requirements. It is extremely important that the RFC-1 not be modified in any way. Modification of this equipment will void the FCC certification, void the warranty, and perhaps pose a hazard to the user of this equipment or to maintenance personnel of your local telephone company.

Service should be performed only by qualified technical personnel who are familiar with the implications of FCC Part 68 registration. Extreme caution should be used if the RFC-1 case is opened while still connected to the telephone line. High voltages may be present on telephone lines.

## Section 3 — Installation



### **WARNING!**

*The RFC-1 Remote Facilities Controller and RP-8 Relay Panel(s) should be installed only by qualified technical personnel. An attempt to install this device by a person who is not technically qualified could result in a hazardous condition to the installer or other personnel, and/or damage to the RFC-1 or other equipment. Broadcast transmitters can operate at voltages that are potentially lethal. Please ensure that proper safety precautions have been made before installing this device.*

### **3.1 System Includes**

The RFC-1 Remote Facilities Controller package contains these items:

- Remote Facilities Controller model RFC-1
- rack mounted chassis
- ribbon cable with two connectors
- 12 VAC wall plug supply
- modular telephone cable
- operation manual

All systems are fully tested before leaving the factory but damage may occur in transport. When the RFC-1 and RP-8 panels are unpacked, they should be inspected for obvious signs of mechanical damage or loose parts. Loose parts should be tightened before installation. If damage is found, save the packing material and report it to the shipping company and the dealer from which it was purchased. Do not install the system.

### **3.2 Installing the System**

The RFC-1 is easy to install if you are careful, patient and alert. Installation is broken down into a series of logical steps. But perhaps most importantly, you should have some previous engineering experience in a broadcast transmitter environment. Access to the building does not necessarily qualify you as an engineer. A transmitter can be extremely unforgiving to stupid mistakes. We cannot protect you from yourself, but we want to make this point very clearly: *if you are unfamiliar with this type of equipment, please contact a properly qualified engineer to handle installation and setup of this system.*



### 3.2.1 Mechanical Installation

The RFC-1 and RP-8 are designed to be mounted in a standard 19 inch equipment rack. The system generates little heat and can be mounted in just about any convenient location. The RP-8 panels should be mounted at a location which is convenient to the control and metering sources that will be connected to it. A flat cable is supplied for interconnection between the RFC-1 and the RP-8. The factory supplied cable is three feet long but it can be replaced with a longer one if the RFC-1 and RP-8 are to be mounted further apart.

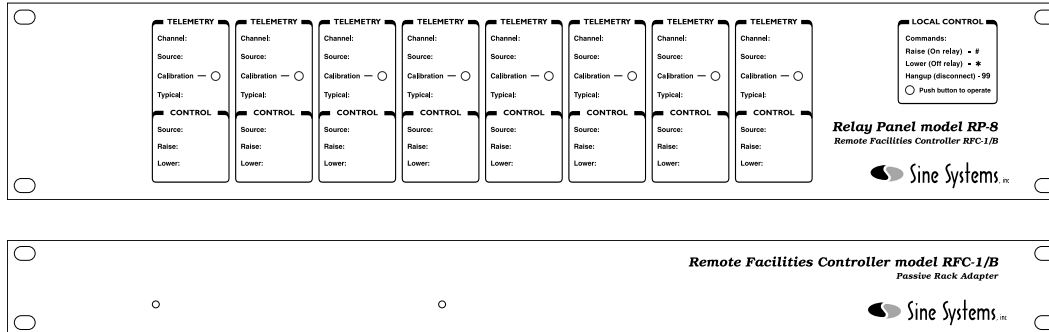


Figure 3.1; RFC-1 Remote Facilities Controller and RP-8 Relay Panel

### 3.2.2 RFC-1 / RP-8 Interconnect

The RFC-1 should be connected to the RP-8 relay panel(s) with the 16 conductor flat (ribbon) cable. This cable is supplied with the RFC-1. The cable is terminated with one connector at each end. If more than one RP-8 is used in a system, an extra connector will be supplied with the additional RP-8. The additional connector must be crimped onto the existing flat cable assembly.

Adding an extra connector to the flat cable is easy--just be careful and be patient. First, slide the connector over the end of the ribbon cable. Be sure to check three things:

- the colored stripe (usually red) is on same side of all connectors
- the ribbon cable lines up with the alignment slots in the connector
- the connector is perpendicular to the length of the cable

When you are sure that the connector is aligned properly, squeeze the connector together with a small vice or a pair of pliers. A couple of small blocks of wood or cardboard will protect the plastic connector from the "gripping teeth" of the vice or pliers. The latches on the edges of the connector will lock into place when the connector is squeezed together sufficiently.

Plan your installation cable before you install additional connectors. For multiple RP-8 panels that are mounted next to each other in the rack, the connectors should be placed about six inches apart on the cable. The supplied cable should work for the most installations. Longer cables may be used if absolutely necessary.

### 3.2.3 RP-8 Channel Block Assignment

If your system uses only one RP-8 you may skip this section.

Each RP-8 panel in the system should be assigned to a different “block” of eight channels. Normally, consecutive blocks of channels are used but this is not absolutely necessary. Channel block assignment is made by moving the selection jumper located at the left end of each RP-8 panel. Place the jumper in the desired channel block position.

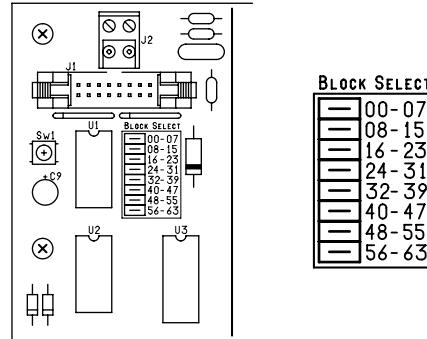


Figure 3.2; RP-8 Channel block select jumper

Be aware that the RFC-1 “rests” on channel 63 during idle conditions (in between telephone calls and not scanning). If the last block of channels is used (56-63), the telemetry relay for channel 63 will be energized during idle periods. This is not normally an issue.

### 3.2.4 RP-8 Telemetry Connections

Telemetry connections to the RP-8 are made through two-conductor screw terminal connectors. The screw terminal connectors can be removed for easier installation. There are no locks or catches, grasp the connector firmly and pull it away from the panel. In addition, the connector can be plugged onto the terminal posts in several directions: horizontal or vertical and left or right facing. You may choose the position that is most convenient. Any connector orientation is fine but be sure to observe proper signal polarity.

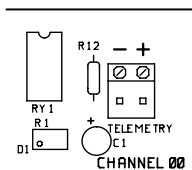


Figure 3.3; RP-8 Telemetry input connection point

Telemetry samples should conform to the following rules:

- for a full scale voltage reading 1.0 volt DC is necessary
- telemetry samples over 4 volts DC should be dropped with an attenuator
- telemetry samples can be offset from ground up to 30 volts DC
- positive or negative DC voltages can be metered

Detailed information on telemetry sources is given later in this section.

### 3.2.5 RP-8 Control Connections

Control connections to the RP-8 are made through three-conductor screw terminal connectors. The screw terminal connectors can be removed for easier installation. There are no locks or catches, grasp the connector firmly and pull it away from the panel. In addition, the connector can be plugged onto the terminal posts in several directions: horizontal or vertical and left or right facing. You may choose the position that is most convenient.

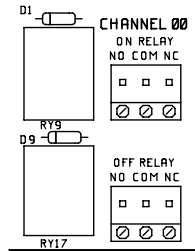


Figure 3.4; RP-8 Control output connection point

The control relays are SPDT with both normally open and normally closed contacts available. Observe proper orientation between the NO, NC and common terminals when making these connections. Detailed information on control outputs is given later in this section.

### 3.2.6 RP-8 Channel Identification

The front of the RP-8 includes a place to record pertinent data regarding each channel. Channels read right to left as viewed from the front of the panel--the lowest channel number is on the far right.

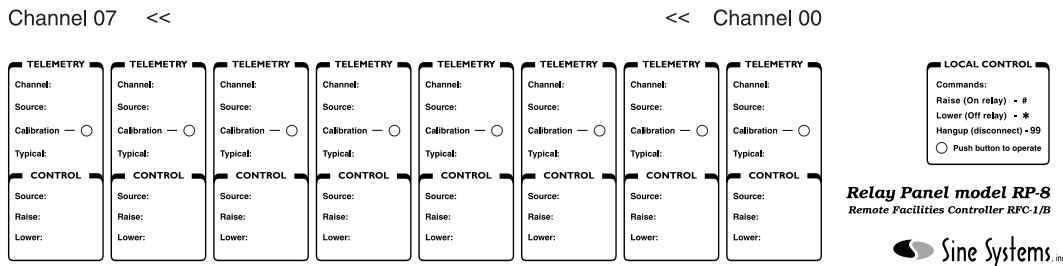


Figure 3.5; Order of RP-8 channels as viewed from front

It is often desirable to write the channel number in the space indicated as well as any other information pertinent to that channel. A grease pencil works well for this task. A permanent marker can be used but it will be difficult to remove the ink without damaging the painted panel if it becomes necessary to do so.

### 3.2.7 Telephone and Telephone Line Connection

The RFC-1 should be connected to a standard (POTS) telephone line with the modular (RJ11C) jack on the rear panel labeled "Line". A telephone cable is supplied with the RFC-1 for this purpose. A telephone may be connected to the jack labeled "Phone". This telephone will be used to control the RFC-1 locally (on-site) and will function normally when the RFC-1 is not online.

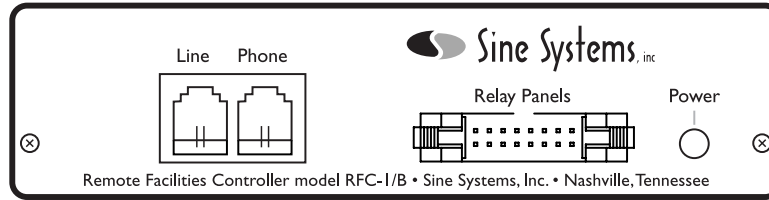


Figure 3.6; RFC-1/B rear panel I/O connectors

### 3.2.8 Power Supply

Power to operate the RFC-1 and up to eight RP-8 panels is supplied by a 12 volt AC wall-plug transformer that is supplied with the RFC-1. This transformer is designed for 120 volts AC at 50-60 Hz and is rated at 1 amp. The leads of this transformer should be stripped and connected to the screw terminal connector marked "12 VAC" on the RP-8. If more than one RP-8 is used, connect to any one of the RP-8 panels. If the supplied transformer has a connector on the end of the power cord, simply cut the connector off and discard it.

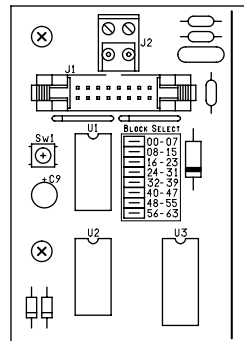


Figure 3.7; RP-8 Power and I/O connections

In installations where 120 volts AC is not available, the RFC-1 may be powered by any source delivering 12.0 to 14.2 volts AC at 50-60 Hz or 15.4 to 17.5 volts DC. The RFC-1 draws a maximum of approximately 0.50 amps when a control relay is engaged. A 12.6 volt filament transformer makes a good substitute power source. The power source must be floating. Neither side of the power source should be connected to ground (earth) nor should the power source be connected to any other equipment. Failure to observe this precaution will result in inaccurate telemetry indications.

### 3.3 Telemetry Source Inputs



#### **WARNING!**

***Telemetry samples may be elevated several hundred volts above ground on some equipment. Permanent damage may occur to the RFC-1 and/or external equipment if a high voltage telemetry source is connected to the RP-8! Failure to observe this warning may also cause injury to the installer or other personnel.***

Telemetry inputs are located across the top of the the RP-8 panel through the 8 two conductor terminal blocks marked "Telemetry". The channels are identified as "00" through "07". In situations where more than one RP-8 is used, channel numbers increase by 8 on each successive relay panel.

The RFC-1 will accept either a positive or negative DC voltage source as a telemetry input. One volt DC is the minimum voltage required for a full scale reading. A lower input voltage can be used but the maximum reading will not reach full scale. Low sample voltages can be calibrated initially but changing readings will appear "notchy" instead of smooth and continuous.

Telemetry samples over 4 volts may be used but calibration accuracy suffers. **Telemetry sample voltage should not exceed 10 volts DC.** Excessive telemetry sample voltage reduces the useful range of the 22 turn calibration pots to the last few turns. The result is an overly sensitive calibration that is "touchy"--a small change of the calibration pot causes a large change in the telemetry reading.

Large telemetry samples (~4 volts or more) should be reduced with an external attenuator. One solution is to add a 2.2K  $\Omega$  shunt resistor across the telemetry input terminals and a series resistor in the telemetry sample. The series resistor should be about 2200  $\Omega$  per volt in excess of two volts. For example, to attenuate a telemetry voltage of 10 volts, use a 2.2K  $\Omega$  shunt resistor and an 18K  $\Omega$  series resistor. The values are not critical.

The telemetry terminal blocks are polarity specific. Connect the positive (high) side of the telemetry source to the "+" terminal and the negative (low) side to the "-" terminal. Either side may be ground referenced if necessary. Telemetry sources may be offset from ground up to 30 volts.

Shielded wire is not normally necessary for short runs to the telemetry inputs since a considerable amount of RFI filtering is built into the RFC-1. However, long runs or lines from AM sampling loops may contain a very large amount of RF which can cause telemetry linearity or other problems. Excessive RF energy can burn the telemetry input components on the RP-8. This problem can usually be eliminated by inserting 2.5 mH chokes in series with each telemetry lead.

It is important to realize that there is no wired connection between the telemetry input and the control I/O. It is entirely possible for a single channel to control a function that is unrelated to the telemetry. If the control relays of a given channel are wired to adjust the output power of a transmitter, then it makes sense to feed an output power sample to that telemetry channel. By the same logic, if the control relays are wired to change the position of an antenna switch, the telemetry input needs a voltage sample that changes when the position of the switch changes. Otherwise, the RFC-1 cannot possibly know the position of the switch.

### 3.3.1 Analog Readings

Any telemetry channel can be a status channel on the RFC-1. Explained briefly, the RFC-1 has the capability to read telemetry over a range of 0000 to 2040. If the reading is:

- between 0003 and 2039 the telemetry is spoken as four digits
- lower than 0003 the words "status off" are spoken
- higher than 2039 the words "status on" are spoken

Thus, any channel can act as either an analog input or a status channel with no specific programming changes. A voltage must be applied to a telemetry input indicate a change of status. The voltage will be interpreted as a logic level signal by the RFC-1 using the rules listed above.

### 3.3.2 Status Readings

The diagram below shows how to wire a telemetry input for a status output. When the external contact is closed, the channel will read "status on" and when the contacts are open the telemetry will read "status off".

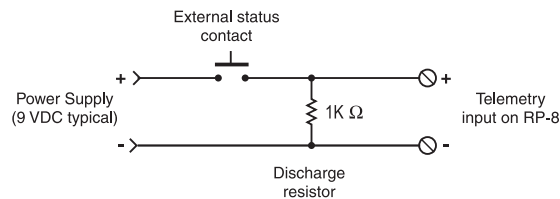


Figure 3.8; Typical wiring for a normally open status channel

The power supply shown in the illustration can be a simple wall-plug transformer that supplies anywhere from 6 to 12 volts DC. A single power supply can be used for many status contacts. The external 1K Ω resistor is added to discharge the input smoothing capacitor on the RP-8 more quickly. Without this resistor it takes about 5 seconds to reach a "status off" reading after the external contacts open. Adjust the telemetry calibration pot so that the system reads "status on" when the external contact closes.

This example illustrates one method of generating a status indication. There are many others. For example, to read a closed contact as "status off", connect the voltage source through a 1K Ω resistor to the positive telemetry terminal and bridge the contact across the positive and negative telemetry terminals. A closed contact will short the voltage and produce a "status off" indication.

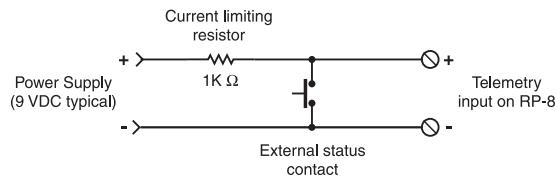


Figure 3.9; Typical wiring for a normally closed status channel

In some cases it is necessary to use an externally generated voltage to indicate status. Suppose, for example, that a large AC contactor that does not have auxiliary contacts is to be metered. A small step-down transformer can be placed across the coil of the contactor to generate a low voltage AC sample. The low voltage AC can then be routed through a series diode and resistor (~1K  $\Omega$ ) to the telemetry input. The 10 mF capacitor on the RP-8 should provide sufficient filtering. Do not apply more than 16 volts DC to the telemetry input terminals!

### 3.3.3 Calibrating Telemetry Readings

*Calibrating the telemetry inputs requires basic operational skills with the RFC-1 in local mode. Skip ahead and read the section that covers operation from the local phone if you have no previous experience with the RFC-1.*

Calibrating the telemetry inputs involves adjusting the channel readings so that they correspond to the readings given from front panel meters. The process is to adjust the calibration pot just behind the front panel for a given channel while checking the value with the local phone. Tweak the calibration pot until the RFC-1 reads the same reading that is shown on the corresponding front channel meter. *Channels read right to left as viewed from the front of the panel--the lowest channel number is on the far right. Make sure that you adjust the correct pot for the channel that you are calibrating.*

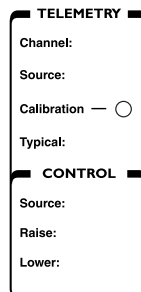


Figure 3.10; Telemetry calibration point

The calibration pots are 22-turn cermet resistors that allow precise adjustment. The pots have a clutch at each extreme to protect the internal mechanism from travelling too far but the pot will turn indefinitely. It does make a faint clicking sound at each end of travel.

As you adjust the pot, the RFC-1 will read new values automatically if the change is very large. However, as you close in on the proper value, you will need to reselect the channel to get an updated reading. Take advantage of as much of the scale as possible. If the normal reading is 100, calibrate the channel to 1000. This is still well within the upper limit of 2040 and offers much higher resolution than if the channel was calibrated to 0100.

From the factory, the RFC-1 will read a four-digit value between 0003 and 2039 with no decimal point. Programming options include different scales, a decimal point, unit words and lead zero suppression. The Advanced Operation section of this manual contains more information.

## 3.4 Control Outputs



### **WARNING!**

***While the control relay contacts are rated for 120 volts AC, only low voltage AC or DC sources should be connected to the RP-8. The large number of exposed terminals on this panel could result in a hazardous condition to the installer or other personnel if high voltage were present.***

Each RP-8 relay panel has eight “On/Raise” relay contacts and eight “Off/Lower” relay contacts. The output relay contacts are form C (SPDT), floating, and rated at 120 volts AC, 5 amperes resistive, 2 amperes inductive. Both normally open (NO) and normally closed (NC) contacts are available on the three conductor terminal block for each relay.

The control relays on the RP-8 are momentary relays that operate as long as the control commands (\* or #) are sent to the RFC-1. An external latching relay must be used if maintained outputs are required. The appropriate output relay of the RP-8 can be used to provide a control signal to the latching relay. Electrical or mechanical latching relays can be used but electrical latching relays may chatter if there is a power supply glitch.

## 3.5 Telephone Interface

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

### 3.5.1 Cellular Telephone with an RJ-11 Adapter

It is possible to connect a cellular telephone to the RFC-1 in place of a telephone line. Some cell phone manufacturers offer devices that provide a cellular telephone with a standard RJ-11 jack. These devices emulate a standard telephone line including dial tone, ring voltage and battery. Additionally, the cell phone will usually need to be outfitted with an external antenna and a constant power supply. Several manufacturers offer these items as part of their product line but product lines change rapidly. The best approach is to discuss your needs with your supplier to find a solution that will work.

Most of these RJ-11 adapters generate a square-wave ring signal on an incoming call instead of the sine-wave ring voltage that is found on a normal telephone line. The RFC-1 has a firmware adjustment that will enable it to recognize the non-standard ring signal. The Advanced Programming section of the RFC-1 documentation provides details on making this adjustment.



### 3.5.2 Fixed Location Cellular Telephones

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

### 3.5.3 Rural Radiotelephones or Ranch Telephones

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

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

### 3.5.4 Dedicated Control Port

The RFC-1 may be operated through a non-dial-up communications link such as a dedicated line, a two way radio, a pager, an STL/SCA link, etc. This additional control method may be used in place of a dial-up line or in addition to a dial-up line. The dedicated communications link is available as a secondary function through the RJ-11 jack labeled "Phone" on the RFC-1. The Dedicated Control Port is activated by firmware settings. The Advanced Programming section of the RFC-1 documentation provides details on making this adjustment.



## **WARNING!**

***The Dedicated Control Port is a two-way audio port with 12 volts DC superimposed for applications that require battery such as a telephone. When the Dedicated Control Port is active the "Phone" port will be connected in parallel with the "Line" port during a dial-up connection. Therefore, any device connected to the "Phone" jack will also be connected to the telephone line and should be FCC Part 68 registered. This is only an issue when the Dedicated Control Port is used and the RFC-1 receives a dial-up call.***

This circuit can be used when connecting a leased line to the Dedicated Control Port.

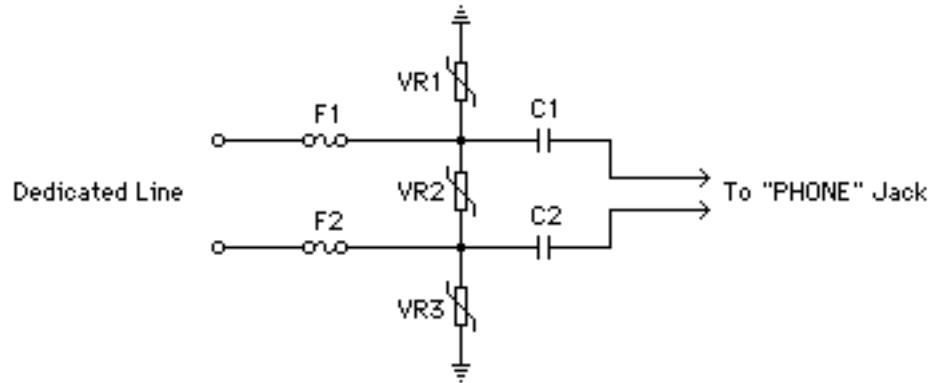


Figure 3.11; Interface for leased line to Dedicated Control Port

The parts for this circuit are:

- F1-F2 1/4 A fast blow fuses
- VR1-VR3 150 volt metal-oxide varistors
- C1-C2 2  $\mu$ F, 200 volt film capacitors

The line to the Dedicated Control Port can be any length from a few feet to thousands of feet depending on the application and tolerable series resistance. C1 and C2 are used to block the 12 volt DC source. If the dedicated line is connected to a telephone set and the DC voltage source is desired to operate the DTMF keypad, the capacitors may be eliminated.

If the DC blocking capacitors are not used, however, two conditions must be satisfied:

- no more than about 50 mA DC should be drawn from this port--this is an equivalent DC load resistance of about 240  $\Omega$
- no DC load, and only a high impedance AC load, should be present across this port when the RFC-1 is being operated from a dial-up line

Both of these conditions will be satisfied if an ordinary telephone is connected to this port and the telephone is left on hook when not in use.

This circuit will interface a radio or other 4-wire communications link to the Dedicated Control Port.

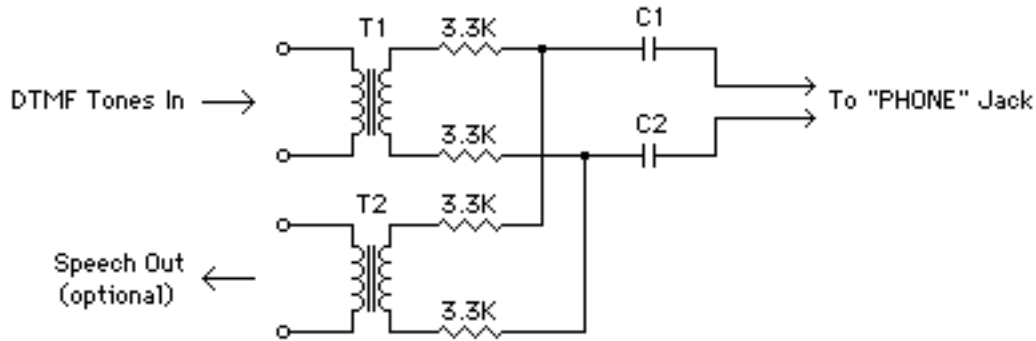


Figure 3.12; Interface for 4-wire audio to Dedicated Control Port

The parts for this circuit are:

- T1-T2 600  $\Omega$  to 600  $\Omega$  audio transformers
- R1-R4 3.3K  $\Omega$  resistors
- C1-C2 2  $\mu$ F, 200 volt film capacitors

C1 and C2 are used to block the 12 volt DC source. This circuit can be used with a two-way radio, a voice pager, an SCA/STL subchannel, or just about any communications link capable of passing voice-grade audio. It is important to remember that operation of the RFC-1 from this port does not require the entry of the security code so the communications link itself should be reasonably secure.

The RFC-1 will respond to any DTMF tones on this line when the Dedicated Control Port is activated. DTMF tone used for other purposes should not appear at this port. The speech synthesizer of the RFC-1 is active on the dedicated control port at all times and telemetry readings will be spoken as the RFC-1 scans the telemetry channels for the monitoring and alarm system.

The proper audio level at the dedicated control port can be determined by experimentation and should be adjusted to the minimum level required for reliable operation. In the above circuit, higher value resistors may be substituted but do not use series resistors less than 3.3K  $\Omega$  if two transformers are used, or less than 1.5K  $\Omega$  if one transformer is used.

## 3.6 Battery Backup and Clock/Calendar

All of the user options and programmable parameters of the RFC-1 are stored in non-volatile memory that remains intact if power is interrupted. The clock/calendar requires continuous power and the system will lose the time and date if power is lost. When power is restored the clock does not advance. Resetting the clock/calendar is simple but programmed events may be missed if the clock is not running.

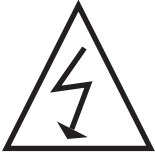
### 3.6.1 Power Failure Alarm

This problem can be eased by setting the Power Failure Alarm. This feature causes the RFC-1 to call and report power failures when AC power is restored. The operator that receives the call can reset the clock and calendar and check the status of devices connected to the RFC-1. For critical applications an uninterruptable power supply is a better solution.

### 3.6.2 Uninterruptable Power Supply

With a proper UPS the RFC-1 can operate normally for extended periods without AC power. A small, inexpensive UPS designed for personal computers will power the RFC-1 for about 1.5 hours. These low end UPS's are not "instant switching" but this should not be an issue because the filter capacitor in the RFC-1 will store enough energy to cover the switching time.

### 3.6.3 Constant DC Supply



## High Voltage!

**Do not under any conditions apply a DC voltage greater than 19.9 volts (peak, if significant ripple is present) to the RFC-1. Prolonged exposure will cause the over-voltage protection circuitry in the RFC-1 to overheat and fail. This maximum voltage rating precludes the use of some rechargeable batteries.**

The RFC-1 is normally powered by 12 volts AC but it may be powered by a DC supply capable of generating approximately +15.2 to +19.9 volts at 800 mA to 1.0 A. The DC source must be "floating", not connected to ground, to allow the telemetry section to work properly. Polarity of the DC supply is unimportant since the power supply input feeds a bridge rectifier.

This simple circuit will allow emergency operation on batteries for around \$20.00 including batteries. *It is very important that this circuit remain floating--not connected to ground. The telemetry sampling circuit in the RFC-1 is floating and will not operate properly with a grounded supply.*

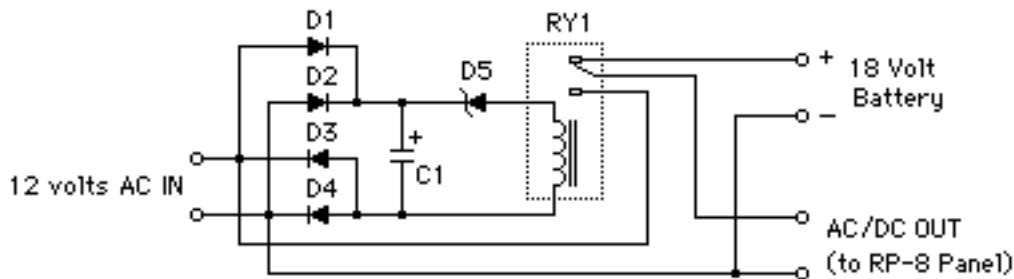


Figure 3.13; Battery backup supply circuit for RFC-1

The parts for this circuit are:

- D1-D4 1N4005 general purpose diode
- D5 6.2 volt, 1 watt zener diode
- C1 47  $\mu$ F, 35 volt electrolytic capacitor
- RY1 SPDT relay with 12 VDC, 300-500  $\Omega$  coil

Most of the values are not critical. C1 should be just large enough to keep RY1 pulled-in during normal power conditions. If it is too large, the switch to battery power will take too long and the clock in the RFC-1 will reset.

The 18 volt battery consists of three 6 volt lantern batteries wired in series. These batteries will power the RFC-1 for about 14 hours. If a very short backup is all that is needed, two 9 volt alkaline batteries may be used. This will power the RFC-1 for about 30 minutes to an hour. In either case, the batteries should be changed every 12 to 18 months due to limited shelf life.

#### **3.6.4 AC Failure Detection on Battery Backup**

When the RFC-1 is powered by a UPS or other constant supply, it is possible to monitor AC power line voltage and generate an alarm when power fails. Simply connect an unregulated DC wall-plug power supply (~3-6 VDC) to one of the telemetry inputs. The telemetry channel can be calibrated directly in volts and set up with a scale and decimal point to reflect 120 VAC wall current. The Advanced Programming section of the RFC-1 documentation provides details on setting the telemetry scale and decimal point.

### **3.7 Lightning Protection Tips**

In most installations the RFC-1 is connected to both a telephone line and a tower (via the transmitter). Any equipment in this situation is subject to severe abuse from lightning. In some installations this happens frequently. lightning can enter through the phone line, mistreat the RFC-1 and exit to the station ground system. It can also hit the tower, elevate the entire ground system above ground by several kilovolts and exit through RFC-1 to ground. This is called a "ground surge." In other words, the telephone line can hit the RFC-1 or the RFC-1 can hit the telephone line. The same thing can happen with the power line.

#### **3.7.1 Proper Ground System**

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

#### **3.7.2 Telephone Line Protection**

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

We highly recommend that you purchase and install your own telephone line surge protector in addition to the one installed by the telephone company. Place this between the incoming telephone line and the RFC-1. These spike protectors are designed to pick up a ground connection through the ground prong on a standard AC outlet so be sure this is in fact connected to your station ground by the shortest possible means. For best result, install a "dummy" AC outlet with no AC connections but with a short jumper from the ground terminal on the outlet the metal rack in which the RP-8 relay panel is mounted. Most protectors have internal, non-replaceable fuses which will blow during a heavy surge. If this happens, replace the protector. Do not attempt to repair it.

### 3.7.3 SP-8 Surge Protector

For installations where the maximum in reliability is required we recommend the Sine Systems SP-8 Surge Protector. The SP-8 provides significant protection against voltage surges from the telephone line, the local telephone and eight telemetry channels using a combination of ground plane construction, gas surge suppressors, metal oxide varistors, and carbon film resistors. It mounts directly to the RP-8 Relay Panel.



## **WARNING!**

***Damage to the RFC-1 and RP-8 by lightning is not covered under warranty. See the complete warranty for more information.***

## 3.8 RF Interference

There have been few reported RF problems with the RFC-1 associated with FM transmitters. The RFC-1 has been tested and found to operate satisfactorily in AM RF fields of 632 volts/meter (the ANSI limit for human exposure) with no additional external filtering. However, extreme conditions exist that require additional external filtering to obtain reliable operation. Extreme conditions are rare but these problems can be overcome by a combination of one or more of the following remedies:

- Install an RF filter before the "Line" jack near the RFC-1
- Install an RF filter before the "Phone" jack near the RFC-1
- Loop the ribbon cable several times through a ferrite core at each end

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

## Section 4 — Accessories and Miscellaneous Circuits

### 4.1 Optional Accessories

Several accessories are available for the RFC-1 that extend the capabilities of the basic system. Documentation for installing and using these accessories is included with the each accessory.

#### 4.1.1 SP-8 Surge Protector

For installations where the maximum in reliability is required we recommend the Sine Systems SP-8 Surge Protector. The SP-8 provides significant protection against voltage surges from the telephone line, the local telephone and eight telemetry channels using a combination of ground plane construction, gas surge suppressors, metal oxide varistors, and carbon film resistors. It mounts directly to the RP-8 Relay Panel.

The SP-8/TO is a version of the SP-8 without the telephone line surge protection. It provides surge protection for eight channels of telemetry in installations with more than one RP-8 relay panel. It is also recommended for use in installation with the RAK-1 Intelligent Rack Adapter. The RAK-1 has telephone line protection built in.

#### 4.1.2 MA-1 Modem Adapter

The Modem Adapter model MA-1 provides a means for the RFC-1 to communicate with a remote computer or to print readings to a remote printer. Voice/DTMF capability is not lost when the MA-1 is installed. The MA-1 consists of a small accessory board that attaches to the RFC-1 and new chassis parts to house the expanded system.

#### 4.1.3 PA-1 Printer Adapter

The Printer Adapter model PA-1 provides a means for the RFC-1 to log readings to a parallel printer located at the RFC-1 site. Voice/DTMF capability is not lost when the PA-1 is installed. The PA-1 consists of a small accessory board that attaches to the RFC-1 and new chassis parts to house the expanded system.

#### 4.1.4 RAK-1 Intelligent Rack Adapter

The Intelligent Rack Adapter model RAK-1 is a great way to add several accessories in one cost effective package. The RAK-1 provides front panel indicators, modem and parallel printing capability, telephone line surge suppression and operation from a battery backed 120/240 VAC supply. The RAK-1 is housed in a standard EIA single space (1U) 19 inch rack mounted case.

#### 4.1.5 RS-232 Serial Data Adapter

The RS-232 Serial Data Adapter provides a means for the RFC-1 to communicate with external serial devices. This adapter may be used with a serial printer on site, an with an external modem to access a remote computer or printer. Voice/DTMF capability is not lost when the RS-232 is installed. The RS-232 consists of a small accessory board that attaches to the RFC-1 and new chassis parts to house the expanded system.

#### **4.1.6 ACM-2 AC Current Monitor**

The ACM-2 AC Current Monitor is designed to monitor tower lighting but it may be used for any application where up to 70 amps of AC current needs to be monitored. Special filter circuits in the ACM-2 average the current reading to a steady value, even if flashing beacons are used. The DC output connects to a telemetry channel on the RP-8. In most cases, the resolution of the ACM-2 is more than sufficient to detect the failure of one bulb in a lighting system.

#### **4.1.7 AFS-2 Audio Failsafe**

The AFS-2 Audio Failsafe is typically used to trigger an alarm on a remote control system or terminate transmission if program audio fails. It monitors one or two audio signals and provides a relay contact closure as long as audio is present on at least one of the two audio inputs. When no audio is present on either input for a preset length of time, the relay contacts open and an Alarm LED lights. The length of the delay is adjustable from 7 seconds to 4.5 minutes.

#### **4.1.8 Thermal Sentry II**

The Thermal Sentry provides an indication of operating efficiency by measuring the temperature difference across two points of a system. This device uses two precision sensors to monitor the temperature at both the air intake and exhaust points of the main transmitter cabinet. The temperature differential is calculated and displayed on the front panel LED display. After normal operating conditions are determined the tolerance can be set to provide a warning when the temperature goes out of range. Thermal efficiency can warn of problems like clogged air filters, failed cooling blowers and antenna icing before damage occurs to the transmitter. Outputs are available so that the temperature differential and the alarm status can be monitored by a remote control system.

#### **4.1.9 TS-1/PS Temperature Sensor with Power Supply**

The TS-1/PS Temperature Sensor is an temperature sensor that measures air temperature from 5.0° F to 203.9° F. The DC output connects to a telemetry input the RP-8 and provides 0.1° resolution. Additional temperature sensors can share the same power supply and are available as part number TS-1.



## 4.2 Auxiliary Circuits

While Sine Systems offers accessories for the RFC-1 that add a variety of capabilities to the system, there are some functions that are simple to add in with just a few extra parts.

### 4.2.1 Audio Detection

In some cases it may be desirable to be able to monitor the presence/loss of an audio signal to trigger an alarm in the RFC-1. Here is a simple audio detector circuit.

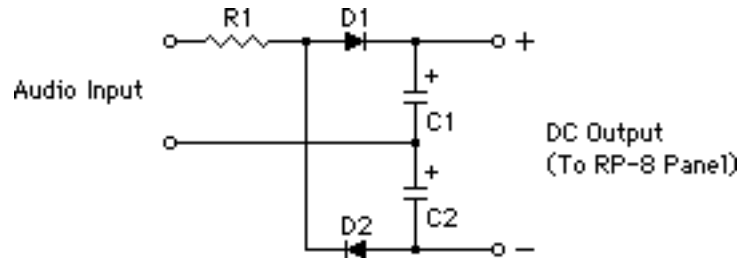


Figure 4.1; Simple audio detection circuit

The parts for this circuit are:

- R1            470  $\Omega$  resistor
- D1-D2        1N4001 general purpose diodes
- C1-C2        470  $\mu$ F, 16 volt electrolytic capacitors

The circuit simply rectifies the audio voltage and stores it in the capacitors. Any audio level of -6 dBv or greater will maintain at least 0.5 volts DC at the output. This covers most "line level" audio sources.

The easiest way to set this up as a loss of audio alarm is to adjust the calibration pot all the way up until you hear a soft clicking sound--the calibration pots are 22 turn cermet trimmers. Then set the upper limit for this channel to 2040 and the lower limit to around 0150. With audio present, the reading will be "status on" almost all the time meaning that the telemetry is pegged against the upper end of the scale. During long pauses the reading will change to numerical values. An alarm will trigger when the value drops to 0150 or below.

## 4.2.2 Latching Relays

Some devices may require a maintained relay contact for proper operation. While the RFC-1 cannot provide a maintained relay contact, it is not difficult to use the relays of the RFC-1 to electrically latch an outboard relay. The disadvantage of this type of latched relay is that if power fails the relay may chatter or change state. In some cases this is not an issue but, if it is, a mechanically latched relay is probably a better solution.

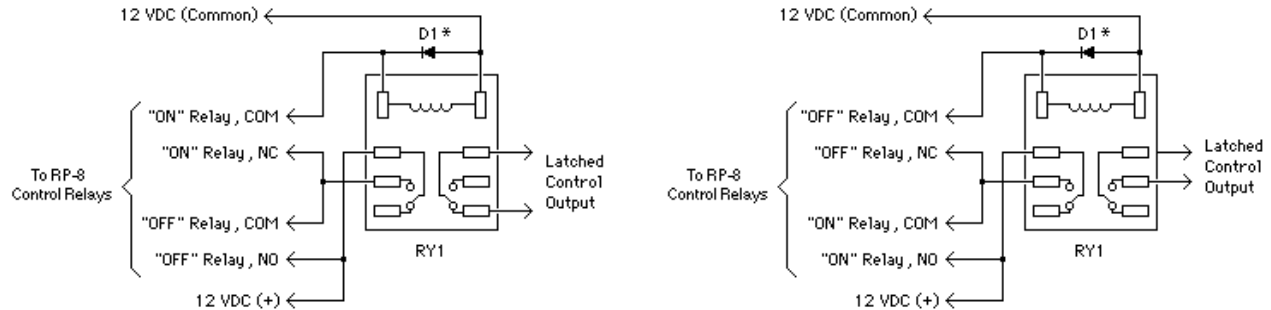


Figure 4.2; Latched relay that powers up in the on position (left) and in the off position (right)

The parts for these circuits are:

- D1 1N4005 general purpose diode (\*omit if a relay with an AC coil is used)
- RY1 DPDT relay with 12 VDC coil
- supply 12 DC wall-plug supply

## Section 5 — Basic Operation

### 5.1 Overview

The RFC-1 can be as simple or complex as necessary depending to the requirements of the installation. After the hardware is installed the unit is capable of answering calls, taking basic telemetry readings and performing manual controls. Only a few adjustments are required to give the system the ability to monitor telemetry channels and place alarm calls. Even non-technical users can take readings and perform simple control operations with the RFC-1.

More demanding installations that require automatic pattern/power changes, sophisticated monitoring and/or data communications can be achieved through system programming. The programming adjustments required for more involved installations are not difficult but more familiarity with the RFC-1 system is necessary.

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

### 5.2 Operation from the Local Telephone

The system can be operated from a telephone that is connected directly to the RFC-1 at the jack labeled "Phone". This telephone is referred to as the "local phone". The RFC-1 can be controlled by entering commands (pressing certain key sequences) on the keypad of the local phone.

#### 5.2.1 Going Online with the RFC-1

Operation from the local phone is initiated by pushing the "Local Control" button located the RP-8 relay panel. When the button is pressed, the RFC-1 connects directly to the local telephone and says "This is RFC-1/B". No security code is necessary to access the system from the local phone. The system goes online immediately after the local control button is pressed and awaits commands. This state of operation will be referred to as the "operating mode" for the rest of this documentation.

As a precaution, the RFC-1 will not stay online indefinitely. After 2.5 minutes of inactivity the RFC-1 will release the local phone and go offline. Press the local control button to bring the RFC-1 online.

#### 5.2.2 Selecting a Channel

To select a channel, simply enter the two digit channel number on the telephone keypad while the system is in operating mode. It is important to use two digits. Enter a leading "0" for channels with less than two digits. Channel numbers start at "00" and continue through "63" depending on how many relay panels are installed. Both digits must be entered within 5 seconds of one another.

Only one channel can be selected at a time. The channel remains selected until

- another channel is selected
- a different function is selected (programming,etc.)
- the system goes offline (hangs up).

A channel must be selected to take readings or operate control relays.

### 5.2.3 Reading Telemetry

Taking telemetry readings is as simple as selecting a channel. The RFC-1 responds with the current telemetry value when a channel is selected. So, to read the telemetry of channel 3, enter 03 on the keypad and the RFC-1 will respond "Channel 03" followed by four digits or "status on/status off" depending on the telemetry input.

Telemetry is reported when:

- a channel is selected
- after a control function
- the telemetry value of the selected channel changes by more than 10% of full scale

To simplify routine telemetry reading, the RFC-1 can scan the channels and report their telemetry values. This is called an "autoscan". To perform an autoscan, enter 64 on the keypad. The RFC-1 will respond with "autoscan" and then begin to read the telemetry values for channel 00 through 07. Interrupt the scan at any time by selecting a channel.

### 5.2.4 Operating the Control Relays

Each channel has two control relays associated with it: one for "on/raise" functions and one for "off/lower" functions.

- the on/raise relay is operated by pressing the # key
- the off/lower relay is operated by pressing the \* key

The control relays will operate as long as either # or \* is pressed (or for a minimum of about half a second). A channel must be selected and the control security code must be entered to operate the control relays.

The *control security code* prevents unauthorized users from controlling the devices that are connected to the RFC-1 control relays. System operation can be restricted so that some operators have the ability to take telemetry readings but not to make adjustments. The control security code is factory programmed to 66.

If an attempt is made to operate the control relays without giving the control security code, the RFC-1 will request it by saying: "enter control security code". If the correct code is not given, the RFC-1 will stop responding to commands and goes offline. More information on the control security code is located in the Advanced Operation section of this manual.

### 5.2.5 Issuing other Commands

The RFC-1 recognizes other commands besides those required for selecting and controlling the channels. The command set is discussed in detail later in this section. Most commands will generate a spoken response. It is not necessary to wait for the RFC-1 to finish speaking before issuing another command.

### 5.2.6 Going Offline with the RFC-1

To complete a session with the RFC-1, hang up the local phone. After 2.5 minutes of inactivity the system will go offline. Another, perhaps better, method is to give the RFC-1 a "hang-up" command that forces it to go offline before hanging up the local phone. The hang-up command is 99. The RFC-1 will respond by saying "Goodbye" and it will go offline 10 seconds later.

## 5.3 Operation from a Remote Telephone

Operating the RFC-1 from a remote telephone is, not surprising, very much like operating it from the local phone (discussed previously). The primary differences are that it is necessary to call the RFC-1 instead of pressing the local control button and that a security code is required for access. The RFC-1 can only be controlled through DTMF tones (Touch Tone®). Rotary/pulse telephones will not work.

### 5.3.1 Going Online with the RFC-1

When the RFC-1 is installed it should be connected to a telephone line. The first step in going online with the RFC-1 from a remote location is to call that telephone number. The RFC-1 will answer after two rings unless someone is online with it locally. In that case, the operator at the site would hear the RFC-1 say “ring ring” each time the incoming telephone line rings. The RFC-1 will continue to work normally for the local operator aside from the verbal ring indicator.

When it answers the line, the RFC-1 will say, "enter". For security, it will not identify itself until the main security code is entered. This is factory programmed as 12345678. Access to the system is granted when the main security code is entered correctly. The RFC-1 will identify itself with the phrase “This is RFC-1/B”. Then it will wait for further commands from the operator.

The main security code must be entered within ten seconds. If the wrong code (or no code) is entered, the RFC-1 will hang-up and refuse any incoming calls for 90 seconds.

### 5.3.2 Operating the RFC-1

The procedure for taking readings and operating control relays is the same from a remote telephone as it is from the local phone. In fact, the RFC-1 behaves exactly the same when operated from a remote telephone as it does from the local phone in almost every way. There are only a few differences:

- remote access requires the main security code before access to the system is granted
- a remote call in progress will be disconnected if the local control button is pressed
- some of the system programming commands are not available from a remote phone
- the basic programming security code is only required from a remote connection

Basic programming options will be discussed later in this section.

### 5.3.3 Going Offline with the RFC-1

To complete a remote session with the RFC-1, hang up the telephone. The RFC-1 will recognize that the line has dropped and the system will go offline. Another, perhaps better, method is to give the RFC-1 a “hang-up” command that forces it to go offline before hanging up the phone. The hang-up command is 99. The RFC-1 will respond by saying “Goodbye” and it will go offline 10 seconds later.

A session can also be completed with the command 98 instead of 99. When the 98 command is issued, the RFC-1 will say “Goodbye” and hang up the phone just as with 99. However, the RFC-1 will refuse to answer any incoming calls for the next two minutes after the command is given. This can be useful if the RFC-1 is sharing the telephone line with other devices.

## 5.4 Alarm System

The RFC-1 can monitor up to eight telemetry channels and originate telephone calls to report abnormal telemetry conditions. In basic operation with the factory settings, the RFC-1 will call up to three telephone numbers to report the condition but it does not attempt to correct the situation.

### 5.4.1 How the Alarm System Works

About ten seconds after powering up or disconnecting with a user, the RFC-1 scans all channels to make new reference readings. Ten seconds later the system begins scanning the monitored channels. Every ten seconds one of the monitored channels is compared against its reference reading. If the current reading exceeds either the upper or lower (user programmable) alarm limit, the alarm sequence is triggered.

Alarms are disabled temporarily when the RFC-1 is online with an operator. If an operator adjusts a telemetry channel out of tolerance using the RFC-1, the RFC-1 interprets this is an adjustment instead of an alarm. For this reason, it is okay to turn a transmitter off with the RFC-1 and no alarm will occur, but if the transmitter output fails an alarm will occur.

When an alarm condition is detected, the RFC-1 will begin making telephone calls to alert personnel of the condition. It will call each telephone number and say "This is RFC-1/B, channel" followed by the number of the channel that caused the alarm. (Or it may say "power failure" if the power failure alarm has been set.) The RFC-1 cannot determine if a call is answered or busy so the call lasts one minute. If an operator does not terminate the sequence, the RFC-1 will wait for one minute and dial the next telephone number.

The alarm sequence terminates when:

- an operator receives an alarm call and enters any key
- an operator calls the system during the pause between calls
- all available telephone numbers have been called three times

Any DTMF tone will acknowledge the alarm and terminate the sequence. New reference readings will be stored when the alarm sequences terminates so the same alarm will not trigger indefinitely.

### 5.4.2 Alarm System Setup

The alarm system must be setup before it can be used. Only a few items need to be programmed.

- up to three telephone numbers to call during the alarm sequence must be stored
- the channels to be monitored and their upper and lower limits must be set
- the alarm system must be enabled

### 5.4.3 Programming Alarm Limits

The memory areas for the eight alarm channels are designated as Alarm A-H. One telemetry channel can be assigned to each. It is not necessary to use all the alarms nor is it necessary to program them in numerical order. For example, Alarm A might monitor telemetry channel 07 and Alarm B could monitor telemetry channel 03 while Alarms C-H are left unused.

The RFC-1 will prompt you through the alarm setup information in basic operation. The commands to setup the Alarms A-H are 90-97 respectively. The procedure to program an Alarm goes like this:

- Step 1 Enter the command (90-97) for the alarm to program: *9x*
- 2 The RFC-1 will read the current settings for that alarm.
- 3 At the prompt, press the # key to reprogram the alarm: #
- 4 At the prompt, enter the two-digit telemetry channel number to assign to this alarm: *nn*
- 5 At the prompt, enter the four-digit upper limit to assign to this alarm: *uuuu*
- 6 At the prompt, enter the four-digit lower limit to assign to this alarm: *llll*
- 7 The RFC-1 responds with OK , the procedure is complete

When one of these commands 90-97 is entered, the RFC-1 responds with "Channel number 64, upper limit 2040, lower limit 1020. Push # to reprogram." You may notice that no such channel exists. To disable an alarm set the channel number to 64. This is the factory default value.

### 5.4.4 Programming Telephone Numbers

The memory areas for the three telephone numbers are designated as Telephone Number A-C. Each telephone number can contain up to twelve digits. Telephone numbers cannot be chained together for more digits in one number. It is not necessary to use all the numbers or all the digits in a number. Enter the \* key for unused digits. The RFC-1 reads the \* back as a ten. This is normal.

The RFC-1 will prompt you through storing the telephone numbers in basic operation. The commands to program Telephone Number A-C are 86-88 respectively.

- Step 1 Enter the command (86-88) for the telephone number to program: *8x*
- 2 The RFC-1 will read the current telephone number in that area.
- 3 At the prompt, press the # key to reprogram the telephone number: #
- 4 At the prompt, enter the twelve-digit telephone number--use the \* for unused digits: *nn . . .*
- 5 The RFC-1 responds with OK , the procedure is complete

There are actually six locations available for telephone numbers. Telephone numbers D-F are only available through advanced programming.

### 5.4.5 Enabling/Disabling the Alarm System

There is a master on/off switch for the telemetry alarm system. The command for this setting is 82. To reprogram the telemetry alarm system:

- Step 1 Enter the command for the telemetry alarm system: *82*
- 2 The RFC-1 will read the current setting for the alarm system.
- 3 At the prompt, press the # key to reprogram the alarm system status: #
- 4 At the prompt, enter a 1 to enable the telemetry alarms or a 0 to disable them: *1*
- 5 The RFC-1 responds with OK , the procedure is complete

### 5.4.6 Enabling/Disabling the Power Failure Alarm

The RFC-1 can alert an operator when there has been a power failure at the remote site when AC power returns. The RFC-1 will follow the normal dialing sequence for alarms with the message "This is RFC-1/B, power failure". This alarm can be acknowledged with a DTMF tone just like any other alarm.

There is a master on/off switch for the power failure alarm. The command for this setting is 81. To reprogram the power failure alarm status:

- Step 1 Enter the command for the power failure alarm: 81
- 2 The RFC-1 will read the current setting for the power failure alarm.
- 3 At the prompt, press the # key to reprogram the power failure alarm: #
- 4 At the prompt, enter a 1 to enable the power failure alarm or a 0 to disable it: 1
- 5 The RFC-1 responds with OK, the procedure is complete

This alarm is useless if the RFC-1 is powered by a UPS or if no telephone numbers have been stored in memory. When powered by a UPS, the RFC-1 can still monitor the presence of AC power by using a small DC wall-plug transformer as a telemetry input. Details are in the Installation section of this documentation. The procedure for storing telephone numbers is discussed earlier in this section.

### 5.4.7 System Limitations

The RFC-1 has no way of recognizing that changes made from the front panel of the transmitter (or by another remote control connected in parallel) are being performed by an operator. If a device that is monitored by the RFC-1 is adjusted out of tolerance and the RFC-1 is not responsible for the adjustment, it will see the condition as an alarm.

The alarm system is not instantaneous. Alarm channels are scanned at a rate of one channel every 10 seconds after the initial reference scan completes. It can take up to 80 seconds before an alarm condition is recognized. This is a worst-case scenario, typically the response time is less depending on the number of alarms that are programmed.

The RFC-1 stops scanning the channels when an alarm triggers. It is possible for the telemetry that caused the alarm to return to a normal reading before an operator is reached. The alarm will continue until all call attempts have been made or until the alarm is cancelled by an operator.

If the power fails to both the transmitter and the RFC-1, it is not likely that the transmitter will return to normal operation without intervention when power returns. The RFC-1 will take a new set of reference readings for all channels when it powers up. Thus, it will appear that the down transmitter is a normal condition and no alarm will occur. Using the power failure alarm avoids this situation.

Remember to inform all personnel who are likely to receive an alarm call from the RFC-1 about the meaning of the various channel numbers that can generate an alarm. A completely different response is required depending on whether the transmitter output power is a little low or the smoke alarm has gone off.



## 5.5 Basic Programming

The RFC-1 can be programmed to suit the individual needs of the installation and its operators. Alarm parameters, telephone numbers, security codes, etc. are all programmable. Most of the settings in this section can be changed from either the local phone or a remote telephone. For safety and security, a few options are only available from the local telephone.

### 5.5.1 Security Codes

To limit system access to authorized personnel and prevent accidental changes, some functions require a security code. Security codes only need to be entered once during a call.

In basic operation there are three security codes.

- Main Security Code: 12345678
- Control Security Code: 66
- Basic Programming Security Code: 4088

The main security code restricts access to the system from any remote telephone. The control security code restricts access to the on/off or raise/lower functions. The basic programming security code restricts access to system options (programming changes).

The commands to change the security codes are:

- Main Security Code: 72
- Control Security Code: 73
- Basic Programming Security Code: 74

The procedure to program the codes is the same except for the command to initiate the process.

- Step 1 Enter the command (72-74) for the security code to program: 7x  
2 The RFC-1 will read the current security code in that area.  
3 At the prompt, press the # key to reprogram the security code: #  
4 At the prompt, enter the appropriate number of digits--use the \* for unused digits: nn...  
5 The RFC-1 responds with OK, the procedure is complete

The main security code can be up to 8 digits, the control security code and the basic programming security code can each be up to 4 digits. Use the \* key to fill in unused spaces. If all spaces for a code are filled with \* the code is disabled.

### 5.5.2 Ring Number

The number of rings that the RFC-1 will wait before it answers can be changed. The procedure is:

- Step 1 Enter the command to program the ring number: 76  
2 The RFC-1 will read the current ring number.  
3 At the prompt, press the # key to reprogram the ring number: #  
4 At the prompt, enter a one-digit ring number: n  
5 The RFC-1 responds with OK, the procedure is complete

The RFC-1 can share a telephone line by adjusting the ring number appropriately.

## 5.6 Operating Commands / Notes

It is wise to keep a table of normal programming for the RFC-1. This serves not only as a reminder of the current programming but it also acts as a handy guide to remember how to change programming.

<u>Cmd</u>	<u>Description</u>	<u>Factory Setting</u>	<u>Current Programming</u>
00	Select channel 00	n/a	n/a
nn	Select channel nn	n/a	n/a
63	Select channel 63	n/a	n/a
64	Autoscan channels	n/a	n/a
66	Enable control functions	66	-----
72	Main Security Code	12345678	-----
73	Control Security Code	66	-----
74	Basic Programming Security Code	4088	-----
76	Ring Number	2	----
81	Power Failure Alarm Status	0	----
82	Telemetry Alarm Status	0	----
86	Telephone Number A	* * * * *	-----
87	Telephone Number B	* * * * *	-----
88	Telephone Number C	* * * * *	-----
90	Monitored Channel A	64 / 2040 / 1020	___ / ___ / ___
91	Monitored Channel B	64 / 2040 / 1020	___ / ___ / ___
92	Monitored Channel C	64 / 2040 / 1020	___ / ___ / ___
93	Monitored Channel D	64 / 2040 / 1020	___ / ___ / ___
94	Monitored Channel E	64 / 2040 / 1020	___ / ___ / ___
95	Monitored Channel F	64 / 2040 / 1020	___ / ___ / ___
96	Monitored Channel G	64 / 2040 / 1020	___ / ___ / ___
97	Monitored Channel H	64 / 2040 / 1020	___ / ___ / ___
98	Hangup and ignore	n/a	n/a
99	Hangup	n/a	n/a

## Section 6 — Advanced Operation



### **WARNING!**

*This section is for qualified technical personnel. It contains information that can change most of the operating characteristics of the RFC-1 system. Improper use of this information can cause incorrect readings, erratic behavior or lock remote users out of the system. We strongly recommend that you understand the basic operation of the RFC-1 and the specifics of the installation you are changing before applying the information in this section.*

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

### **6.1 Overview**

More demanding installations that require automatic pattern/power changes, sophisticated monitoring and/or data communications can be served by a properly configured RFC-1. The programming adjustments required for more involved installations are not difficult but more familiarity with the RFC-1 system is necessary. Functional knowledge and a degree of comfort with the RFC-1 is assumed in the sections that follow. Basic operating commands are covered previously in this documentation.

There is an awful lot of information to discuss in this section due to the flexibility of the RFC-1. Almost all of the adjustments described in this section must be made in the Advanced Programming Mode. In this mode the RFC-1 gives you access to the area of memory that controls almost every aspect of its operation. The programming mode is not complicated but it is detail oriented. It takes a little time to learn at first but the power and flexibility it reveals are well worth the effort.

### **6.2 Advanced Programming**

To utilize the full potential of the RFC-1 you must learn how to use its Advanced Programming Mode--also simply referred to as programming mode. Programming mode makes changes directly to the user memory of the RFC-1. The value that is programmed and the address at which the value is written will change a certain behavior of the RFC-1. The trick is to know which address to use and what value to program there to get the desired result.

Finding the memory address is fairly simple. There are 1024 possible user memory locations that are grouped by function. The first block of memory holds the information for telemetry channel format and descriptions. The next block holds date and time trigger programming information and so on. There is a complete table of the memory locations in Appendix A. This table plays a key role in programming mode.

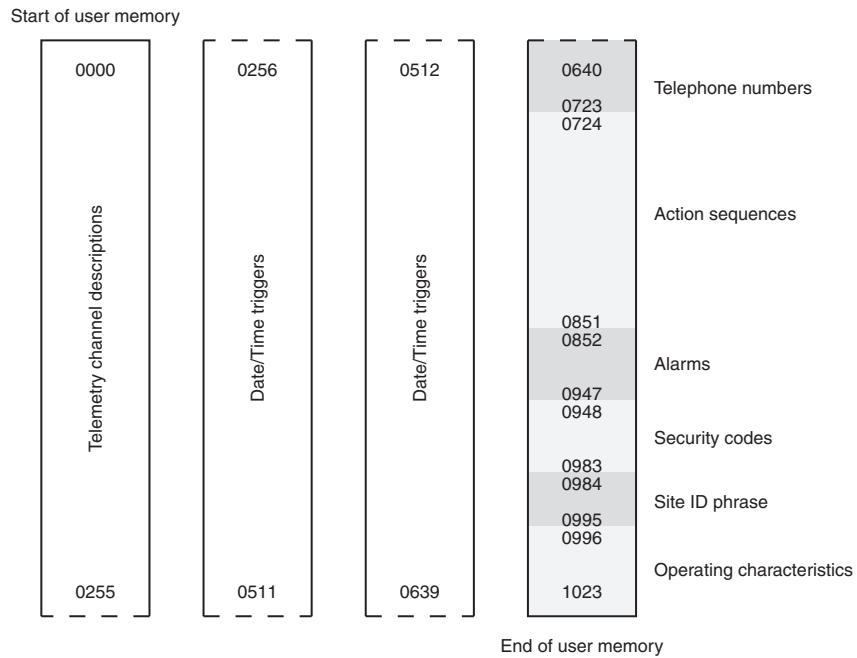


Figure 6.1; RFC-1 User memory map

Determining what value to program at an address is a matter of locating the documentation for a feature and researching the appropriate value for the desired result. In some cases, more than one value must be programmed to achieve a result.

### 6.2.1 Using the Programming Mode

Normal operations are suspended in programming mode. Channels are not selected and control relays do not function. This releases the keypad so that keystrokes can have different functions.

- the command to enter programming mode is: 80
- the command to exit programming mode is: \*
- in programming mode, the # key acts like an enter key
- the advanced programming security code is: 4150

Here is how it works. Enter 80 on the keypad to activate the programming mode. The RFC-1 will respond with "enter advanced programming security code". Enter the correct code and the RFC-1 will say "enter four digit address". Enter the address for the item that you are changing. (The addresses are discussed in detail later in this section.) The RFC-1 will repeat the memory address as confirmation and wait for you to enter data.

When the RFC-1 is waiting for data in programming mode, your options are:

- Push # to read the data at the current memory location
- Push nn# to write the value nn at this memory location
- Push 80 to enter to a new memory address
- Push \* to exit the programming mode

If you choose to read or write data, every time you press the # key the RFC-1 will read or write the data at the current address and increment to the next address. It is not necessary to enter 80 and a new address for each memory location if you are reading or writing a series of continuous locations. It is like filling in a form on a computer: each time you press the enter key, the computer accepts the data and skips to the next item. Only use the 80 command when you want to skip to a new address.

## 6.3 Telemetry Channels

*You must be familiar with the advanced programming mode of the RFC-1 for the following information to be useful. If you have not done so already, please read the section of this documentation that explains how the programming mode works before continuing.*

Each telemetry channel in the RFC-1 can be programmed with a unit word and a decimal point, and the scale can be changed. There are four memory locations for each channel that determine these characteristics.

- the first two memory locations identify the unit word spoken after the channel reading
- the third memory location determines the maximum reading and decimal point location
- the fourth memory location controls whether a linear or logarithmic scale is used

The programming address table in Appendix A provides a list of all the memory address and their functions. Telemetry channel descriptions occupy addresses 0000-0255 in the table.

### 6.3.1 Unit Words

A unit word is a descriptive word that the RFC-1 will say after the telemetry reading for a channel. The words that are available (kilovolts, amperes, etc.) are listed in Appendix A along with a two digit code that identifies each word. Program this code into the first two memory locations for a specific channel to assign the unit word to that channel.

Suppose you want to program Channel 00 with the unit word “kilovolts”.

- Step 1 Enter the Advanced Programming Mode: 80
- 2 Enter the Advanced Programming Security Code: 4150
- 3 Enter the starting address (from the Address Table) for Channel 00 telemetry units: 0000
- 4 Find the word “kilovolts” in the Word Table and get the values V1 and V2: V1=4, V2=2
- 5 Enter V1 for the word “kilovolts”: 4
- 6 Press the # key to enter this value and increment to the next address in memory
- 7 Enter V2 for the word “kilovolts”: 2
- 8 Press the \* key to exit programming mode and return to operating mode

If you select channel 00 and there is telemetry voltage present, the RFC-1 will give the reading with the unit word kilovolts. If there is no telemetry voltage, the RFC-1 will say “status off”.

### 6.3.2 Unit Word Exceptions--status readings

The first sixteen words in the word table (Appendix B) are numbers. Since numbers do not make good unit words, this set of values (0-0 to 0-15) are used to identify other data formats. The table below contains these exceptions to Unit Word programming and the codes that are used to activate them. Program the code into the first two memory locations for a specific channel to assign the new behavior to that channel.

#### V1-V2    Telemetry/Status Format

0-0	total silence--no channel number, no telemetry and no units are spoken
0-1	channel is identified but telemetry is not spoken
0-2	telemetry is spoken with no unit word--automatic status on/off is disabled
0-3	telemetry is spoken with no unit word--automatic status on/off is enabled (factory setting)
0-4	unused
0-5	"status off" or "status on" with a mid-scale trip point--1024
0-6	"off" or "on" with a mid-scale trip point--1024
0-7	"main" or "auxiliary" with a mid-scale trip point--1024
0-8	"status 1" or "status 2" with a mid-scale trip point--1024
0-9	"night" or "day" with a mid-scale trip point--1024
0-10	"normal" or "alarm" with a mid-scale trip point--1024
0-11	"normal" or "intrusion" with a mid-scale trip point--1024
0-12	"normal" or "fire" with a mid-scale trip point--1024
0-13	"status A" or "status B" with a mid-scale trip point--1024
0-14	"power failure" or "normal" with a mid-scale trip point--1024
0-15	"normal" or "EBS alarm" with a mid-scale trip point--1024

### 6.3.3 Maximum Reading and Decimal Point

To change the maximum reading and decimal point location, find the smallest item in the list below that is larger than the highest expected reading on the channel being adjusted. Be sure to allow for out of tolerance readings or the telemetry channel will exceed the maximum reading and say "status on". Program the value from the column V1 into the third memory location for the selected channel.

<u>V1</u>	<u>Max reading and decimal point</u>	<u>V1</u>	<u>Max reading and decimal point</u>
0	8160	8	81.60
1	4080	9	40.80
2	2040 (factory default)	10	20.40
3	1020	11	10.20
4	816.0	12	8.160
5	408.0	13	4.080
6	204.0	14	2.040
7	102.0	15	1.020

### 6.3.4 Linear and Logarithmic Scales

Telemetry samples follow either a linear or logarithmic scale. The output of the device will determine which scale should be used. Transmission line (power) samples are usually logarithmic however some equipment will provide a linear output even for power-proportional signals. Select the scale from the table below and program the value from the column V1 into the fourth memory location for the selected channel.

<u>V1</u>	<u>Linear/Log/Indirect</u>	<u>Auto Control Relay</u>
0	linear	no
1	logarithmic	no
2	indirect power	no
3	indirect power (duplicate setting)	no
4	linear	yes
5	logarithmic	yes

The Auto Control Relay provides an auxiliary contact closure for equipment that requires a switch closure to operate properly--such as an antenna monitor. Most equipment does not need this but for equipment that does, select a scale that has "yes" in the Auto Control Relay column above. When this is selected, the "off/lower" control relay will close when a channel is selected. The off/lower relay will remain closed until another channel is selected or until the on/raise relay is closed by pressing the # key. There is no setting for control relay activation with indirect power.

### 6.3.5 Indirect Power Calculation

The RFC-1 can calculate output power from plate voltage and plate current when a power sample is not available. No telemetry signal is fed to a channel when it is used for indirect power. Instead, the calculation is derived from the two channels that precede it. Any channel from 02 up can be setup for indirect power. Connect the plate voltage to channel 00 and the plate current sample to channel 01 for an indirect power reading on channel 02.

The programming for indirect power uses the same area of memory as the channel descriptors detailed above use, but the values that are programmed into that memory come from a the computations that follow. The computations are easy but the process is a little time consuming.

*If you have internet access, Sine Systems provides a web page that will perform these calculations and tell you what values to program into the RFC-1 memory. Our web site is <http://www.sinesystems.com>. Follow links to the RFC-1 Indirect Power Calculation page in the Support area. Your browser must be javascript capable to use this page. Current versions of most popular browsers support javascript.*

You must know the transmitter efficiency to program the RFC-1 to calculate the transmitter power output (TPO). For effective radiated power (ERP) calculations, you must know the efficiency of the entire system--transmitter through antenna.

Use a calculator as necessary to complete the following steps. In all cases, write down the number when instructed, even if it is a zero. If a calculation is instructed, only write down the digits in the result that are to the left of the decimal point. For example, if the result is 0.28125, write down "0".

Step 1 Determine the efficiency from 1% to 1023%, expressed as a whole number from 1 to 1023 (for example, for an efficiency of 72% use "72"). Write this number on line L1.

L1: \_\_\_\_\_

2 Divide L1 by 256. Place the number in the result to the left of the decimal point on L2.

L2: \_\_\_\_\_

3 Multiply L2 times 256 and place the result on L3.

L3: \_\_\_\_\_

4 Subtract L3 from L1 and enter the result on L4.

L4: \_\_\_\_\_

5 Divide L4 by 16 and place the number(s) in the result to the left of the decimal point on L5.

L5: \_\_\_\_\_

6 Multiply L5 times 16 and place the result on L6.

L6: \_\_\_\_\_

7 Subtract L6 from L4 and place the result on L7.

L7: \_\_\_\_\_

8 Multiply L2 times 4 and place the result on L8.

L8: \_\_\_\_\_

9 For the unit word "kilowatts" add 2 to L8 and place the result on L9.  
For the phrase "percent power" add 3 to L8 and place the result on L9.

L9: \_\_\_\_\_

10 Select the number (0 to 3) from the following list for the desired decimal point location and place it on L10.

- 0 1234
- 1 123.4
- 2 12.34
- 3 1.234

L10: \_\_\_\_\_



I1 Multiply L10 times 4 and place the result on L11.

L11: \_\_\_\_\_

I2 Select the scale multiplier from the list below and write the number (0 to 2) on line L12. The scale multiplier is used to force the final result into the target range of 0000 to 9999. (Start with 10 and adjust up or down if the results are unsatisfactory.)

0 x 1  
1 x 10  
2 x 100

L12: \_\_\_\_\_

I3 Add L11 to L12 and place the result on L13.

L13: \_\_\_\_\_

I4 Locate the appropriate memory area for the channel you have selected for indirect power and program the following values in that memory area.

V1: program the number on L5  
V2: program the number on L7  
V3: program the number on L13  
V4: program the number on L9

If you have completed the sequence correctly, the RFC-1 will recognize that the values you programmed represent indirect power parameters instead of the normal unit words and scales. It will take the appropriate readings and calculate indirect power when you select this channel.

### **Indirect Power--Theory of Operation**

*This section provides background information on calculating indirect power. If you can make it through the previous sequence, you do not need to read this section unless you are simply curious.*

The telemetry value for the indirect power channel can be any reading from 0000 to 9999. If the computed value exceeds 9999 or either the voltage or current channel reaches full-scale, the words "Upper Limit" will be spoken. The telemetry value for the indirect power channel is computed from the following equation:

$$P = (E * I * \text{Eff} * S) / 10,000,000$$

where:

P = the four-digit power reading that is calculated (disregarding decimal point)  
E = the normal four-digit voltage reading in volts (disregarding decimal point)  
I = the normal four-digit current reading in amps (disregarding decimal point)  
Eff = the transmitter (or system) efficiency value from 1 to 1023 (disregarding the %)  
S = the user-selected scale multiplier--1, 10 or 100

E and I are the readings from the plate voltage and plate current channels respectively. These values are in volts and amps with up to four significant digits but no decimal point. By these rules, the value 10.54 would be 1054.

Efficiencies (Eff) greater than 100% can be used to compute effective radiated power (ERP). For example, suppose the antenna has a gain of 6.5, the feedline has an efficiency of 75% and the transmitter has an efficiency of 72%. The overall efficiency (input power-to-ERP) is  $6.5 \times 0.75 \times 0.72 = 3.51$ . Using this example, the efficiency would be 351% for ERP calculations. However, the efficiency would be 72% for transmitter power output (TPO) calculations.

The efficiency value can also be adjusted to allow the computed reading to express a percentage of authorized power. In this case, the efficiency resulting from the above formula should be multiplied by 100 and then divided by the normal transmitter output power in kilowatts. The goal is for the reading to be "100.0" at 100% of authorized power. In this case, select the option for "percent power" the programming sequence above.

The scale multiplier S is used to force the final reading into the acceptable range of readings from 0000 to 9999. To determine this value, perform a trial calculation of the formula above with the expected normal voltage, current and efficiency. Set S to 10 and compute P. Disregard the decimal point and use only the four digits of data for voltage and current. For example, use "4130" for voltage if the voltage is metered as either "4130 volts" or "4.130 kilovolts." If P is outside of the range 0000 to 9999 or extremely close to either end, try adjusting S to 1 for a smaller P or 100 for a larger P.

As an example, suppose the expected plate voltage is 8.0 kilovolts, the expected plate current is 3.8 amperes and the efficiency is 72%. Using the above equation:

$$(8000 \times 3800 \times 72 \times 1) / 10,000,000 = 218.88$$

The telemetry reading will use only the digits to the left of the decimal point--0218. In this example, it would be better to set S to 10 to force the value closer to the middle of the acceptable range. The result from the equation above would change to 2188. Setting S to 100 would force the result to 21888 which is well beyond the maximum of 9999. The decimal point is not lost, it is added back in at a later step in the programming sequence.

#### **6.3.6 Lead Zero Suppress**

The RFC-1 reads telemetry as a four digit value. Typically, a channel will be calibrated to take advantage of as much of the telemetry scale as possible for maximum resolution. Sometimes a telemetry reading will have a leading zero when it is in part of its operating scale. The RFC-1 can ignore leading zeros when it reads telemetry. Program a 1 at address 0998 to enable lead zero suppression or a 0 to disable lead zero suppression.

### 6.3.7 Telemetry Settling Time

Sometimes the initial reading on a telemetry channel is slightly different than subsequent readings of that channel. This can be caused by the smoothing capacitors on the telemetry inputs if the telemetry source impedance is above about 5KΩ. Increasing the delay between the time the channel is selected and the time the RFC-1 samples the voltage can remedy this situation.

The factory setting of 0.8 seconds and is satisfactory for most purposes but it can be adjusted. Program the value from the column V1 into memory address 0997 to change the telemetry settling time. The list follows the formula  $T = 0.2 + (0.2 \times V1)$ .

<u>VI</u>	<u>Settling time</u>	<u>VI</u>	<u>Settling time</u>
0	0.2 seconds	8	1.8 seconds
1	0.4 seconds (factory default)	9	2.0 seconds
2	0.6 seconds	10	2.2 seconds
3	0.8 seconds	11	2.4 seconds
4	1.0 seconds	12	2.6 seconds
5	1.2 seconds	13	2.8 seconds
6	1.4 seconds	14	3.0 seconds
7	1.6 seconds	15	3.2 seconds

### 6.3.8 Programming more than 16 Channels

With factory settings, the RFC-1 memory is configured for 16 channels of telemetry descriptors and 72 date/time triggers. The telemetry descriptors occupy memory locations 0000-0063 and the date/time triggers occupy the next block of memory locations 0064-0255. The point at which these two blocks of memory meet can be adjusted so that more than 16 telemetry channel descriptors can be used by trading memory space with date/time triggers.

Program the value from the column V1 into memory address 1015 to change the number of date/time triggers that are available.

<u>VI</u>	<u>Telemetry Channels</u>	<u>D/T Triggers</u>
0	00 to 63	48
1	00 to 55	52
2	00 to 47	56
3	00 to 39	60
4	00 to 31	64
5	00 to 23	68
6	00 to 15	72 (factory default)
7	00 to 07	76
8	none	80

Telemetry channels can still be used if their descriptor memory has been reallocated. The channel will behave according to the default channel format stored at memory locations 1020-1023.

## 6.4 Action Sequences

*You must be familiar with the advanced programming mode of the RFC-1 for the following information to be useful. If you have not done so already, please read the section of this documentation that explains how the programming mode works before continuing.*

The RFC-1 can be programmed to function automatically in response to the telemetry conditions or the time and date. These automatic functions rely on action sequences--series of instructions stored in memory to perform a specific task or set of tasks.

Action sequences can manipulate the control relays of the RFC-1, place telephone calls, print readings, etc. A typical sequence might be to activate a relay, pause, then activate another relay. Such a sequence could be used to turn on a transmitter.

An action sequence is of little use by itself. It is merely a set of instructions to perform a task like a macro in a computer application. The action sequence must be activated or triggered to perform its task. When combined with a date/time trigger or an alarm trigger, an action sequence gives the RFC-1 the ability to function automatically.

- An action sequence is a stored set of instructions that perform a task when activated.
- An action sequence must be triggered by an alarm or the clock/calendar to function.

It is difficult to discuss action sequences without making references to alarms and date/time triggers and it is impossible to discuss alarms in the RFC-1 without knowledge of action sequences. Only action sequences will be covered in this section. Alarms and date/time triggers will be covered in the next section. The topics are discussed separately to help avoid information overload. Section 7 contains programming examples that help illustrate how all the pieces fit together.

### 6.4.1 Action Sequence Programming

The RFC-1 can store up to eight action sequences having up to eight steps each. The available instructions are listed in the text that follows along with a unique two-digit code that identifies each instruction. Select the instructions and program the corresponding codes in the appropriate area of memory for the action sequence. The programming address table in Appendix A provides a list of all memory address and their functions. Action sequences occupy addresses 0724-0851 in the table.

Instructions in an action sequence are performed in order from step 1 to step 8. A step that is "blank" will terminate the action sequence. The instruction code for a blank instruction is 15-15. The factory setting for all action sequences is blank except for action sequence 1 which is programmed to place a series of telephone calls to all available numbers (instruction code 9-1).

## 6.4.2 Control Relay Operation

The RFC-1 can operate any of the control relays as a step in an action sequence. Select an instruction from the list below and program V1 and V2 in the action sequence to activate the associated control relay.

<u>VI-V2</u>	<u>Relay Operation</u>	<u>VI-V2</u>	<u>Relay Operation</u>	<u>VI-V2</u>	<u>Relay Operation</u>	<u>VI-V2</u>	<u>Relay Operation</u>
0-0	Channel 00: on	1-0	Channel 16: on	2-0	Channel 32: on	3-0	Channel 48: on
0-1	Channel 01: on	1-1	Channel 17: on	2-1	Channel 33: on	3-1	Channel 49: on
0-2	Channel 02: on	1-2	Channel 18: on	2-2	Channel 34: on	3-2	Channel 49: on
0-3	Channel 03: on	1-3	Channel 19: on	2-3	Channel 35: on	3-3	Channel 49: on
0-4	Channel 04: on	1-4	Channel 20: on	2-4	Channel 36: on	3-4	Channel 49: on
0-5	Channel 05: on	1-5	Channel 21: on	2-5	Channel 37: on	3-5	Channel 49: on
0-6	Channel 06: on	1-6	Channel 22: on	2-6	Channel 38: on	3-6	Channel 49: on
0-7	Channel 07: on	1-7	Channel 23: on	2-7	Channel 39: on	3-7	Channel 49: on
0-8	Channel 08: on	1-8	Channel 24: on	2-8	Channel 40: on	3-8	Channel 49: on
0-9	Channel 09: on	1-9	Channel 25: on	2-9	Channel 41: on	3-9	Channel 49: on
0-10	Channel 10: on	1-10	Channel 26: on	2-10	Channel 42: on	3-10	Channel 49: on
0-11	Channel 11: on	1-11	Channel 27: on	2-11	Channel 43: on	3-11	Channel 49: on
0-12	Channel 12: on	1-12	Channel 28: on	2-12	Channel 44: on	3-12	Channel 49: on
0-13	Channel 13: on	1-13	Channel 29: on	2-13	Channel 45: on	3-13	Channel 49: on
0-14	Channel 14: on	1-14	Channel 30: on	2-14	Channel 46: on	3-14	Channel 49: on
0-15	Channel 15: on	1-15	Channel 31: on	2-15	Channel 47: on	3-15	Channel 49: on
4-0	Channel 00: off	5-0	Channel 16: off	6-0	Channel 32: off	7-0	Channel 48: off
4-1	Channel 01: off	5-1	Channel 17: off	6-1	Channel 33: off	7-1	Channel 49: off
4-2	Channel 02: off	5-2	Channel 18: off	6-2	Channel 34: off	7-2	Channel 50: off
4-3	Channel 03: off	5-3	Channel 19: off	6-3	Channel 35: off	7-3	Channel 51: off
4-4	Channel 04: off	5-4	Channel 20: off	6-4	Channel 36: off	7-4	Channel 52: off
4-5	Channel 05: off	5-5	Channel 21: off	6-5	Channel 37: off	7-5	Channel 53: off
4-6	Channel 06: off	5-6	Channel 22: off	6-6	Channel 38: off	7-6	Channel 54: off
4-7	Channel 07: off	5-7	Channel 23: off	6-7	Channel 39: off	7-7	Channel 55: off
4-8	Channel 08: off	5-8	Channel 24: off	6-8	Channel 40: off	7-8	Channel 56: off
4-9	Channel 09: off	5-9	Channel 25: off	6-9	Channel 41: off	7-9	Channel 57: off
4-10	Channel 10: off	5-10	Channel 26: off	6-10	Channel 42: off	7-10	Channel 58: off
4-11	Channel 11: off	5-11	Channel 27: off	6-11	Channel 43: off	7-11	Channel 59: off
4-12	Channel 12: off	5-12	Channel 28: off	6-12	Channel 44: off	7-12	Channel 60: off
4-13	Channel 13: off	5-13	Channel 29: off	6-13	Channel 45: off	7-13	Channel 61: off
4-14	Channel 14: off	5-14	Channel 30: off	6-14	Channel 46: off	7-14	Channel 62: off
4-15	Channel 15: off	5-15	Channel 31: off	6-15	Channel 47: off	7-15	Channel 63: off

Control relays are momentary in the RFC-1. The *relay operate time* controls the minimum length that a control relay will activate manually or when activated by an action sequence. This setting is controlled by the value at memory address 1006 and the formula  $T = 0.3 + (.3 * V)$ . The relay operate time is factory set to 0.6 seconds.

<u>VI</u>	<u>Relay Operate Time</u>	<u>VI</u>	<u>Relay Operate Time</u>
0	0.3 seconds	8	2.7 seconds
1	0.6 seconds (factory default)	9	3.0 seconds
2	0.9 seconds	10	3.3 seconds
3	1.2 seconds	11	3.6 seconds
4	1.5 seconds	12	3.9 seconds
5	1.8 seconds	13	4.2 seconds
6	2.1 seconds	14	4.5 seconds
7	2.4 seconds	15	4.8 seconds

### 6.4.3 Action Sequence Delay

The RFC-1 pauses for about one half second between the steps of an action sequence with the factory settings. This can be adjusted by changing the action sequence delay or by placing a delay instruction in the action sequence. Select an appropriate delay from the list below and program V1 and V2 in the action sequence for the required delay. Longer delays can be achieved by placing two or more delay commands in adjacent action sequence steps.

V1-V2    Sequence delay

8-0	1 second
8-1	2 seconds
8-2	5 seconds
8-3	10 seconds
8-4	20 seconds
8-5	40 seconds
8-6	80 seconds

Program the value from column V1 in the list below at memory address 1007 to change the default delay between steps in an action sequence. The list uses the formula  $T = 0.2 + (0.2 * V1)$

<u>V1</u>	<u>Sequence delay</u>	<u>V1</u>	<u>Sequence delay</u>
0	0.2 seconds	8	1.8 seconds
1	0.4 seconds (factory default)	9	2.0 seconds
2	0.6 seconds	10	2.2 seconds
3	0.8 seconds	11	2.4 seconds
4	1.0 seconds	12	2.6 seconds
5	1.2 seconds	13	2.8 seconds
6	1.4 seconds	14	3.0 seconds
7	1.6 seconds	15	3.2 seconds

### 6.4.4 Telephone Calls

The RFC-1 can place one or more telephone calls as a step in an action sequence. The message that is delivered will depend on whether the action sequence is triggered by telemetry conditions or by the clock/calendar. Select an instruction from the list below and program the code in the action sequence to generate telephone calls.

V1-V2    Telephone Calls

9-0	Call all telephone numbers in rotation A, B, C, D, E, F, A, B, etc.
9-1	Call all telephone numbers in weighted rotation A, B, A, C, A, D, A, E, A, F, A, B, etc.
9-2	Call telephone number A one time
9-3	Call telephone number B one time
9-4	Call telephone number C one time
9-5	Call telephone number D one time
9-6	Call telephone number E one time
9-7	Call telephone number F one time

When the RFC-1 places multiple telephone calls, it will pause between them to allow a user to contact the system to clear the alarm. The pause between calls is adjustable at memory address 1004. It is factory set to 60 seconds. The outgoing call duration is also adjustable at address 1003 and is factory set to 60 seconds. Outgoing call duration applies to voice mode calls only.

### 6.4.5 Printing Readings

The RFC-1 can print readings to a printer as a step in an action sequence. The printer can be a local printer that is connected directly to the RFC-1 through a PA-1 Parallel Printer Adapter or an RS-232 Serial Data Adapter. Or, the printer can be a remote printer that can be contacted by the RFC-1 through an MA-1 Modem Adapter. Select an instruction from the list below and program the code in the action sequence to print the readings.

Readings are printed from channel 00 through the *autoscan stop channel*. The autoscan stop channel is located at memory addresses 1010-1011 and is set to channel 15 at the factory. Program the first digit of the stop channel at memory location 1010 and the second digit at memory location 1011. Program a zero at location 1010 if the stop channel is less than 10. This setting also defines the stop channel for the autoscan command (64).

Readings will be printed with a header that includes the time, date and site identification.

#### VI-V2    Print Telemetry

8-8      Print telemetry readings to a local printer.

8-9      Print telemetry readings to a remote printer.

(This requires a modem and a telephone number stored at telephone number location F.)

### 6.4.6 Conditional Execution

There are no instructions in the RFC-1 action sequences for looping or decision trees. There are some instructions that can be used to perform conditional execution in an action sequence.

#### VI-V2    Description

8-14      Stop execution and recheck telemetry. This instruction should only be used in an action sequence that is triggered by a telemetry alarm. The instruction stops execution of an action sequence and checks the telemetry again on the channel that triggered the alarm. If the alarm condition still exists, the action sequence starts over from the first step but does not stop to check telemetry again. Instead, it continues to the next step in the action sequence.

For example, suppose channel 02 reads the plate current of a transmitter. An alarm is programmed to monitor channel 02. If the plate current falls out of tolerance, an action sequence is triggered that consists of the following instructions:

0-2 channel 02 on

8-14 stop execution and recheck

x-x other instructions to change over to a backup transmitter

The first instruction (0-2) attempts to reset the transmitter overload circuit. Then channel 02 is checked again (after the normal scan delay of 10 seconds). If the plate current has returned to normal the sequence will not repeat. However, if the plate current is still out of tolerance, the action sequence will start again. Another attempt at reset will be made but it will most likely fail again. This time the action sequence will ignore the instruction to stop and recheck telemetry and will continue with the steps to change over to the backup transmitter.

#### VI-V2    Description

8-15      Inhibit new telemetry reference scan upon completion of the action sequence. To keep the system from triggering the same alarm over and over, the RFC-1 normally takes a new set of reference readings after and action sequence completes. Placing this instruction in an action sequence suppresses this telemetry reference scan. This instruction should only be used as the last step in an action sequence.

For example, suppose this instruction is placed in an action sequence that adjusts transmitter power. When the power adjustment is made, the RFC-1 activates the control relay for the programmed length of time, it does not hold the relay until a specific power level is reached. Thus, it is possible to adjust the power but still be out of tolerance. If the RFC-1 is allowed to take a new set of telemetry reference readings at the end of the action sequence, the out of tolerance condition will appear to be a normal condition. Inhibiting this reference scan will cause the RFC-1 to see the power as an out of tolerance condition on the next alarm scan. The action sequence will be triggered again and the power will be adjusted again. This process will continue until the power is adjusted to an acceptable level according to the alarm limits programmed by the user.

The following instructions force the RFC-1 to record an in-range (between the upper and lower limits) alarm reference value regardless of the actual telemetry on the channel that is monitored by the alarm. This might be used in an action sequence that turns on a piece of equipment that is monitored by an alarm--it will make sure that the device powers up properly. The 10-X instruction makes the RFC-1 think that the equipment powered up normally. However, on the next alarm scan the actual telemetry from the device will show that it did not power up properly and the alarm will trigger. These instructions may be placed anywhere in the action sequence.

V1-V2    Description

10-1	Force next telemetry reference for Alarm Channel A between upper/lower limits
10-2	Force next telemetry reference for Alarm Channel B between upper/lower limits
10-3	Force next telemetry reference for Alarm Channel C between upper/lower limits
10-4	Force next telemetry reference for Alarm Channel D between upper/lower limits
10-5	Force next telemetry reference for Alarm Channel E between upper/lower limits
10-6	Force next telemetry reference for Alarm Channel F between upper/lower limits
10-7	Force next telemetry reference for Alarm Channel G between upper/lower limits
10-8	Force next telemetry reference for Alarm Channel H between upper/lower limits

#### **6.4.7 Testing an Action Sequence**

Action sequences are typically activated by telemetry alarms or by date/time triggers. However, it is possible to trigger an action sequence manually for testing purposes or for ease of system use. For example, a set of timed relay functions used to power up a transmitter can be programmed as an action sequence. The RFC-1 can call upon this action sequence to turn on the transmitter as necessary. Additionally, station personnel can use the same action sequence to power up the transmitter manually when necessary instead of activating the control relays individually.

- In the normal operating mode, enter 85 to manually trigger an action sequence. The RFC-1 responds with "enter one digit action sequence"
- Enter a single digit from 1-8 to activate the corresponding action sequence or, enter 0 to abort the command.

The control security code, 66, must be entered before a manual action sequence trigger. This is to verify that the user is authorized to control the equipment attached to the RFC-1.

#### **6.4.8 Power-up Action Sequence**

The RFC-1 can trigger an action sequence on power up. In fact, the power failure alarm uses this feature to trigger action sequence 1 which is factory programmed to generate telephone calls. Program the number of the action sequence (1-8) to trigger when the RFC-1 powers up at memory address 1008. Program 0 in place of the action sequence number to disable this function.



## 6.5 Telemetry Alarms

*You must be familiar with the advanced programming mode of the RFC-1 for the following information to be useful. If you have not done so already, please read the section of this documentation that explains how the programming mode works before continuing.*

The RFC-1 can be programmed to function automatically in response to the telemetry conditions (alarms) or the date and time (via the internal clock/calendar). This section describes how to have the RFC-1 function automatically using alarms, date/time triggers and action sequences. Alarms and date/time triggers call upon action sequences--programmed series of instructions--to do the real work.

Action sequences were described previously. Alarms and date/time triggers are covered in this section. The topics are discussed separately to help avoid information overload. Section 7 contains programming examples that help illustrate how all the pieces fit together.

### 6.5.1 Telemetry Alarm Programming

There are eight alarms in the RFC-1 that can monitor a telemetry channel for abnormal . They are designated Alarm A-H. A telemetry channel is assigned to an alarm in user adjustable programming. In basic operation with the factory settings, the RFC-1 will call up to three telephone numbers to report the condition but it does not attempt to correct the situation. With a little extra programming the RFC-1 can be configured to take corrective action.

Each telemetry alarm in the RFC-1 must be programmed with a channel number, upper and lower telemetry limits, an action sequence to trigger and a trigger rule. There are 12 memory locations for each alarm that store this data.

- the first two memory locations identify the telemetry channel to monitor
- the third memory location identifies the trigger rule for the alarm
- the fourth memory location stores the number of the action sequence that is triggered
- the rest of the memory locations store upper and lower limits of four digits each

The programming address table in Appendix A provides a list of all the memory address and their functions. Alarms A-H occupy memory addresses 0852-0947 in the table.

Each alarm can monitor only one telemetry channel but a telemetry channel can be monitored by more than one alarm. This is useful for monitoring power output where at one set of limits you want the RFC-1 to take corrective action and at another set of limits you want it to alert an operator.

### 6.5.2 Channel Number

The channel number is the physical telemetry input channel that is monitored by the alarm. Telemetry channels range from 00 to 63. One digit must be programmed in each of the first two memory locations of the alarm. If the channel number is less than 10, the first memory location of the alarm must be programmed with 0. An unused alarm should be programmed with an alarm channel of 64. This is an indication to the system that this alarm is not used since there is no channel 64.

### 6.5.3 Trigger Rules

The trigger rule determines the conditions that the alarm triggers such as exceeding limits, etc. The rules listed below are the ten trigger rules. Program the value from the column V1 into the third memory location for the selected alarm.

<i>VI</i>	<i>Trigger the alarm when the telemetry value...</i>
1	varies more than 2.5% from the reference reading
2	varies more than 5% from the reference reading
3	varies more than 10% from the reference reading
4	varies more than 20% from the reference reading
5	crosses either limit--but only if it was between the limits during the last reference scan
6	exceeds the upper limit--but only if it was between the limits during the last reference scan
7	falls below the lower limit--but only if it was between the limits during the last reference scan
8	exceeds the upper limit or falls below the lower limit--unconditionally
9	exceeds the upper limit--unconditionally
10	falls below the lower limit--unconditionally

Trigger rules 1 through 4 do not consider the upper or lower limits. The limits can be programmed to any value when any of these four trigger rules are used. No alarm is triggered if you use the RFC-1 to set a piece of equipment into a condition that exceeds the tolerance of the trigger rule.

Trigger rules 5 through 7 are used most of the time. They allow you to set specific upper and lower limits and they also allow you to use the RFC-1 to set a piece of equipment into a condition that exceeds these limits without triggering an alarm.

Use trigger rules 8-10 carefully. They can cause the RFC-1 to trigger an alarm continuously because they do not consider that the RFC-1 may be used to set a piece of equipment into an alarm condition (such as shutting down a transmitter).

### 6.5.4 Action Sequence

This value specifies which action sequence will trigger when the alarm activates. Action sequences are numbered from 1 to 8. The selected action sequence must be programmed to perform the appropriate task. Enter the number of the action sequence into the fourth memory location for the selected alarm.

### 6.5.5 Upper and Lower Limits

The upper and lower limits specify the range of acceptable telemetry values for a channel. Limits are programmed using four digits. When deciding on limits, ignore any decimal point in the telemetry reading. For example, if your normal reading is 100.0 kilovolts and you want to program an alarm at 105.0 kilovolts, set the upper limit to 1050. Limits must be four digits long. Pad the left side of the number with zeros for smaller values so that all four digits are used.

The upper limit is stored in memory locations 5-8 of an alarm. The lower limit is stored in memory locations 9-12 of the alarm. Refer to the Programming Address Table in Appendix A for more information.

To ignore an upper limit, program it to 9999 and make sure that the telemetry on the monitored channel will never reach that value. To ignore a lower limit, program it to 0000 and make sure that the telemetry on the monitored channel will never go that low.

### 6.5.6 Enabling/Disabling Telemetry Alarms

The telemetry alarm system has a master on/off switch that can be changed through programming. The easiest way to change it is to enter the command 82 from the operating mode. The RFC-1 will say “telemetry alarm status x” where x is either 0 (off) or 1 (on). Then it will say “push # to reprogram”. If you press the # key, the RFC-1 responds with “enter one digit”. Press 0 to disable the telemetry alarm system or 1 to enable the telemetry alarm system.

*The RFC-1 ships from the factory with the telemetry alarm system disabled. You must enable this system for the RFC-1 to generate telemetry alarms.*

This setting can also be changed in the programming mode at memory address 1009. The programming choices are 0 (off) and 1 (on). All other values are invalid.

The easiest way to disable a single telemetry alarm for an undetermined period of time is to program the channel number to 64. See section 6.4.2 above for more information.

It is also possible to disable a telemetry alarm for a certain time period on a daily basis by programming an alarm block or lock-out. This might be used to eliminate an output power alarm overnight for a transmitter that does not operate overnight. Alarm blocks use the same memory area that date/time triggers use (memory locations 0256-0639). Date/time triggers are discussed in the next section. You may skip forward and read that section now if you like but it is not necessary.

Each date/time trigger uses eight memory locations. An alarm block uses only the first six of these locations.

- the first memory location is always programmed to 10 for an alarm block
- the second memory location identifies the alarm (A-H) to block
- the third and fourth memory locations store the start time (hour) of the alarm block
- the fifth and sixth memory locations store the end time (hour) of the alarm block
- the seventh and eighth memory locations are ignored and should be set to 0

Programming a 10 in the first memory location is a signal to the RFC-1 that this is an alarm block and not a date/time trigger. Use numbers 1-8 to represent alarms A-H where A=1, B=2, C=3, D=4, E=5, F=6, G=7, H=8. Use a 24 hour clock to set the start time and stop time hours. For instance, to program a block from 10:00pm to 6:00am, set the start time to 2-2 and the end time to 0-6.

### 6.5.7 Scan Interval/Sequence

With factory settings, every 10 seconds the RFC-1 compares one of the telemetry alarms (A-H) against its reference reading. An alarm is triggered if the reading exceeds the programmed alarm limits. If only one alarm is used, it will be recognized within 10 seconds. If all eight alarms are used, it can take up to 80 seconds to recognize an out of tolerance condition and trigger the alarm.

Normally the alarms are scanned in order: A, B, C, D, E, F, G, H. In cases where this response time is not fast enough, there is a weighted scan where alarm H is checked between each of the other channels: A, H, B, H, C, H, etc. Alarm H is checked every 20 seconds using this rotation. Program the value from the column V1 into memory address 1013 to adjust the scan interval and weighted channel rotation.

<u>VI</u>	<u>Scan Interval</u>	<u>VI</u>	<u>Scan Interval</u>
	weighted scan off		weighted scan on
0	10 seconds (factory default)	4	10 seconds
1	20 seconds	5	20 seconds
2	50 seconds	6	50 seconds
3	100 seconds	7	100 seconds

## 6.6 Timed Events

*You must be familiar with the advanced programming mode of the RFC-1 for the following information to be useful. If you have not done so already, please read the section of this documentation that explains how the programming mode works before continuing.*

The RFC-1 has an internal clock and calendar that allow it to trigger an action sequence by date and time-of-day. With factory settings, there are 48 date/time triggers available. The programming address table in Appendix A provides a list of all the memory address and their functions. With factory settings, date/time triggers occupy memory addresses 0256-0639 in the table. More date/time triggers are available by swapping unused channel memory (programmed at address 1015). This will be discussed later in this section.

*The RFC-1 does not have an internal battery for the clock/calendar. The time and date will be lost if the system loses power. When power returns, the clock will not run until it is reset by a user.*

New telemetry reference values are taken after an action sequence is triggered by the internal clock/calendar. This prevents the RFC-1 from interpreting a programmed activity as an alarm condition and taking corrective actions that might be inappropriate. If the RFC-1 is used to adjust equipment to an out of tolerance condition, it assumes that this is an intentional action and does not trigger an alarm. The reference scan can be inhibited by special programming in the action sequence discussed previously in this section.

### 6.6.1 Setting the calendar

Set the calendar in the RFC-1 by entering the command 70 in normal operating mode. The RFC-1 will respond by reading the current month, day and year in its internal calendar. Then it will give you the opportunity to reset the calendar with the prompt, "push # to reprogram". Press # to reset the calendar. The RFC-1 will ask for the two-digit month, day and year. Enter two digits at each prompt. Use leading zeros for values less than 10.

The two digit year does not present any Y2K issues. The RFC-1 only stores the year to calculate leap years. It does not store chronological data based on the calendar nor does it allow date/time programming that is year specific. The calendar will roll-over from 99 to 00 and continue counting.

### 6.6.2 Setting the clock

Set the clock in the RFC-1 by entering the command 71 in normal operating mode. The RFC-1 will respond by reading the current hours and minutes in its internal clock. Then it will give you the opportunity to reset the clock with the prompt, "push # to reprogram". Press # to reset the clock. The RFC-1 will ask for the two-digit hour and minute. Enter two digits at each prompt. Use a 24 hour clock and use leading zeros for values less than 10. The seconds reset to zero when the last digit is entered.

### 6.6.3 Disabling timed events

When the RFC-1 loses power the clock resets to 00:99:00 and freezes. In fact, any time the minutes are set to 99 the clock will freeze. Set the minutes to 99 if you ever need to disable all date/time triggered events at once.

#### 6.6.4 Programming a Time Trigger

Date/time triggers rely on action sequence programming that is discussed previously in this section. Using a date/time trigger, an action sequence can be activated on a specific month, date, hour and minute. Global match entries allow a single date/time trigger to operate repeatedly every month, date or hour. Each date/time trigger uses eight memory locations.

- the first memory location identifies the action sequence to trigger
- the second memory location store the month in which to trigger
- the third and fourth memory locations store the date on which to trigger
- the fifth and sixth memory locations store the hour at which to trigger
- the seventh and eight memory locations store the minute at which to trigger

Program a single digit 1-8 for the number of the action sequence that the date/time should trigger. Program a month from 1 to 12. It is okay to program a two-digit month in this location (enter both digits the press # to write the value.) The date, hour and minute all use two memory locations. Program the first digit in the first location and the second digit in the second location. Program 0 for the first digit if any of these values are less than 10. Use a 24 hour clock for the hour.

Month, date and hour can all be programmed with a global match value that will make the date time trigger on any value. For instance, program the month to 15 and the date/time will trigger every month. Program the month to 15 and the date to 15-15 (15 in both memory locations) and the date/time will trigger every day of every month. Program the month to 5 and the date to 15-15 and the hour to 1-9 and the action sequence will trigger every day of May at 7:00pm. Program all of these with 15 and the action sequence will trigger every hour of every day of every month. There is no global match for the minute.

#### 6.6.5 Programming more than 72 Timed Events

With factory settings, the RFC-1 memory is configured for 72 date/time triggers and 16 channels of telemetry descriptors. The telemetry descriptors occupy memory locations 0000-0063 and the date/time triggers occupy the next block of memory locations 0064-0255. The point at which these two blocks of memory meet can be adjusted so that more than 72 date/time triggers can be used by trading memory space with telemetry channel descriptors. Program the value from the column V1 into memory address 1015 to change the number of date/time triggers that are available.

<i>V1</i>	<i>D/T Triggers</i>	<i>Telemetry Channels</i>
0	48	00 to 63
1	52	00 to 55
2	56	00 to 47
3	60	00 to 39
4	64	00 to 31
5	68	00 to 23
6	72	00 to 15 (factory default)
7	76	00 to 07
8	80	none

Telemetry channels can still be used if their descriptor memory has been reallocated. The channel will behave according to the default channel format stored at memory locations 1020-1023.

### 6.6.6 Adjusting the Clock Accuracy

This adjustment trims the speed of the internal clock to compensate for variances in timing components in the RFC-1. Increase this value if the clock runs fast. Decrease this value if the clock runs slow. Each step changes the speed by one-half second over a 24 hour period.

The values required to adjust the clock speed are listed in the table below. The programming address table in Appendix A provides a list of all the memory address and their functions. The clock speed adjustment is located at memory addresses 1018-1019. The factory setting is 8-8. Program the first digit of the adjustment value at memory location 1018 and the second digit at memory location 1019.

Suppose that long term measurement shows that the clock loses 25 seconds over a period of 5 days--an equivalent of 5 seconds per day. Start at the current (factory) setting of 8-8 and find the value that speeds the clock by 5 seconds per day. V1=7 and V2=14 at that setting. To make the appropriate correction, program a 7 at address 1018 and a 14 at address 1019.

<i>V1-V2</i>	<i>Adjustment</i>	<i>V1-V2</i>	<i>Adjustment</i>	<i>V1-V2</i>	<i>Adjustment</i>	<i>V1-V2</i>	<i>Adjustment</i>	<i>V1-V2</i>	<i>Adjustment</i>	<i>V1-V2</i>	<i>Adjustment</i>
0-0	-68.0 s	2-11	-46.5 s	5-6	-25.0 s	8-1	-3.5 s	10-13	+18.0 s	13-8	+39.5 s
0-1	-67.5 s	2-12	-46.0 s	5-7	-24.5 s	8-2	-3.0 s	10-14	+18.5 s	13-9	+40.0 s
0-2	-67.0 s	2-13	-45.5 s	5-8	-24.0 s	8-3	-2.5 s	10-15	+19.0 s	13-10	+40.5 s
0-3	-66.5 s	2-14	-45.0 s	5-9	-23.5 s	8-4	-2.0 s	11-0	+19.5 s	13-11	+41.0 s
0-4	-66.0 s	2-15	-44.5 s	5-10	-23.0 s	8-5	-1.5 s	11-1	+20.0 s	13-12	+41.5 s
0-5	-65.5 s	3-0	-44.0 s	5-11	-22.5 s	8-6	-1.0 s	11-2	+20.5 s	13-13	+42.0 s
0-6	-65.0 s	3-1	-43.5 s	5-12	-22.0 s	8-7	-0.5 s	11-3	+21.0 s	13-14	+42.5 s
0-7	-64.5 s	3-2	-43.0 s	5-13	-21.5 s	8-8	0.0 s (def.)	11-4	+21.5 s	13-15	+43.0 s
0-8	-64.0 s	3-3	-42.5 s	5-14	-21.0 s	8-9	+0.5 s	11-5	+22.0 s	14-0	+43.5 s
0-9	-63.5 s	3-4	-42.0 s	5-15	-20.5 s	8-10	+1.0 s	11-6	+22.5 s	14-1	+44.0 s
0-10	-63.0 s	3-5	-41.5 s	6-0	-20.0 s	8-11	+1.5 s	11-7	+23.0 s	14-2	+44.5 s
0-11	-62.5 s	3-6	-41.0 s	6-1	-19.5 s	8-12	+2.0 s	11-8	+23.5 s	14-3	+45.0 s
0-12	-62.0 s	3-7	-40.5 s	6-2	-19.0 s	8-13	+2.5 s	11-9	+24.0 s	14-4	+45.5 s
0-13	-61.5 s	3-8	-40.0 s	6-3	-18.5 s	8-14	+3.0 s	11-10	+24.5 s	14-5	+46.0 s
0-14	-61.0 s	3-9	-39.5 s	6-4	-18.0 s	8-15	+3.5 s	11-11	+25.0 s	14-6	+46.5 s
0-15	-60.5 s	3-10	-39.0 s	6-5	-17.5 s	9-0	+4.0 s	11-12	+25.5 s	14-7	+47.0 s
1-0	-60.0 s	3-11	-38.5 s	6-6	-17.0 s	9-1	+4.5 s	11-13	+26.0 s	14-8	+47.5 s
1-1	-59.5 s	3-12	-38.0 s	6-7	-16.5 s	9-2	+5.0 s	11-14	+26.5 s	14-9	+48.0 s
1-2	-59.0 s	3-13	-37.5 s	6-8	-16.0 s	9-3	+5.5 s	11-15	+27.0 s	14-10	+48.5 s
1-3	-58.5 s	3-14	-37.0 s	6-9	-15.5 s	9-4	+6.0 s	12-0	+27.5 s	14-11	+49.0 s
1-4	-58.0 s	3-15	-36.5 s	6-10	-15.0 s	9-5	+6.5 s	12-1	+28.0 s	14-12	+49.5 s
1-5	-57.5 s	4-0	-36.0 s	6-11	-14.5 s	9-6	+7.0 s	12-2	+28.5 s	14-13	+50.0 s
1-6	-57.0 s	4-1	-35.5 s	6-12	-14.0 s	9-7	+7.5 s	12-3	+29.0 s	14-14	+50.5 s
1-7	-56.5 s	4-2	-35.0 s	6-13	-13.5 s	9-8	+8.0 s	12-4	+29.5 s	14-15	+51.0 s
1-8	-56.0 s	4-3	-34.5 s	6-14	-13.0 s	9-9	+8.5 s	12-5	+30.0 s	15-0	+51.5 s
1-9	-55.5 s	4-4	-34.0 s	6-15	-12.5 s	9-10	+9.0 s	12-6	+30.5 s	15-1	+52.0 s
1-10	-55.0 s	4-5	-33.5 s	7-0	-12.0 s	9-11	+9.5 s	12-7	+31.0 s	15-2	+52.5 s
1-11	-54.5 s	4-6	-33.0 s	7-1	-11.5 s	9-12	+10.0 s	12-8	+31.5 s	15-3	+53.0 s
1-12	-54.0 s	4-7	-32.5 s	7-2	-11.0 s	9-13	+10.5 s	12-9	+32.0 s	15-4	+53.5 s
1-13	-53.5 s	4-8	-32.0 s	7-3	-10.5 s	9-14	+11.0 s	12-10	+32.5 s	15-5	+54.0 s
1-14	-53.0 s	4-9	-31.5 s	7-4	-10.0 s	9-15	+11.5 s	12-11	+33.0 s	15-6	+54.5 s
1-15	-52.5 s	4-10	-31.0 s	7-5	-9.5 s	10-1	+12.0 s	12-12	+33.5 s	15-7	+55.0 s
2-0	-52.0 s	4-11	-30.5 s	7-6	-9.0 s	10-2	+12.5 s	12-13	+34.0 s	15-8	+55.5 s
2-1	-51.5 s	4-12	-30.0 s	7-7	-8.5 s	10-3	+13.0 s	12-14	+34.5 s	15-9	+56.0 s
2-2	-51.0 s	4-13	-29.5 s	7-8	-8.0 s	10-4	+13.5 s	12-15	+35.0 s	15-10	+56.5 s
2-3	-50.5 s	4-14	-29.0 s	7-9	-7.5 s	10-5	+14.0 s	13-0	+35.5 s	15-11	+57.0 s
2-4	-50.0 s	4-15	-28.5 s	7-10	-7.0 s	10-6	+14.5 s	13-1	+36.0 s	15-12	+57.5 s
2-5	-49.5 s	5-0	-28.0 s	7-11	-6.5 s	10-7	+15.0 s	13-2	+36.5 s	15-13	+58.0 s
2-6	-49.0 s	5-1	-27.5 s	7-12	-6.0 s	10-8	+15.5 s	13-3	+37.0 s	15-14	+58.5 s
2-7	-48.5 s	5-2	-27.0 s	7-13	-5.5 s	10-9	+16.0 s	13-4	+37.5 s	15-15	+59.0 s
2-8	-48.0 s	5-3	-26.5 s	7-14	-5.0 s	10-10	+16.5 s	13-5	+38.0 s		
2-9	-47.5 s	5-4	-26.0 s	7-15	-4.5 s	10-11	+17.0 s	13-6	+38.5 s		
2-10	-47.0 s	5-5	-25.5 s	8-0	-4.0 s	10-12	+17.5 s	13-7	+39.0 s		

## 6.7 Communications



### **WARNING!**

*Incorrect communications settings can cause the RFC-1 to place repeated, unwanted calls to unsuspecting people or places. It is solely your responsibility to verify that the RFC-1 is programmed to contact only authorized personnel.*

#### **6.7.1 Programming Telephone Numbers**

The memory areas for the six telephone numbers are designated as Telephone Number A-F. Each telephone number can contain up to twelve digits. Telephone numbers cannot be chained together for more digits in one number. It is not necessary to use all the numbers or all the digits in a number. In programming mode, enter one digit for each digit in the telephone number and enter 10 for unused digits. The RFC-1 recognizes 10 as a blank space in a telephone number.

In addition to the 12 digits, each telephone number in the RFC-1 can be programmed with a dialing mode and a number of attempts. There are fourteen memory locations available for each telephone number.

- the first twelve memory locations store the telephone number
- the thirteenth memory location stores the dialing mode and an optional pager site ID digit
- the fourteenth memory location determines how many call attempts are made to the number

The programming address table in Appendix A provides a list of all the memory address and their functions. Telephone numbers are stored in memory at addresses 0640-0723 in the table.

To insert a pause in voice dialing, program an 11 in the number where the pause should occur. This generates a four second pause in DTMF dialing or a one second pause in pulse dialing.

To insert a pause in data dialing, program a 15 in the number where the pause should occur. This sends a comma to the modem which AT command set modems interpret as a two-second pause.

#### **6.7.2 Setting Call Attempts**

You may want to make more attempts to connect to a voice number that is likely to be busy than to a pager number. Each telephone number has an individually assigned value for call attempts.

The programming address table in Appendix A provides a list of all the memory address and their functions. Telephone numbers are stored in memory at addresses 0640-0723 in the address table. Each telephone number occupies fourteen memory addresses. The call attempt value is set at the fourteenth (last) memory location of the telephone number. Call attempts can be set from 1 to 4. Programming a value greater than 4 will result in only 4 call attempts. The factory default value is 3 attempts.

### 6.7.2 Dialing Mode--calling a pager

Telephone numbers are individually programmed for dialing mode: voice, data or pager. The pager site ID digit is an extra DTMF tone that is repeated several times after the telephone number is dialed that should show up on the pager display to identify the site that triggered the call. Otherwise, the pager display will be blank.

The programming address table in Appendix A provides a list of all the memory addresses and their functions. Telephone numbers are stored in memory at addresses 0640-0723 in the address table. Each telephone number occupies fourteen memory addresses. The dialing mode is set at the thirteenth memory location of the telephone number. Program the value from column V1 in the list below to determine how the number will be dialed and what site ID digit will be sent to a pager, if any.

<u>VI</u>	<u>Dialing Mode (and pager digit)</u>	<u>VI</u>	<u>Dialing Mode (and pager digit)</u>
0	Voice call (factory default)	3	Voice call with pager site ID digit 0
1	Data call with tone dialing (ATDT)	4	Voice call with pager site ID digit 1
2	Data call with pulse dialing (ATDP)	5	Voice call with pager site ID digit 2
		6	Voice call with pager site ID digit 3
		7	Voice call with pager site ID digit 4
		8	Voice call with pager site ID digit 5
		9	Voice call with pager site ID digit 6
		10	Voice call with pager site ID digit 7
		11	Voice call with pager site ID digit 8
		12	Voice call with pager site ID digit 9

### 6.7.3 Tone/Pulse Dialing

The RFC-1 does not contain a dedicated DTMF generator. Special *imprecise* DTMF tones are generated by the RFC-1 using tones are stored in memory. These tones are swept slightly in frequency and are sent at a lower amplitude than normal DTMF tones to compensate for component tolerances. These tones are a workable substitute for precise DTMF tones in almost all cases but we cannot guarantee their effectiveness in all cases. Pulse dialing can be used in situations where the imprecise DTMF tones work intermittently or fail entirely.

The programming address table in Appendix A provides a list of all the memory addresses and their functions. The tone/pulse dialing option is set through programming at addresses 0999 in the table. Program a 0 at this address for pulse dialing or a 1 for DTMF dialing. The factory default is for pulse dialing. This setting only sets the dialing mode for voice mode calls.

### 6.7.4 Alarm Call Message Duration

During voice mode alarm calls, the RFC-1 will repeat the site identification phrase and the cause of the alarm for a predetermined period of time. This period of time, the call message duration, is adjustable in programming.

Program the value from column V1 in the list below at memory address 1003 to change the alarm call message duration. The list uses the formula  $T = 10 \text{ secs} * V1$ . This adjustment applies to voice mode calls only.

<u>VI</u>	<u>Alarm Call Duration</u>	<u>VI</u>	<u>Alarm Call Duration</u>
0	10 seconds	8	80 seconds
1	10 seconds	9	90 seconds
2	20 seconds	10	100 seconds
3	30 seconds	11	110 seconds
4	40 seconds	12	120 seconds
5	50 seconds	13	130 seconds
6	60 seconds (factory default)	14	140 seconds
7	70 seconds	15	150 seconds



### 6.7.5 Alarm Call Pause Duration

During voice mode alarm calls, the RFC-1 will pause between multiple calls for a predetermined period of time. This period of time, the call pause duration, is adjustable in programming from 10 to 150 seconds.

Program the value from column V1 in the list below at memory address 1004 to change the alarm call pause duration. The list uses the formula  $T = 10 \text{ secs} * V1$ . This adjustment applies to voice mode calls only.

<u>V1</u>	<u>Pause Duration</u>	<u>V1</u>	<u>Pause Duration</u>
0	10 seconds	8	80 seconds
1	10 seconds	9	90 seconds
2	20 seconds	10	100 seconds
3	30 seconds	11	110 seconds
4	40 seconds	12	120 seconds
5	50 seconds	13	130 seconds
6	60 seconds (factory default)	14	140 seconds
7	70 seconds	15	150 seconds

### 6.7.6 Using a Cellular Telephone--ring sensitivity

It is possible to connect a cellular telephone to the RFC-1 in place of a telephone line for both dial in and out capabilities. Some cell phone manufacturers offer devices that provide a cellular telephone with a standard RJ-11 jack. These devices emulate a standard telephone line including dial tone, ring voltage and battery. Most of these RJ-11 adapters generate a square-wave ring signal on an incoming call instead of the sine-wave ring voltage that is found on a normal telephone line. Additionally, the RFC-1 is factory programmed to dial out using pulse mode dialing instead of DTMF tones. Some adapters will recognize pulse dialing or the RFC-1 can dial out using internally stored, "imprecise" DTMF tones. See the setting for tone/pulse for more information.

The RFC-1 has a firmware ring sensitivity adjustment that will enable it to recognize the non-standard ring signal of a cell phone. Program the value from column V1 at memory address 1014 to adjust the ring sensitivity. We suggest a value of V1=8 when using an RJ-11 adapter. (Be careful when selecting a value--the list is not in numerical order.)

<u>V1</u>	<u>Ring Sensitivity (and Dedicated Control Port)</u>
	Dedicated Control Port Off
8	Ring sensitivity = 10 (maximum)
10	Ring sensitivity = 4.66
12	Ring sensitivity = 3.04
14	Ring sensitivity = 2.25
0	Ring sensitivity = 1.79 (factory default)
2	Ring sensitivity = 1.48
4	Ring sensitivity = 1.27
6	Ring sensitivity = 1.11 (minimum)
	Dedicated Control Port On
9	Ring sensitivity = 10 (maximum)
11	Ring sensitivity = 4.66
13	Ring sensitivity = 3.04
15	Ring sensitivity = 2.25
1	Ring sensitivity = 1.79
3	Ring sensitivity = 1.48
5	Ring sensitivity = 1.27
7	Ring sensitivity = 1.11 (minimum)

### 6.7.7 Dedicated Control Port

*Hardware setup for the Dedicated Control Port is covered in the Installation section of this documentation.*

Another use for the local phone jack on the RFC-1 is as a port for a dedicated communications link. This could be a radio link, a dedicated line, or any system that will transmit voice-grade audio in both directions. Operation in this mode is exactly the same as operation from the local telephone. DTMF tones are used to control the RFC-1 and it speaks back. The dedicated control port does not eliminate the dial-up capabilities of the RFC-1 but only one connection can be active at a time. The dedicated control port will be disabled during a remote call.

The dedicated control port shares a memory location with the ring sensitivity adjustment. Using the table above, program the value from column V1 at memory address 1014 to enable the dedicated control port. If you intend to maintain dial-up capability, choose the appropriate ring sensitivity value when you enable the dedicated control port. V1=1 is equivalent to the factory programmed ring sensitivity but with the dedicated control port enabled. To enable the dedicated control ports and use a cell phone adapter for dial-up capability (as described in the previous section) we suggest V1=9.

### 6.7.8 Communications Mode--voice/data

Using optional adapters, the RFC-1 can connect to a data terminal or a remote computer. Data mode can be used in addition to or in place of DTMF/voice communications. Operation and commands in data mode are exactly the same as from DTMF/voice mode. Custom software for data operation is in development at the time of this writing but sample scripts for some common terminal packages are available from the our web site at <http://www.sinesystems.com>.

The RFC-1 enables only the voice mode or the data mode at any given moment. Both voice and data modes can be used but not simultaneously. Program the value from column V1 at memory address 1002 to set which communications mode the RFC-1 uses first to connect to an incoming call.

#### V1      Communication Mode

- 0      Answer in voice mode only (factory default)
- 1      Answer in serial data mode first--if no connection is made within 10 seconds, try voice mode
- 2      Answer in voice mode first--if no DTMF is received within 10 seconds, try data mode
- 3      Answer in serial data mode only

In communications mode 1 and 2, incorrect security code lockout time is also used to determine the length of time that the RFC-1 will wait to connect before switching to the alternate communications mode. We suggest setting this to 10 seconds when mode 1 or 2 is used. See the security codes section for more information.

With factory settings, the RFC-1 communicates at 2400 baud with 8 data bits, 1 stop bit and no parity. Communications speed is adjustable from 75 to 9600 baud. Protocol is fixed at 8, N, 1. Program the value from column V1 at memory address 1005 to change the baud rate.

<i>V1</i>	<i>Communication Speed (baud)</i>
0	9600
1	4800
2	2400 (factory default)
3	1200
4	600
5	300
6	150
7	75

### **6.7.9 Forced Serial Mode/Data Dump**

For testing purposes, the RFC-1 can be forced to shift from voice mode to data mode from the local phone. Issue the command 84 from normal operating mode. The RFC-1 will respond with "enter one digit command".

- enter 0 to force the communications mode to to data mode immediately
- enter 1 to perform a data dump--all 1024 memory locations are copied to the data port in a tabular format
- enter \* to abort this command

## 6.8 Security Codes

Most of the security code information is discussed in the basic operation section of this documentation.

### 6.8.1 Security Code Programming

The easiest way to program the security codes in the RFC-1 is through basic operation discussed previously in this documentation. However, all of the codes can be changed in programming mode--including two control security codes that are not discussed in basic operation.

The programming address table in Appendix A provides a list of all the memory address and their functions. Security codes are stored in memory at addresses 0948-0983 in the table.

- the main security code starts at address 0948
- control security code A starts at address 0956
- control security code B starts at address 0960
- control security code C starts at address 0964
- the advanced programming security code starts at address 0972
- control security code block assignments start at address 0976

The main security code can be up to eight digits long. All other codes can be up to four digits long. Program a single digit into each memory location. Fill unused spaces with 10. The RFC-1 will interpret a 10 as a blank. A code will be disabled if it filled entirely with 10's (blanks).

Another (easier) way to change the advanced programming security code is to issue the command 75 from normal operating mode. Much like the other security codes documented in basic operation, this method prompts you through the process of changing the code.

- Step 1 Enter the command 75 for the advanced programming security code: 75  
2 The RFC-1 will read the current security code.  
3 At the prompt, press the # key to reprogram the security code: #  
4 At the prompt, enter the new security code--use the \* for unused digits: nn...  
5 The RFC-1 responds with OK, the procedure is complete

### 6.8.2 Control Security Code Mapping

The basic operation documentation would lead you to believe that there is one control security code in the RFC-1. One is all that is required for most installations but there are actually three control security codes. Each block of control channels can be programmed with one of the three codes. (See the installation section for clarification of channel blocks.) This allows you to wire system critical functions to one relay panel and non-critical functions to another panel and protect each set of control relays with a different code. Personnel can be given the appropriate control code(s) for the functions that they are authorized to use. All authorized personnel can take readings on all channels without having control authorization on all channels.

All 64 channels are assigned the control security code A in the factory settings. This code is factory set to 66. However, each block of eight channels can be assigned any of the three control security codes through programming at memory address 0976-0983. Each of these eight addresses can store a single value in the range 1-3. Program the value from the column V1 in the list below to map the appropriate control security code to the block of channels.

#### V1      Control Security Code Assignment

- |   |                         |
|---|-------------------------|
| 1 | control security code A |
| 2 | control security code B |
| 3 | control security code C |

### 6.8.3 Incorrect Code Lockout/Communications Mode Switch Delay

The RFC-1 disconnects itself anytime the user fails to enter a security code correctly when it is requested. After it disconnects, it will ignore incoming call attempts for a short period of time to slow repeated attempts at breaking a code. This lockout period does not apply to the local control connection.

Program the value from column V1 in the list below at memory address 1016 to change the incorrect security code lockout time. The list uses the formula  $T = 10 \text{ secs} * V1$ .

<u>V1</u>	<u>Lockout Time</u>	<u>V1</u>	<u>Lockout Time</u>
0	10 seconds	8	80 seconds
1	10 seconds (factory default)	9	90 seconds
2	20 seconds	10	100 seconds
3	30 seconds	11	110 seconds
4	40 seconds	12	120 seconds
5	50 seconds	13	130 seconds
6	60 seconds	14	140 seconds
7	70 seconds	15	150 seconds

This value also determines the length of time the RFC-1 will wait before switching communications mode when one of the communications mode 1 or 2 is used. These are the modes where the RFC-1 answers in one mode, voice or data, and automatically switches to the other mode if it does not establish a connection. This should be set to 10 seconds if one of these communications modes are used. The communication mode programming is discussed previously.

## 6.9 Other Commands and Options

The section contains information on commands and features that do not fall into any of the major topics that have been covered elsewhere.

### 6.9.1 Site Identification Phrase

This is the phrase that the RFC-1 uses to identify itself when it comes online and when it reports an alarm. It is factory set to "This is RFC-1/B" but it can be programmed with any six words from the word table in Appendix B. The words are listed with a two digit code that identifies each word.

The programming address table in Appendix A provides a list of all the memory address and their functions. The site ID phrase occupies memory locations 0984-0995. Each word requires two consecutive address. Program the word codes from the word table into the site ID phrase memory area to change the site ID phrase.

*Be very careful not to overwrite memory location 0996 that immediately follows the site ID phrase. This memory location stores an indicator to the system when a firmware upgrade is installed in older hardware. If the value is incorrectly programmed, the RFC-1 will seize the telephone line and you will not be able to dial into the system.*

If word 6 (addresses 0994-0995) is programmed as "voice pause 5" from the word table, the RFC-1 will not say "enter" when it answers a call. This may be useful when the RFC-1 shares the telephone line with other equipment.

If word 6 (addresses 0994-0995) is programmed as "voice pause 4" from the word table, the RFC-1 will pause an extra 2 seconds before it says "enter" when it answers a call. This is helpful in situations where the telephone network system is uses tones for data feedback that may emulate DTMF tones and interfere with the user entering the main security code.

## 6.9.2 Hardware Version and Pulse Hang-up Detection



### **WARNING!**

*The setting stores an indicator to the system when a firmware upgrade is installed in early hardware revisions. If the value is incorrectly programmed, the RFC-1 will seize the telephone line and you will not be able to dial into the system. Do not change this value unless you are absolutely certain that it is required for your installation.*

RFC-1 main board revisions 1.05 and earlier use a prepackaged telephone line interface module labeled "XECOM". When the firmware in these early board revisions is updated to firmware version 4.0 or greater, the firmware must be adjusted to recognize this type of telephone interface. Since this adjustment alters the behavior of the telephone interface, it should only be made from the local phone attached directly to the RFC-1.

This adjustment also provides a means to disable the pulse hang-up detector in the RFC-1. The pulse hang-up detector is responsible for determining when the RFC-1 has lost the telephone line unexpectedly. With the detector disabled, the RFC-1 will not respond to a lost telephone line. It will remain in operating mode until the hang-up timer expires--2.5 minutes with factory programming. The pulse hang-up detector should only be disabled in situations where the RFC-1 is receiving false pulses and dropping the connection at inappropriate times on a recurring basis.

The programming address table in Appendix A provides a list of all the memory address and their functions. Program the value from column V1 in the list below into memory location 0996 to adjust the hardware version and/or the pulse hang-up detector.

<u>V1</u>	<u>Hardware Version</u>	<u>Pulse Hang-up Detector</u>
0	1.05 and earlier	enabled
1	1.99 and later	enabled
2	1.05 and earlier	disabled
3	1.99 and later	disabled

## 6.9.3 Idle System Timeout

As a precautionary measure, the RFC-1 will go offline after a predetermined period of inactivity (no DTMF tones). This period of time is adjustable through programming. Program the value from column V1 in the list below into memory location 1000 to adjust the time period for the idle system timeout.

<u>V1</u>	<u>Idle Timeout</u>	<u>V1</u>	<u>Idle Timeout</u>
0	30 seconds	8	32.5 minutes
1	60 seconds	9	41 minutes
2	2.5 minutes (factory default)	10	50.5 minutes
3	5 minutes	11	61 minutes
4	8.5 minutes	12	72.5 minutes
5	13 minutes	13	85 minutes
6	18.5 minutes	14	98.5 minutes
7	25 minutes	15	113 minutes

## 6.10 Operating Commands / Notes

It is wise to keep a table of normal programming for the RFC-1. This serves not only as a reminder of the current programming but it also acts as a handy guide to remember how to change programming.

<u>Cmd</u>	<u>Description</u>	<u>Factory Setting</u>	<u>Current Programming</u>
00	Select channel 00	n/a	n/a
nn	Select channel nn	n/a	n/a
63	Select channel 63	n/a	n/a
64	Autoscan channels	n/a	n/a
66	Enable control functions	66	n/a
70	Set calendar	00/00/00	n/a
71	Set clock	00:99:00	n/a
72	Main Security Code	12345678	_____
73	Control Security Code	66	_____
74	Basic Programming Security Code	4088	_____
75	Advanced Programming Security Code	4150	_____
76	Ring Number	2	____
78	Software Version (firmware)	5.xx	n/a
80	Advanced Programming Mode	n/1	n/a
81	Power Failure Alarm Status	0	____
82	Telemetry Alarm Status	0	____
84	Manual Serial Commands	n/a	n/a
85	Manual Action Sequence Trigger	n/a	n/a
86	Telephone Number A	*****	_____
87	Telephone Number B	*****	_____
88	Telephone Number C	*****	_____
90	Monitored Channel A	64 / 2040 / 1020	____ / _____ / _____
91	Monitored Channel B	64 / 2040 / 1020	____ / _____ / _____
92	Monitored Channel C	64 / 2040 / 1020	____ / _____ / _____
93	Monitored Channel D	64 / 2040 / 1020	____ / _____ / _____
94	Monitored Channel E	64 / 2040 / 1020	____ / _____ / _____
95	Monitored Channel F	64 / 2040 / 1020	____ / _____ / _____
96	Monitored Channel G	64 / 2040 / 1020	____ / _____ / _____
97	Monitored Channel H	64 / 2040 / 1020	____ / _____ / _____
98	Hangup and ignore	n/a	n/a
99	Hangup	n/a	n/a

## Section 7 — Programming Examples

This section contains programming examples, it does not contain information about using the Advanced Programming Mode of the RFC-1. You should read and be familiar with the section of this documentation that details Advanced Programming before attempting the examples in this section.



### **WARNING!**

*You must be familiar with both setup and operation of the RFC-1 for the information in this section to make any sense. Unplanned or random changes in the Advanced Programming Mode can cause erratic behavior in the RFC-1.*

### **7.1 Site Identification Phrase**

In the first example we will change the Site Identification Phrase--the phrase that the RFC-1 says when it answers the phone or when it reports an alarm. The factory programming is "This is RFC-1/B". We will change it to say "Hello this is Curly".

- Step 1 Enter the Advanced Programming Mode: 80
- 2 Enter the Advanced Programming Security Code: 4150
  
- 3 Enter the starting address (from the Address Table) for the Site ID Phrase: 0984
- 4 Find the word hello in the Word Table and get the values V1 and V2: V1=3, V2=8
- 5 Enter V1 for the word hello : 3
- 6 Press the # key to enter this value and increment to the next address in memory
- 7 Enter V2 for the word hello : 8
- 8 Press the # key to write this value and increment to the next address in memory
  
- 9 Find the words this is in the Word Table and get the values V1 and V2: V1=7, V2=11
- 10 Enter V1 for the words this is : 7
- 11 Press the # key to enter this value and increment to the next address in memory
- 12 Enter V2 for the words this is : 11
- 13 Press the # key to write this value and increment to the next address in memory
  
- 14 Find the word Curly in the Word Table and get the values V1 and V2: V1=2, V2=4
- 15 Enter V1 for the word Curly : 2
- 16 Press the # key to enter this value and increment to the next address in memory
- 17 Enter V2 for the word Curly : 4
- 18 Press the # key to write this value and increment to the next address in memory
  
- 19 Find the 25ms voice pause in the Word Table and get the values V1 and V2: V1=10, V2=5
- 20 Enter V1 for the 25ms voice pause : 10
- 21 Press the # key to enter this value and increment to the next address in memory
- 22 Enter V2 for the 25ms voice pause : 5
- 23 Press the # key to write this value and increment to the next address in memory
  
- 24 Find the 25ms voice pause in the Word Table and get the values V1 and V2: V1=10, V2=5
- 25 Enter V1 for the 25ms voice pause : 10



- 26 Press the # key to enter this value and increment to the next address in memory
- 27 Enter V2 for the 25ms voice pause : 5
- 28 Press the # key to write this value and increment to the next address in memory
  
- 29 Find the 25ms voice pause in the Word Table and get the values V1 and V2: V1=10, V2=5
- 30 Enter V1 for the 25ms voice pause : 10
- 31 Press the # key to enter this value and increment to the next address in memory
- 32 Enter V2 for the 25ms voice pause : 5
- 33 Press the # key to write this value and increment to the next address in memory
  
- 34 Press the \* key to exit the programming mode

The Site ID Phrase can be up to six “words” long. “Hello this is Curly” only uses three of those words (“this is” is considered a single word). The last three words are programmed with the “25 ms voice pause” so that they will be silent. For a little more fun, try replacing one of the voice pauses with “nyuk, nyuk, nyuk” in the Site ID Phrase.

## 7.2 Telemetry Channels--unit word, full scale, decimal point

In this example we will program Channel 00 with the unit word “kilovolts”, a maximum reading with decimal point of “204.0” and set the channel for “logarithmic” tracking.

- Step 1 Enter the Advanced Programming Mode: 80
- 2 Enter the Advanced Programming Security Code: 4150
  
- 3 Enter the starting address (from the Address Table) for Channel 00 telemetry units: 0000
- 4 Find the word kilovolts in the Word Table and get the values V1 and V2: V1=4, V2=2
- 5 Enter V1 for the word kilovolts : 4
- 6 Press the # key to enter this value and increment to the next address in memory
- 7 Enter V2 for the word kilovolts : 2
- 8 Press the # key to write this value and increment to the next address in memory
  
- 9 From section 6.3.3 (Programming), find the maximum reading of 204.0 and get the value V1: V1=6
- 10 Enter V1 for the maximum reading of 204.0 : 6
- 11 Press the # key to write this value and increment to the next address in memory
  
- 12 From section 6.3.4 (Programming), find the setting for logarithmic tracking and get the value V1: V1=1
- 13 Enter V1 for logarithmic tracking: 1
- 14 Press the # key to write this value and increment to the next address in memory
  
- 15 Press the \* key to exit the programming mode

Every channel can be setup with a unit word; the full scale reading and decimal point location can be changed; and the tracking method--linear, logarithmic or indirect--can be changed. Change the starting address the address appropriate for the channel to be programmed.

### 7.3 Action Sequences

In this example we will program Action Sequence 2 to activate the channel 00 “on” relay, pause 15 seconds, and then activate the channel “01” on relay. A sequence like this might be used to power up transmitter filaments with a short delay then turn on the plate voltage.

- Step 1 Enter the Advanced Programming Mode: 80  
2 Enter the Advanced Programming Security Code: 4150
- 3 Enter the starting address (from the Address Table) for Action Sequence 2: 0740  
4 From Section 6, find the command for channel 00 on and get V1 and V2: V1=0, V2=0  
5 Enter V1 for the command channel 00 on: 0  
6 Press the # key to enter this value and increment to the next address in memory  
7 Enter V2 for the command channel 00 on: 0  
8 Press the # key to write this value and increment to the next address in memory
- 9 From Section 6, find the command for a 15 second pause and get V1 and V2: V1=8, V2=3  
10 Enter V1 for the 15 second pause command: 8  
11 Press the # key to enter this value and increment to the next address in memory  
12 Enter V2 for the 15 second pause command: 3  
13 Press the # key to write this value and increment to the next address in memory
- 14 From Section 6, find the command for channel 01 on and get V1 and V2: V1=0, V2=1  
15 Enter V1 for the command channel 01 on: 0  
16 Press the # key to enter this value and increment to the next address in memory  
17 Enter V2 for the command channel 01 on: 1  
18 Press the # key to write this value and increment to the next address in memory
- 19 Press the \* key to exit the programming mode

An action sequence is of little use by itself--it is merely a set of instructions to perform a task. It must be told when to perform that task. When combined with a time trigger or an alarm trigger, an action sequence gives the RFC-1 the ability to perform functions automatically.

In the next example we will program a time trigger that could be used to call upon this action sequence to turn the transmitter on.

## 7.4 Time Trigger

In this example we will program Date/Time Trigger 1 to activate the action sequence that we programmed in the previous segment. The action sequence is one that could be used to turn on a transmitter: activate the channel 00 on relay, pause 15 seconds, and then activate the channel 01 on relay. We will program the time trigger to activate the action sequence every day at 6:00am.

- Step
- 1 Enter the Advanced Programming Mode: 80
  - 2 Enter the Advanced Programming Security Code: 4150
  
  - 3 Enter the starting address (from the Address Table) for Date/Time Trigger 1: 0632
  - 4 Enter the number of the action sequence that should be triggered: 2
  - 6 Press the # key to enter this value and increment to the next address in memory
  
  - 7 Enter up to two digits for the month in which this trigger should function: 15 (every month)
  - 8 Press the # key to write this value and increment to the next address in memory
  
  - 9 Enter the first digit for the date in which this trigger should function: 15 (every day)
  - 10 Press the # key to write this value and increment to the next address in memory
  - 11 Enter the second digit for the date in which this trigger should function: 15 (every day)
  - 12 Press the # key to write this value and increment to the next address in memory
  
  - 13 Enter the first digit for the hour at which this trigger should function: 0
  - 14 Press the # key to write this value and increment to the next address in memory
  - 15 Enter the second digit for the hour at which this trigger should function: 6
  - 16 Press the # key to write this value and increment to the next address in memory
  
  - 17 Enter the first digit for the minute at which this trigger should function: 0
  - 18 Press the # key to write this value and increment to the next address in memory
  - 19 Enter the second digit for the minute at which this trigger should function: 0
  - 20 Press the # key to write this value and increment to the next address in memory
  
  - 21 Press the \* key to exit the programming mode

The text in Section 6 describes the use of the value 15 for a “global match”--an entry that will match any condition in a time trigger.

The clock must be set before the time trigger can function properly. Setting the clock/calendar is easy. Issue the commands 70 and 71 in the operating mode, not programming mode, and the RFC-1 will prompt you for the time and date.

## 7.5 Alarm Limits

In this example we will program alarm channel A to monitor telemetry channel 03 for an upper limit of 105.0 and a lower limit of 090.0 and place a series of alarm calls if either limit is exceeded. In this example, we assume that the factory programming for action sequence 1 is intact--it is programmed to call all programmed telephone numbers in sequence. When programming alarm limits, ignore the decimal point and enter four significant digits.

- Step 1 Enter the Advanced Programming Mode: 80
- 2 Enter the Advanced Programming Security Code: 4150
  
- 3 Enter the starting address (from the Address Table) for Alarm Channel A: 0852
- 4 Enter the first digit of the telemetry channel to be monitored: 0
- 5 Press the # key to write this value and increment to the next address in memory
- 6 Enter the second digit of the telemetry channel to be monitored: 3
- 7 Press the # key to write this value and increment to the next address in memory
  
- 8 From Section 6, enter the number of the trigger rule: 5 (upper or lower limit crossing)
- 9 Press the # key to enter this value and increment to the next address in memory
  
- 10 Enter the number of the Action Sequence that should be triggered: 1 (place telephone calls)
- 11 Press the # key to enter this value and increment to the next address in memory
  
- 12 Enter the first digit of the upper limit: 1
- 13 Press the # key to write this value and increment to the next address in memory
- 14 Enter the second digit of the upper limit: 0
- 15 Press the # key to write this value and increment to the next address in memory
- 16 Enter the third digit of the upper limit: 5
- 17 Press the # key to write this value and increment to the next address in memory
- 18 Enter the fourth digit of the upper limit: 0
- 19 Press the # key to write this value and increment to the next address in memory
  
- 20 Enter the first digit of the lower limit: 0
- 21 Press the # key to write this value and increment to the next address in memory
- 22 Enter the second digit of the lower limit: 9
- 23 Press the # key to write this value and increment to the next address in memory
- 24 Enter the third digit of the lower limit: 0
- 25 Press the # key to write this value and increment to the next address in memory
- 26 Enter the fourth digit of the lower limit: 0
- 27 Press the # key to write this value and increment to the next address in memory
  
- 28 Press the \* key to exit the programming mode

The first three telephone numbers can be programmed through basic programming commands 86-88. Memory locations are available for three more telephone numbers that are only accessible in programming mode.

## Section 8 — Troubleshooting and Repair

### 8.1 Common Problems and Possible Solutions

*Problem:* The RFC-1 does not power up.

*Solutions:* With the ribbon cable connecting the RFC-1 and the RP-8 check for a short circuit across the 12 VAC terminals on the RP-8. Check the wall-plug power supply for 12 VAC.

*Problem:* The RFC-1 powers up and responds but telemetry can not be calibrated.

*Solutions:* The wrong calibration pot is being adjusted. The telemetry connections count left to right from the rear of the RP-8 panel, but the pots are counted from right to left as viewed from the front of the panel. Channel 00 is on the far right, channel 07 is on the far left.

The channel may be programmed incorrectly. Check the fourth data location in the programming for the channel that is not responding. Typically the value should be 0 or 1 but 4 or 5 may also be appropriate. Other values will cause the channel to be treated as an indirect power channel where the data for the channel is calculated from the two preceding channels instead of the DC sample on the channel input.

*Problem:* Telemetry works but control functions don't work. RFC-1 says "enter control security code".

*Solutions:* Read the section on operation completely. The command to enable control relay functions is 66. If the control security code has been changed from the factory setting, you will need to enter it as well.

*Problem:* Telemetry works but control functions don't work. The RFC-1 drops the line when a control is activated.

*Solutions:* This is a symptom of lightning damage. There are many possible component failures that can cause this problem. The most common are D18 and D19 on the relay panel; U1, U2 or U3 on the relay panel; or U6 in the main system.

*Problem:* One or more telemetry channels always read "status off" regardless of the voltage on the sample.

*Solutions:* Telemetry samples are polarity sensitive. Make sure that the telemetry sample is connected properly. Or, the calibration pot is turned all the way down. These pots are 22 turns from end to end. They do not stop turning at the ends, there is an internal clutch that protects the internal mechanism.

When a system is damaged by lightning it may be unable to switch the relays necessary to select a telemetry sample. In this case the system will need to be repaired by a knowledgeable technician.

*Problem:* One or more telemetry channels always read "status on" regardless of the voltage on the sample.

*Solutions:* The calibration pot is turned up too high. These pots are 22 turns from end to end. They do not stop turning at the ends, there is an internal clutch that protects the internal mechanism.

When a system is damaged by lightning it may be unable to switch the relays necessary to select a telemetry sample. In this case the system will need to be repaired by a knowledgeable technician.

*Problem:* There is hum on the line when the RFC-1 answers a call but there is no hum when operated locally.

*Solutions:* One side of the telephone line is shorted to ground or the telephone line is too long and is receiving external interference. Check the line. If it is okay, try shielded cable and an off-the-shelf inline filter to eliminate the offending signal. Depending on the frequency of the interference ferrite beads, filter capacitors or chokes may be necessary.

*Problem:* The RFC-1 operates normally from the local phone but works intermittantly from remote locations.

*Solutions:* Check the telephone line for problems or interference and eliminate any problems on the line. Try shielded cable and an off-the-shelf inline filter to eliminate the offending signal. Depending on the frequency of the interference ferrite beads, filter capacitors or chokes may be necessary.

If the RFC-1 only fails to recognize tones from a specific location, it is likely that there is something unusual about the phones at that site. Many phone systems produce only short tone bursts when a key is pressed. These tone bursts are typically on the order of about 50ms. The RFC-1 requires 40ms of clean tone to detect and decode. It only takes about 10ms of distortion to make this fail. Some telephone systems (and cellular phones) have longer tones as a programming option.

*(This section refers only to systems with CD22202/3 or 75T202/3 IC at position U2.)* Line level can be a factor especially with cellular phones. The tone detector in the RFC-1 is not adjustable but we have found that allowing a little more signal into the detector can be helpful in this situation. Many systems have a 270K ohm resistor at position R23 (it will be located near the only empty IC socket on the board, above U1 and between C1 and R13). Try replacing the 270K ohm resistor with a 220K ohm resistor. Smaller values can be used but only if absolutely necessary. Do not use a value below 10K ohms.

*Problem:* The telephone line to the RFC-1 always rings busy when the RFC-1 is connected to the line. When the RFC-1 is not connected to the line, the telephone rings normally.

*Solutions:* It is very likely that memory address 0996 was overwritten by accident when the site ID phrase was reprogrammed. Reprogram address with the value "1" and the RFC-1 should return to normal operation.

Here is the procedure step by step. Enter the keystrokes in bold type.

1. Go online with the RFC-1/B from the local phone
2. Enter the programming mode: **80**
3. The RFC-1/B will prompt for the advanced programming security code: **4150**
4. The RFC-1/B will prompt for a four digit address: **0996**
5. The RFC-1/B will repeat the address and wait for a command
6. Enter the correct value and press the pound key (#): **1#**
7. Exit the programming mode by pressing the star (\*) key: **\***
8. Disconnect from the RFC-1/B and hang up: **99**

*Problem:* A latching control relay contact is needed and the RFC-1 control relays only activate momentarily.

*Solutions:* The RFC-1 cannot latch the control relays. An outboard latching relay is required. A dual coil latching relay is probably easiest to connect. Select the coil and contact ratings as required for the specific installation. Use the RFC-1 control relays to switch the control voltage to the coils of the latching relay.

## **8.2 Factory Service Policy**

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

### **8.2.1 Factory Warranty**

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

### **8.2.2 Factory Return Policy**

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

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

*30 days "no questions asked"*

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

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

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

*no return after 60 days*

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

### **8.2.3 Factory Service Policy**

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

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

#### **8.2.4 Warranty Service**

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

#### **8.2.5 Service Rates**

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

*Minor programming adjustments or no damage, \$50 plus shipping*

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

*Minor repairs are up to \$150 plus shipping*

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

*Moderate repairs are \$250 plus shipping*

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

*Major repairs cost more than \$250 plus shipping*

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

*Damaged beyond recognition, assessed on a per case basis*

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

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



### 8.2.6 Instructions for Factory Service

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

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

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

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

### 8.3 Repair Procedure



#### **WARNING!**

***The RFC-1 or the RP-8 relay panels should be installed or repaired only by qualified technical personnel. An attempt to repair this device by a person who is not technically qualified could result in a hazardous condition to the installer or other personnel, and/or damage to the RFC-1 or other equipment. Please ensure that proper safety precautions have been made before installing or repairing this device.***

***Because the RFC-1 is an FCC registered device, it must not be modified in any way. Any components which are replaced must be replaced with ones of exactly the same type and rating. This is particularly critical in the circuitry involving connection to the telephone line. Unless repair is performed by a properly qualified technician, it is strongly recommended that the RFC-1 be returned to Sine Systems for repair.***

### 8.3.1 Procedure

The first step in troubleshooting should be to look for signs of burned or damaged parts. It is normal for U8, U9 and D6 to run fairly warm but they should not be hot enough to burn the PC board.

Disconnect the power supply, telephone line and all control and telemetry connections from the RP-8 panel. Remove all ICs, except U5, U8 and U9 from the RFC-1 board and all ICs from the RP-8 panel.

Measure the in-circuit values of R21 and R22 and replace if necessary.

If a bench supply is available, set the output voltage to 17 VDC and limit the current to about 400 milliamperes. Connect it to the 12 VAC terminals on the RP-8 panel in place of the wall plug transformer.

If resettable fuse F1 opens, disconnect the left (input) lead (nearest the resettable fuse) of U9, and one lead of D5 and D7. Reconnect these leads one at a time, replacing anything that opens the resettable fuse.

Measure all power supply voltages. Using the heat sink (1/4" spacer) connected to U8 as a reference, there should be about +10 volts on the left lead of U9, -5.1 volts on the center lead of U9, +6.9 volts on the right lead of U9 and +5 volts on the right lead of U8.

When the power supply checks out OK, set up a test meter to measure the total AC current drawn by the RFC-1. With nothing but U5 and the regulators installed, the RFC-1 should draw less than 250 milliamperes AC (rms) if the 12 volt AC wall plug transformer is used, or less than 150 milliamperes DC if a 17 volt DC supply is being used.

Disconnect power and install U6. Reconnect power and note current flow. Repeat this step with each IC on the RFC-1 board, one at a time, and replace anything that causes the total AC current to exceed 450 milliamperes AC if the 12 volt AC wall plug transformer is used, or 275 milliamperes DC if a 17 volt DC supply is being used.

Replace the IC's on the RP-8 panel using the same technique. The current supplied to the RP-8 panel can be checked by temporarily removing one end of resettable fuse F2 and connecting a milliammeter. The current should be somewhere in the vicinity of 30 milliamperes DC with a telemetry channel selected. The supply voltage delivered to the RP-8 panel should be around 9.5 to 10.5 volts, unregulated.

With all ICs installed, very carefully feel each component. A malfunction could cause a component to be hot enough to cause a burn so use appropriate caution. U8, U9 and D6 are normally quite warm, however, no other component should be significantly warm. Replace any component which is hot or significantly warm with the exception of U8, U9, or D6.

When all components have been checked for normal temperature begin a functional test of the unit. Test for proper operation of the system using the local telephone first. Press the local control button and listen for "This is RFC-1/B." Replace U1 if this does not happen. If the unit does not respond to DTMF tones, replace U2.

Command and telemetry functions are affected by U6 in the RFC-1 and U1, U2 and U3 on the RP-8 panel. If the telemetry relays are working and are feeding a telemetry sample to the RFC-1 but all readings are either "status on" or "status off", replace U7.

As a final test, reinstall the RFC-1 board in its case, connect the telephone line and call it to verify that it RFC-1 will operate from a remote telephone. Also check to see that the RFC-1 does not cause a hum on the telephone line. This would be an indication that one side of the telephone line was shorted to ground somewhere. If everything sounds normal, the repair is complete.

## Section 9 — Specifications

### 9.1 RFC-1 Remote Facilities Controller

<i>Power</i>	12 Volts AC @ 0.55 amps 18 Volts DC @ 0.55 amps (from alternate DC supply on site or backup battery)
<i>Indicators</i>	Power LED (green) indicates internal 5 Volt DC supply operating
<i>Ports</i>	Relay Panels (16 conductor pin/plug type) Phone (RJ-11C modular) Line (RJ-11C modular)
<i>Telemetry</i>	(see RP-8 below)
<i>Accuracy</i>	resolution of one part in 1020 minimum depending on user programming with accuracy of 0.5% of programmed full scale
<i>Dimensions</i>	19" (w) x 6.5" (d) x 1.75" (h) 1U rack mount
<i>Weight</i>	1.5 lbs.
<i>Interference</i>	Complies with the limits for a Class B computing device pursuant to Subpart J of Part 15 of FCC Rules

### 9.2 RP-8 Relay Panel

<i>Power</i>	DC power for RP-8 is supplied by RFC-1—12V AC input terminals only supply RFC-1 main system
<i>Ports</i>	RFC-1 Power & I/O (16 conductor pin/plug type) Telemetry Input (2 position pluggable screw terminal) Control Output (3 position pluggable screw terminal)
<i>Telemetry</i>	Typical telemetry sample voltage is 5 Volts DC Absolute maximum voltage sample is 10 Volts DC Minimum required voltage to achieve full scale reading is 1 Volt DC  Samples may be positive or negative DC voltage input but not both on same channel Sources may be offset up to 30 volts from ground 50K to 60K $\Omega$ input impedance
<i>Control relays</i>	Form C contacts rated at 120 volts AC, 5 amps resistive / 2 amps inductive
<i>Dimensions</i>	19" (w) x 1.5" (d) x 3.5" (h) 2U rack mount
<i>Weight</i>	1.5 lbs.

# Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0000	Channel 00: telemetry units or status format - value 1	6.3.1	0	___	Date/time 80: action sequence
0001	Channel 00: telemetry units or status format - value 2	6.3.1	3	___	Date/time 80: month
0002	Channel 00: full scale and decimal point	6.3.3	2	___	Date/time 80: day - value 1
<u>0003</u>	<u>Channel 00: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	Date/time 80: day - value 2
0004	Channel 01: telemetry units or status format - value 1	6.3.1	0	___	Date/time 80: hour - value 1
0005	Channel 01: telemetry units or status format - value 2	6.3.1	3	___	Date/time 80: hour - value 2
0006	Channel 01: full scale and decimal point	6.3.3	2	___	Date/time 80: minute - value 1
<u>0007</u>	<u>Channel 01: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	<u>Date/time 80: minute - value 2</u>
0008	Channel 02: telemetry units or status format - value 1	6.3.1	0	___	Date/time 79: action sequence
0009	Channel 02: telemetry units or status format - value 2	6.3.1	3	___	Date/time 79: month
0010	Channel 02: full scale and decimal point	6.3.3	2	___	Date/time 79: day - value 1
<u>0011</u>	<u>Channel 02: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	Date/time 79: day - value 2
0012	Channel 03: telemetry units or status format - value 1	6.3.1	0	___	Date/time 79: hour - value 1
0013	Channel 03: telemetry units or status format - value 2	6.3.1	3	___	Date/time 79: hour - value 2
0014	Channel 03: full scale and decimal point	6.3.3	2	___	Date/time 79: minute - value 1
<u>0015</u>	<u>Channel 03: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	<u>Date/time 79: minute - value 2</u>
0016	Channel 04: telemetry units or status format - value 1	6.3.1	0	___	Date/time 78: action sequence
0017	Channel 04: telemetry units or status format - value 2	6.3.1	3	___	Date/time 78: month
0018	Channel 04: full scale and decimal point	6.3.3	2	___	Date/time 78: day - value 1
<u>0019</u>	<u>Channel 04: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	Date/time 78: day - value 2
0020	Channel 05: telemetry units or status format - value 1	6.3.1	0	___	Date/time 78: hour - value 1
0021	Channel 05: telemetry units or status format - value 2	6.3.1	3	___	Date/time 78: hour - value 2
0022	Channel 05: full scale and decimal point	6.3.3	2	___	Date/time 78: minute - value 1
<u>0023</u>	<u>Channel 05: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	<u>Date/time 78: minute - value 2</u>
0024	Channel 06: telemetry units or status format - value 1	6.3.1	0	___	Date/time 77: action sequence
0025	Channel 06: telemetry units or status format - value 2	6.3.1	3	___	Date/time 77: month
0026	Channel 06: full scale and decimal point	6.3.3	2	___	Date/time 77: day - value 1
<u>0027</u>	<u>Channel 06: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	Date/time 77: day - value 2
0028	Channel 07: telemetry units or status format - value 1	6.3.1	0	___	Date/time 77: hour - value 1
0029	Channel 07: telemetry units or status format - value 2	6.3.1	3	___	Date/time 77: hour - value 2
0030	Channel 07: full scale and decimal point	6.3.3	2	___	Date/time 77: minute - value 1
<u>0031</u>	<u>Channel 07: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	<u>Date/time 77: minute - value 2</u>
0032	Channel 08: telemetry units or status format - value 1	6.3.1	0	___	Date/time 76: action sequence
0033	Channel 08: telemetry units or status format - value 2	6.3.1	3	___	Date/time 76: month
0034	Channel 08: full scale and decimal point	6.3.3	2	___	Date/time 76: day - value 1
<u>0035</u>	<u>Channel 08: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	Date/time 76: day - value 2
0036	Channel 09: telemetry units or status format - value 1	6.3.1	0	___	Date/time 76: hour - value 1
0037	Channel 09: telemetry units or status format - value 2	6.3.1	3	___	Date/time 76: hour - value 2
0038	Channel 09: full scale and decimal point	6.3.3	2	___	Date/time 76: minute - value 1
<u>0039</u>	<u>Channel 09: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	<u>Date/time 76: minute - value 2</u>
0040	Channel 10: telemetry units or status format - value 1	6.3.1	0	___	Date/time 75: action sequence
0041	Channel 10: telemetry units or status format - value 2	6.3.1	3	___	Date/time 75: month
0042	Channel 10: full scale and decimal point	6.3.3	2	___	Date/time 75: day - value 1
<u>0043</u>	<u>Channel 10: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	Date/time 75: day - value 2
0044	Channel 11: telemetry units or status format - value 1	6.3.1	0	___	Date/time 75: hour - value 1
0045	Channel 11: telemetry units or status format - value 2	6.3.1	3	___	Date/time 75: hour - value 2
0046	Channel 11: full scale and decimal point	6.3.3	2	___	Date/time 75: minute - value 1
<u>0047</u>	<u>Channel 11: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	___	<u>Date/time 75: minute - value 2</u>

## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0048	Channel 12: telemetry units or status format - value 1	6.3.1	0	___	Date/time 74: action sequence
0049	Channel 12: telemetry units or status format - value 2	6.3.1	3	___	Date/time 74: month
0050	Channel 12: full scale and decimal point	6.3.3	2	___	Date/time 74: day - value 1
<u>0051</u>	<u>Channel 12: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 74: day - value 2
0052	Channel 13: telemetry units or status format - value 1	6.3.1	0	___	Date/time 74: hour - value 1
0053	Channel 13: telemetry units or status format - value 2	6.3.1	3	___	Date/time 74: hour - value 2
0054	Channel 13: full scale and decimal point	6.3.3	2	___	Date/time 74: minute - value 1
<u>0055</u>	<u>Channel 13: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 74: minute - value 2</u>
0056	Channel 14: telemetry units or status format - value 1	6.3.1	0	___	Date/time 73: action sequence
0057	Channel 14: telemetry units or status format - value 2	6.3.1	3	___	Date/time 73: month
0058	Channel 14: full scale and decimal point	6.3.3	2	___	Date/time 73: day - value 1
<u>0059</u>	<u>Channel 14: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 73: day - value 2
0060	Channel 15: telemetry units or status format - value 1	6.3.1	0	___	Date/time 73: hour - value 1
0061	Channel 15: telemetry units or status format - value 2	6.3.1	3	___	Date/time 73: hour - value 2
0062	Channel 15: full scale and decimal point	6.3.3	2	___	Date/time 73: minute - value 1
<u>0063</u>	<u>Channel 15: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 73: minute - value 2</u>
0064	Channel 16: telemetry units or status format - value 1	6.3.1	0	___	Date/time 72: action sequence
0065	Channel 16: telemetry units or status format - value 2	6.3.1	3	___	Date/time 72: month
0066	Channel 16: full scale and decimal point	6.3.3	2	___	Date/time 72: day - value 1
<u>0067</u>	<u>Channel 16: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 72: day - value 2
0068	Channel 17: telemetry units or status format - value 1	6.3.1	0	___	Date/time 72: hour - value 1
0069	Channel 17: telemetry units or status format - value 2	6.3.1	3	___	Date/time 72: hour - value 2
0070	Channel 17: full scale and decimal point	6.3.3	2	___	Date/time 72: minute - value 1
<u>0071</u>	<u>Channel 17: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 72: minute - value 2</u>
0072	Channel 18: telemetry units or status format - value 1	6.3.1	0	___	Date/time 71: action sequence
0073	Channel 18: telemetry units or status format - value 2	6.3.1	3	___	Date/time 71: month
0074	Channel 18: full scale and decimal point	6.3.3	2	___	Date/time 71: day - value 1
<u>0075</u>	<u>Channel 18: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 71: day - value 2
0076	Channel 19: telemetry units or status format - value 1	6.3.1	0	___	Date/time 71: hour - value 1
0077	Channel 19: telemetry units or status format - value 2	6.3.1	3	___	Date/time 71: hour - value 2
0078	Channel 19: full scale and decimal point	6.3.3	2	___	Date/time 71: minute - value 1
<u>0079</u>	<u>Channel 19: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 71: minute - value 2</u>
0080	Channel 20: telemetry units or status format - value 1	6.3.1	0	___	Date/time 70: action sequence
0081	Channel 20: telemetry units or status format - value 2	6.3.1	3	___	Date/time 70: month
0082	Channel 20: full scale and decimal point	6.3.3	2	___	Date/time 70: day - value 1
<u>0083</u>	<u>Channel 20: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 70: day - value 2
0084	Channel 21: telemetry units or status format - value 1	6.3.1	0	___	Date/time 70: hour - value 1
0085	Channel 21: telemetry units or status format - value 2	6.3.1	3	___	Date/time 70: hour - value 2
0086	Channel 21: full scale and decimal point	6.3.3	2	___	Date/time 70: minute - value 1
<u>0087</u>	<u>Channel 21: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 70: minute - value 2</u>
0088	Channel 22: telemetry units or status format - value 1	6.3.1	0	___	Date/time 69: action sequence
0089	Channel 22: telemetry units or status format - value 2	6.3.1	3	___	Date/time 69: month
0090	Channel 22: full scale and decimal point	6.3.3	2	___	Date/time 69: day - value 1
<u>0091</u>	<u>Channel 22: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 69: day - value 2
0092	Channel 23: telemetry units or status format - value 1	6.3.1	0	___	Date/time 69: hour - value 1
0093	Channel 23: telemetry units or status format - value 2	6.3.1	3	___	Date/time 69: hour - value 2
0094	Channel 23: full scale and decimal point	6.3.3	2	___	Date/time 69: minute - value 1
<u>0095</u>	<u>Channel 23: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 69: minute - value 2</u>

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Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0096	Channel 24: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 68: action sequence
0097	Channel 24: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 68: month
0098	Channel 24: full scale and decimal point	6.3.3	2	_____	Date/time 68: day - value 1
<u>0099</u>	<u>Channel 24: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	Date/time 68: day - value 2
0100	Channel 25: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 68: hour - value 1
0101	Channel 25: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 68: hour - value 2
0102	Channel 25: full scale and decimal point	6.3.3	2	_____	Date/time 68: minute - value 1
<u>0103</u>	<u>Channel 25: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	<u>Date/time 68: minute - value 2</u>
0104	Channel 26: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 67: action sequence
0105	Channel 26: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 67: month
0106	Channel 26: full scale and decimal point	6.3.3	2	_____	Date/time 67: day - value 1
<u>0107</u>	<u>Channel 26: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	Date/time 67: day - value 2
0108	Channel 27: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 67: hour - value 1
0109	Channel 27: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 67: hour - value 2
0110	Channel 27: full scale and decimal point	6.3.3	2	_____	Date/time 67: minute - value 1
<u>0111</u>	<u>Channel 27: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	<u>Date/time 67: minute - value 2</u>
0112	Channel 28: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 66: action sequence
0113	Channel 28: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 66: month
0114	Channel 28: full scale and decimal point	6.3.3	2	_____	Date/time 66: day - value 1
<u>0115</u>	<u>Channel 28: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	Date/time 66: day - value 2
0116	Channel 29: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 66: hour - value 1
0117	Channel 29: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 66: hour - value 2
0118	Channel 29: full scale and decimal point	6.3.3	2	_____	Date/time 66: minute - value 1
<u>0119</u>	<u>Channel 29: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	<u>Date/time 66: minute - value 2</u>
0120	Channel 30: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 65: action sequence
0121	Channel 30: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 65: month
0122	Channel 30: full scale and decimal point	6.3.3	2	_____	Date/time 65: day - value 1
<u>0123</u>	<u>Channel 30: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	Date/time 65: day - value 2
0124	Channel 31: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 65: hour - value 1
0125	Channel 31: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 65: hour - value 2
0126	Channel 31: full scale and decimal point	6.3.3	2	_____	Date/time 65: minute - value 1
<u>0127</u>	<u>Channel 31: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	<u>Date/time 65: minute - value 2</u>
0128	Channel 32: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 64: action sequence
0129	Channel 32: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 64: month
0130	Channel 32: full scale and decimal point	6.3.3	2	_____	Date/time 64: day - value 1
<u>0131</u>	<u>Channel 32: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	Date/time 64: day - value 2
0132	Channel 33: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 64: hour - value 1
0133	Channel 33: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 64: hour - value 2
0134	Channel 33: full scale and decimal point	6.3.3	2	_____	Date/time 64: minute - value 1
<u>0135</u>	<u>Channel 33: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	<u>Date/time 64: minute - value 2</u>
0136	Channel 34: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 63: action sequence
0137	Channel 34: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 63: month
0138	Channel 34: full scale and decimal point	6.3.3	2	_____	Date/time 63: day - value 1
<u>0139</u>	<u>Channel 34: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	Date/time 63: day - value 2
0140	Channel 35: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 63: hour - value 1
0141	Channel 35: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 63: hour - value 2
0142	Channel 35: full scale and decimal point	6.3.3	2	_____	Date/time 63: minute - value 1
<u>0143</u>	<u>Channel 35: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>_____</u>	<u>Date/time 63: minute - value 2</u>

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Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0144	Channel 36: telemetry units or status format - value 1	6.3.1	0	___	Date/time 62: action sequence
0145	Channel 36: telemetry units or status format - value 2	6.3.1	3	___	Date/time 62: month
0146	Channel 36: full scale and decimal point	6.3.3	2	___	Date/time 62: day - value 1
<u>0147</u>	<u>Channel 36: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 62: day - value 2
0148	Channel 37: telemetry units or status format - value 1	6.3.1	0	___	Date/time 62: hour - value 1
0149	Channel 37: telemetry units or status format - value 2	6.3.1	3	___	Date/time 62: hour - value 2
0150	Channel 37: full scale and decimal point	6.3.3	2	___	Date/time 62: minute - value 1
<u>0151</u>	<u>Channel 37: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 62: minute - value 2</u>
0152	Channel 38: telemetry units or status format - value 1	6.3.1	0	___	Date/time 61: action sequence
0153	Channel 38: telemetry units or status format - value 2	6.3.1	3	___	Date/time 61: month
0154	Channel 38: full scale and decimal point	6.3.3	2	___	Date/time 61: day - value 1
<u>0155</u>	<u>Channel 38: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 61: day - value 2
0156	Channel 39: telemetry units or status format - value 1	6.3.1	0	___	Date/time 61: hour - value 1
0157	Channel 39: telemetry units or status format - value 2	6.3.1	3	___	Date/time 61: hour - value 2
0158	Channel 39: full scale and decimal point	6.3.3	2	___	Date/time 61: minute - value 1
<u>0159</u>	<u>Channel 39: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 61: minute - value 2</u>
0160	Channel 40: telemetry units or status format - value 1	6.3.1	0	___	Date/time 60: action sequence
0161	Channel 40: telemetry units or status format - value 2	6.3.1	3	___	Date/time 60: month
0162	Channel 40: full scale and decimal point	6.3.3	2	___	Date/time 60: day - value 1
<u>0163</u>	<u>Channel 40: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 60: day - value 2
0164	Channel 41: telemetry units or status format - value 1	6.3.1	0	___	Date/time 60: hour - value 1
0165	Channel 41: telemetry units or status format - value 2	6.3.1	3	___	Date/time 60: hour - value 2
0166	Channel 41: full scale and decimal point	6.3.3	2	___	Date/time 60: minute - value 1
<u>0167</u>	<u>Channel 41: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 60: minute - value 2</u>
0168	Channel 42: telemetry units or status format - value 1	6.3.1	0	___	Date/time 59: action sequence
0169	Channel 42: telemetry units or status format - value 2	6.3.1	3	___	Date/time 59: month
0170	Channel 42: full scale and decimal point	6.3.3	2	___	Date/time 59: day - value 1
<u>0171</u>	<u>Channel 42: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 59: day - value 2
0172	Channel 43: telemetry units or status format - value 1	6.3.1	0	___	Date/time 59: hour - value 1
0173	Channel 43: telemetry units or status format - value 2	6.3.1	3	___	Date/time 59: hour - value 2
0174	Channel 43: full scale and decimal point	6.3.3	2	___	Date/time 59: minute - value 1
<u>0175</u>	<u>Channel 43: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 59: minute - value 2</u>
0176	Channel 44: telemetry units or status format - value 1	6.3.1	0	___	Date/time 58: action sequence
0177	Channel 44: telemetry units or status format - value 2	6.3.1	3	___	Date/time 58: month
0178	Channel 44: full scale and decimal point	6.3.3	2	___	Date/time 58: day - value 1
<u>0179</u>	<u>Channel 44: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 58: day - value 2
0180	Channel 45: telemetry units or status format - value 1	6.3.1	0	___	Date/time 58: hour - value 1
0181	Channel 45: telemetry units or status format - value 2	6.3.1	3	___	Date/time 58: hour - value 2
0182	Channel 45: full scale and decimal point	6.3.3	2	___	Date/time 58: minute - value 1
<u>0183</u>	<u>Channel 45: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 58: minute - value 2</u>
0184	Channel 46: telemetry units or status format - value 1	6.3.1	0	___	Date/time 57: action sequence
0185	Channel 46: telemetry units or status format - value 2	6.3.1	3	___	Date/time 57: month
0186	Channel 46: full scale and decimal point	6.3.3	2	___	Date/time 57: day - value 1
<u>0187</u>	<u>Channel 46: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 57: day - value 2
0188	Channel 47: telemetry units or status format - value 1	6.3.1	0	___	Date/time 57: hour - value 1
0189	Channel 47: telemetry units or status format - value 2	6.3.1	3	___	Date/time 57: hour - value 2
0190	Channel 47: full scale and decimal point	6.3.3	2	___	Date/time 57: minute - value 1
<u>0191</u>	<u>Channel 47: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 57: minute - value 2</u>

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Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0192	Channel 48: telemetry units or status format - value 1	6.3.1	0	___	Date/time 56: action sequence
0193	Channel 48: telemetry units or status format - value 2	6.3.1	3	___	Date/time 56: month
0194	Channel 48: full scale and decimal point	6.3.3	2	___	Date/time 56: day - value 1
<u>0195</u>	<u>Channel 48: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 56: day - value 2
0196	Channel 49: telemetry units or status format - value 1	6.3.1	0	___	Date/time 56: hour - value 1
0197	Channel 49: telemetry units or status format - value 2	6.3.1	3	___	Date/time 56: hour - value 2
0198	Channel 49: full scale and decimal point	6.3.3	2	___	Date/time 56: minute - value 1
<u>0199</u>	<u>Channel 49: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 56: minute - value 2</u>
0200	Channel 50: telemetry units or status format - value 1	6.3.1	0	___	Date/time 55: action sequence
0201	Channel 50: telemetry units or status format - value 2	6.3.1	3	___	Date/time 55: month
0202	Channel 50: full scale and decimal point	6.3.3	2	___	Date/time 55: day - value 1
<u>0203</u>	<u>Channel 50: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 55: day - value 2
0204	Channel 51: telemetry units or status format - value 1	6.3.1	0	___	Date/time 55: hour - value 1
0205	Channel 51: telemetry units or status format - value 2	6.3.1	3	___	Date/time 55: hour - value 2
0206	Channel 51: full scale and decimal point	6.3.3	2	___	Date/time 55: minute - value 1
<u>0207</u>	<u>Channel 51: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 55: minute - value 2</u>
0208	Channel 52: telemetry units or status format - value 1	6.3.1	0	___	Date/time 54: action sequence
0209	Channel 52: telemetry units or status format - value 2	6.3.1	3	___	Date/time 54: month
0210	Channel 52: full scale and decimal point	6.3.3	2	___	Date/time 54: day - value 1
<u>0211</u>	<u>Channel 52: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 54: day - value 2
0212	Channel 53: telemetry units or status format - value 1	6.3.1	0	___	Date/time 54: hour - value 1
0213	Channel 53: telemetry units or status format - value 2	6.3.1	3	___	Date/time 54: hour - value 2
0214	Channel 53: full scale and decimal point	6.3.3	2	___	Date/time 54: minute - value 1
<u>0215</u>	<u>Channel 53: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 54: minute - value 2</u>
0216	Channel 54: telemetry units or status format - value 1	6.3.1	0	___	Date/time 53: action sequence
0217	Channel 54: telemetry units or status format - value 2	6.3.1	3	___	Date/time 53: month
0218	Channel 54: full scale and decimal point	6.3.3	2	___	Date/time 53: day - value 1
<u>0219</u>	<u>Channel 54: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 53: day - value 2
0220	Channel 55: telemetry units or status format - value 1	6.3.1	0	___	Date/time 53: hour - value 1
0221	Channel 55: telemetry units or status format - value 2	6.3.1	3	___	Date/time 53: hour - value 2
0222	Channel 55: full scale and decimal point	6.3.3	2	___	Date/time 53: minute - value 1
<u>0223</u>	<u>Channel 55: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 53: minute - value 2</u>
0224	Channel 56: telemetry units or status format - value 1	6.3.1	0	___	Date/time 52: action sequence
0225	Channel 56: telemetry units or status format - value 2	6.3.1	3	___	Date/time 52: month
0226	Channel 56: full scale and decimal point	6.3.3	2	___	Date/time 52: day - value 1
<u>0227</u>	<u>Channel 56: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 52: day - value 2
0228	Channel 57: telemetry units or status format - value 1	6.3.1	0	___	Date/time 52: hour - value 1
0229	Channel 57: telemetry units or status format - value 2	6.3.1	3	___	Date/time 52: hour - value 2
0230	Channel 57: full scale and decimal point	6.3.3	2	___	Date/time 52: minute - value 1
<u>0231</u>	<u>Channel 57: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 52: minute - value 2</u>
0232	Channel 58: telemetry units or status format - value 1	6.3.1	0	___	Date/time 51: action sequence
0233	Channel 58: telemetry units or status format - value 2	6.3.1	3	___	Date/time 51: month
0234	Channel 58: full scale and decimal point	6.3.3	2	___	Date/time 51: day - value 1
<u>0235</u>	<u>Channel 58: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	Date/time 51: day - value 2
0236	Channel 59: telemetry units or status format - value 1	6.3.1	0	___	Date/time 51: hour - value 1
0237	Channel 59: telemetry units or status format - value 2	6.3.1	3	___	Date/time 51: hour - value 2
0238	Channel 59: full scale and decimal point	6.3.3	2	___	Date/time 51: minute - value 1
<u>0239</u>	<u>Channel 59: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	<u>___</u>	<u>Date/time 51: minute - value 2</u>



# Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0240	Channel 60: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 50: action sequence
0241	Channel 60: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 50: month
0242	Channel 60: full scale and decimal point	6.3.3	2	_____	Date/time 50: day - value 1
<u>0243</u>	<u>Channel 60: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	_____	Date/time 50: day - value 2
0244	Channel 61: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 50: hour - value 1
0245	Channel 61: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 50: hour - value 2
0246	Channel 61: full scale and decimal point	6.3.3	2	_____	Date/time 50: minute - value 1
<u>0247</u>	<u>Channel 61: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	_____	<u>Date/time 50: minute - value 2</u>
0248	Channel 62: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 49: action sequence
0249	Channel 62: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 49: month
0250	Channel 62: full scale and decimal point	6.3.3	2	_____	Date/time 49: day - value 1
<u>0251</u>	<u>Channel 62: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	_____	Date/time 49: day - value 2
0252	Channel 63: telemetry units or status format - value 1	6.3.1	0	_____	Date/time 49: hour - value 1
0253	Channel 63: telemetry units or status format - value 2	6.3.1	3	_____	Date/time 49: hour - value 2
0254	Channel 63: full scale and decimal point	6.3.3	2	_____	Date/time 49: minute - value 1
<u>0255</u>	<u>Channel 63: linear/log/indirect and auto relay</u>	<u>6.3.4</u>	<u>0</u>	_____	<u>Date/time 49: minute - value 2</u>
0256	Date/time 48: action sequence	6.6.4	0	_____	_____
0257	Date/time 48: month	6.6.4	0	_____	_____
0258	Date/time 48: day - value 1	6.6.4	0	_____	_____
0259	Date/time 48: day - value 2	6.6.4	0	_____	_____
0260	Date/time 48: hour - value 1	6.6.4	0	_____	_____
0261	Date/time 48: hour - value 2	6.6.4	0	_____	_____
0262	Date/time 48: minute - value 1	6.6.4	0	_____	_____
<u>0263</u>	<u>Date/time 48: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0264	Date/time 47: action sequence	6.6.4	0	_____	_____
0265	Date/time 47: month	6.6.4	0	_____	_____
0266	Date/time 47: day - value 1	6.6.4	0	_____	_____
0267	Date/time 47: day - value 2	6.6.4	0	_____	_____
0268	Date/time 47: hour - value 1	6.6.4	0	_____	_____
0269	Date/time 47: hour - value 2	6.6.4	0	_____	_____
0270	Date/time 47: minute - value 1	6.6.4	0	_____	_____
<u>0271</u>	<u>Date/time 47: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0272	Date/time 46: action sequence	6.6.4	0	_____	_____
0273	Date/time 46: month	6.6.4	0	_____	_____
0274	Date/time 46: day - value 1	6.6.4	0	_____	_____
0275	Date/time 46: day - value 2	6.6.4	0	_____	_____
0276	Date/time 46: hour - value 1	6.6.4	0	_____	_____
0277	Date/time 46: hour - value 2	6.6.4	0	_____	_____
0278	Date/time 46: minute - value 1	6.6.4	0	_____	_____
<u>0279</u>	<u>Date/time 46: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0280	Date/time 45: action sequence	6.6.4	0	_____	_____
0281	Date/time 45: month	6.6.4	0	_____	_____
0282	Date/time 45: day - value 1	6.6.4	0	_____	_____
0283	Date/time 45: day - value 2	6.6.4	0	_____	_____
0284	Date/time 45: hour - value 1	6.6.4	0	_____	_____
0285	Date/time 45: hour - value 2	6.6.4	0	_____	_____
0286	Date/time 45: minute - value 1	6.6.4	0	_____	_____
<u>0287</u>	<u>Date/time 45: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____

## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0288	Date/time 44: action sequence	6.6.4	0	_____	_____
0289	Date/time 44: month	6.6.4	0	_____	_____
0290	Date/time 44: day - value 1	6.6.4	0	_____	_____
0291	Date/time 44: day - value 2	6.6.4	0	_____	_____
0292	Date/time 44: hour - value 1	6.6.4	0	_____	_____
0293	Date/time 44: hour - value 2	6.6.4	0	_____	_____
0294	Date/time 44: minute - value 1	6.6.4	0	_____	_____
<u>0295</u>	<u>Date/time 44: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0296	Date/time 43: action sequence	6.6.4	0	_____	_____
0297	Date/time 43: month	6.6.4	0	_____	_____
0298	Date/time 43: day - value 1	6.6.4	0	_____	_____
0299	Date/time 43: day - value 2	6.6.4	0	_____	_____
0300	Date/time 43: hour - value 1	6.6.4	0	_____	_____
0301	Date/time 43: hour - value 2	6.6.4	0	_____	_____
0302	Date/time 43: minute - value 1	6.6.4	0	_____	_____
<u>0303</u>	<u>Date/time 43: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0304	Date/time 42: action sequence	6.6.4	0	_____	_____
0305	Date/time 42: month	6.6.4	0	_____	_____
0306	Date/time 42: day - value 1	6.6.4	0	_____	_____
0307	Date/time 42: day - value 2	6.6.4	0	_____	_____
0308	Date/time 42: hour - value 1	6.6.4	0	_____	_____
0309	Date/time 42: hour - value 2	6.6.4	0	_____	_____
0310	Date/time 42: minute - value 1	6.6.4	0	_____	_____
<u>0311</u>	<u>Date/time 42: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0312	Date/time 41: action sequence	6.6.4	0	_____	_____
0313	Date/time 41: month	6.6.4	0	_____	_____
0314	Date/time 41: day - value 1	6.6.4	0	_____	_____
0315	Date/time 41: day - value 2	6.6.4	0	_____	_____
0316	Date/time 41: hour - value 1	6.6.4	0	_____	_____
0317	Date/time 41: hour - value 2	6.6.4	0	_____	_____
0318	Date/time 41: minute - value 1	6.6.4	0	_____	_____
<u>0319</u>	<u>Date/time 41: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0320	Date/time 40: action sequence	6.6.4	0	_____	_____
0321	Date/time 40: month	6.6.4	0	_____	_____
0322	Date/time 40: day - value 1	6.6.4	0	_____	_____
0323	Date/time 40: day - value 2	6.6.4	0	_____	_____
0324	Date/time 40: hour - value 1	6.6.4	0	_____	_____
0325	Date/time 40: hour - value 2	6.6.4	0	_____	_____
0326	Date/time 40: minute - value 1	6.6.4	0	_____	_____
<u>0327</u>	<u>Date/time 40: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0328	Date/time 39: action sequence	6.6.4	0	_____	_____
0329	Date/time 39: month	6.6.4	0	_____	_____
0330	Date/time 39: day - value 1	6.6.4	0	_____	_____
0331	Date/time 39: day - value 2	6.6.4	0	_____	_____
0332	Date/time 39: hour - value 1	6.6.4	0	_____	_____
0333	Date/time 39: hour - value 2	6.6.4	0	_____	_____
0334	Date/time 39: minute - value 1	6.6.4	0	_____	_____
<u>0335</u>	<u>Date/time 39: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____

# Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0336	Date/time 38: action sequence	6.6.4	0	_____	_____
0337	Date/time 38: month	6.6.4	0	_____	_____
0338	Date/time 38: day - value 1	6.6.4	0	_____	_____
0339	Date/time 38: day - value 2	6.6.4	0	_____	_____
0340	Date/time 38: hour - value 1	6.6.4	0	_____	_____
0341	Date/time 38: hour - value 2	6.6.4	0	_____	_____
0342	Date/time 38: minute - value 1	6.6.4	0	_____	_____
<u>0343</u>	<u>Date/time 38: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0344	Date/time 37: action sequence	6.6.4	0	_____	_____
0345	Date/time 37: month	6.6.4	0	_____	_____
0346	Date/time 37: day - value 1	6.6.4	0	_____	_____
0347	Date/time 37: day - value 2	6.6.4	0	_____	_____
0348	Date/time 37: hour - value 1	6.6.4	0	_____	_____
0349	Date/time 37: hour - value 2	6.6.4	0	_____	_____
0350	Date/time 37: minute - value 1	6.6.4	0	_____	_____
<u>0351</u>	<u>Date/time 37: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0352	Date/time 36: action sequence	6.6.4	0	_____	_____
0353	Date/time 36: month	6.6.4	0	_____	_____
0354	Date/time 36: day - value 1	6.6.4	0	_____	_____
0355	Date/time 36: day - value 2	6.6.4	0	_____	_____
0356	Date/time 36: hour - value 1	6.6.4	0	_____	_____
0357	Date/time 36: hour - value 2	6.6.4	0	_____	_____
0358	Date/time 36: minute - value 1	6.6.4	0	_____	_____
<u>0359</u>	<u>Date/time 36: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0360	Date/time 35: action sequence	6.6.4	0	_____	_____
0361	Date/time 35: month	6.6.4	0	_____	_____
0362	Date/time 35: day - value 1	6.6.4	0	_____	_____
0363	Date/time 35: day - value 2	6.6.4	0	_____	_____
0364	Date/time 35: hour - value 1	6.6.4	0	_____	_____
0365	Date/time 35: hour - value 2	6.6.4	0	_____	_____
0366	Date/time 35: minute - value 1	6.6.4	0	_____	_____
<u>0367</u>	<u>Date/time 35: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0368	Date/time 34: action sequence	6.6.4	0	_____	_____
0369	Date/time 34: month	6.6.4	0	_____	_____
0370	Date/time 34: day - value 1	6.6.4	0	_____	_____
0371	Date/time 34: day - value 2	6.6.4	0	_____	_____
0372	Date/time 34: hour - value 1	6.6.4	0	_____	_____
0373	Date/time 34: hour - value 2	6.6.4	0	_____	_____
0374	Date/time 34: minute - value 1	6.6.4	0	_____	_____
<u>0375</u>	<u>Date/time 34: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0376	Date/time 33: action sequence	6.6.4	0	_____	_____
0377	Date/time 33: month	6.6.4	0	_____	_____
0378	Date/time 33: day - value 1	6.6.4	0	_____	_____
0379	Date/time 33: day - value 2	6.6.4	0	_____	_____
0380	Date/time 33: hour - value 1	6.6.4	0	_____	_____
0381	Date/time 33: hour - value 2	6.6.4	0	_____	_____
0382	Date/time 33: minute - value 1	6.6.4	0	_____	_____
<u>0383</u>	<u>Date/time 33: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____

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Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0384	Date/time 32: action sequence	6.6.4	0	_____	_____
0385	Date/time 32: month	6.6.4	0	_____	_____
0386	Date/time 32: day - value 1	6.6.4	0	_____	_____
0387	Date/time 32: day - value 2	6.6.4	0	_____	_____
0388	Date/time 32: hour - value 1	6.6.4	0	_____	_____
0389	Date/time 32: hour - value 2	6.6.4	0	_____	_____
0390	Date/time 32: minute - value 1	6.6.4	0	_____	_____
<u>0391</u>	<u>Date/time 32: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0392	Date/time 31: action sequence	6.6.4	0	_____	_____
0393	Date/time 31: month	6.6.4	0	_____	_____
0394	Date/time 31: day - value 1	6.6.4	0	_____	_____
0395	Date/time 31: day - value 2	6.6.4	0	_____	_____
0396	Date/time 31: hour - value 1	6.6.4	0	_____	_____
0397	Date/time 31: hour - value 2	6.6.4	0	_____	_____
0398	Date/time 31: minute - value 1	6.6.4	0	_____	_____
<u>0399</u>	<u>Date/time 31: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0400	Date/time 30: action sequence	6.6.4	0	_____	_____
0401	Date/time 30: month	6.6.4	0	_____	_____
0402	Date/time 30: day - value 1	6.6.4	0	_____	_____
0403	Date/time 30: day - value 2	6.6.4	0	_____	_____
0404	Date/time 30: hour - value 1	6.6.4	0	_____	_____
0405	Date/time 30: hour - value 2	6.6.4	0	_____	_____
0406	Date/time 30: minute - value 1	6.6.4	0	_____	_____
<u>0407</u>	<u>Date/time 30: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0408	Date/time 29: action sequence	6.6.4	0	_____	_____
0409	Date/time 29: month	6.6.4	0	_____	_____
0410	Date/time 29: day - value 1	6.6.4	0	_____	_____
0411	Date/time 29: day - value 2	6.6.4	0	_____	_____
0412	Date/time 29: hour - value 1	6.6.4	0	_____	_____
0413	Date/time 29: hour - value 2	6.6.4	0	_____	_____
0414	Date/time 29: minute - value 1	6.6.4	0	_____	_____
<u>0415</u>	<u>Date/time 29: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0416	Date/time 28: action sequence	6.6.4	0	_____	_____
0417	Date/time 28: month	6.6.4	0	_____	_____
0418	Date/time 28: day - value 1	6.6.4	0	_____	_____
0419	Date/time 28: day - value 2	6.6.4	0	_____	_____
0420	Date/time 28: hour - value 1	6.6.4	0	_____	_____
0421	Date/time 28: hour - value 2	6.6.4	0	_____	_____
0422	Date/time 28: minute - value 1	6.6.4	0	_____	_____
<u>0423</u>	<u>Date/time 28: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0424	Date/time 27: action sequence	6.6.4	0	_____	_____
0425	Date/time 27: month	6.6.4	0	_____	_____
0426	Date/time 27: day - value 1	6.6.4	0	_____	_____
0427	Date/time 27: day - value 2	6.6.4	0	_____	_____
0428	Date/time 27: hour - value 1	6.6.4	0	_____	_____
0429	Date/time 27: hour - value 2	6.6.4	0	_____	_____
0430	Date/time 27: minute - value 1	6.6.4	0	_____	_____
<u>0431</u>	<u>Date/time 27: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____

## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0432	Date/time 26: action sequence	6.6.4	0	_____	_____
0433	Date/time 26: month	6.6.4	0	_____	_____
0434	Date/time 26: day - value 1	6.6.4	0	_____	_____
0435	Date/time 26: day - value 2	6.6.4	0	_____	_____
0436	Date/time 26: hour - value 1	6.6.4	0	_____	_____
0437	Date/time 26: hour - value 2	6.6.4	0	_____	_____
0438	Date/time 26: minute - value 1	6.6.4	0	_____	_____
<u>0439</u>	<u>Date/time 26: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0440	Date/time 25: action sequence	6.6.4	0	_____	_____
0441	Date/time 25: month	6.6.4	0	_____	_____
0442	Date/time 25: day - value 1	6.6.4	0	_____	_____
0443	Date/time 25: day - value 2	6.6.4	0	_____	_____
0444	Date/time 25: hour - value 1	6.6.4	0	_____	_____
0445	Date/time 25: hour - value 2	6.6.4	0	_____	_____
0446	Date/time 25: minute - value 1	6.6.4	0	_____	_____
<u>0447</u>	<u>Date/time 25: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0448	Date/time 24: action sequence	6.6.4	0	_____	_____
0449	Date/time 24: month	6.6.4	0	_____	_____
0450	Date/time 24: day - value 1	6.6.4	0	_____	_____
0451	Date/time 24: day - value 2	6.6.4	0	_____	_____
0452	Date/time 24: hour - value 1	6.6.4	0	_____	_____
0453	Date/time 24: hour - value 2	6.6.4	0	_____	_____
0454	Date/time 24: minute - value 1	6.6.4	0	_____	_____
<u>0455</u>	<u>Date/time 24: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0456	Date/time 23: action sequence	6.6.4	0	_____	_____
0457	Date/time 23: month	6.6.4	0	_____	_____
0458	Date/time 23: day - value 1	6.6.4	0	_____	_____
0459	Date/time 23: day - value 2	6.6.4	0	_____	_____
0460	Date/time 23: hour - value 1	6.6.4	0	_____	_____
0461	Date/time 23: hour - value 2	6.6.4	0	_____	_____
0462	Date/time 23: minute - value 1	6.6.4	0	_____	_____
<u>0463</u>	<u>Date/time 23: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0464	Date/time 22: action sequence	6.6.4	0	_____	_____
0465	Date/time 22: month	6.6.4	0	_____	_____
0466	Date/time 22: day - value 1	6.6.4	0	_____	_____
0467	Date/time 22: day - value 2	6.6.4	0	_____	_____
0468	Date/time 22: hour - value 1	6.6.4	0	_____	_____
0469	Date/time 22: hour - value 2	6.6.4	0	_____	_____
0470	Date/time 22: minute - value 1	6.6.4	0	_____	_____
<u>0471</u>	<u>Date/time 22: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0472	Date/time 21: action sequence	6.6.4	0	_____	_____
0473	Date/time 21: month	6.6.4	0	_____	_____
0474	Date/time 21: day - value 1	6.6.4	0	_____	_____
0475	Date/time 21: day - value 2	6.6.4	0	_____	_____
0476	Date/time 21: hour - value 1	6.6.4	0	_____	_____
0477	Date/time 21: hour - value 2	6.6.4	0	_____	_____
0478	Date/time 21: minute - value 1	6.6.4	0	_____	_____
<u>0479</u>	<u>Date/time 21: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____

## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0480	Date/time 20: action sequence	6.6.4	0	_____	_____
0481	Date/time 20: month	6.6.4	0	_____	_____
0482	Date/time 20: day - value 1	6.6.4	0	_____	_____
0483	Date/time 20: day - value 2	6.6.4	0	_____	_____
0484	Date/time 20: hour - value 1	6.6.4	0	_____	_____
0485	Date/time 20: hour - value 2	6.6.4	0	_____	_____
0486	Date/time 20: minute - value 1	6.6.4	0	_____	_____
<u>0487</u>	<u>Date/time 20: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0488	Date/time 19: action sequence	6.6.4	0	_____	_____
0489	Date/time 19: month	6.6.4	0	_____	_____
0490	Date/time 19: day - value 1	6.6.4	0	_____	_____
0491	Date/time 19: day - value 2	6.6.4	0	_____	_____
0492	Date/time 19: hour - value 1	6.6.4	0	_____	_____
0493	Date/time 19: hour - value 2	6.6.4	0	_____	_____
0494	Date/time 19: minute - value 1	6.6.4	0	_____	_____
<u>0495</u>	<u>Date/time 19: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0496	Date/time 18: action sequence	6.6.4	0	_____	_____
0497	Date/time 18: month	6.6.4	0	_____	_____
0498	Date/time 18: day - value 1	6.6.4	0	_____	_____
0499	Date/time 18: day - value 2	6.6.4	0	_____	_____
0500	Date/time 18: hour - value 1	6.6.4	0	_____	_____
0501	Date/time 18: hour - value 2	6.6.4	0	_____	_____
0502	Date/time 18: minute - value 1	6.6.4	0	_____	_____
<u>0503</u>	<u>Date/time 18: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0504	Date/time 17: action sequence	6.6.4	0	_____	_____
0505	Date/time 17: month	6.6.4	0	_____	_____
0506	Date/time 17: day - value 1	6.6.4	0	_____	_____
0507	Date/time 17: day - value 2	6.6.4	0	_____	_____
0508	Date/time 17: hour - value 1	6.6.4	0	_____	_____
0509	Date/time 17: hour - value 2	6.6.4	0	_____	_____
0510	Date/time 17: minute - value 1	6.6.4	0	_____	_____
<u>0511</u>	<u>Date/time 17: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0512	Date/time 16: action sequence	6.6.4	0	_____	_____
0513	Date/time 16: month	6.6.4	0	_____	_____
0514	Date/time 16: day - value 1	6.6.4	0	_____	_____
0515	Date/time 16: day - value 2	6.6.4	0	_____	_____
0516	Date/time 16: hour - value 1	6.6.4	0	_____	_____
0517	Date/time 16: hour - value 2	6.6.4	0	_____	_____
0518	Date/time 16: minute - value 1	6.6.4	0	_____	_____
<u>0519</u>	<u>Date/time 16: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0520	Date/time 15: action sequence	6.6.4	0	_____	_____
0521	Date/time 15: month	6.6.4	0	_____	_____
0522	Date/time 15: day - value 1	6.6.4	0	_____	_____
0523	Date/time 15: day - value 2	6.6.4	0	_____	_____
0524	Date/time 15: hour - value 1	6.6.4	0	_____	_____
0525	Date/time 15: hour - value 2	6.6.4	0	_____	_____
0526	Date/time 15: minute - value 1	6.6.4	0	_____	_____
<u>0527</u>	<u>Date/time 15: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____

## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0528	Date/time 14: action sequence	6.6.4	0	_____	_____
0529	Date/time 14: month	6.6.4	0	_____	_____
0530	Date/time 14: day - value 1	6.6.4	0	_____	_____
0531	Date/time 14: day - value 2	6.6.4	0	_____	_____
0532	Date/time 14: hour - value 1	6.6.4	0	_____	_____
0533	Date/time 14: hour - value 2	6.6.4	0	_____	_____
0534	Date/time 14: minute - value 1	6.6.4	0	_____	_____
<u>0535</u>	<u>Date/time 14: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0536	Date/time 13: action sequence	6.6.4	0	_____	_____
0537	Date/time 13: month	6.6.4	0	_____	_____
0538	Date/time 13: day - value 1	6.6.4	0	_____	_____
0539	Date/time 13: day - value 2	6.6.4	0	_____	_____
0540	Date/time 13: hour - value 1	6.6.4	0	_____	_____
0541	Date/time 13: hour - value 2	6.6.4	0	_____	_____
0542	Date/time 13: minute - value 1	6.6.4	0	_____	_____
<u>0543</u>	<u>Date/time 13: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0544	Date/time 12: action sequence	6.6.4	0	_____	_____
0545	Date/time 12: month	6.6.4	0	_____	_____
0546	Date/time 12: day - value 1	6.6.4	0	_____	_____
0547	Date/time 12: day - value 2	6.6.4	0	_____	_____
0548	Date/time 12: hour - value 1	6.6.4	0	_____	_____
0549	Date/time 12: hour - value 2	6.6.4	0	_____	_____
0550	Date/time 12: minute - value 1	6.6.4	0	_____	_____
<u>0551</u>	<u>Date/time 12: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0552	Date/time 11: action sequence	6.6.4	0	_____	_____
0553	Date/time 11: month	6.6.4	0	_____	_____
0554	Date/time 11: day - value 1	6.6.4	0	_____	_____
0555	Date/time 11: day - value 2	6.6.4	0	_____	_____
0556	Date/time 11: hour - value 1	6.6.4	0	_____	_____
0557	Date/time 11: hour - value 2	6.6.4	0	_____	_____
0558	Date/time 11: minute - value 1	6.6.4	0	_____	_____
<u>0559</u>	<u>Date/time 11: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0560	Date/time 10: action sequence	6.6.4	0	_____	_____
0561	Date/time 10: month	6.6.4	0	_____	_____
0562	Date/time 10: day - value 1	6.6.4	0	_____	_____
0563	Date/time 10: day - value 2	6.6.4	0	_____	_____
0564	Date/time 10: hour - value 1	6.6.4	0	_____	_____
0565	Date/time 10: hour - value 2	6.6.4	0	_____	_____
0566	Date/time 10: minute - value 1	6.6.4	0	_____	_____
<u>0567</u>	<u>Date/time 10: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0568	Date/time 9: action sequence	6.6.4	0	_____	_____
0569	Date/time 9: month	6.6.4	0	_____	_____
0570	Date/time 9: day - value 1	6.6.4	0	_____	_____
0571	Date/time 9: day - value 2	6.6.4	0	_____	_____
0572	Date/time 9: hour - value 1	6.6.4	0	_____	_____
0573	Date/time 9: hour - value 2	6.6.4	0	_____	_____
0574	Date/time 9: minute - value 1	6.6.4	0	_____	_____
<u>0575</u>	<u>Date/time 9: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____

## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0576	Date/time 8: action sequence	6.6.4	0	_____	_____
0577	Date/time 8: month	6.6.4	0	_____	_____
0578	Date/time 8: day - value 1	6.6.4	0	_____	_____
0579	Date/time 8: day - value 2	6.6.4	0	_____	_____
0580	Date/time 8: hour - value 1	6.6.4	0	_____	_____
0581	Date/time 8: hour - value 2	6.6.4	0	_____	_____
0582	Date/time 8: minute - value 1	6.6.4	0	_____	_____
<u>0583</u>	<u>Date/time 8: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0584	Date/time 7: action sequence	6.6.4	0	_____	_____
0585	Date/time 7: month	6.6.4	0	_____	_____
0586	Date/time 7: day - value 1	6.6.4	0	_____	_____
0587	Date/time 7: day - value 2	6.6.4	0	_____	_____
0588	Date/time 7: hour - value 1	6.6.4	0	_____	_____
0589	Date/time 7: hour - value 2	6.6.4	0	_____	_____
0590	Date/time 7: minute - value 1	6.6.4	0	_____	_____
<u>0591</u>	<u>Date/time 7: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0592	Date/time 6: action sequence	6.6.4	0	_____	_____
0593	Date/time 6: month	6.6.4	0	_____	_____
0594	Date/time 6: day - value 1	6.6.4	0	_____	_____
0595	Date/time 6: day - value 2	6.6.4	0	_____	_____
0596	Date/time 6: hour - value 1	6.6.4	0	_____	_____
0597	Date/time 6: hour - value 2	6.6.4	0	_____	_____
0598	Date/time 6: minute - value 1	6.6.4	0	_____	_____
<u>0599</u>	<u>Date/time 6: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0600	Date/time 5: action sequence	6.6.4	0	_____	_____
0601	Date/time 5: month	6.6.4	0	_____	_____
0602	Date/time 5: day - value 1	6.6.4	0	_____	_____
0603	Date/time 5: day - value 2	6.6.4	0	_____	_____
0604	Date/time 5: hour - value 1	6.6.4	0	_____	_____
0605	Date/time 5: hour - value 2	6.6.4	0	_____	_____
0606	Date/time 5: minute - value 1	6.6.4	0	_____	_____
<u>0607</u>	<u>Date/time 5: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0608	Date/time 4: action sequence	6.6.4	0	_____	_____
0609	Date/time 4: month	6.6.4	0	_____	_____
0610	Date/time 4: day - value 1	6.6.4	0	_____	_____
0611	Date/time 4: day - value 2	6.6.4	0	_____	_____
0612	Date/time 4: hour - value 1	6.6.4	0	_____	_____
0613	Date/time 4: hour - value 2	6.6.4	0	_____	_____
0614	Date/time 4: minute - value 1	6.6.4	0	_____	_____
<u>0615</u>	<u>Date/time 4: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0616	Date/time 3: action sequence	6.6.4	0	_____	_____
0617	Date/time 3: month	6.6.4	0	_____	_____
0618	Date/time 3: day - value 1	6.6.4	0	_____	_____
0619	Date/time 3: day - value 2	6.6.4	0	_____	_____
0620	Date/time 3: hour - value 1	6.6.4	0	_____	_____
0621	Date/time 3: hour - value 2	6.6.4	0	_____	_____
0622	Date/time 3: minute - value 1	6.6.4	0	_____	_____
<u>0623</u>	<u>Date/time 3: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____



## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0624	Date/time 2: action sequence	6.6.4	0	_____	_____
0625	Date/time 2: month	6.6.4	0	_____	_____
0626	Date/time 2: day - value 1	6.6.4	0	_____	_____
0627	Date/time 2: day - value 2	6.6.4	0	_____	_____
0628	Date/time 2: hour - value 1	6.6.4	0	_____	_____
0629	Date/time 2: hour - value 2	6.6.4	0	_____	_____
0630	Date/time 2: minute - value 1	6.6.4	0	_____	_____
<u>0631</u>	<u>Date/time 2: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0632	Date/time 1: action sequence	6.6.4	0	_____	_____
0633	Date/time 1: month	6.6.4	0	_____	_____
0634	Date/time 1: day - value 1	6.6.4	0	_____	_____
0635	Date/time 1: day - value 2	6.6.4	0	_____	_____
0636	Date/time 1: hour - value 1	6.6.4	0	_____	_____
0637	Date/time 1: hour - value 2	6.6.4	0	_____	_____
0638	Date/time 1: minute - value 1	6.6.4	0	_____	_____
<u>0639</u>	<u>Date/time 1: minute - value 2</u>	<u>6.6.4</u>	<u>0</u>	_____	_____
0640	Telephone number A: value 1	6.7.1	10	_____	_____
0641	Telephone number A: value 2	6.7.1	10	_____	_____
0642	Telephone number A: value 3	6.7.1	10	_____	_____
0643	Telephone number A: value 4	6.7.1	10	_____	_____
0644	Telephone number A: value 5	6.7.1	10	_____	_____
0645	Telephone number A: value 6	6.7.1	10	_____	_____
0646	Telephone number A: value 7	6.7.1	10	_____	_____
0647	Telephone number A: value 8	6.7.1	10	_____	_____
0648	Telephone number A: value 9	6.7.1	10	_____	_____
0649	Telephone number A: value 10	6.7.1	10	_____	_____
0650	Telephone number A: value 11	6.7.1	10	_____	_____
0651	Telephone number A: value 12	6.7.1	10	_____	_____
0652	Telephone number A: voice/data/pager ID	6.7.2	0	_____	_____
<u>0653</u>	<u>Telephone number A: call attempts</u>	<u>6.7.3</u>	<u>3</u>	_____	_____
0654	Telephone number B: value 1	6.7.1	10	_____	_____
0655	Telephone number B: value 2	6.7.1	10	_____	_____
0656	Telephone number B: value 3	6.7.1	10	_____	_____
0657	Telephone number B: value 4	6.7.1	10	_____	_____
0658	Telephone number B: value 5	6.7.1	10	_____	_____
0659	Telephone number B: value 6	6.7.1	10	_____	_____
0660	Telephone number B: value 7	6.7.1	10	_____	_____
0661	Telephone number B: value 8	6.7.1	10	_____	_____
0662	Telephone number B: value 9	6.7.1	10	_____	_____
0663	Telephone number B: value 10	6.7.1	10	_____	_____
0664	Telephone number B: value 11	6.7.1	10	_____	_____
0665	Telephone number B: value 12	6.7.1	10	_____	_____
0666	Telephone number B: voice/data/pager ID	6.7.2	0	_____	_____
<u>0667</u>	<u>Telephone number B: call attempts</u>	<u>6.7.3</u>	<u>3</u>	_____	_____
0668	Telephone number C: value 1	6.7.1	10	_____	_____
0669	Telephone number C: value 2	6.7.1	10	_____	_____
0670	Telephone number C: value 3	6.7.1	10	_____	_____
0671	Telephone number C: value 4	6.7.1	10	_____	_____

## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0672	Telephone number C: value 5	6.7.1	10	_____	_____
0673	Telephone number C: value 6	6.7.1	10	_____	_____
0674	Telephone number C: value 7	6.7.1	10	_____	_____
0675	Telephone number C: value 8	6.7.1	10	_____	_____
0676	Telephone number C: value 9	6.7.1	10	_____	_____
0677	Telephone number C: value 10	6.7.1	10	_____	_____
0678	Telephone number C: value 11	6.7.1	10	_____	_____
0679	Telephone number C: value 12	6.7.1	10	_____	_____
0680	Telephone number C: voice/data/pager ID	6.7.2	0	_____	_____
<u>0681</u>	<u>Telephone number C: call attempts</u>	<u>6.7.3</u>	<u>3</u>	_____	_____
0682	Telephone number D: value 1	6.7.1	10	_____	_____
0683	Telephone number D: value 2	6.7.1	10	_____	_____
0684	Telephone number D: value 3	6.7.1	10	_____	_____
0685	Telephone number D: value 4	6.7.1	10	_____	_____
0686	Telephone number D: value 5	6.7.1	10	_____	_____
0687	Telephone number D: value 6	6.7.1	10	_____	_____
0688	Telephone number D: value 7	6.7.1	10	_____	_____
0689	Telephone number D: value 8	6.7.1	10	_____	_____
0690	Telephone number D: value 9	6.7.1	10	_____	_____
0691	Telephone number D: value 10	6.7.1	10	_____	_____
0692	Telephone number D: value 11	6.7.1	10	_____	_____
0693	Telephone number D: value 12	6.7.1	10	_____	_____
0694	Telephone number D: voice/data/pager ID	6.7.2	0	_____	_____
<u>0695</u>	<u>Telephone number D: call attempts</u>	<u>6.7.3</u>	<u>3</u>	_____	_____
0696	Telephone number E: value 1	6.7.1	10	_____	_____
0697	Telephone number E: value 2	6.7.1	10	_____	_____
0698	Telephone number E: value 3	6.7.1	10	_____	_____
0699	Telephone number E: value 4	6.7.1	10	_____	_____
0700	Telephone number E: value 5	6.7.1	10	_____	_____
0701	Telephone number E: value 6	6.7.1	10	_____	_____
0702	Telephone number E: value 7	6.7.1	10	_____	_____
0703	Telephone number E: value 8	6.7.1	10	_____	_____
0704	Telephone number E: value 9	6.7.1	10	_____	_____
0705	Telephone number E: value 10	6.7.1	10	_____	_____
0706	Telephone number E: value 11	6.7.1	10	_____	_____
0707	Telephone number E: value 12	6.7.1	10	_____	_____
0708	Telephone number E: voice/data/pager ID	6.7.2	0	_____	_____
<u>0709</u>	<u>Telephone number E: call attempts</u>	<u>6.7.3</u>	<u>3</u>	_____	_____
0710	Telephone number F: value 1	6.7.1	10	_____	_____
0711	Telephone number F: value 2	6.7.1	10	_____	_____
0712	Telephone number F: value 3	6.7.1	10	_____	_____
0713	Telephone number F: value 4	6.7.1	10	_____	_____
0714	Telephone number F: value 5	6.7.1	10	_____	_____
0715	Telephone number F: value 6	6.7.1	10	_____	_____
0716	Telephone number F: value 7	6.7.1	10	_____	_____
0717	Telephone number F: value 8	6.7.1	10	_____	_____
0718	Telephone number F: value 9	6.7.1	10	_____	_____
0719	Telephone number F: value 10	6.7.1	10	_____	_____

## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0720	Telephone number F: value 11	6.7.1	10	_____	_____
0721	Telephone number F: value 12	6.7.1	10	_____	_____
0722	Telephone number F: voice/data/pager ID	6.7.2	0	_____	_____
<u>0723</u>	<u>Telephone number F: call attempts</u>	<u>6.7.3</u>	<u>3</u>	_____	_____
0724	Action Sequence 1: step 1 - value 1	6.4.1	9	_____	_____
0725	Action Sequence 1: step 1 - value 2	6.4.1	0	_____	_____
0726	Action Sequence 1: step 2 - value 1	6.4.1	15	_____	_____
0727	Action Sequence 1: step 2 - value 2	6.4.1	15	_____	_____
0728	Action Sequence 1: step 3 - value 1	6.4.1	15	_____	_____
0729	Action Sequence 1: step 3 - value 2	6.4.1	15	_____	_____
0730	Action Sequence 1: step 4 - value 1	6.4.1	15	_____	_____
0731	Action Sequence 1: step 4 - value 2	6.4.1	15	_____	_____
0732	Action Sequence 1: step 5 - value 1	6.4.1	15	_____	_____
0733	Action Sequence 1: step 5 - value 2	6.4.1	15	_____	_____
0734	Action Sequence 1: step 6 - value 1	6.4.1	15	_____	_____
0735	Action Sequence 1: step 6 - value 2	6.4.1	15	_____	_____
0736	Action Sequence 1: step 7 - value 1	6.4.1	15	_____	_____
0737	Action Sequence 1: step 7 - value 2	6.4.1	15	_____	_____
0738	Action Sequence 1: step 8 - value 1	6.4.1	15	_____	_____
<u>0739</u>	<u>Action Sequence 1: step 8 - value 2</u>	<u>6.4.1</u>	<u>15</u>	_____	_____
0740	Action Sequence 2: step 1 - value 1	6.4.1	15	_____	_____
0741	Action Sequence 2: step 1 - value 2	6.4.1	15	_____	_____
0742	Action Sequence 2: step 2 - value 1	6.4.1	15	_____	_____
0743	Action Sequence 2: step 2 - value 2	6.4.1	15	_____	_____
0744	Action Sequence 2: step 3 - value 1	6.4.1	15	_____	_____
0745	Action Sequence 2: step 3 - value 2	6.4.1	15	_____	_____
0746	Action Sequence 2: step 4 - value 1	6.4.1	15	_____	_____
0747	Action Sequence 2: step 4 - value 2	6.4.1	15	_____	_____
0748	Action Sequence 2: step 5 - value 1	6.4.1	15	_____	_____
0749	Action Sequence 2: step 5 - value 2	6.4.1	15	_____	_____
0750	Action Sequence 2: step 6 - value 1	6.4.1	15	_____	_____
0751	Action Sequence 2: step 6 - value 2	6.4.1	15	_____	_____
0752	Action Sequence 2: step 7 - value 1	6.4.1	15	_____	_____
0753	Action Sequence 2: step 7 - value 2	6.4.1	15	_____	_____
0754	Action Sequence 2: step 8 - value 1	6.4.1	15	_____	_____
<u>0755</u>	<u>Action Sequence 2: step 8 - value 2</u>	<u>6.4.1</u>	<u>15</u>	_____	_____
0756	Action Sequence 3: step 1 - value 1	6.4.1	15	_____	_____
0757	Action Sequence 3: step 1 - value 2	6.4.1	15	_____	_____
0758	Action Sequence 3: step 2 - value 1	6.4.1	15	_____	_____
0759	Action Sequence 3: step 2 - value 2	6.4.1	15	_____	_____
0760	Action Sequence 3: step 3 - value 1	6.4.1	15	_____	_____
0761	Action Sequence 3: step 3 - value 2	6.4.1	15	_____	_____
0762	Action Sequence 3: step 4 - value 1	6.4.1	15	_____	_____
0763	Action Sequence 3: step 4 - value 2	6.4.1	15	_____	_____
0764	Action Sequence 3: step 5 - value 1	6.4.1	15	_____	_____
0765	Action Sequence 3: step 5 - value 2	6.4.1	15	_____	_____
0766	Action Sequence 3: step 6 - value 1	6.4.1	15	_____	_____
0767	Action Sequence 3: step 6 - value 2	6.4.1	15	_____	_____

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Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0768	Action Sequence 3: step 7 - value 1	6.4.1	15	_____	_____
0769	Action Sequence 3: step 7 - value 2	6.4.1	15	_____	_____
0770	Action Sequence 3: step 8 - value 1	6.4.1	15	_____	_____
<u>0771</u>	<u>Action Sequence 3: step 8 - value 2</u>	<u>6.4.1</u>	<u>15</u>	_____	_____
0772	Action Sequence 4: step 1 - value 1	6.4.1	15	_____	_____
0773	Action Sequence 4: step 1 - value 2	6.4.1	15	_____	_____
0774	Action Sequence 4: step 2 - value 1	6.4.1	15	_____	_____
0775	Action Sequence 4: step 2 - value 2	6.4.1	15	_____	_____
0776	Action Sequence 4: step 3 - value 1	6.4.1	15	_____	_____
0777	Action Sequence 4: step 3 - value 2	6.4.1	15	_____	_____
0778	Action Sequence 4: step 4 - value 1	6.4.1	15	_____	_____
0779	Action Sequence 4: step 4 - value 2	6.4.1	15	_____	_____
0780	Action Sequence 4: step 5 - value 1	6.4.1	15	_____	_____
0781	Action Sequence 4: step 5 - value 2	6.4.1	15	_____	_____
0782	Action Sequence 4: step 6 - value 1	6.4.1	15	_____	_____
0783	Action Sequence 4: step 6 - value 2	6.4.1	15	_____	_____
0784	Action Sequence 4: step 7 - value 1	6.4.1	15	_____	_____
0785	Action Sequence 4: step 7 - value 2	6.4.1	15	_____	_____
0786	Action Sequence 4: step 8 - value 1	6.4.1	15	_____	_____
<u>0787</u>	<u>Action Sequence 4: step 8 - value 2</u>	<u>6.4.1</u>	<u>15</u>	_____	_____
0788	Action Sequence 5: step 1 - value 1	6.4.1	15	_____	_____
0789	Action Sequence 5: step 1 - value 2	6.4.1	15	_____	_____
0790	Action Sequence 5: step 2 - value 1	6.4.1	15	_____	_____
0791	Action Sequence 5: step 2 - value 2	6.4.1	15	_____	_____
0792	Action Sequence 5: step 3 - value 1	6.4.1	15	_____	_____
0793	Action Sequence 5: step 3 - value 2	6.4.1	15	_____	_____
0794	Action Sequence 5: step 4 - value 1	6.4.1	15	_____	_____
0795	Action Sequence 5: step 4 - value 2	6.4.1	15	_____	_____
0796	Action Sequence 5: step 5 - value 1	6.4.1	15	_____	_____
0797	Action Sequence 5: step 5 - value 2	6.4.1	15	_____	_____
0798	Action Sequence 5: step 6 - value 1	6.4.1	15	_____	_____
0799	Action Sequence 5: step 6 - value 2	6.4.1	15	_____	_____
0800	Action Sequence 5: step 7 - value 1	6.4.1	15	_____	_____
0801	Action Sequence 5: step 7 - value 2	6.4.1	15	_____	_____
0802	Action Sequence 5: step 8 - value 1	6.4.1	15	_____	_____
<u>0803</u>	<u>Action Sequence 5: step 8 - value 2</u>	<u>6.4.1</u>	<u>15</u>	_____	_____
0804	Action Sequence 6: step 1 - value 1	6.4.1	15	_____	_____
0805	Action Sequence 6: step 1 - value 2	6.4.1	15	_____	_____
0806	Action Sequence 6: step 2 - value 1	6.4.1	15	_____	_____
0807	Action Sequence 6: step 2 - value 2	6.4.1	15	_____	_____
0808	Action Sequence 6: step 3 - value 1	6.4.1	15	_____	_____
0809	Action Sequence 6: step 3 - value 2	6.4.1	15	_____	_____
0810	Action Sequence 6: step 4 - value 1	6.4.1	15	_____	_____
0811	Action Sequence 6: step 4 - value 2	6.4.1	15	_____	_____
0812	Action Sequence 6: step 5 - value 1	6.4.1	15	_____	_____
0813	Action Sequence 6: step 5 - value 2	6.4.1	15	_____	_____
0814	Action Sequence 6: step 6 - value 1	6.4.1	15	_____	_____
0815	Action Sequence 6: step 6 - value 2	6.4.1	15	_____	_____

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Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0816	Action Sequence 6: step 7 - value 1	6.4.1	15	_____	_____
0817	Action Sequence 6: step 7 - value 2	6.4.1	15	_____	_____
0818	Action Sequence 6: step 8 - value 1	6.4.1	15	_____	_____
<u>0819</u>	<u>Action Sequence 6: step 8 - value 2</u>	<u>6.4.1</u>	<u>15</u>	_____	_____
0820	Action Sequence 7: step 1 - value 1	6.4.1	15	_____	_____
0821	Action Sequence 7: step 1 - value 2	6.4.1	15	_____	_____
0822	Action Sequence 7: step 2 - value 1	6.4.1	15	_____	_____
0823	Action Sequence 7: step 2 - value 2	6.4.1	15	_____	_____
0824	Action Sequence 7: step 3 - value 1	6.4.1	15	_____	_____
0825	Action Sequence 7: step 3 - value 2	6.4.1	15	_____	_____
0826	Action Sequence 7: step 4 - value 1	6.4.1	15	_____	_____
0827	Action Sequence 7: step 4 - value 2	6.4.1	15	_____	_____
0828	Action Sequence 7: step 5 - value 1	6.4.1	15	_____	_____
0829	Action Sequence 7: step 5 - value 2	6.4.1	15	_____	_____
0830	Action Sequence 7: step 6 - value 1	6.4.1	15	_____	_____
0831	Action Sequence 7: step 6 - value 2	6.4.1	15	_____	_____
0832	Action Sequence 7: step 7 - value 1	6.4.1	15	_____	_____
0833	Action Sequence 7: step 7 - value 2	6.4.1	15	_____	_____
0834	Action Sequence 7: step 8 - value 1	6.4.1	15	_____	_____
<u>0835</u>	<u>Action Sequence 7: step 8 - value 2</u>	<u>6.4.1</u>	<u>15</u>	_____	_____
0836	Action Sequence 8: step 1 - value 1	6.4.1	15	_____	_____
0837	Action Sequence 8: step 1 - value 2	6.4.1	15	_____	_____
0838	Action Sequence 8: step 2 - value 1	6.4.1	15	_____	_____
0839	Action Sequence 8: step 2 - value 2	6.4.1	15	_____	_____
0840	Action Sequence 8: step 3 - value 1	6.4.1	15	_____	_____
0841	Action Sequence 8: step 3 - value 2	6.4.1	15	_____	_____
0842	Action Sequence 8: step 4 - value 1	6.4.1	15	_____	_____
0843	Action Sequence 8: step 4 - value 2	6.4.1	15	_____	_____
0844	Action Sequence 8: step 5 - value 1	6.4.1	15	_____	_____
0845	Action Sequence 8: step 5 - value 2	6.4.1	15	_____	_____
0846	Action Sequence 8: step 6 - value 1	6.4.1	15	_____	_____
0847	Action Sequence 8: step 6 - value 2	6.4.1	15	_____	_____
0848	Action Sequence 8: step 7 - value 1	6.4.1	15	_____	_____
0849	Action Sequence 8: step 7 - value 2	6.4.1	15	_____	_____
0850	Action Sequence 8: step 8 - value 1	6.4.1	15	_____	_____
<u>0851</u>	<u>Action Sequence 8: step 8 - value 2</u>	<u>6.4.1</u>	<u>15</u>	_____	_____
0852	Alarm A: channel number - value 1	6.5.2	6	_____	_____
0853	Alarm A: channel number - value 2	6.5.2	4	_____	_____
0854	Alarm A: trigger rule	6.5.3	5	_____	_____
0855	Alarm A: action sequence	6.5.4	1	_____	_____
0856	Alarm A: upper limit - value 1	6.5.5	2	_____	_____
0857	Alarm A: upper limit - value 2	6.5.5	0	_____	_____
0858	Alarm A: upper limit - value 3	6.5.5	4	_____	_____
0859	Alarm A: upper limit - value 4	6.5.5	0	_____	_____
0860	Alarm A: lower limit - value 1	6.5.5	1	_____	_____
0861	Alarm A: lower limit - value 2	6.5.5	0	_____	_____
0862	Alarm A: lower limit - value 3	6.5.5	2	_____	_____
<u>0863</u>	<u>Alarm A: lower limit - value 4</u>	<u>6.5.5</u>	<u>0</u>	_____	_____

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Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0864	Alarm B: channel number - value 1	6.5.2	6	_____	_____
0865	Alarm B: channel number - value 2	6.5.2	4	_____	_____
0866	Alarm B: trigger rule	6.5.3	5	_____	_____
0867	Alarm B: action sequence	6.5.4	1	_____	_____
0868	Alarm B: upper limit - value 1	6.5.5	2	_____	_____
0869	Alarm B: upper limit - value 2	6.5.5	0	_____	_____
0870	Alarm B: upper limit - value 3	6.5.5	4	_____	_____
0871	Alarm B: upper limit - value 4	6.5.5	0	_____	_____
0872	Alarm B: lower limit - value 1	6.5.5	1	_____	_____
0873	Alarm B: lower limit - value 2	6.5.5	0	_____	_____
0874	Alarm B: lower limit - value 3	6.5.5	2	_____	_____
<u>0875</u>	<u>Alarm B: lower limit - value 4</u>	<u>6.5.5</u>	<u>0</u>	_____	_____
0876	Alarm C: channel number - value 1	6.5.2	6	_____	_____
0877	Alarm C: channel number - value 2	6.5.2	4	_____	_____
0878	Alarm C: trigger rule	6.5.3	5	_____	_____
0879	Alarm C: action sequence	6.5.4	1	_____	_____
0880	Alarm C: upper limit - value 1	6.5.5	2	_____	_____
0881	Alarm C: upper limit - value 2	6.5.5	0	_____	_____
0882	Alarm C: upper limit - value 3	6.5.5	4	_____	_____
0883	Alarm C: upper limit - value 4	6.5.5	0	_____	_____
0884	Alarm C: lower limit - value 1	6.5.5	1	_____	_____
0885	Alarm C: lower limit - value 2	6.5.5	0	_____	_____
0886	Alarm C: lower limit - value 3	6.5.5	2	_____	_____
<u>0887</u>	<u>Alarm C: lower limit - value 4</u>	<u>6.5.5</u>	<u>0</u>	_____	_____
0888	Alarm D: channel number - value 1	6.5.2	6	_____	_____
0889	Alarm D: channel number - value 2	6.5.2	4	_____	_____
0890	Alarm D: trigger rule	6.5.3	5	_____	_____
0891	Alarm D: action sequence	6.5.4	1	_____	_____
0892	Alarm D: upper limit - value 1	6.5.5	2	_____	_____
0893	Alarm D: upper limit - value 2	6.5.5	0	_____	_____
0894	Alarm D: upper limit - value 3	6.5.5	4	_____	_____
0895	Alarm D: upper limit - value 4	6.5.5	0	_____	_____
0896	Alarm D: lower limit - value 1	6.5.5	1	_____	_____
0897	Alarm D: lower limit - value 2	6.5.5	0	_____	_____
0898	Alarm D: lower limit - value 3	6.5.5	2	_____	_____
<u>0899</u>	<u>Alarm D: lower limit - value 4</u>	<u>6.5.5</u>	<u>0</u>	_____	_____
0900	Alarm E: channel number - value 1	6.5.2	6	_____	_____
0901	Alarm E: channel number - value 2	6.5.2	4	_____	_____
0902	Alarm E: trigger rule	6.5.3	5	_____	_____
0903	Alarm E: action sequence	6.5.4	1	_____	_____
0904	Alarm E: upper limit - value 1	6.5.5	2	_____	_____
0905	Alarm E: upper limit - value 2	6.5.5	0	_____	_____
0906	Alarm E: upper limit - value 3	6.5.5	4	_____	_____
0907	Alarm E: upper limit - value 4	6.5.5	0	_____	_____
0908	Alarm E: lower limit - value 1	6.5.5	1	_____	_____
0909	Alarm E: lower limit - value 2	6.5.5	0	_____	_____
0910	Alarm E: lower limit - value 3	6.5.5	2	_____	_____
<u>0911</u>	<u>Alarm E: lower limit - value 4</u>	<u>6.5.5</u>	<u>0</u>	_____	_____

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			Default	Current	
0912	Alarm F: channel number - value 1	6.5.2	6	_____	_____
0913	Alarm F: channel number - value 2	6.5.2	4	_____	_____
0914	Alarm F: trigger rule	6.5.3	5	_____	_____
0915	Alarm F: action sequence	6.5.4	1	_____	_____
0916	Alarm F: upper limit - value 1	6.5.5	2	_____	_____
0917	Alarm F: upper limit - value 2	6.5.5	0	_____	_____
0918	Alarm F: upper limit - value 3	6.5.5	4	_____	_____
0919	Alarm F: upper limit - value 4	6.5.5	0	_____	_____
0920	Alarm F: lower limit - value 1	6.5.5	1	_____	_____
0921	Alarm F: lower limit - value 2	6.5.5	0	_____	_____
0922	Alarm F: lower limit - value 3	6.5.5	2	_____	_____
<u>0923</u>	<u>Alarm F: lower limit - value 4</u>	<u>6.5.5</u>	<u>0</u>	_____	_____
0924	Alarm G: channel number - value 1	6.5.2	6	_____	_____
0925	Alarm G: channel number - value 2	6.5.2	4	_____	_____
0926	Alarm G: trigger rule	6.5.3	5	_____	_____
0927	Alarm G: action sequence	6.5.4	1	_____	_____
0928	Alarm G: upper limit - value 1	6.5.5	2	_____	_____
0929	Alarm G: upper limit - value 2	6.5.5	0	_____	_____
0930	Alarm G: upper limit - value 3	6.5.5	4	_____	_____
0931	Alarm G: upper limit - value 4	6.5.5	0	_____	_____
0932	Alarm G: lower limit - value 1	6.5.5	1	_____	_____
0933	Alarm G: lower limit - value 2	6.5.5	0	_____	_____
0934	Alarm G: lower limit - value 3	6.5.5	2	_____	_____
<u>0935</u>	<u>Alarm G: lower limit - value 4</u>	<u>6.5.5</u>	<u>0</u>	_____	_____
0936	Alarm H: channel number - value 1	6.5.2	6	_____	_____
0937	Alarm H: channel number - value 2	6.5.2	4	_____	_____
0938	Alarm H: trigger rule	6.5.3	5	_____	_____
0939	Alarm H: action sequence	6.5.4	1	_____	_____
0940	Alarm H: upper limit - value 1	6.5.5	2	_____	_____
0941	Alarm H: upper limit - value 2	6.5.5	0	_____	_____
0942	Alarm H: upper limit - value 3	6.5.5	4	_____	_____
0943	Alarm H: upper limit - value 4	6.5.5	0	_____	_____
0944	Alarm H: lower limit - value 1	6.5.5	1	_____	_____
0945	Alarm H: lower limit - value 2	6.5.5	0	_____	_____
0946	Alarm H: lower limit - value 3	6.5.5	2	_____	_____
<u>0947</u>	<u>Alarm H: lower limit - value 4</u>	<u>6.5.5</u>	<u>0</u>	_____	_____
0948	Main security code - value 1	6.8.1	1	_____	_____
0949	Main security code - value 2	6.8.1	2	_____	_____
0950	Main security code - value 3	6.8.1	3	_____	_____
0951	Main security code - value 4	6.8.1	4	_____	_____
0952	Main security code - value 5	6.8.1	5	_____	_____
0953	Main security code - value 6	6.8.1	6	_____	_____
0954	Main security code - value 7	6.8.1	7	_____	_____
<u>0955</u>	<u>Main security code - value 8</u>	<u>6.8.1</u>	<u>8</u>	_____	_____
0956	Control security code A - value 1	6.8.1	6	_____	_____
0957	Control security code A - value 2	6.8.1	6	_____	_____
0958	Control security code A - value 3	6.8.1	10	_____	_____
<u>0959</u>	<u>Control security code A - value 4</u>	<u>6.8.1</u>	<u>10</u>	_____	_____

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Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0960	Control security code B - value 1	6.8.1	6	—	
0961	Control security code B - value 2	6.8.1	6	—	
0962	Control security code B - value 3	6.8.1	10	—	
<u>0963</u>	<u>Control security code B - value 4</u>	<u>6.8.1</u>	<u>10</u>	—	
0964	Control security code C - value 1	6.8.1	6	—	
0965	Control security code C - value 2	6.8.1	6	—	
0966	Control security code C - value 3	6.8.1	10	—	
<u>0967</u>	<u>Control security code C - value 4</u>	<u>6.8.1</u>	<u>10</u>	—	
0968	Basic programming security code - value 1	6.8.1	4	—	
0969	Basic programming security code - value 2	6.8.1	0	—	
0970	Basic programming security code - value 3	6.8.1	8	—	
<u>0971</u>	<u>Basic programming security code - value 4</u>	<u>6.8.1</u>	<u>8</u>	—	
0972	Advanced programming security code - value 1	6.8.1	4	—	
0973	Advanced programming security code - value 2	6.8.1	1	—	
0974	Advanced programming security code - value 3	6.8.1	5	—	
<u>0975</u>	<u>Advanced programming security code - value 4</u>	<u>6.8.1</u>	<u>0</u>	—	
0976	Control security code for channels 00-07	6.8.2	1	—	
0977	Control security code for channels 08-15	6.8.2	1	—	
0978	Control security code for channels 16-23	6.8.2	1	—	
0979	Control security code for channels 24-31	6.8.2	1	—	
0980	Control security code for channels 32-39	6.8.2	1	—	
0981	Control security code for channels 40-47	6.8.2	1	—	
0982	Control security code for channels 48-55	6.8.2	1	—	
<u>0983</u>	<u>Control security code for channels 56-63</u>	<u>6.8.2</u>	<u>1</u>	—	
0984	Site ID phrase: word 1 - value 1	6.9.1	7	—	
0985	Site ID phrase: word 1 - value 2	6.9.1	11	—	
0986	Site ID phrase: word 2 - value 1	6.9.1	9	—	
0987	Site ID phrase: word 2 - value 2	6.9.1	8	—	
0988	Site ID phrase: word 3 - value 1	6.9.1	8	—	
0989	Site ID phrase: word 3 - value 2	6.9.1	12	—	
0990	Site ID phrase: word 4 - value 1	6.9.1	8	—	
0991	Site ID phrase: word 4 - value 2	6.9.1	9	—	
0992	Site ID phrase: word 5 - value 1	6.9.1	0	—	
0993	Site ID phrase: word 5 - value 2	6.9.1	1	—	
0994	Site ID phrase: word 6 - value 1	6.9.1	8	—	
<u>0995</u>	<u>Site ID phrase: word 6 - value 2</u>	<u>6.9.1</u>	<u>8</u>	—	



## Appendix A — Programming Address Table

Address	Description	Section	- Programming -		Alternate Use / Notes
			Default	Current	
0996	Hardware version	6.9.2	1	_____	_____
0997	Telemetry settling time	6.3.7	3	_____	_____
0998	Telemetry lead zero suppression	6.3.6	0	_____	_____
0999	Tone/pulse/pager dialing	6.7.3	0	_____	_____
1000	Idle system timeout	6.9.3	2	_____	_____
1001	Answer ring number	5.5.2	2	_____	_____
1002	Communications mode	6.7.8	0	_____	_____
1003	Alarm call message duration	6.7.4	6	_____	_____
1004	Alarm call pause duration	6.7.5	6	_____	_____
1005	Serial data baud rate	6.7.8	2	_____	_____
1006	Relay (minimum) operate time	6.4.2	1	_____	_____
1007	Action sequence step delay	6.4.3	1	_____	_____
1008	Power-up action sequence	6.4.8	0	_____	_____
1009	Enable/disable telemetry alarms	6.5.6	0	_____	_____
1010	Autoscan stop channel - value 1	6.4.5	0	_____	_____
1011	Autoscan stop channel - value 2	6.4.5	7	_____	_____
1012	reserved	—	0	_____	_____
1013	Telemetry scan interval sequence	6.5.7	0	_____	_____
1014	Dedicated control port control and ring sensitivity	6.7.6	0	_____	_____
1015	EEROM map (telemetry labels/time triggers)	6.3.8	6	_____	_____
1016	Incorrect security code lockout time	6.8.3	1	_____	_____
1017	reserved	—	0	_____	_____
1018	Clock speed adjustment - value 1	6.6.6	8	_____	_____
1019	Clock speed adjustment - value 2	6.6.6	8	_____	_____
1020	Default telemetry units or status format - value 1	6.3.1	0	_____	_____
1021	Default telemetry units or status format - value 2	6.3.1	3	_____	_____
1022	Default full scale and decimal point	6.3.3	2	_____	_____
1023	Default linear/log/indirect and auto relay	6.3.4	0	_____	_____

## Appendix B — Word Table

Values V1 and V2 are used to identify the words when programming.

<u>Word</u>	<u>V1</u>	<u>V2</u>	<u>Word</u>	<u>V1</u>	<u>V2</u>	<u>Word</u>	<u>V1</u>	<u>V2</u>
zero	0	0	I	8	15	status	7	8
one	0	1	Igor	3	12	T	9	10
two	0	2	intrusion	3	14	telemetry	7	9
three	0	3	J	9	0	telephone	7	10
four	0	4	Joe	3	15	temperature	2	2
five	0	5	K	9	1	This is	7	11
six	0	6	kilovolts	4	2	time	7	12
seven	0	7	kilowatts	4	3	to	7	13
eight	0	8	L	9	2	transmitter	7	14
nine	0	9	Larry	4	4	triggered	7	15
ten	0	10	limit	4	5	U	9	11
eleven	0	11	local	4	6	upper	8	1
twelve	0	12	lower	4	7	V	9	12
thirteen	0	13	M	9	3	version	8	2
fourteen	0	14	main	4	8	volts	8	3
fifteen	0	15	malfunction	2	1	W	9	13
A	8	7	manual	4	9	water	1	13
action	1	0	memory	4	10	watts	8	4
address	1	1	milliamps	4	14	Woofer	8	5
advanced	1	2	millivolts	4	15	X	9	14
alarm	1	3	milliwatts	5	0	Y	9	15
AM	1	4	minutes	5	1	year	8	6
amperes	1	5	Moe	5	3	Z	10	0
audio	1	7	month	5	5	25 ms voice pause	10	5
auto	1	6	N	9	4	50 ms voice pause	10	6
auxiliary	1	11	network	5	4	100 ms voice pause	10	7
B	8	8	night	5	7	200 ms voice pause	10	8
basic	1	8	normal	5	8	500 ms voice pause	10	9
Billy Bob	1	9	number	5	9	,	10	14
Bozo	1	10	nyuk nyuk nyuk	2	9	;	10	2
C	8	9	O	9	5	:	10	3
channel	1	12	off	5	10	/	10	1
code	1	15	OK	5	11	=	10	13
command	2	0	on	5	12	CR	10	11
control	2	3	Oscar	5	14	CR&LF	10	10
Curly	2	4	P	9	6	&	10	4
D	8	10	percent	5	15	+++	10	12
day	2	5	percent power	6	0	DTMF 0	10	15
degrees	2	7	point	6	1	DTMF 1	11	0
digit	2	8	pound	6	3	DTMF 2	11	1
E	8	11	power	6	5	DTMF 3	11	2
enter	2	10	programming	6	7	DTMF 4	11	3
error	2	11	push	6	8	DTMF 5	11	4
exit	2	13	Q	9	7	DTMF 6	11	5
F	8	12	R	9	8	DTMF 7	11	6
failure	2	14	ratio	6	10	DTMF 8	11	7
fire	3	0	reflected	1	14	DTMF 9	11	8
FM	3	1	reprogram	6	11	3.95 second voice pause	11	9
G	8	13	ring	6	12			
Gary	3	3	S	9	9			
Gonzo	3	4	scan	6	14			
goodbye	3	5	security	6	15			
H	8	14	sequence	7	1			
Hal	3	7	site	7	2			
hello	3	8	software	7	3			
here	3	9	Spanky	7	4			
hours	3	11	speaking	7	5			