Remote Facilities Controller

Model RFC-1/B

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Relay Panel

Model RP-8

– INSTALLATION AND OPERATION –

Remote Facilities Controller firmware version 6.00

Sine Systems, inc

www.sinesystems.com

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Section 1 — Safety Information and FCC Compliance

1.1 Safety Information

Only qualified technical personnel should attempt to install the RFC-1 system. 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. Ensure that safety precautions are 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.

The RFC-1 Remote Facilities Controller should be serviced 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.

All cables should be disconnected when servicing the RFC-1 system. Extreme caution should be used when opening the RFC-1 chassis. High voltages may be present on telephone lines. Although the RFC-1 has a 12-volt AC power transformer, failure of the transformer could cause dangerous and potentially lethal voltages to become present.

Depending on the installation, the control circuits of the RP-8 Relay Panel may be connected to sources of up to 120 volts AC and/or several amperes of current. Under certain conditions, these voltage sources can be lethal. Always use caution when working around these circuits. Disconnect all high voltage and high current sources before servicing the RFC-1 system.

Exercise caution when working near the connectors on the RP-8. The removable connectors used on the RP-8 leave slightly exposed tips even when the connector is in place. The tips are not dangerous but they are pointed. Furthermore, the exposed metal provides a very small point where a short could occur. Be careful when using metal tools near any exposed wiring. Power should be removed form all devices when performing service.

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

The RFC-1, like 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.

1.2 FCC 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 number 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 (RJ-11C) 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 usually provides 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. 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 telephone lines. 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 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 only be performed by qualified technicians that 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 2 — New Features and System Changes

2.1 Version 6.00

General Feature Updates

The RFC-1 can reset all user programmable settings to their factory default values. A special advanced programming code has been added to the system that performs this operation.

The system can be manually forced to both data and voice mode with the command 84. Previously it was possible to force data mode but the system can now be forced back to voice mode too.

The memory dump/print command has additional options. The legacy mode table-style memory dump is included for backward compatibility. A new annotated memory dump displays the data in logical groups by function and includes a description on each line of data. The memory restore dump formats the data so that it can be saved to a text file and used to reprogram the RFC-1 user memory.

Several user prompts have changed. The prompt to enter the main security code changes from “enter” to “enter security code.” When an incorrect security code is given, the system now says, “error, goodbye” before disconnecting. The alert that there is an incoming call when user is connected locally changes from “ring-ring” to “telephone, ring-ring”. The commands to read/reprogram telephone numbers and alarms now identify the item by letter “A, B, C, etc”.

Clock & Calenear Updates

The real time clock can optionally adjust automatically for Daylight Savings Time as observed in the United States using rules established in 2007. This feature is disabled by default to avoid issues in areas that do not observe the seasonal time change. The feature is enabled through a simple adjustment that is stored in non-volatile memory.

The RFC-1 calendar determines the day of the week when the date is set. This operation is automatic and occurs without user intervention.

The calendar recognizes all four digits for the year.

When appropriate hardware is available, the real time clock synchronizes to the incoming AC power and corrects the internal time base for better long-term accuracy. The feature works in areas using either 50 Hz or 60 Hz AC power and operation is completely transparent. It is enabled by default but can be overridden through user programming. The legacy clock adjustment procedure still exists for sites that are not powered from an AC main supply. *This feature requires hardware support available in systems that shipped after mid 2003.*

Systems that are able to perform the automatic clock sync described above also support an internal power failure alarm. The system is able to recognize the loss of AC power. This feature works in addition to the legacy power failure alarm that triggers when power is restored after a failure. The power failure alarm is disabled by default and is enabled with the command 82.

Telemetry System Updates

Telemetry channels that are programmed as status channels ("on/off", "normal/alarm", etc.) can be individually programmed to invert the status reading. Typical behavior is a reading of "off" when no voltage is present and "on" when voltage is present. The readings can be swapped so that no voltage reads "on" and voltage present reads "off". This eliminates the need for wiring an external inverter circuit.

There are a couple of changes to the telemetry channel status options. Option 0-4 changes from unused to "normal" (low) / "failure" (high). Option 0-15 changes from "normal / EAS" to "audio failure" (low) / "normal" (high).

Timed-Event Updates

Timed events can be programmed according to the day of the week. In addition to the previously available options, time triggers can be programmed to operate only on a specific day of the week, weekdays only or weekends only.

New date/time trigger options are available to repeat an event on specific intervals. The value 15 has always been used to match all values for month, date and hour. The hour can now be programmed with 15-1, 15-2, 15-3 or 15-4 to repeat an event every 1, 2, 3 or 4 hours. Similarly, minute settings can use 15-1 through 15-5 to repeat an event every 1 through 5 minutes. Programming of events that repeat on a regular cycle is greatly simplified.

Alarms can be enabled and disabled by commands in an action sequence. This means that timed events can now be used to enable and disable alarms using all of the date/time trigger options.

Telephone Related Updates

The DTMF tone dialing system is capable of generating the tones associated with the ✻ and # keys. These tones are required by some telephone systems. Previous versions of the RFC-1 could not generate these tones due to memory limits of the speech processor. Some of the names in the word table were eliminated to create space in memory for the additional DTMF tones.

The tone dialing system can use a dedicated DTMF tone generator if it is available in hardware. Early hardware versions use the speech processor to reproduce stored tones. A dedicated tone generator is faster and generates tones with more accuracy.

Multiple telephone numbers can be chained together to achieve dialing stings longer than the default twelve digits. Voice calls using tone dialing and data mode calls can utilize this feature. Pulse dialing is limited to 12 digits per telephone number.

The command 89 now reads and programs telephone number D.

Alarm System Updates

The telemetry alarm channel scanning intervals have changed. The factory default scan interval is still one channel per 10 seconds. Several new intervals have been added including a shorter 5-second interval as well as a very long 240-second interval.

Alarms can be blocked according to the day of the week. As with timed events, the RFC-1 can block an alarm on a specific day of the week, weekdays only or weekends only.

Alarms can be blocked for a specific month. This allows alarm blocking to “float” from month to month. This will help stations that operate at multiple power levels.

Action sequences with fixed programming are stored in the system. These action sequences perform common tasks without occupying any of the user programmable memory space. Pre-programmed action sequences are available to place telephone calls, print readings to a local printer or print readings to a remote printer. This frees action sequence 1 and eliminates some potential programming errors that cause the alarm system to not work as expected.

The user programmable action sequences are designated 1 through 8. The factory programmed action sequences are designated from 9 up.

The factory programming for all alarms is to trigger action sequence 9. If an alarm occurs and the action sequence that is triggered has no instructions, the system will substitute action sequence 9.

Action sequences can be chained together to achieve sequences longer than eight instructions.

Alarm calls can be made to text based pagers with a site ID number and can optionally include the number of the channel that triggered the alarm. In previous RFC-1 versions, the message was limited to a single digit repeated ID digit. This mode is completely DTMF tone driven however some paging systems may not support this feature.

Alarm calls can be made to text based pagers with complete text messages including the channel that triggered the alarm and the channel reading when the failure occurred. This feature requires the RFC-1 to have a data modem (MA-1/2 or RAK-1) and data support from the pager service provider. The data communication follows the automatic messaging mode specified in the TAP protocol that is supported by most paging terminals. Additional data protocols have been added to the RFC-1 to support standard and non-standard TAP implementations.

Section 3 — Installation

Only qualified technical personnel should attempt to install the RFC-1 system. 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. Ensure that safety precautions are 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
- Flat cable with two connectors, 3 ft long
- 12 VAC wall plug supply
- Modular telephone cable, 7 ft long
- Flat blade adjustment screwdriver
- 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. Perhaps more importantly, you should have some previous engineering experience in a broadcast transmitter environment. Having access to the building does not qualify you as an engineer. A transmitter can be extremely unforgiving to stupid mistakes. We cannot protect you from yourself.

We want to make this point very clear: *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 should be mounted in a standard 19-inch equipment rack. The system generates little heat. It can be mounted in nearly any convenient location. The RP-8 panels should be mounted at a location that 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.

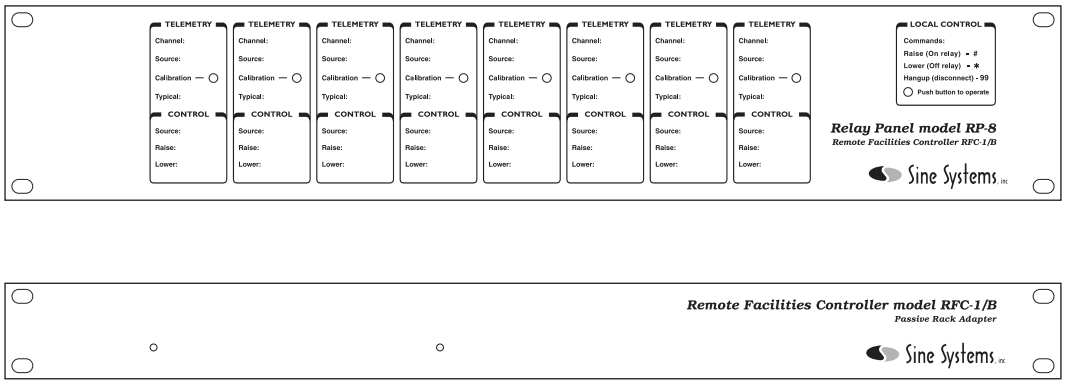


Figure 3.1; RFC-1 Remote Facilities Controller and RP-8 Relay Panel

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 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. The channel blocks are: 00-07, 08-15, 16-23, 24-31, 32-39, 40-47, 48-55 and 56-63. Normally, consecutive blocks of channels are used but this is not necessary.

Channel block assignment is made by moving a selection jumper located at the left end of each RP-8 panel. Simply move the jumper to the desired block position.

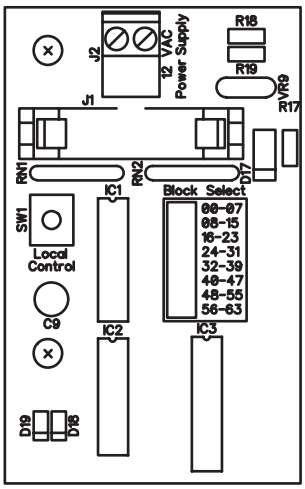


Figure 3.2; RP-8 Channel block select jumper

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.

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 acceptable but be sure to observe proper signal polarity.

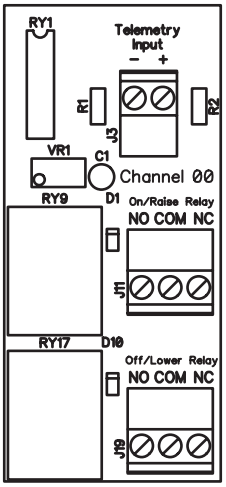


Figure 3.3; RP-8 Telemetry input connection point

Telemetry samples should conform to the following rules:

- For a full scale voltage reading a minimum of 1.0 volt DC is necessary
- Telemetry samples significantly over 5 volts DC should be dropped with an external attenuator
- Absolute maximum telemetry sample is 10 volts DC
- Telemetry samples can be offset from ground up to 30 volts DC
- Positive or negative DC voltages can be metered but not both on the same channel

More information on telemetry sources is provided 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.

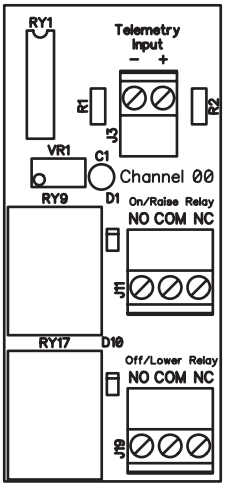


Figure 3.4; RP-8 Control output connection point

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. Remember, the channels read in the correct order from the back of the panel when wiring. *Channels read right to left as viewed from the front of the panel—the lowest channel number is on the far right.*

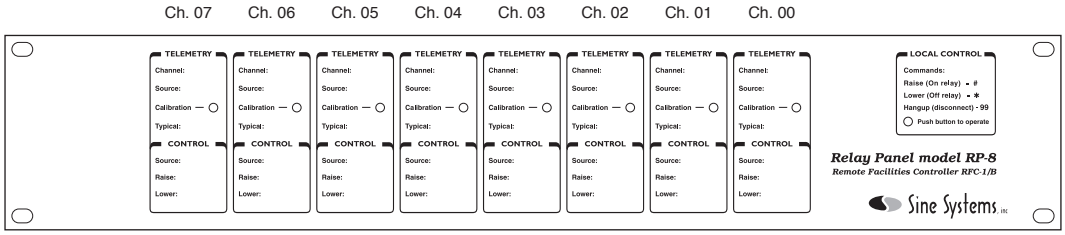


Figure 3.5; Order of RP-8 channels as viewed from front

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.

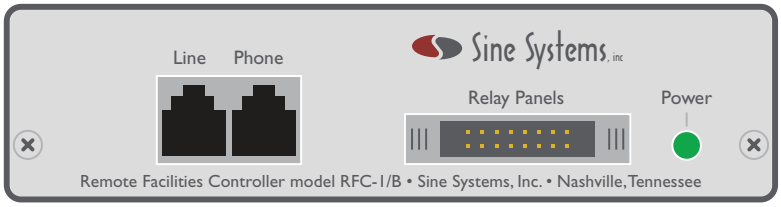


Figure 3.6; RFC-1/B rear panel I/O connectors

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.

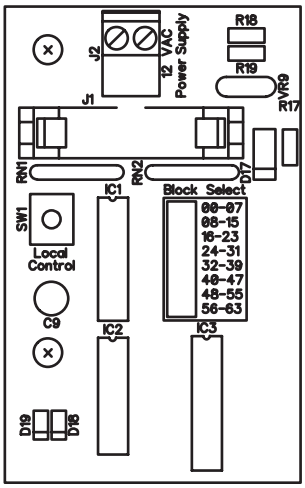


Figure 3.7; RP-8 Power and I/O connections

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 16 to 18 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

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 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 have steps instead of being smooth and continuous.

Telemetry samples over 5 volts may be used but calibration accuracy suffers on analog readings. Telemetry sample voltage is less critical for status on/off channels. Samples for status channels may be up to 10 volts DC. **Telemetry sample voltage should never exceed 16 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.

Telemetry samples that are significantly over 5 volts should be reduced with an external attenuator. One solution is to add a 2.2 KΩ shunt resistor across the telemetry input terminals and a series resistor in the telemetry sample. The series resistor should be about 2200 Ω per volt in excess of two volts. For example, to attenuate a telemetry voltage of 10 volts, use a 2.2 KΩ shunt resistor and an 18 KΩ 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 cable runs or lines from AM sampling loops may contain a very large amount of RF energy 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 makes sense for the telemetry and control on a channel to be related. If the relays on a channel are wired to control transmitter power, then the telemetry sample on that channel should indicate transmitter power too.

There is no internal hardware connection between the telemetry input and the control I/O. It is entirely possible for a single channel to control a function that is completely unrelated to the telemetry. System operation is not intuitive in such a case but the RFC-1 allows this.

Channel readings do not change just because a control function is given. A sample voltage is required to indicate any change of state. In other words, if you activate the control relay on a channel to turn on a device and there is no telemetry sample from that device to indicate that the device turned on, the channel reading will still be "status off".

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 2037 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".

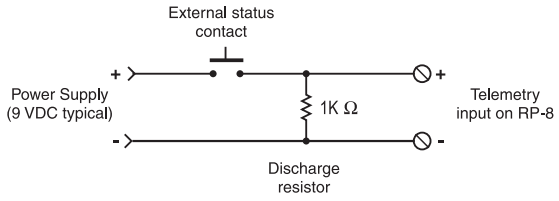


Figure 3.8; Typical wiring for a normally open status channel

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 1 KΩ 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 1 KΩ 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.

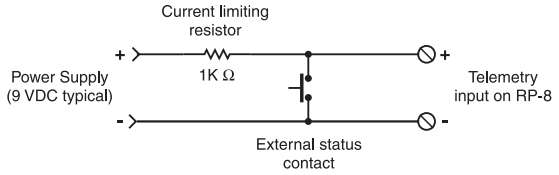


Figure 3.9; Typical wiring for a normally closed status channel

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 (approximately 1 KΩ) to the telemetry input. The 10 µF 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.*

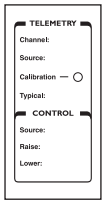


Figure 3.10; Telemetry calibration point

The calibration pots are 22-turn trimmer resistors that allow precise adjustment. The pots have a clutch at each extreme to protect the internal mechanism from traveling 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

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 should 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 phone manufacturers offer docking-station devices that equip an off-the-shelf cellular telephone with a standard RJ-11 jack. There are also stand-alone devices that combine the radio and emulation hardware in one device. Both types of devices emulate a standard telephone line including dial tone, ring voltage and battery.

Most devices of this type operate better in a typical transmitter environment with an external antenna and a constant power supply. Some manufacturers offer these items as part of their product line. There are also many aftermarket devices that may be useful. The best approach is to discuss your needs with your supplier to find a solution that meets the needs of the specific site.

Most devices that emulate a telephone line generate a functional but non-standard ring signal on incoming calls. The RFC-1 has a firmware adjustment to help it 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 phone designed specifically for fixed locations. These devices combine the wireless radio and line emulation hardware into one device.

Fixed location devices tend to cost more than docking stations but they are typically more flexible and more robust then their low-cost counterparts. For instance, most fixed-location devices easily support an external antenna.

3.5.3 Radiotelephones and Wireless Extenders

This class of device uses a full duplex radio circuit to extend a POTS telephone line over a radio link. Two small transceivers are used. One is connected to the telephone line and the remote device emulates the telephone line.

Radiotelephones have a range of roughly 1 to 20 miles depending on terrain. Typically these systems must be licensed. Channels are usually available in the areas where radiotelephones are most often needed.

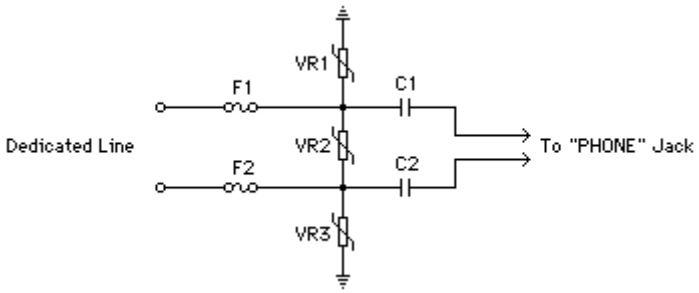
Radiotelephone systems can be expensive initially but there is no recurring cost for service once the system installed.

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.

The Dedicated Control Port is a two-way audio port with 12 volts DC battery to power 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 circuit can be used when connecting a leased line to the Dedicated Control Port.



Part	Description
F1-F4	¼ amp fast blow fuses
VR1-VR3	150 volt metal-oxide varistors
C1-C2	2 µF, 200 volt film capacitors

Figure 3.11; Interface for leased line to Dedicated Control Port

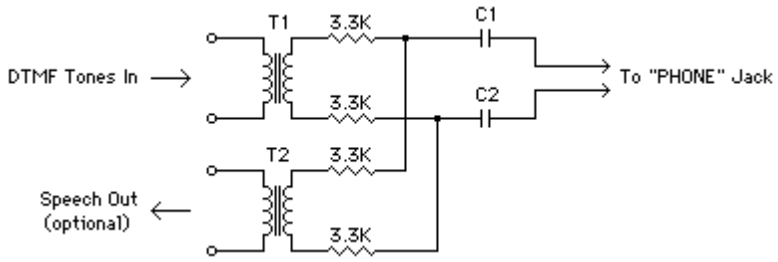
The line to the Dedicated Control Port can be any length from a few feet to thousands of feet depending on the application and tolerable series resistance. C1 and C2 are used to block the 12 volt DC source. If the dedicated line is connected to a telephone set and the DC voltage source is desired to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



Part	Description
T1-T2	600 Ω - 600 Ω audio transformers
R1-R4	3.3 KΩ resistors
C1-C2	2 µF, 200 volt film capacitors

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

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 sub-channel, 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 3.3 KΩ if two transformers are used, or less than 1.5K Ω 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 uninterruptible 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. Low end UPS's are not "instant switching" but the filter capacitor in the RFC-1 should store enough energy to cover the switching time.

3.6.3 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 (approximately 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 that 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. Instead, 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.

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 normally 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. 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 to extend the capabilities of the basic system. Photographs and other literature are available from our web site http://www.sinesystems.com.

4.1.1 RP-8 Relay Panel

Every RFC-1 installation must have at least one relay panel. Installations that require more than eight channels of telemetry and/or control can add extra relay panels. Each additional RP-8 will add eight telemetry inputs and eight raise/lower control relay pairs. A single RFC-1 can operate up to eight RP-8 Relay Panels for a maximum of 64 channels of telemetry and control.

Additional relay panels install on the existing flat cable with a press on connector that is included with the RP-8. A block select jumper sets the channel numbers for the new relay panel. Each RP-8 requires two rack spaces.

4.1.2 SIP-8 Status Input Panel

Similar to an RP-8 and not to be confused with the surge protector that has a similar model number, the SIP-8 offers eight status-only inputs. Unlike the inputs of the RP-8 that require an external voltage source, the SIP-8 inputs are activated by a switch or relay closure from an external device. It has no control relays.

The Status Input Panel connects to the existing flat cable like an RP-8 and has a block select jumper to set the channel numbers. It requires a single rack space. This is an ideal solution for sites that have several devices that need to be monitored in a status configuration.

4.1.2 SP-8 Surge Protector

For maximum reliability we recommend using the SP-8 Surge Protector. The SP-8 mounts on the RP-8 and protects the telemetry inputs against voltage surges. The SP-8 also includes telephone line surge suppression that provides significant protection for the RFC-1 against telephone line surges. The SP-8 utilizes a combination of ground plane construction, gas arrestors, metal oxide varistors, and resistors.

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

4.1.4 MA-2 Modem Adapter

The Modem Adapter model MA-2 provides a means for the RFC-1 to communicate with a remote computer to log readings remotely. Voice/DTMF capability is not lost when the MA-2 is installed. The MA-2 consists of a small accessory board that attaches to the RFC-1 and new chassis parts to house the expanded system.

4.1.5 PA-2 Printer Adapter

The Printer Adapter model PA-2 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-2 is installed. The PA-2 consists of a small accessory board that attaches to the RFC-1 and new chassis parts to house the expanded system.

4.1.6 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 can be used with a serial printer on site, or with an external modem or network translation device 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.

4.1.7 RAK-2 Intelligent Rack Adapter

The Intelligent Rack Adapter model RAK-2 gives the RFC-1 a network interface that provides a web interface, email/SMS messaging and network time syncing capabilities. The system includes front panel indicators, telephone line surge suppression and a universal 120/240 VAC supply. The RAK-2 is housed in a rack mountable chassis and requires a single rack space.

4.1.8 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 requiring AC current monitoring. The ACM-2 can monitor up to 70 amps of AC current and it provides a proportional DC voltage output. Filter circuits in the ACM-2 average the alternating current so that a steady reading is available even when 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.

4.1.9 AFS-3 Audio Failsafe

The AFS-3 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 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 30 seconds to 5.0 minutes in 30-second increments.

4.1.10 Thermal Sentry III

The Thermal Sentry provides an indication of operating efficiency by measuring the air temperature difference across the transmitter. This device uses 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 an alarm 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. Analog outputs for the intake, exhaust and differential temperatures are provided for monitoring by the RFC-1. A logic output for the alarm is also provided.

4.1.11 DCA-2 DC Voltage Amplifier

The DCA-2 Telemetry Amplifier increases the voltage of a telemetry sample when the voltage is too low to generate an accurate reading. The RFC-1/B will give a full scale reading with as little as one volt applied at the telemetry input. The vast majority of broadcast equipment can generate an adequate sample voltage without assistance. The DCA-2 is designed to assist devices that do not meet the minimum voltage requirement.

4.1.12 TS-1/PS Temperature Sensor with Power Supply

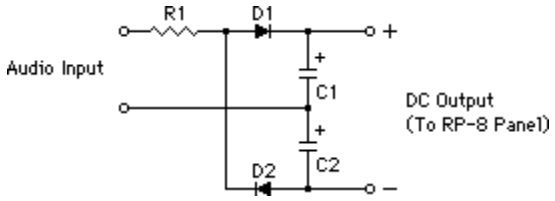
The TS-1/PS Temperature Sensor is a temperature sensor that measures air temperature from 5.0° F to 203.9° F. The DC output connects to a telemetry input the RP-8 and provides 0.1° resolution. Additional temperature sensors can share a single power supply and are available as part number TS-1.

4.2 Auxiliary Circuits

Accessories are available that give the RFC-1 extra capabilities. Some functions are simple to add with just a few extra parts.

4.2.1 Audio Detection

In some cases it is desirable to monitor the presence or loss of an audio signal with the RFC-1. This signal can be used to trigger an alarm in the RFC-1. The circuit shown below is a simple audio detector. It does not provide the features of AFS-3 Audio Failsafe but it can provide a basic audio status indication.



Part	Description
R1	470 Ω resistor
D1-D2	1N4001 general-purpose diodes
C1-C2	470 µF, 16-volt electrolytic capacitors

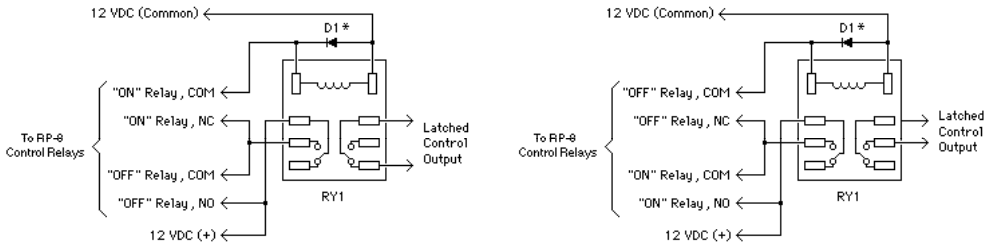
Figure 4.1; Simple audio detection circuit

The circuit simply rectifies the audio voltage and charges the capacitors. Any audio level of -6 dBv or greater will maintain at least 0.5 volts DC at the output. Most line level audio sources are sufficient.

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 trim pot. 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 control 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 mechanical or magnetically latched relay is probably a better solution.



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

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

4.2.2 Telemetry Pulse Stretching

It is sometimes necessary to monitor a device that generates a relatively short pulse to indicate a change of status. If the duration of the input signal is too short, the RFC-1/B may not have time to capture the pulse and respond appropriately.

These circuits use a readily available IC, the 74HC123A, to sense the input pulse and generate an output pulse that can last several seconds. If a second input pulse arrives before the first output pulse has completed, the output signal timer restarts.

Do not apply an input signal greater than 5 VDC to the 74HC123A or the IC will be damaged. Use a pot or an L-pad to reduce the input signal voltage.

Power Supply

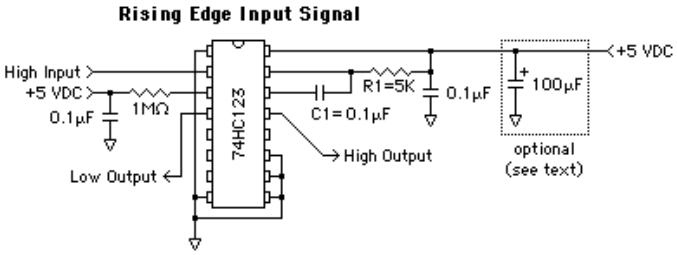
Any regulated 5 VDC power supply should work since the IC draws very little current. The optional 100µF capacitor should be added if a switching supply is used.

Timing Options

The duration of the output signal depends on the choice of resistor R1 and capacitor C1. The values in the schematic produce an output pulse of about 30 seconds.

- Use C1=0.1µF and R1=5K for an output pulse of about 30 seconds
- Use C1=0.1µF and R1=10K for an output pulse of about 1 minute
- Use C1=1.0µF and R1=10K for an output pulse of about 10 minutes

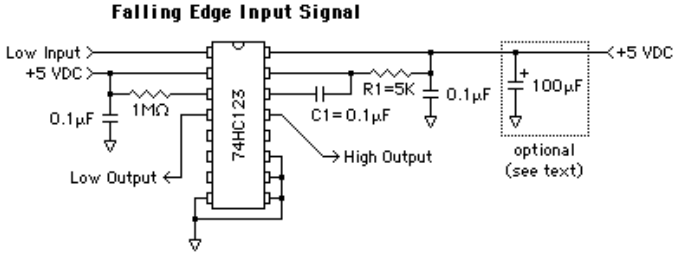
4.2.2.1 Rising Edge Detection Circuit



Part	Description
U1	74HC123AN retriggerable timer IC
C1-C2	0.1µF 50V monolithic ceramic capacitor*
R1	5K Ohm ¼ W carbon film resistor*
R2	1M Ohm ¼ W carbon film resistor
Power	5VDC regulated power supply

Figure 4.3; Circuit to detect and extend a rising edge pulse

4.2.2.2 Falling Edge Detection Circuit



Part	Description
U1	74HC123AN retriggerable timer IC
C1-C2	0.1µF 50V monolithic ceramic capacitor*
R1	5K Ohm ¼ W carbon film resistor*
R2	1M Ohm ¼ W carbon film resistor
Power	5VDC regulated power supply

Figure 4.4; Circuit to detect and extend a falling edge pulse

4.2.3 Battery Backup

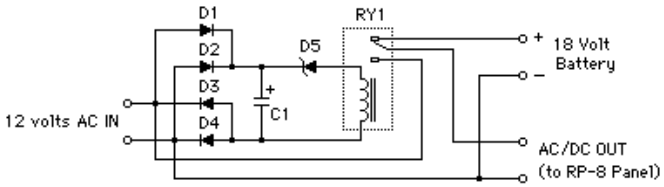
Do not under any conditions apply a DC voltage greater than 19.9 volts (19.9 VDC peak if significant ripple is present) to the RFC-1. Prolonged exposure will cause the protection circuitry in the RFC-1 to overheat and be damaged. This maximum voltage rating precludes the use of some rechargeable batteries.

The user settings in the RFC-1 are stored in non-volatile memory. No user settings are lost when the RFC-1 loses power. The time and date are the only operational data that are lost as a result of a power failure.

The RFC-1 can be operated on a small uninterruptible power supply. A small UPS designed for small-office, home-office use should power the RFC-1 for 30 minutes to several hours depending on the capacity of the UPS.

Alternately, the RFC-1 can be operated during power failures by an external 16 to 18 VDC power supply connected to the 12 VAC supply input. *The DC source must be "floating" (neither side connected to ground) to allow the telemetry section of the RFC-1 to work properly.*

Polarity of the voltage is unimportant since the input connector applies power to the bridge rectifier in the RFC-1. The following simple circuit provides battery backup for a few dollars plus the cost of batteries.



Part	Description
D1-D4	1N4005 general-purpose diode
D5	6.2 volt, 1 W zener diode
C1	47 µF, 16 volt or higher*
RY1	DPDT relay with 12 VDC coil

Figure 4.5; Battery backup switching circuit

The value of C1 should be just large enough to keep RY1 pulled-in during normal power conditions. If its value is too large, the switchover will take too long and the RFC-1 will reset. A good starting value for C1 is 47 µF.

The 18-volt battery can be as simple as three 6-volt heavy-duty lantern batteries wired in series. This type of battery will power the RFC-1 for several hours. The batteries should be changed at intervals of 12 to 18 months even if they are seldom used due to their limited shelf life.

Section 5 — Basic Operation

5.1 Overview

The primary function of the RFC-1 is to monitor and control outboard devices. To perform these functions, a user connects to the RFC-1 with a telephone. The telephone can be directly connected or through a telephone line. The user issues two-digit commands with the telephone keypad. The RFC-1 responds with a synthesized voice.

The RFC-1 is controlled with the tones generated by a typical telephone keypad. Rotary phones do not work.

RFC-1 installations can be simple or as complex as is reasonably necessary depending on the site requirements. The system is capable of answering calls, taking basic telemetry readings and performing manual control activity immediately on installation. Even non-technical users can take readings and perform basic control operations. With a few adjustments, basic monitoring activities with telephone alarms can be enabled.

The RFC-1 can also serve more demanding installations requiring automatic power and/or pattern changes. With appropriate hardware accessories, the system can perform sophisticated monitoring activities with optional data communications. These more advanced features are described in Section 6 of this document.

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”. Users control the RFC-1 by entering commands with the keypad of the local phone. The command codes are described later in this document.

5.2.1 Connecting to the RFC-1

Operation from the local phone is initiated by pushing the button labeled "Local Control" on the RP-8 relay panel. When the button is pressed, the RFC-1 activates the local phone and speaks the identification phrase "This is RFC-1/B". No security code is needed to access the system from the local phone. The system activates immediately and awaits commands. This state of operation is referred to as the “operating mode”.

As a security precaution, the RFC-1 will not remain active indefinitely. After 2.5 minutes of inactivity the RFC-1 will release the local phone. Press the local control button to re-activate the RFC-1.

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 zero 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. A channel remains selected until any of the following occur:

- Another channel is selected
- A programming command is entered
- The user hangs up and/or the system disconnects

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

5.2.3 Reading Telemetry Channels

Taking a telemetry reading is as simple as selecting a channel. The RFC-1 responds with the current telemetry value as soon as the channel is selected. For example, enter 03 on the keypad to take a reading on channel 3. The RFC-1 responds “Channel 03” followed by a four-digit reading or, depending on the calibration, it may give a status reading.

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 the full scale

To simplify telemetry logging, the RFC-1 can scan the channels and report the telemetry values with a single command. This is an “auto-scan”. Enter the command 64 to perform an auto-scan. The RFC-1 responds with "auto-scan" and then reads the telemetry values for channel 00 through 07. Interrupt the scan by entering any command.

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.

- Press the # key to operate the on/raise relay
- Press the ✻ key to operate the off/lower relay

To activate a control relay, select a channel then press either of the control keys # or ✻. If the control security code has not been entered, the RFC-1 will request it.

The control relays will operate as long as a control key is pressed, or for a minimum of about one-half 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 disconnect.

5.2.5 Issuing Other Commands

The RFC-1 recognizes commands besides those required for selecting and controlling the channels. The command set is discussed in this section and in the next. All commands are two digits long and generate a spoken response. It is not necessary to wait for the RFC-1 to finish speaking before issuing another command.

5.2.6 Disconnecting from the RFC-1

To complete a session with the RFC-1, enter the command 99 and hang up the local phone. The RFC-1 will say “goodbye” when it receives the hang-up command. If the hang-up command is not issued, the RFC-1 will disconnect automatically after 2.5 minutes of inactivity.

5.3 Operation from a Remote Telephone

Operating the RFC-1 from a remote telephone is very much like operating it from the local phone. The primary difference is that the connection is made from a remote location through a telephone line. A user dials the telephone number at the site where the RFC-1 is installed. The RFC-1 answers and requests a security code. When the correct code is given, the RFC-1 allows user access. After that, operation is the same from local or remote phones.

5.3.1 Connecting to the RFC-1

The RFC-1 should be connected to a telephone line when it is installed. The first step in connecting to the RFC-1 from a remote location is to call the telephone number. The RFC-1 will answer after two rings and say, “enter security code”. After the user enters the correct main security code, the RFC-1 identifies itself with the phrase, “this is RFC-1/B”, and awaits further commands.

The factory setting for the main security code is 12345678. The user has a 10 second window in which to enter this code. If the correct code is not entered, the RFC-1 says, “error, goodbye” and disconnects from the line.

For security reasons the RFC-1 does not identify itself until the security code is entered. If someone dials the number by accident, the RFC-1 has not given any useful information.

The RFC-1 can have only one connection active at a time. If an engineer is operating the RFC-1 locally and another user calls the system, the RFC-1 will alert the local user of the incoming call by saying, “telephone ring-ring”. The local call will not be interrupted. The incoming call is ignored and the remote user must call back.

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 almost exactly the same when operated from a remote telephone as it does from the local phone. There are only a few differences:

- Remote connections require a security code before access is granted to the system
- A remote call in progress will be disconnected if the local control button is pressed
- Security code programming commands are not allowed from a remote phone
- The basic programming security code is only required from a remote connection

Most system adjustments require a security code to be entered before changes are allowed. Since direct access to the RFC-1 is typically restricted, the security code is not requested when changes are made from the local phone.

5.3.3 Disconnecting from the RFC-1

To complete a session with the RFC-1, enter the command 99 and hang up the local phone. The RFC-1 will say “goodbye” when it receives the hang-up command. If the hang-up command is not issued on a remote call, the RFC-1 will usually disconnect instantly. If it does not, it will disconnect automatically after 2.5 minutes of inactivity.

A session can also be terminated with the command 98 instead of 99. When the command 98 is issued, the RFC-1 disconnects as it does with 99 and it ignores incoming calls for 90 second. This can be useful if the RFC-1 shares the telephone line with other devices.

5.4 Alarm System

The RFC-1 can monitor up to eight channels for abnormal telemetry conditions. If an out-of-tolerance condition is detected, the system will call up to four telephone numbers to notify an operator of the condition. In basic operation, the RFC-1 calls an operator but it does not attempt to correct the situation without user intervention.

5.4.1 How the Alarm System Works

After the alarm channels have been setup, the RFC-1 compares the current telemetry reading on the channel against the alarm limits. As long as all systems are operating normally, the telemetry readings should stay within limits. If the reading is outside of the programmed limits, the channel is technically in an alarm state. However, if the comparison stopped there, it would be impossible to shut down a transmitter on purpose without generating an alarm.

To avoid that problem, the RFC-1 makes a reference scan at the end of every call, both local and remote. The idea is that at the end of a call the systems are in a known state and the resulting telemetry conditions are acceptable. The conditions at that time determine what alarms are armed. If an alarm channel is out of tolerance during the reference scan, the alarm does not arm on that channel. *The telemetry reading must be within the alarm limits at the end of a call for the alarm on that channel to arm.*

All alarms are disabled temporarily when the RFC-1 is online with an operator. Using the RFC-1 to adjust a device out of limits does not generate an alarm. Likewise, no alarm occurs if a device goes out of limits by itself while a user is connected.

When an alarm condition is detected, the RFC-1 begins making telephone calls to alert personnel of the condition. It calls each number and says, “This is RFC-1/B. Telemetry alarm. Channel number,” followed by the number of the channel that caused the alarm. Then it gives the channel reading at the time of the alarm. Earlier versions of the RFC-1 gave a less detailed alarm message providing only the site ID and the number of the channel that failed.

Pressing any key interrupts the alarm message and clears the alarm. No more calls will be made for that alarm. When a user has cleared an alarm, minimal access to the system is granted. Telemetry channels may be polled to determine current system conditions. The system is still secure because control access has not been granted. If a control function is activated, the control security code will be requested. The RFC-1 disconnects if the user does not enter the correct security code.

The alarm call lasts for one minute if a user does not press a key to clear the alarm. The RFC-1 waits one minute before placing the next call. This provides an opportunity for personnel to contact the RFC-1 and correct the situation. If a user does not clear the alarm, the call sequence terminates after three call attempts to each number.

If a user clears the alarm, new reference readings are taken when the call ends. The user must adjust the offending channel back into limits to re-arm the alarm on that channel. If the dialing sequence goes to completion without user intervention, new reference readings are taken at the end of the sequence. This stops the RFC-1 from dialing indefinitely for a single alarm.

5.4.2 Alarm System Setup

Three items must be programmed to use the alarm system in the RFC-1.

1. The channel numbers of the telemetry channels to monitor and appropriate upper and lower limits
2. Telephone numbers to call when the alarm sequence triggers—up the four telephone numbers
3. The telemetry alarm system must be enabled using the command 82

5.4.3 Programming Alarm Limits

The eight alarm channels are designated as A through H. One telemetry channel can be assigned to each alarm. It is not necessary to use all the alarms nor is it necessary to program them in 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.

Using the commands 90 through 97, the RFC-1 will prompt through setting up each alarm. Enter the command 90 to setup alarm A, 91 for alarm B, and so on. The programming procedure goes like this:

1. Enter the command 90-97 depending on the alarm to program: `9x`
2. The RFC-1 reads the current settings for the alarm: channel number, upper limit and lower limit
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

The factory settings for all alarms are channel 64 with an upper limit of 2040 and a lower limit of 1020. Channel number 64 indicates an unused alarm. Channel 64 does not exist. Programming an alarm to channel 64 disables the alarm. The upper and lower limits do not matter if the channel number is 64.

5.4.4 Programming Telephone Numbers

The telephone numbers are designated as A through D. Each telephone number can contain up to twelve digits. It is not necessary to use all of the telephone numbers. It is also not necessary to use all the digits in a telephone number. Enter the ✻ key for unused digits at the end of the telephone number. The RFC-1 reads the blank digits as the value 10—this is normal.

Using the commands 86 through 89, the RFC-1 will prompt through programming each telephone number. Enter the command 86 to program telephone number A, 87 for telephone number B, and so on. Use the telephone numbers in order A through D.

1. Enter the command 86-89 depending on the telephone number to program: `8x`
2. The RFC-1 reads the current telephone number, all 10s if the number is blank
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 E and F are only available through advanced programming.

5.4.5 Enabling / Disabling the Telemetry Alarm System

The master setting for the telemetry alarm system enables or disables all telemetry alarms with a single command. The command to change this setting is 82. Set the value to 0 to disable the alarm system or 1 to enable the telemetry alarms. The telemetry alarm system is disabled when the RFC-1 ships from the factory.

1. Enter the command for the telemetry alarm system: `82`
2. The RFC-1 reads 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 of an AC power failure at the remote site. In most cases, this alarm triggers when AC power returns. The RFC-1 uses the same dialing procedure as it does for telemetry alarms as described in section 5.4.1 but the message delivered is "This is RFC-1/B. Power failure." An operator clears this alarm just like any other alarm.

The command to enable or disable the power failure alarm is 82. Set the value to 0 to disable the power failure alarm system or 1 to enable it. The power failure alarm is disabled when the RFC-1 ships from the factory.

1. Enter the command for the power failure alarm: `81`
2. The RFC-1 reads 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

At least one telephone number must be programmed for the power failure alarm to be effective. The procedure for storing telephone numbers is described in section 5.4.4.

More recent hardware versions of the RFC-1 have the ability to detect the loss of AC power. When the power failure alarm is enabled in a system with this capability, the system will trigger an alarm when loss of AC power is detected. This allows the system to generate an alarm while operating from a DC supply, such as a backup battery.

When the RFC-1 places telephone calls as a result of the power failure alarm it delivers a message including the site identification phrase and the alarm message "AC power failure."

The internal power failure alarms are ineffective when a UPS is used because the RFC-1 does not lose power. To detect loss of AC power at the site, connect 3-6 volt, unregulated DC wall-plug transformer to an unused telemetry channel. Calibrate and program the channel to read 120 volts. The system is now able to monitor AC line power.

Program a telemetry alarm on this channel to have the system contact station personnel when power fails.

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, an alarm will be triggered.

If multiple alarms trigger at once, for instance if a site loses AC power and everything shuts down at once, only one alarm triggers. Which alarm triggers is determined by where the RFC-1 is in the scanning sequence when the failure occurs. The system relies on the operator to poll the system and determine the nature and degree of failure.

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. In the worst case, it can take up to 80 seconds before an alarm is recognized. In reality, alarms are nearly always recognized much quicker than that. If not all alarms are used, the worst-case scenario is less than 80 seconds. The worst case is the number of alarms used multiplied by 10 seconds.

The system stops scanning when alarm triggers. It is possible for the telemetry channel that caused an alarm to return to normal before an operator is reached. The system does not automatically terminate the alarm.

If there is not a generator and a UPS is not used, when AC power fails at a site, both the RFC-1 and the transmitter lose power. When power returns, the RFC-1 makes a new reference scan. If the transmitter does not power up automatically, the reference scan will show that the power off condition is normal and no alarm will trigger. Use the power failure alarm to avoid this situation.

Instruct all personnel who will receive alarm calls from the RFC-1 about the various alarms and associated channel numbers. They need this information so that they can respond appropriately to the alarms.

5.5 Clock and Calendar

Setting the clock and calendar allows the RFC-1 to report the time and date when an alarm occurs. The clock and calendar are also used to trigger events automatically by the date and time. This is a more advanced topic that is discussed in the next section of this manual.

5.5.1 Setting the Calendar

Set the calendar in the RFC-1 by entering the command 70. Use leading zeros for values less than 10.

1. Enter the command to set the calendar: `70`
2. The RFC-1 will read the current settings from memory.
3. At the prompt, press the # key to set the date: *#*
4. At the prompt, enter a two-digit month: *n*
5. At the prompt, enter a two-digit date: *n*
6. At the prompt, enter a four-digit year: *n*
7. The RFC-1 responds with “OK”, the procedure is complete

5.5.2 Setting the Clock

Set the clock in the RFC-1 by entering the command 71. 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.

1. Enter the command to set the clock: `71`
2. The RFC-1 will read the current settings from memory.
3. At the prompt, press the # key to set the date: *#*
4. At the prompt, enter a two-digit hour: *n*
5. At the prompt, enter a two-digit minute: *n*
6. The RFC-1 responds with “OK”, the procedure is complete

5.6 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 phone.

5.6.1 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 the ability to change system options.

The commands to read and program the security codes are shown below. For security reasons, these commands only work from the local phone.

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

The procedure to program all security codes is basically the same.

1. Enter the command, 72, 73 or 74, for the security code to program: `7x`
2. The RFC-1 will read the current setting for that security code
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 eight digits long, the control security code and the basic programming security code can each be up to four digits. Use the ✻ key to fill in unused spaces at the end of the code. A security code can be disabled by programming all of the code digits with ✻.

5.6.2 Ring Number

In the factory setting, the RFC-1 answers the phone after the second ring. The number of rings is programmable.

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 with another device by adjusting the ring number to an appropriate value.

5.7 Operating Commands / Programming Notes

It may be helpful 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 some common system settings.

Command	Function	Factory Setting	Current Setting
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	Auto-scan channels	n/a	n/a
66	Enable control functions	66	n/a
70	Set calendar	00/00/0000	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	_____
76	Ring Number	2	____
78	Firmware Version	6.xx	n/a
81	Power Failure Alarm Status	0	____
82	Telemetry Alarm Status	0	____
86	Telephone Number A	**********	_____
87	Telephone Number B	**********	_____
88	Telephone Number C	**********	_____
89	Telephone Number D	**********	_____
90	Alarm A	64 / 2040 / 1020	____ / _____ / _____
91	Alarm B	64 / 2040 / 1020	____ / _____ / _____
92	Alarm C	64 / 2040 / 1020	____ / _____ / _____
93	Alarm D	64 / 2040 / 1020	____ / _____ / _____
94	Alarm E	64 / 2040 / 1020	____ / _____ / _____
95	Alarm F	64 / 2040 / 1020	____ / _____ / _____
96	Alarm G	64 / 2040 / 1020	____ / _____ / _____
97	Alarm H	64 / 2040 / 1020	____ / _____ / _____
98	Hang-up and ignore	n/a	n/a
99	Hang-up	n/a	n/a

Section 6 — Advanced Operation

This section is for qualified technical personnel. It contains information to alter most operating characteristics of the RFC-1 system. Improper use of this information can cause unexpected or undesirable behavior. We strongly recommend having a full understanding of the basic operation of the RFC-1 and the specifics of the installation before applying this information.

Information in this document is based on the original factory programming. Some data presented may not match the system being programmed if adjustments have already been made.

Effective RFC-1 programming requires attention to detail. The system follows instructions based on the rules and parameters that you provide. If that data is not correct then the system does not behave as expected.

Functional knowledge of the specific installation is required to make use of the information presented here. In addition, some degree of comfort working with the RFC-1 is presumed in the documentation that follows.

6.1 Introduction

Section 5 of this document provides enough information to get a basic RFC-1 system running. Using only the data in that section it is possible to set up a functional remote control. The programming tasks documented in Section 5 are limited to items that are easy to adjust through command prompts.

Section 6 addresses tasks that require more involved programming. Some of the tasks are commonly used such as changing the site identification phrase or adjusting the scale, decimal and unit word on telemetry channels. Other tasks are used by more demanding installations such as sites that require automatic power and pattern changes. These sites can also be served by a properly configured RFC-1.

Programming instructions for several of the more commonly used features are available from our web site, http://www.sinesystems.com. Navigate to the tech support section for the RFC-1 and follow the link to the page that discusses the specific feature of interest. When given the appropriate input these pages generate step-by-step programming instructions for setting up the selected feature.

There is a considerable amount of information to discuss in this section due to the flexibility of the RFC-1. The majority of the adjustments are made in the Advanced Programming Mode. In this mode the RFC-1 allows access to memory that controls nearly every aspect of its operation. A little effort is required initially to master the programming mode but the power and flexibility revealed are well worth the effort.

6.2 Advanced Programming

The full potential of the RFC-1 can only be utilized through use of the Advanced Programming Mode—also referred to simply as programming mode. Programming mode allows access to all of the features and functions of the RFC-1.

This section starts with instructions for using programming mode—how programming mode works. The rest of the section describes specific features and provides the data needed to make use of the various features.

The documentation for each feature starts with a description of the function performed and available options. In most cases one or more data tables are presented. The tables assign numeric codes to each available option. These numeric codes are used to instruct the RFC-1 how it should perform various tasks. Codes are written to specific areas of memory to enable and disable features and modify system behavior. Each memory location has a designated address. Programming mode is the means through which the codes are written to memory addresses.

This is where many users start to panic. Relax and take a deep breath. This is not as difficult as it may sound.

6.2.1 Programming Address Table

In the appendix of this document there is a list of all memory addresses with descriptions of what feature is controlled at each address—the Programming Address Table. This list is the key to programming mode in the RFC-1. It translates the memory address numbers that the RFC-1 uses into a descriptive map.

The sample below shows the first four memory addresses from the table, 0000 through 0003. The descriptions indicate that these address control the behavior of telemetry channel 00—setting the unit word, decimal and scale.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0000	Channel 00: telemetry units or status format - value 1	6.3.2	0	____	Date/time 80: action sequence
0001	Channel 00: telemetry units or status format - value 2	6.3.2	3	____	Date/time 80: month
0002	Channel 00: full scale and decimal point	6.3.4	2	____	Date/time 80: date - value 1
0003	Channel 00: linear/log/indirect/invert and auto relay	6.3.5	0	____	Date/time 80: date - value 2

Memory is broken down into logical blocks. Similar items are grouped together so that they are easier to locate both by users and the RFC-1. In most cases more than one address must be programmed to achieve a result. In this example, four addresses are needed to adjust all the options available on the telemetry channel.

There are 1024 unique addresses. For programming purposes they are numbered from 0000 to 1023. Do not be alarmed by the seemingly large number of addresses. They are grouped into a relatively small number of features. The shaded areas in Figure 6.1 show how the memory map is broken down by feature. Most of the map is devoted to telemetry channel settings and date/time functions. These are features that will be discussed shortly.

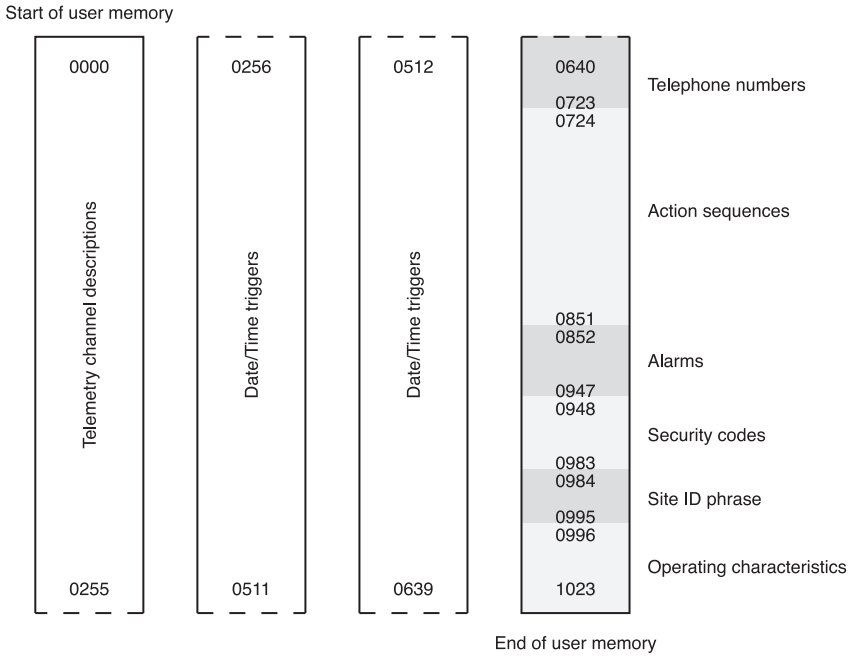


Figure 6.1; RFC-1 user memory map

Documentation in this section and the Programming Address Table must be used together. The address table has a column titled *Programming Section* that gives the section number that holds the data table(s) for each address. Additionally, each feature description gives the address or range of addresses at which that feature is programmed.

6.2.2 Using the Programming Mode

The programming method is the same for setting up any feature using programming mode. Different address and data tables are used for each feature but every address is programmed the same way.

Programming mode temporarily suspends normal system activity—telemetry channels are not selected and control relays do not activate. This frees 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

This is how programming mode works:

1. Enter 80 on the keypad to activate the programming mode.
2. The RFC-1 responds with "enter advanced programming security code".
3. Enter the correct code and the RFC-1 will prompt: "enter four digit address".
4. Enter the address for the item being changed.
5. 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 *n*# to write the value *n* at the current memory location where *n* is a value from 0 to 15
- Push 80 to jump to a different memory address
- Push ✻ to exit the programming mode

Any time the # key is pressed in this mode, the RFC-1 reads or writes the data at the current address *and increments to the next address*. It works like the Enter key does when using a word processor. Pressing the Enter key accepts the current line and increments to the next line.

Because the address increments automatically, it is not necessary to enter a new address for each data item when reading or writing a series of addresses. Enter 80 and a new address when jumping forward or backward.

This behavior of the # key leads to the following common mistake. Suppose that an address is entered and the # key is pressed to read the data. The RFC-1 reads the data and increments the address. The user decides that it should be changed. *At this point the user must press 80 and enter the original address again in order to overwrite the data.*

The address has already incremented as a result of reading the data. If the user simply enters the new data and presses the # key, the new data is written at the address *following* the original address and not the original address.

6.2.3 Restore Factory Settings

In programming mode there is a special extension command that will reset the RFC-1 back to the factory default settings. This command will restore all programmable items to the factory settings including security codes, alarm values, date and time functions, channel settings, telephone numbers, site ID phrase, etc.

To restore the factory settings in the RFC-1:

6. Enter programming mode: 80
7. At the prompt, enter the advanced programming security code: 4150
8. At the prompt for a memory address, enter the restore command: 5623
9. To RFC-1 will ask you to confirm the operation by pressing the pound key: #
10. The RFC-1 will say “OK” when the process is complete—it will take several seconds.

Do not press the # key unless you are certain that you want to restore all user programmable options. The process is cannot be stopped or undone once the # key has been pressed.

6.3 Telemetry Channels

Incorrect use of the following information can cause unexpected or undesirable behavior. We strongly recommend that you understand the basic operation of the RFC-1 and the specifics of the installation before continuing. If you have not done so already, please read the documentation above that describes the Advanced Programming Mode before continuing.

Each telemetry channel in the RFC-1 can deliver a status indication or an analog reading with unit word and decimal point. Channels work either way in the factory setting with default scale. Instead of reading 0000 at the bottom of the scale, the RFC-1 says "status off". Instead of reading 2040 at the top of the scale, the RFC-1 says "status on". Readings in between are delivered as a 4-digit number with no unit word or decimal point.

To use a channel as a status indicator with the factory settings, apply the voltage and adjust the telemetry calibration pot until the "status on" reading is delivered. The "status off" reading will be delivered when the voltage is removed.

In cases where the factory settings are not appropriate, any channel can be programmed as a dedicated status channel or as a purely analog channel. Other status word combinations are also available with this adjustment.

6.3.1 Telemetry Channel Programming

The behavior of a telemetry channel is controlled by four parameters stored in the RFC-1. Each channel is assigned its own four addresses where these parameters are stored.

- The first two addresses identify the unit word for analog channels or the word pair for status channels.
- The third address sets the scale (maximum reading) and the decimal point location.
- The fourth address sets the type of scale (linear/logarithmic) and controls other options

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.

Telemetry readings are identified by the channel number. Descriptive names cannot be assigned to a channel.

6.3.2 Unit Words

A unit word is a descriptive word that the RFC-1 says *after* the telemetry reading for a channel. The available words: kilovolts, amperes, etc. are listed in the Word Table in the Appendix along with a two-digit code identifying each word. Program the word codes into the first two channel addresses to assign a unit word to the channel.

For example, suppose you want to program Channel 00 with the unit word "kilovolts".

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 enter this value and increment to the next address in memory
9. Press the ✳ key to exit programming mode and return to operating mode

When a user selects channel 00, the RFC-1 will give the telemetry value followed by the unit word "kilovolts".

6.3.3 Status Reading

Status channels are programmed like the unit words above but they are treated as a special case. The first 16 words in the Word Table (words 0-0 through 0-15) are numbers. Assigning a number as a unit word would be confusing. Instead, those values behave according to the table below.

Select a telemetry format or status option from one of the tables below and program the values from columns V1 and V2 in the first two channel addresses.

V1	V2	Telemetry Option / Status Format
0	0	Total silence—the channel is selected but nothing is reported
0	1	The channel is identified but the telemetry value is not reported
0	2	The channel is identified and the telemetry value is reported without unit word—auto status is disabled
0	3	The channel is identified and the telemetry value is reported without unit word—auto status is enabled

The factory setting is 0-3.

V1	V2	Speak on logic low	Speak on logic high
0	4	“normal”	“failure”
0	5	“status off”	“status on”
0	6	“off”	“on”
0	7	“main”	“auxiliary”
0	8	“status 1”	“status 2”
0	9	“night”	“day”
0	10	“normal”	“alarm”
0	11	“normal”	“intrusion”
0	12	“normal”	“fire”
0	13	“status A”	“status B”
0	14	“power failure”	“normal”
0	15	“audio failure”	“normal”

Internally, status channels work like analog channels using the default scale 0000 to 2040. The analog reading is masked with the status words when the channel reading is spoken. The mid-point of the scale, 1020, is the status trip point from low to high. Therefore, below the trip point is status low and above the trip point is status high.

To calibrate a status channel, apply the telemetry voltage, select the channel and turn the calibration trim pot until the logic high reading is delivered. The logic low reading is delivered when voltage is removed.

Status readings can be inverted so that the readings are opposite in the table above. This is useful in the case of devices that use negative or reverse logic. The inverted status feature is enabled with special programming at the fourth channel address. This feature is documented in section 6.3.5.

Programming example: suppose you want to program Channel 01 with the status pair “normal/alarm”.

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: 0004
4. Find the status pair “normal/alarm” in the table above and get the values V1 and V2: V1=0, V2=10
5. Enter V1 for the status pair “normal/alarm”: 0
6. Press the # key to enter this value and increment to the next address in memory
7. Enter V2 for the status pair “normal/alarm”: 10
8. Press the # key to enter this value and increment to the next address in memory
9. Press the ✻ key to exit programming mode and return to operating mode

When a user selects channel 01, the RFC-1 will read “normal” or “alarm” depending on the voltage applied.

6.3.4 Maximum Scale and Decimal Point

Setting an appropriate scale allows the RFC-1 to give a more accurate reading. When choosing the scale, find the smallest item in the table below that is larger than the highest expected reading. Be sure to allow some headroom for out of tolerance readings. A telemetry channel will report "upper limit" if the reading exceeds the top of the scale,

Select the maximum scale reading and decimal point location from the table below. Program the value from column V1 into the third address for the selected channel.

V1	Max reading and decimal	V1	Max reading and decimal
0	8160	8	81.60
1	4080	9	40.80
2	2040 (factory setting)	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

Some devices generate very low sample voltages. The RFC-1 requires at least 1.0 volt DC to generate a full-scale reading no matter which scale is selected. If the maximum sample voltage is less than 1.0 volt, the maximum attainable reading will be proportional to the maximum voltage. For instance, if the maximum sample voltage is only 1/2 volt then the maximum attainable reading will be 1/2 of the selected scale.

6.3.5 Linear and Logarithmic Scales, Inverted Status and Auto-control Relay

As the sample voltage of a device changes, it normally follows a standard scale so that it can be tracked. The two most common scales are linear and logarithmic. Most devices output voltages on a linear scale. Power samples are the most common logarithmic samples but not all power samples are logarithmic. The device output determines which scale must be used. The factory setting is appropriate in most cases.

Select the scale from the table below and program the value from the column V1 into the fourth address for the selected channel. Limit the choice to V1=0 or V1=1 unless other specific features are needed.

V1	Linear / Log / Indirect / Inverted	Auto Control Relay	Comments
0	Linear scale	Disabled	Default value
1	Logarithmic scale	Disabled	
2	Indirect power—kilowatts	Not available	Do not program directly, use procedure
3	Indirect power—percent power	Not available	Do not program directly, use procedure
4	Inverted status reading	Disabled	Inverted status described below
5	Linear scale	Enabled	Auto-control relay described below
6	Logarithmic scale	Enabled	Auto-control relay described below
7	Inverted status reading	Enabled	Auto-control relay described below

The inverted status option allows the RFC-1 to internally swap the status reported by a channel. This eliminates the need for an external logic inverter for devices operating with negative logic. The channel must be programmed with a status option from the table in section 6.3.3. This option modifies the behavior (changes the polarity) of that setting.

The auto-control relay feature provides an auxiliary contact for equipment that requires a switch closure to operate properly—such as an antenna monitor. When this feature is active, the off/lower relay activates when the associated channel is selected. The relay deactivates when another channel is selected.

Do not activate auto-control relay unless you are certain that it is necessary. Improperly activating this feature may cause the external device to operate unexpectedly.

6.3.6 Indirect Power

The RFC-1 can calculate output power from plate voltage and plate current when a power sample is not available. This is referred to as an indirect power calculation. This feature requires careful setup to work properly.

Sine Systems provides a web page that will perform the appropriate calculations and generate values to program into the RFC-1. The web site is http://www.sinesystems.com. Navigate to the tech support section for the RFC-1 and follow links to the Indirect Power Calculation page. Your web browser must have Javascript enabled to use the page.

No telemetry input is connected on an indirect power channel. 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 two channels lower than the indirect power channel. Connect the plate current one channel lower than the indirect power channel. For example, connect the plate voltage to channel 00 and the plate current sample to channel 01 for an indirect power reading on channel 02. Program and calibrate the plate voltage and plate current channels normally.

The indirect power settings use all four channel memory addresses. The normal use described in the Programming Address Table does not apply. The values that are programmed into those addresses come from the computations that follow, or that are generated by the web page. The computations are not difficult. The procedure takes a few minutes to complete.

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. Due to antenna gain, this is not the same as the transmission line efficiency.

Complete the following steps in order. Write down the result from each instruction on the line to the left of the instruction. Disregard digits to the right of the decimal after a calculation even if the result is a zero.

Line	Value	Instructions
1		Write down the efficiency as a whole number from 1 to 1023 (see notes above)
2		Divide line 1 by 256 and write the numbers to the left of the decimal
3		Multiple line 2 256 and write the result
4		Subtract line 3 from line 1 and write the result
5		Divide line 4 by 16 and write the numbers to the left of the decimal
6		Multiply line 5 by 16 and write the result
7		Subtract line 6 from line 4 and write the result
8		Multiply line 2 by 4 and write the result
9		Units: for “kilowatts” add 2 to line 8 or for “percent power” add 3 to line 8 and write the result
10		Decimal: use 0 for none, use 1 for 000.0, use 2 for 00.00, use 3 for 0.000
11		Multiply line 10 by 4 and write the result
12		Scale multiplier: use 0 for 1x, use 1 for 10x, use 2 for 100x
13		Add line 11 to line 12 and write the result

Locate the memory addresses for the channel that report the indirect power reading. Use the address table to find the appropriate channel addresses. Ignore the descriptions in the table and program the values as shown below.

The critical values are in the four yellow shaded areas in the table above.

- Program the value on line 5 in the first memory address
- Program the value on line 7 in the second memory address
- Program the value on line 13 in the third memory address
- Program the value on line 9 in the fourth memory address

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

6.3.6.a Indirect Power—Theory of Operation

This section provides further information on calculating indirect power. If the sequence above is completed and it operates successfully then it is not necessary to read this section. This information is useful for troubleshooting.

An indirect power channel has a reading from 0000 to 9999. A decimal point is optional and the unit word will be either “kilowatts” or “percent power”. If the computed value exceeds 9999 or if either the voltage or current channel exceeds full-scale, the words "upper limit" are spoken. The telemetry value for the indirect power channel is computed from the following equation:

P = (E * I * Eff * S) / 10,000,000

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 = efficiency of the transmission line or the entire system 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. These values are taken from the two channels below the channel that is calculating the power.

The efficiency value, Eff, comes from the transmitter and transmission line for transmitter power output, TPO, calculations or from the entire system including antenna gain for effective radiated power, ERP. In the latter case, it is not unusual for the efficiency number to be greater than 100.

For example, suppose the antenna has a gain of 6.5, the feed line has an efficiency of 75% and the transmitter has an efficiency of 72%. The overall efficiency (input power-to-ERP) is 6.5 x 0.75 x 0.72 = 3.51. Using this example, the efficiency would be 351% for ERP calculations. However, the efficiency would be only 72% for TPO calculations.

The efficiency value can 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. First use S=10 and compute P. Disregard the decimal point and use the four data digits for voltage and current. If the calculated value for P is outside of the range 0000 to 9999 or extremely close to either end, use S=1 for a smaller P or S=100 for a larger P.

For 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 x 3800 x 72 x 1) / 10,000,000 = 218.88

The telemetry reading will use only the digits to the left of the decimal point: 0218. This is a small value given that the maximum reading is 9999. So in this case it would be better to use S=10 to force the value closer to the middle of the scale. With S=10 the resulting P=2188 which fits nicely in the scale. Setting S=100 results in P=21888 which is well beyond the maximum of 9999.

If needed, a decimal point is added to the reading in the channel settings.

6.3.7 Telemetry Leading Zero Suppression

Telemetry values in the RFC-1 are four-digits long. A channel should be calibrated to take advantage of as much of the telemetry scale as possible for maximum accuracy. Sometimes a telemetry reading will have a zero as the left most zero in part of its operating scale. The RFC-1 can ignore leading zeros when it *reports* the telemetry value. The leading zero still exists as part of the value but it is not spoken.

- Program 1 at address 0998 to enable leading zero suppression
- Program 0 at address 0998 to disable leading zero suppression

A leading zero is considered a significant digit if it occurs immediately before a decimal point. In this case the zero will be spoken even if leading zero suppression is enabled. For example, if a channel reading is 0.951 the leading zero is not dropped because it is significant. But it is dropped from the reading 09.51 because it is not significant.

It is important to remember that leading zeros are significant when programming alarm limits. The RFC-1 alarm system *always* operates with four significant digits. Remember, leading zero suppression silences the leading zeros but it does not remove them.

It is a common mistake to program alarm limits incorrectly when leading zero suppression is enabled. The best method is to take a reading of the channel that the alarm will monitor and write down the numbers. If the telemetry value is not 4 digits long, add zeros to the left of the value until it is 4 digits long. Then set the alarm limits using the 4-digit number. The following example should clarify this point.

Suppose a channel reads “99.5 percent” with leading zero suppression enabled. Alarms are to be programmed at 105.0 percent and 90.0 percent. The common mistake is to program the upper limit as 0105 for 105% and the lower limit as 0090 for 90%. These values are incorrect because the actual channel reading is 0995. Both the upper and lower limits are well below the normal reading. The alarm never triggers because it never even arms. The correct upper limit in this case is 1050 and the correct lower limit is 0900.

6.3.8 Telemetry Settling Time

The telemetry settling time is a very brief delay that occurs between the selection of a channel and the sampling of the telemetry voltage by the RFC-1 processor. The delay gives sample voltage time to stabilize before the processor samples it. The factory setting is appropriate in most cases.

Occasionally the initial reading on a telemetry channel is slightly different, usually lower, than subsequent readings of the same channel. Increasing the delay between the time the channel is selected and the time the RFC-1 samples the voltage can remedy this situation.

This adjustment affects all channels. If the settling time is set to a large value, there will be a noticeable pause in between the channel selection and the telemetry value report. Program the value from the column V1 into memory address 0997 to change the telemetry settling time.

V1	Telemetry settling time	V1	Telemetry settling time
0	0.2 seconds	8	1.8 seconds
1	0.4 seconds	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

* This is the default setting.

6.3.9 Number of Telemetry Channels Available

The RFC-1 can support up to 8 relay Panels. Each relay panel has 8 channels. Memory addresses must be available for all 64 possible channels even though most RFC-1 systems use fewer than that. Rather than leave the memory for unused channels empty and potentially wasted, that memory space can be used for more date/time triggers. (Date/time triggers are discussed later in this document.)

The factory setting reserves memory for 16 channels or 2 relay panels. This is adequate for most installations. When a third (or higher) relay panel is added memory must be swapped back for channel settings. Channel settings can be programmed before the memory swap is performed and the data will be stored but channels will not respond to the new settings until the memory swap is programmed.

The table below lists the available options of relay panels used (or channels available) vs. the number of date/time triggers available. Each relay panel added reduces the available number of date/time triggers by 4. Find the number of relay panels in use in the table below. Program the value from column V1 at memory address 1015 to reserve memory for the appropriate number of channels.

V1	Relay Panels	Telemetry Channels Available	Date/Time Triggers Available
0	8 relay panels	Channels 00-63	48 available
1	7 relay panels	Channels 00-55	52 available
2	6 relay panels	Channels 00-47	56 available
3	5 relay panels	Channels 00-39	60 available
4	4 relay panels	Channels 00-31	64 available
5	3 relay panels	Channels 00-23	68 available
6 *	2 relay panels	Channels 00-15	72 available
7	1 relay panel	Channels 00-07	76 available
8	0 relay panels	All channels use default setting (see below)	80 available

* This is the default setting.

Telemetry channels can still be used if their memory has been reallocated to date/time triggers. The channel will behave according to the default channel setting stored at memory addresses 1020-1023. The default setting has the same options as all other channels.

The Programming Address Table has an extra column on the right of the page titled “Alternate Use”. This column provides the description for each memory address when used as a date/time trigger. A sample is shown below.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0000	Channel 00: telemetry units or status format - value 1	6.3.2	0	____	Date/time 80: action sequence
0001	Channel 00: telemetry units or status format - value 2	6.3.2	3	____	Date/time 80: month
0002	Channel 00: full scale and decimal point	6.3.4	2	____	Date/time 80: date - value 1
0003	Channel 00: linear/log/indirect/invert and auto relay	6.3.5	0	____	Date/time 80: date - value 2
0004	Channel 01: telemetry units or status format - value 1	6.3.2	0	____	Date/time 80: hour - value 1
0005	Channel 01: telemetry units or status format - value 2	6.3.2	3	____	Date/time 80: hour - value 2
0006	Channel 01: full scale and decimal point	6.3.4	2	____	Date/time 80: minute - value 1
0007	Channel 01: linear/log/indirect/invert and auto relay	6.3.5	0	____	Date/time 80: minute - value 2

6.4 Clock and Calendar

The clock and calendar are used by the RFC-1 to trigger events by the date and time. Enhancements to the timing system give the RFC-1 very good long-term accuracy. The clock will attempt to synchronize with the AC main supply when the RFC-1 is powered from either a 50 Hz or 60 Hz AC supply.

The time and date are lost when the system loses power. When power returns, the clock does not run until an operator resets it. A small external UPS provides an easy solution for this issue.

6.4.1 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 an option to adjust the calendar with the prompt, “push # to reprogram”. Press the # key to set the date. The RFC-1 will ask for two-digit month and day and four-digit year. Enter the appropriate digits at each prompt. Use leading zeros for values less than 10.

6.4.2 Day of the Week

Some date/time functions can be programmed to occur only on certain days of the week. To support these features the RFC-1 determines the day of the week based on the calendar date. This task is performed automatically when the calendar is set. There is no user command to set the day of the week.

To read the day of the week, enter the command 70 as if reading the calendar date. At the “push # to reprogram” prompt, press the ✻ key. The RFC-1 will respond with the word “day” followed by a number from 1 to 7 representing the day of the week. 1=Monday, 2=Tuesday, 3=Wednesday, 4=Thursday, 5=Friday, 6=Saturday, 7=Sunday.

6.4.3 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 an option to adjust the clock with the prompt, “push # to reprogram”. Press the # key to set 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.

To avoid random time triggering issues, the RFC-1 clock freezes at power up with 0 hours and 99 minutes. The clock can be stopped any time by setting those values.

6.4.4 Automatic Daylight Saving Time Adjustment

When this feature is enabled, the RFC-1 will adjust the clock automatically in areas of the United States that observe Daylight Saving Time. The calendar must be set to the correct date for this option to work properly.

The time change occurs according to the rules established in 2007. The clock is set forward one hour at 2:00 AM on the second Sunday in March and it is set back one hour at 2:00 AM on the first Sunday in November.

This feature is enabled or disabled in programming mode at address 1017. The table below shows available options.

V1	Automatic Daylight Saving Time Change
0	Disabled—no automatic change
1	Enabled—DST clock adjust (factory setting)

Automatic DST time change is enabled when shipped from the factory. Follow the instructions below to disable it.

1. Enter the Advanced Programming Mode: 80
2. Enter the Advanced Programming Security Code: 4150
3. Enter the address (from the Address Table) for the Auto DST function: 1017
4. Enter a value of 0 to disable this function: 0 (or enter 1 to enable this function)
5. Press the # key to write this value (and increment to the next address in memory)
6. Press the ✻ key to exit programming mode and return to operating mode

Automatic DST adjusts the clock as required. No other changes are made in the system. All date/time triggers occur according to the values that are programmed. Trigger times are compared against the DST adjusted clock.

6.4.5 Clock Calibration

The RFC-1 real time clock is based in the main processor. Like any processor-based clock, its accuracy is subject to the manufacturing tolerance of the components. It is normal for the time to drift a little over long time periods.

6.4.5.1 Automatic Calibration

The RFC-1 attempts to synchronize the real time clock to the incoming AC power supply. This typically offers very good long-term stability. This feature is enabled by default and operates without user intervention when the RFC-1 is powered from either a 50 Hz or 60 Hz AC main power supply.

Automatic clock calibration requires hardware that was added to RFC-1 systems in mid-2003. Early RFC-1 versions do not have the hardware necessary to support this feature.

6.4.6.2 Manual Calibration

The RFC-1 clock can be calibrated manually. This can be used to improve the accuracy of RFC-1 versions that do not have the AC sample hardware or that operate from DC supplies. The RAK-1 powers the RFC-1 from an internal DC supply so it also benefits from this feature.

Manual clock adjustment trims the speed of the internal clock to compensate for variances in timing components in the RFC-1. Each step changes the speed by one-half second over a 24-hour period. *The AC sync feature is automatically disabled when a manual clock calibration adjustment is made.*

To calibrate the RFC-1 clock, set the RFC-1 clock to a known accurate source. Let it run for several days until the time drifts by more than a minute. Divide the number of minutes of drift by the number of days to determine how many seconds the clock drifts per day. Seconds of drift per day = (minutes of drift * 60) / number of days.

Look in the table below for the number that is closest to the clock drift. If the clock runs slow, look for a negative number. If the clock runs fast, look for a positive number. Each setting in the table is represented by a pair of values: V1-V2. Program V1 at memory address 1018 and program V2 at address 1019.

The clock loses time when it runs to slow. Suppose the clock is set to a known accurate time. Six days later at 6:00 pm the RFC-1 clock is checked. Instead of 6:00 pm it reads 5:58 pm. It is running too slow and has lost 2 minutes. Negative numbers in the table below make the clock run faster. The drift is (-1) * (2 * 60) / 6 = -20 seconds/day.

The clock gains time when it runs too fast. Suppose the clock is set to a known accurate time. Six days later at 6:00 pm the RFC-1 clock is checked. Instead of 6:00 pm it reads 6:01 pm. It is running too fast and has gained 1 minute. Positive numbers in the table below make the clock run slower. The drift is (1 * 60) / 6 = 10 seconds/day.

Using the first example above, find -20 seconds in the table. V1=8 and V2=3. Program the value 8 at address 1018 and the value 3 at address 1019 to make the appropriate calibration.

Using the second example above, find 10 seconds in the table. V1=9 and V2=4. Program the value 9 at address 1018 and the value 4 at address 1019 to make the appropriate calibration.

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

The default setting is 0.0 seconds—the values are V1=8 and V2=0.

6.5 Action Sequences

Functional knowledge of the specific installation is required to make use of the information presented here. In addition, some degree of comfort working with the RFC-1 is presumed in the documentation that follows.

The RFC-1 can be programmed to respond to 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 are simple, pre-programmed tasks. They operate only when called by an alarm or a time trigger.

Action sequences can manipulate the control relays of the RFC-1, place telephone calls, print readings, etc. A typical action sequence might be to activate a relay to turn on filaments, pause several seconds and activate another relay to turn on the plate voltage. The sequence can be stored so that, when called upon, it will power up the transmitter.

An action sequence is of little use by itself. It is merely a stored set of instructions that perform a specific task. The action sequence must be activated, or triggered, to perform the 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. Action sequences will be covered here. Alarms and date/time triggers will be covered in the next segment. The topics are discussed separately to help avoid information overload. Section 7 contains programming examples that illustrate how all the pieces fit together.

The RFC-1 stores eight user-programmable action sequences and five fixed-programming action sequences. There is no difference between the two types of action sequences except where they are stored in the system. Otherwise, they obey the same system rules and operate using the same set of instructions.

6.5.1 Fixed-programming Action Sequences

There are five fixed-programming action sequences that can be used to perform common tasks. They are stored in the permanent memory of the system and cannot be altered. These action sequences are designated as shown in the following table.

Seq	Instructions	Description
9	9-0	Initiates a set of telephone calls to all available numbers
10	8-8	Sends a set of telemetry readings to a local device
11	8-8, 8-15	Sends a set of telemetry readings to a local device without a new reference scan
12	8-8, 9-0	Sends a set of telemetry readings to a local device then initiates a set of telephone calls
13	8-9	Sends a set of telemetry readings to a remote device

Previous software versions of the RFC-1 used action sequence 1 as the default action sequence for all alarms. As of software version 6, all alarms default to action sequence 9. This frees all of the programmable action sequences for use without any adverse effects. Reprogramming action sequence 1 no longer disrupts the standard alarm calling ability. Simply use action sequence 9, the default setting, when the standard call loop is needed.

6.5.2 User-programmable Action Sequences

The RFC-1 can store up to 8 action sequences having up to 8 steps each. The available instructions are listed in the text that follows along with a unique 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.

This section of the programming address table for action sequence 1 is shown below. Notice that each step is identified by two values that are listed as value 1 and value 2. These two values correspond to the column labeled V1-V2 in the tables of available commands that follow.

			- Programming -		
Addr	Description	Section	Default	Current	Alternate Use / Notes
0724	Action Sequence 1: step 1 – value 1	6.4.1	15	____	_____
0725	Action Sequence 1: step 1 – value 2	6.4.1	15	____	_____
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	____	_____
0739	Action Sequence 1: step 8 – value 2	6.4.1	15	____	_____

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 user-programmable action sequences is completely blank.

6.5.3 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. Control relays are *momentary activation only*. There is no need to execute an on instruction followed by a corresponding off instruction.

V1-V2	Relay Activated	V1-V2	Relay Activated	V1-V2	Relay Activated	V1-V2	Relay Activated
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 50 on
0-3	Channel 03 on	1-3	Channel 19 on	2-3	Channel 35 on	3-3	Channel 51 on
0-4	Channel 04 on	1-4	Channel 20 on	2-4	Channel 36 on	3-4	Channel 52 on
0-5	Channel 05 on	1-5	Channel 21 on	2-5	Channel 37 on	3-5	Channel 53 on
0-6	Channel 06 on	1-6	Channel 22 on	2-6	Channel 38 on	3-6	Channel 54 on
0-7	Channel 07 on	1-7	Channel 23 on	2-7	Channel 39 on	3-7	Channel 55 on
0-8	Channel 08 on	1-8	Channel 24 on	2-8	Channel 40 on	3-8	Channel 56 on
0-9	Channel 09 on	1-9	Channel 25 on	2-9	Channel 41 on	3-9	Channel 57 on
0-10	Channel 10 on	1-10	Channel 26 on	2-10	Channel 42 on	3-10	Channel 58 on
0-11	Channel 11 on	1-11	Channel 27 on	2-11	Channel 43 on	3-11	Channel 59 on
0-12	Channel 12 on	1-12	Channel 28 on	2-12	Channel 44 on	3-12	Channel 60 on
0-13	Channel 13 on	1-13	Channel 29 on	2-13	Channel 45 on	3-13	Channel 61 on
0-14	Channel 14 on	1-14	Channel 30 on	2-14	Channel 46 on	3-14	Channel 62 on
0-15	Channel 15 on	1-15	Channel 31 on	2-15	Channel 47 on	3-15	Channel 63 on

V1-V2	Relay Activated	V1-V2	Relay Activated	V1-V2	Relay Activated	V1-V2	Relay Activated
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 relay activations are always momentary. The *relay operating time* controls the minimum length of time that a control relay is engaged when activated. When a relay is activated manually, the relay will be engaged as long as the control key is pressed. This setting is stored at memory address 1006 in the address table.

V1	Minimum control relay operate time	V1	Minimum control relay operate time
0	0.3 seconds	8	2.7 seconds
1	0.6 seconds (default setting)	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

6.5.4 Action Sequence Delays

The RFC-1 pauses for about one-half second between the steps of an action sequence. This can be adjusted in an individual action sequence by placing a delay instruction at the appropriate point(s) in the action sequence. Delay instructions can be used in succession to create a longer delay. Select the appropriate delay instruction(s) from the table below and program corresponding V1 in the action sequence as needed.

V1	V2	Delay Length
8	0	1 second
8	1	2 seconds
8	2	5 seconds
8	3	10 seconds
8	4	20 seconds
8	5	30 seconds
8	6	45 seconds
8	7	60 seconds

The default delay of one-half second between the steps of an action sequence can also be adjusted globally. This setting changes the delay in between all instructions of all action sequences. Select an appropriate delay from the table below and program V1 at address 1007 in the memory address table.

V1	Delay length	V1	Delay length
0	0.2 seconds	8	1.8 seconds
1	0.4 seconds (default setting)	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

6.5.5 Alarm Calls

The RFC-1 can place telephone calls as a step in an action sequence. The message delivered depends on the condition that triggers the action sequence. The message typically consists of the site identification phrase followed by an indication of the condition that triggered the call such as a telemetry alarm or power failure. The message repeats for a pre-determined length of time.

Select an instruction from the table below and program the corresponding V1 and V2 in the action sequence to generate telephone calls as part of an action sequence.

V1	V2	Telephone call instructions
9	0	Call all telephone numbers in rotation: A, B, C, D, E, F, A, B, C, …
9	1	Call all telephone numbers in weighted rotation: A, B, A, C, A, D, A, E, A, F, A, B, …
9	2	Call telephone number A the programmed number of times
9	3	Call telephone number B the programmed number of times
9	4	Call telephone number C the programmed number of times
9	5	Call telephone number D the programmed number of times
9	6	Call telephone number E the programmed number of times
9	7	Call telephone number F the programmed number of times

The number of calls placed to a given telephone number is determined by the call attempts setting. Each telephone number has its own call attempts setting. The setting is programming in the address following the telephone number digits. See telephone number programming for more information.
When the RFC-1 places a telephone call, the call lasts for a pre-set amount of time, the call duration. The outgoing message is repeated for the duration of the call. Select a call duration setting from the table below and program the corresponding V1 at address 1003. Call duration applies to voice mode calls only.

V1	Telephone call duration	V1	Telephone call duration
0	10 seconds	8	80 seconds
1	10 seconds	9	90 seconds
2	20 seconds	10	100 seconds
3	30 seconds (default setting)	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

The RFC-1 pauses between outgoing calls when multiple telephone calls are made, the call pause duration. This provides an opening for an operator to contact the system. Select a call pause duration from the table below and program the corresponding V1 at address 1004.

V1	Telephone call pause duration	V1	Telephone call pause duration
0	10 seconds	8	80 seconds
1	10 seconds	9	90 seconds
2	20 seconds	10	100 seconds
3	30 seconds (default setting)	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

6.5.6 Logging Telemetry Readings

The RFC-1 can send a set of telemetry readings to a printer or computer as a step in an action sequence. The logging device can be connected directly to the RFC-1 or at a remote location. The set of readings will start with channel 00 and end at the programmed *auto-scan stop channel*. The default setting stops at channel 07. Readings are printed with a header that includes the site identification phrase, the date and time and the action sequence.

Select the appropriate logging function from the table below and program the corresponding V1 and V2 in the action sequence to log a set of telemetry readings as part of an action sequence.

V1	V2	Telemetry Logging Function
8	8	Send readings to a local device or using a full time connection
8	9	Send readings to a remote device that requires a telephone call

Instruction 8-9, logging to a remote device, requires an optional data modem to be installed in the RFC-1. This instruction automatically dials telephone number F. The telemetry readings are sent after the modems connect.

To stop the RFC-1 from dialing telephone number F as part of the normal dialing loop, program 10 for the first digit of the telephone number. Programming a 10 as the first digit makes telephone number F appear to be blank to the dialing sequence. The first active digit of the telephone number will be at address 0711. The remote logging command is programmed to lookup telephone number F this way.

6.5.7 Conditional Execution

There are no instructions in the RFC-1 action sequences for performing loops or making complex decisions. These kinds of functions are simply beyond the capabilities of the available memory and processing power. However, there are some instructions that can be used to perform simple conditional behavior.

V1	V2	Description
8	14	Stop execution and recheck telemetry This instruction stops execution of the action sequence and rechecks the telemetry on the channel that triggered the alarm. If the alarm condition has cleared, the action sequence terminates immediately. 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 after the 8-14 instruction. *Use only in an action sequence that is triggered by a telemetry alarm.*

A common use for this instruction is to stop the RFC-1 from calling with an alarm when a telemetry input briefly fluctuates out of tolerance. A short delay is inserted at the beginning of the action sequence to allow the device time to self-correct. Then the 8-14 instruction is used and then the alarm dialing instruction is used.

For example, suppose the telemetry input on channel 02 is a small DC voltage that is proportional to the audio input to a transmitter. An alarm is programmed to monitor channel 02 so that when this voltage drops below a certain point, a call is made to alert personnel of an audio failure. Even with a large capacitor it may be normal for this voltage to briefly drop below the alarm threshold during extended quite passages. In this case an alarm might trigger because input falls out of tolerance. But by the time the RFC-1 alerts station personnel it is likely that the quite passage is done and everything is normal. It will appear to be a false alarm.

The 8-14 instruction can be used to avoid the above situation. A new action sequence will be programmed and, keeping with the example, the alarm that monitors channel 02 will be programmed to trigger the new action sequence. The action sequence consists of: a short delay of 5 seconds with the instruction 8-2 (from section 6.5.3), then the 8-14 instruction, then the typical dialing instruction, 9-0. When triggered, the action sequence will pause for 5 seconds giving the audio level time to recover. The 8-14 instruction will cause channel 02 to be rechecked. If it is back in limits the sequence terminates. If it is still out of limits the action sequence will restart. The delay repeats, the 8-14 is ignored on the second pass and then the dialing instruction executes.

V1	V2	Description
8	15	Inhibit new telemetry reference scan upon completion of the action sequence The RFC-1 normally records a new set of reference readings at the end of an action sequence. This stops the system from triggering the same alarm repeatedly. Placing this instruction as the final step of an action sequence suppresses this telemetry reference scan.

A common use for this instruction is to automatically adjust a channel until it is back in limits. The action sequence typically consists of one or more relay actions with delays, if needed. The final step in the sequence is 8-15.

An example is the easiest way to illustrate how this works. Suppose the telemetry input on channel 01 is a transmitter output power sample. An alarm is programmed to monitor channel 01 so that if the transmitter power goes too high, the RFC-1 will adjust it down into limits.

The RFC-1 control relays are momentary activation, about one-half second. Depending on how the transmitter control works, there is no guarantee that a single, brief relay closure will bring the transmitter power back into limits.

Without the 8-15 instruction, the RFC-1 will activate the action sequence normally. When the action sequence completes, a new set of reference readings are taken. Keeping with the example, after the action sequence completes the power will be lower but not necessarily in limits. When the new reference reading is made, the out-of-tolerance condition will be considered normal on the next alarm check because the reference reading reflects the out-of-tolerance condition. (If you are wondering why the system operates this way, consider what would happen if it did not and you tried to shut your transmitter off. The non-stop phone calls would become annoying very quickly!)

The solution is to use the 8-15 instruction in the action sequence. The action sequence has the necessary relay closure(s) to lower the transmitter power followed by the 8-15 instruction. *The 8-15 instruction must be the final step.* When this action sequence executes, the relays operate and the reference reading update is skipped. On the next alarm check, the current power reading is still out-of-tolerance. The action sequence will be triggered again and the power will be lowered until it is back into limits.

In certain conditions it is necessary to have the RFC-1 treat an alarm as if the channel reading is within limits so that the alarm will trigger as needed. Common uses for this behavior are transmitter power changes and tower light monitoring. These instructions are typically used in conjunction with devices that operate at multiple levels and have alarm limits associated with each level of operation. This implies that there are multiple alarms set up monitoring the channel with the inappropriate alarms blocked during hours of the day in which they do not apply.

Setting up and blocking alarms is beyond the scope of this example. The next section of this documentation discusses these topics. For this example it is only necessary to accept that multiple alarms can monitor the same channel and alarms can be blocked during inappropriate hours of the day so that alarms do not conflict.

V1	V2	Description
10	1	Force the telemetry reference for Alarm A into limits
10	2	Force the telemetry reference for Alarm B into limits
10	3	Force the telemetry reference for Alarm C into limits
10	4	Force the telemetry reference for Alarm D into limits
10	5	Force the telemetry reference for Alarm E into limits
10	6	Force the telemetry reference for Alarm F into limits
10	7	Force the telemetry reference for Alarm G into limits
10	8	Force the telemetry reference for Alarm H into limits

An example best illustrates use of these instructions. Suppose a transmitter is supposed drop to low power in the evening. A power reading on channel 01 indicates at what power level the transmitter is operating. Two alarms in the RFC-1 monitor this channel. One alarm is active during the day and has limits that are appropriate for daytime power; it is blocked at night. The other alarm is active at night after the power change and has appropriate nighttime power limits; it is blocked during the day.

In this example, the RFC-1 has been programmed to make the power changes automatically. At the appropriate times of day the RFC-1 will execute an action sequence activating relays as needed to change the transmitter power. When the sequence terminates a new reference reading is made for the alarms. If for some reason the transmitter does not change power, the RFC-1 will record the current reading as the reference and it will be considered normal even if it is out-of-tolerance. What is needed is a mechanism to verify that the transmitter made the power change and is within the appropriate limits.

The solution requires a few things to happen in sequence. First, the block on the low power alarm must end. This occurs automatically as a function of time. Just make sure the alarm block ends before the power change occurs. Next, the power change action sequence executes. Following the relay commands to change the transmitter power, the action sequence has the instruction 10-X selected from the table above. The instruction to use depends on which alarm is monitoring the telemetry channel. For this example, Alarm B is monitoring the power channel at nighttime power so the instruction is 10-2 for alarm B.

With the addition of the 10-2 instruction the system verifies the power change on the first alarm scan after the power change occurs. The 10-X instructions effectively enable or activate the specified alarm by setting the channel reading within alarm limits. The true status of the system is determined on the next alarm scan and the alarm will trigger if the channel reading is out of limits. The alarm can call station personnel to alert that the transmitter power did not change so that the change can be made manually.

Similar behavior can be used to verify that tower lights have turned on in the evening. In most cases the tower lights are controlled by an automated system so the action sequence only has the appropriate 10-X instruction without any relay commands. Otherwise the example is the same. Tower light alarms are typically blocked during the day so first the alarm block must expire. Then a timed action sequence executes the 10-X instruction. The next alarm scan checks the tower light status and calls personnel if needed.

6.5.8 Enabling / Disabling Telemetry Alarms

Telemetry alarms can be selectively enabled and disabled by an action sequence. This is particularly useful for transmitters that operate at multiple power levels. The appropriate alarm can be enabled using the same action sequence that changes the transmitter power.

Be aware that any alarms that are disabled using these commands will remain disabled until they are enabled using the corresponding enable command, or until the system restarts. These commands do not have a time limit.

All alarms are enabled at power up. When these command are used, there is the potential for a false alarm if main system power fails. The next action sequence event that occurs after power is restored enables and disables the alarms as programmed.

V1	V2	Disable a telemetry alarm	V1	V2	Enable a telemetry alarm
11	0	Disable alarm A	11	8	Enable alarm A
11	1	Disable alarm B	11	9	Enable alarm B
11	2	Disable alarm C	11	10	Enable alarm C
11	3	Disable alarm D	11	11	Enable alarm D
11	4	Disable alarm E	11	12	Enable alarm E
11	5	Disable alarm F	11	13	Enable alarm F
11	6	Disable alarm G	11	14	Enable alarm G
11	7	Disable alarm H	11	15	Enable alarm H

6.5.9 Extending an Action Sequence

A single action sequence can have up to eight instructions. This is satisfactory for most uses. There are rare instances that require more than eight steps to occur. Action sequences can be chained together in series to address such situations. Chaining together action sequences comes at the expense of reducing the total number of action sequences available. Memory is available for eight action sequences. If two are chained together then the system effectively has only seven action sequences.

A second action sequence is chained to the first by including an instruction at the final position of the first sequence. The instruction indicates to the system that a chain is to occur and which action sequence is next in the chain. The instructions are shown in the following table.

V1	V2	Description
12	1	Execute action sequence 1 next
12	2	Execute action sequence 2 next
12	3	Execute action sequence 3 next
12	4	Execute action sequence 4 next
12	5	Execute action sequence 5 next
12	6	Execute action sequence 6 next
12	7	Execute action sequence 7 next
12	8	Execute action sequence 8 next

An action sequence cannot chain to itself. This would result in an infinite loop.

6.5.10 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.

Suppose an action sequence is programmed to adjust an antenna switch and change transmitter power. The action sequence can be used to perform the procedure manually. This would help ensure that the procedure is done correctly when performed by personnel without a strong technical background.

1. From normal operating mode, enter the command 85 to manually trigger an action sequence.
2. The RFC-1 requests the *control security code* if it has not already been given during this call.
3. The RFC-1 responds with “enter one digit action sequence”.
4. Enter a single digit from 1-8 to activate the corresponding action sequence or, enter 0 to cancel.

The control security code 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. The RFC-1 will request the code if it has not been entered already during the call.

6.6 Telemetry Alarms

Incorrect use of the following information can cause unexpected or undesirable behavior. We strongly recommend that you understand the basic operation of the RFC-1 and the specifics of the installation before continuing. Please read the documentation above that describes the Advanced Programming Mode before continuing if you have not done so already.

There are 8 telemetry alarms in the RFC-1. Each alarm can be programmed to monitor any physical channel from channel 00 to 63. It is also possible for two alarms to monitor the same physical channel such as when a transmitter operates at two different power levels. In these cases only one alarm is usually active at a time, the other alarms are blocked so that they do not trigger at inappropriate times of day.

In response to an out-of-tolerance alarm condition, the RFC-1 can be programmed to call station personnel and report the problem or to log a set of telemetry readings or to try and take corrective actions or even a combination of these. The default response is to call station personnel and report the condition. Programming the system to make corrections requires thorough knowledge of the installation and the devices. In most cases calling to report the condition and/or logging readings is sufficient.

When an alarm condition is detected an action sequence is triggered. The alarm specifies the condition to watch for such as the channel number and the telemetry limits. It points to an action sequence that will execute when the alarm limits are exceeded. In the factory settings all alarms trigger a default action sequence that has one instruction—call all the available telephone numbers to report the alarm.

It is easy to reprogram an alarm to trigger a different action sequence if a different response is desired. The action sequence can contain any of the commands discussed in section 6.5 of this document.

6.6.1 Telemetry Alarm Programming

The eight telemetry alarms in the RFC-1 are designated Alarm A-H. Each alarm 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 addresses that store the data for each alarm.

- 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.

6.6.2 Channel Number

As mentioned above, there are 8 telemetry alarms in the RFC-1. Each alarm can be programmed to monitor any physical channel's telemetry input from channel 00 to 63. When programming the channel number in the alarm, the first digit of the channel number is programmed at the first memory address and the second digit of the channel is programmed at the second address. Program the first address with 0 if the channel number is less than 10.

Unused alarms are set to monitor channel number 64. This channel cannot exist so the alarm is disabled.

Each alarm can monitor only one telemetry channel but two alarms (or more) can monitor the same channel. This is useful in situations such as a transmitter that operates at multiple power levels. In these cases only one alarm is usually active at a time, the other alarms are blocked so that they do not trigger at inappropriate times of day.

6.6.3 Trigger Rules

The trigger rule determines the conditions under which the alarm activates—which alarm limits are critical. The default trigger rule is adequate in most cases as long as the alarm limits are set properly. Program the value from the column V1 into the third memory location for the selected alarm.

It is a common mistake to program alarm limits incorrectly when leading zero suppression is enabled. The best method is to take a reading of the channel that the alarm will monitor and write down the numbers. If the telemetry value is not 4 digits long, add zeros to the left of the value until it is 4 digits long. Set the alarm limits using the 4-digit number. See section 6.3.7 for more information.

V1	Trigger Condition—trigger the alarm when…
1	The telemetry varies more than 2.5% from the reference reading
2	The telemetry varies more than 5.0% from the reference reading
3	The telemetry varies more than 10% from the reference reading
4	The telemetry varies more than 20% from the reference reading
5*	The telemetry crosses either limit—but only if it was within limits at the time of the reference scan
6	The telemetry exceeds the upper limit—but only if it was within limits at the time of the reference scan
7	The telemetry falls below the lower limit—but only if it was within limits at the time of the reference scan
8	The telemetry crosses either limit—unconditionally
9	The telemetry exceeds the upper limit—unconditionally
10	The telemetry falls below the lower limit—unconditionally

* This is the default setting.

Trigger rules 1-4, the percentage change rules, are useful for transmitters operating at multiple power levels. Using the percentage change rules allows a single alarm to monitor the transmitter at all power levels. The reference reading is taken automatically when the transmitter power level is changed by the RFC-1, either manually or automated with date/time triggers. The upper and lower limits are ignored when these trigger rules are used. For convenience they can be set to 9999 and 0000 respectively.

Trigger rules 5 through 7 are appropriate for most cases. In fact, trigger rule 5 can be used in place of 6 and 7 most of the time by programming the alarm limits properly. The important distinction for trigger rules 5-7 is that the RFC-1 can be used to adjust a piece of equipment to an out of tolerance condition without generating an alarm. If this was not the case, consider what happens when a transmitter must run at abnormally low power for maintenance or turning the transmitter off.

Trigger rules 8-10 should be used with caution. They seem harmless from their short descriptions but they make the RFC-1 alarms very persistent. These rules trigger as long as the monitored device is out of tolerance—they do not stop calling after contacting an operator. If the situation is left uncorrected, they will trigger repeatedly until the condition is rectified. Consider this carefully before using them.

6.6.4 Action Sequence

This value specifies which action sequence executes when the alarm triggers. Valid action sequences numbers are from 1 to 12. Action sequences 1-8 are programmable. Action sequences 9-12 are fixed. Action sequence 9 is usually a safe choice if you are not sure which action sequence to use.

The selected action sequence must be programmed to perform the appropriate task. If the selected action sequence has no instructions or if an invalid sequence number is used, the system will substitute action sequence 9.

Review section 6.5 for more information on action sequences. Program the number of the action sequence to execute at the fourth memory address for the selected alarm.

6.6.5 Upper and Lower Limits

The upper and lower limits specify the range of acceptable telemetry values for a channel. Limits are programmed using 4 digits. If the telemetry channel reading has a decimal point, ignore the decimal but keep the digits following the decimal. Digits are critical. Decimal points and unit words are not critical. If the reading is not 4 digits long, add zeros to the left until the reading has 4 digits.

For example, to program an upper limit of 105.0 percent when the normal reading is 99.8 percent, set the upper limit to 1050. To program a lower limit of 90 percent when the normal reading is 99.8 percent, set the lower limit to 0900.

In come cases only one limit is considered critical. The default trigger rule can be used. Set the alarm limits to compensate.

- If only the upper limit is critical, set the upper limit as necessary and set the lower limit to 0000
- If only the lower limit is critical, set the lower limit as necessary and set the upper limit to 9999

Setting alarm values on status channels causes some confusion but it is really quite easy. Status channels are treated as numbers internally. The scale is the same as the factory default setting, 0000 to 2040, and the trip point is mid-scale, 1020. When monitoring a status channel, typically only one limit is considered critical and the other is usually ignored. The following general rules work well in most cases.

- To trigger when the input goes from low to high, set the upper limit to 1500 and the lower limit to 0000
- To trigger when the input goes from high to low, set the upper limit to 9999 and the lower limit to 0500

These rules refer to the voltage sample on the telemetry input; not the resulting channel reading. Status channel readings can be inverted in software. The channel reading may not be an accurate indicator of the voltage sample.

6.6.6 Enabling and Disabling Telemetry Alarms

There are three ways to enable and disable telemetry alarms in the RFC-1.

1. Enter commands manually to enable or disable a single alarm or the entire alarm system.
2. Use alarm blocks to disable one or more alarms as a function of month, day and time of day.
3. Selectively enable and disable alarms with commands in an action sequence.

The telemetry alarm system can be enabled and disabled with a single command, 82, in the RFC-1. The RFC-1 will deliver the current telemetry alarm system status 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. All other entries are invalid.

The RFC-1 ships from the factory with the telemetry alarm system disabled. You must enable it for the RFC-1 to scan for telemetry conditions.

In the default settings all alarms are programmed to monitor channel 64. This effectively disables the alarm. Enable an alarm by programming a valid channel number and upper and lower limits. The commands 90-97 are provide the easiest method for reading and adjusting alarm values. See Section 5 of this manual for details on these commands.

Enabling and disabling telemetry alarms in an action sequence is discussed in Section 6.5 of this manual. That section covers all of the commands that can be used in an action sequence.

6.6.7 Blocking Alarms by Time

It is possible to disable a telemetry alarm during certain hours of the day by programming an alarm block. Alarm blocks are used in cases where an alarm is not valid during part of the day. Tower light monitoring is a good example. Tower lights are typically not on during daylight hours so an alarm monitoring tower light power can be blocked to prevent a false alarm.

Alarm blocks use the same memory area that date/time triggers use—memory addresses 0256-0639. An alarm block is a special programming case and the RFC-1 will recognize it as an alarm block instead of a date/time trigger. Date/time triggers are discussed in the next section. It is not necessary to know how they work yet. Alarm blocks share the memory space. A sample selection from the programming address table will help illustrate this.

			- Programming -		
Addr	Description	Section	Default	Current	Alternate Use / Notes
0256	Date/time trigger 48: action sequence	6.7.4	0	____	Alarm block 48: block indicator
0257	Date/time trigger 48: month	6.7.4	0	____	Alarm block 48: alarm to block
0258	Date/time trigger 48: date—value 1	6.7.4	0	____	Alarm block 48: month
0259	Date/time trigger 48: date—value 2	6.7.4	0	____	Alarm block 48: day(s) of week
0260	Date/time trigger 48: hour—value 1	6.7.4	0	____	Alarm block 48: start hour—V1
0261	Date/time trigger 48: hour—value 2	6.7.4	0	____	Alarm block 48: start hour—V2
0262	Date/time trigger 48: minute—value 1	6.7.4	0	____	Alarm block 48: end hour—V1
0263	Date/time trigger 48: minute—value 2	6.7.4	0	____	Alarm block 48: end hour—V2

The listing above shows how the alarm block data uses the date/time trigger memory. Look specifically at the column labeled *Alternate Use*. It describes the alarm block.

- The first memory address is always programmed to 15 for an alarm block.
- The second memory address identifies the alarm (A-H) to block using numbers 1-8 respectively.
- The third memory location identifies the month (1-12 or 15) in which to activate the block.
- The fourth memory location identifies the day of week (1-7 or 13-15) on which to activate the block.
- The fifth and sixth memory locations store the start time (hour) of the alarm block.
- The seventh and eighth memory locations store the end time (hour) of the alarm block.

Always program a 15 in the first memory location to indicate to the RFC-1 that this is an alarm block and not a date/time trigger.

For the alarm to block, use numbers 1-8 to represent alarms A-H where: 1=A, 2=B, 3=C, 4=D, 5=E, 6=F, 7=G, 8=H.

An alarm block can be active every month or during only a specific month. Use numbers 1-12 to represent the months January - December respectively. Program the value 15 if the block should be active *every* month.

An alarm block can be active every day of the week, a specific day of the week, weekdays only or weekends only. Use numbers 1-7 to represent the days of the week where: 1=Monday, 2=Tuesday, 3=Wednesday, 4=Thursday, 5=Friday, 6=Saturday, 7=Sunday. Extra day of the week values are: 13=every weekday (Monday-Friday), 14=weekend days (Saturday & Sunday), 15=every day of the week.

The start hour and stop hour define the hours of the day that the block will be active. When a block is active, the specified alarm does not occur—it is blocked. Alarm blocks start and stop on the hour—there are not enough memory address in the group to store hours and minutes. Alarm block hours are programmed using a 24-hour clock. The block time can cross midnight.

Each hour setting uses 2 memory addresses. Program the first digit of the hour at the location listed as "V1" and program the second digit at the memory location listed as "V2". Do this with both the start and stop hours. The example below shows programming for an alarm block that is active every day of the week in every month from 8:00pm (20 hours) to 6:00am (06 hours).

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0256	Date/time trigger 48: action sequence	6.7.4	0	15	Alarm block 48: block indicator
0257	Date/time trigger 48: month	6.7.4	0	1	Alarm block 48: alarm to block
0258	Date/time trigger 48: date—value 1	6.7.4	0	15	Alarm block 48: month
0259	Date/time trigger 48: date—value 2	6.7.4	0	15	Alarm block 48: day(s) of week
0260	Date/time trigger 48: hour—value 1	6.7.4	0	2	Alarm block 48: start hour—V1
0261	Date/time trigger 48: hour—value 2	6.7.4	0	0	Alarm block 48: start hour—V2
0262	Date/time trigger 48: minute—value 1	6.7.4	0	0	Alarm block 48: end hour—V1
0263	Date/time trigger 48: minute—value 2	6.7.4	0	6	Alarm block 48: end hour—V2

6.6.7 Alarm Scan Interval and Sequence

The alarm scan interval determines how frequently the RFC-1 checks the alarm channels. The alarm scan sequence determines in what order the alarm channels are checked.

In the factory setting the RFC-1 checks one alarm channel every 10 seconds. The alarms are checked in rotation: alarm A, B, C, and so on. After alarm H is checked the system loops back to alarm A. Unused alarms are ignored so if only alarms A-C are used the rotation will loop from alarm C to alarm A.

The rate at which the alarms are checked can be changed according to the table below. Additionally, there is a weighted scan rotation that checks alarm H more frequently than all other alarms. The weighted scan rotation is: alarm A, H, B, H, C, H, and so on. The weighted scan gives alarm H higher priority than the other alarms.

V1	Scan Interval	Scan Rotation	V1	Scan Interval	Scan Rotation
0	5 seconds	Normal: A, B, C, D, E, F, …	8	5 seconds	Weighted: A, H, B, H, C, H, …
1 *	10 seconds	Normal: A, B, C, D, E, F, …	9	10 seconds	Weighted: A, H, B, H, C, H, …
2	15 seconds	Normal: A, B, C, D, E, F, …	10	15 seconds	Weighted: A, H, B, H, C, H, …
3	30 seconds	Normal: A, B, C, D, E, F, …	11	30 seconds	Weighted: A, H, B, H, C, H, …
4	45 seconds	Normal: A, B, C, D, E, F, …	12	45 seconds	Weighted: A, H, B, H, C, H, …
5	60 seconds	Normal: A, B, C, D, E, F, …	13	60 seconds	Weighted: A, H, B, H, C, H, …
6	120 seconds	Normal: A, B, C, D, E, F, …	14	120 seconds	Weighted: A, H, B, H, C, H, …
7	240 seconds	Normal: A, B, C, D, E, F, …	15	240 seconds	Weighted: A, H, B, H, C, H, …

* This is the default setting.

The scan interval and sequence are programmed at memory address 1013. Select the value from the table above and program it at this address to adjust the scan interval and/or scan rotation.

The scan interval and the number alarms in use determine how often a specific alarm channel will be checked. Assuming the default setting of 10 seconds for the scan interval, a single alarm will be checked every 10 seconds. If two alarms are used, each alarm is checked every 20 seconds. Alarm conditions are typically recognized within several seconds in actual use due to randomness and statistical distribution.

6.7 Timed Events

Incorrect use of the following information can cause unexpected or undesirable behavior. We strongly recommend that you understand the basic operation of the RFC-1 and the specifics of the installation before continuing. Please read the documentation above that describes the Advanced Programming Mode before continuing if you have not done so already.

The RFC-1 has an internal clock and calendar that allow it to trigger an action sequence by the time and date with a wide variety of options. Memory is available for at least 48 date/time triggers but there may be more depending on the installation. This will be discussed later in this section.

Timed events are disabled when a user is connected. This includes local and remote connections in both voice and data modes. When a connection is active, any timed events that are scheduled will not occur either during the session or after it ends. The user session completely overrides automated activity. This decreases the potential for a user and the RFC-1 perform conflicting activities.

New telemetry reference values for the alarm system are taken after an action sequence completes. This includes action sequences that are triggered by the internal clock/calendar. This is usually desirable as it prevents the RFC-1 from interpreting a programmed activity as an alarm condition and taking inappropriate corrective actions.

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. If this not the desired behavior, the telemetry reference scan can be inhibited through action sequence programming discussed previously.

6.7.1 Enabling Timed Events

The clock controls the master on/off switch for timed events. Set the clock and calendar with valid date and time information and any timed events that are programmed will be active.

6.7.2 Disabling Timed Events

When the RFC-1 loses power the clock resets to 00:99:00 and freezes. Timed events cannot occur in this state. Likewise, to disable all timed events, set the clock hours to 00 and the minutes to 99. Disable an individual timed event by writing its memory block with the value 0. This completely removes the date/time trigger from memory.

6.7.3 Date/Time Triggers and Telemetry Channels—Shared Memory Region

Memory is permanently allocated for 48 date/time triggers in the RFC-1. These 48 date/time triggers occupy addresses 0256-0639 in the Programming Address Table. Additionally, shared memory is available that can increase the number up to 80 date/time triggers. The extra memory is taken from memory that would otherwise store telemetry channel descriptors. Memory for the higher channel numbers that are not commonly used can be allocated for more date/time triggers.

Looking at the Programming address table, the date/time triggers appear to be numbered backward. As the address increases—the normal direction for programming—the number of the date/time trigger decreases. This is not a mistake. The numbering is consistent as the date/time triggers transition into shared memory. This selection from the Programming Address Table highlights the transition—notice the Alternate Use column. See section 6.7.4 for more information on allocating memory for date/time triggers.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0248	Channel 62: telemetry units or status format - value 1	6.3.2	0	____	Date/time 49: action sequence
0249	Channel 62: telemetry units or status format - value 2	6.3.2	3	____	Date/time 49: month
0250	Channel 62: full scale and decimal point	6.3.4	2	____	Date/time 49: date - value 1
0251	Channel 62: linear/log/indirect and auto relay	6.3.5	0	____	Date/time 49: date - value 2
0252	Channel 63: telemetry units or status format - value 1	6.3.2	0	____	Date/time 49: hour - value 1
0253	Channel 63: telemetry units or status format - value 2	6.3.2	3	____	Date/time 49: hour - value 2
0254	Channel 63: full scale and decimal point	6.3.4	2	____	Date/time 49: minute - value 1
0255	Channel 63: linear/log/indirect and auto relay	6.3.5	0	____	Date/time 49: minute - value 2
0256	Date/time trigger 48: action sequence	6.7.4	0	____	Alarm block 48: block indicator
0257	Date/time trigger 48: month	6.7.4	0	____	Alarm block 48: alarm to block
0258	Date/time trigger 48: date—value 1	6.7.4	0	____	Alarm block 48: month
0259	Date/time trigger 48: date—value 2	6.7.4	0	____	Alarm block 48: day(s) of week
0260	Date/time trigger 48: hour—value 1	6.7.4	0	____	Alarm block 48: start hour—V1
0261	Date/time trigger 48: hour—value 2	6.7.4	0	____	Alarm block 48: start hour—V2
0262	Date/time trigger 48: minute—value 1	6.7.4	0	____	Alarm block 48: end hour—V1
0263	Date/time trigger 48: minute—value 2	6.7.4	0	____	Alarm block 48: end hour—V2

6.7.4 Programming a Timed Event

A timed event is a combination of two things: a date/time trigger and an action sequence. The date/time trigger contains all data for *when* the event will occur but not what happens. The action sequence holds the instructions that are executed but it contains no timing information whatsoever. This results in a system that is both flexible and efficient.

- 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 or day of week 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 a month value larger than 9. Program the value 15 to have the trigger activate *every* month.

The date setting uses two memory locations. Program the first digit of the date in the first location (V1) and the second digit of the date in the second location (V2). Use 0 for the first digit (V1) if the date is below 10. Program the value 15 at both locations to trigger an event every day of a month.

The hour setting uses two memory locations. Program the first digit of the hour in the first location (V1) and the second digit in the second location (V2). Use a 24-hour clock. Program a 0 for the first digit if the value is below 10. Program the value 15 at both locations to trigger an event every hour of a day.

The minute setting uses two memory locations. Program the first digit of the minute in the first location (V1) and the second digit in the second location (V2). Program a 0 for the first digit if the value is below 10.

Special codes that provide other triggering options are described below.

6.7.5 Special Triggering Options

The RFC-1 has settings that simplify programming for events that repeat on easily defined intervals. A single date/time trigger will trigger an event using the specified interval(s).

Program V1 and V2 from the table below for date value 1 and 2 to trigger an event on the specified days of the week.

V1	V2	Day(s) of the Week	V1	V2	Day(s) of the Week
15	1	Monday	15	6	Saturday
15	2	Tuesday	15	7	Sunday
15	3	Wednesday	15	13	Weekdays only: Monday through Friday
15	4	Thursday	15	14	Weekends only: Saturday & Sunday
15	5	Friday	15	15	Every day: Monday through Sunday

Program V1 and V2 from the table below for hour value 1 and 2 to trigger an event when the specified number of hours passes.

V1	V2	Hour trigger
15	1	Every hour (same as 15-15)
15	2	Every 2nd hour
15	3	Every 3rd hour
15	4	Every 4th hour
15	15	Every hour

Program V1 and V2 from the table below for minute value 1 & 2 to trigger an event when the specified number of minutes passes.

V1	V2	Minute trigger
15	1	Every minute (same as 15-15)
15	2	Every 2 minutes
15	3	Every 3 minutes
15	4	Every 4 minutes
15	5	Every 5 minutes
15	15	Every minute

6.7.6 Programming Examples

Shown below are examples of some commonly performed tasks and minor variations of those tasks to show how the programming changes. Programming date/time triggers is not difficult; there are just a number of options to consider.

Suppose we need to print a set of telemetry readings to a local printer once every hour at 5 minutes after the hour on every day of every month. The preset action sequence 11 will perform the print function. We will use date/time trigger 1 but any unused date/time trigger will work. Starting at address 0632 the programming is shown below.

			- Programming -		
Addr	Description	Section	Default	Current	Alternate Use / Notes
0632	Date/time trigger 1: action sequence	6.6.4	0	11	Alarm block 1: block indicator
0633	Date/time trigger 1: month	6.6.4	0	15	Alarm block 1: alarm
0634	Date/time trigger 1: day - value 1	6.6.4	0	15	Alarm block 1: month
0635	Date/time trigger 1: day - value 2	6.6.4	0	15	Alarm block 1: day of week
0636	Date/time trigger 1: hour - value 1	6.6.4	0	15	Alarm block 1: start hour - V1
0637	Date/time trigger 1: hour - value 2	6.6.4	0	15	Alarm block 1: start hour - V2
0638	Date/time trigger 1: minute - value 1	6.6.4	0	0	Alarm block 1: end hour - V1
0639	Date/time trigger 1: minute - value 2	6.6.4	0	5	Alarm block 1: end hour - V2

This tells the system to trigger action sequence 10, every month, every day, every hour at 5 minutes after the hour.

The previous example can be altered to print every day at 6:00 am. The programming is shown below.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0632	Date/time trigger 1: action sequence	6.6.4	0	11	Alarm block 1: block indicator
0633	Date/time trigger 1: month	6.6.4	0	15	Alarm block 1: alarm
0634	Date/time trigger 1: day - value 1	6.6.4	0	15	Alarm block 1: month
0635	Date/time trigger 1: day - value 2	6.6.4	0	15	Alarm block 1: day of week
0636	Date/time trigger 1: hour - value 1	6.6.4	0	0	Alarm block 1: start hour - V1
0637	Date/time trigger 1: hour - value 2	6.6.4	0	6	Alarm block 1: start hour - V2
0638	Date/time trigger 1: minute - value 1	6.6.4	0	0	Alarm block 1: end hour - V1
0639	Date/time trigger 1: minute - value 2	6.6.4	0	0	Alarm block 1: end hour - V2

Use multiple date/time triggers to repeat an event at different times. To print a second set of readings at 6:00 pm, program *another* date/time trigger. Remember to use a 24-hour clock. The programming is shown below.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0624	Date/time trigger 2: action sequence	6.6.4	0	11	Alarm block 2: block indicator
0625	Date/time trigger 2: month	6.6.4	0	15	Alarm block 2: alarm
0626	Date/time trigger 2: day - value 1	6.6.4	0	15	Alarm block 2: month
0627	Date/time trigger 2: day - value 2	6.6.4	0	15	Alarm block 2: day of week
0628	Date/time trigger 2: hour - value 1	6.6.4	0	1	Alarm block 2: start hour - V1
0629	Date/time trigger 2: hour - value 2	6.6.4	0	8	Alarm block 2: start hour - V2
0630	Date/time trigger 2: minute - value 1	6.6.4	0	0	Alarm block 2: end hour - V1
0631	Date/time trigger 2: minute - value 2	6.6.4	0	0	Alarm block 2: end hour - V2

Or, use a single date/time trigger to repeat an event at an interval. To print a set of readings every 3 hours, program a date/time trigger as shown below.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0632	Date/time trigger 1: action sequence	6.6.4	0	11	Alarm block 1: block indicator
0633	Date/time trigger 1: month	6.6.4	0	15	Alarm block 1: alarm
0634	Date/time trigger 1: day - value 1	6.6.4	0	15	Alarm block 1: month
0635	Date/time trigger 1: day - value 2	6.6.4	0	15	Alarm block 1: day of week
0636	Date/time trigger 1: hour - value 1	6.6.4	0	15	Alarm block 1: start hour - V1
0637	Date/time trigger 1: hour - value 2	6.6.4	0	3	Alarm block 1: start hour - V2
0638	Date/time trigger 1: minute - value 1	6.6.4	0	0	Alarm block 1: end hour - V1
0639	Date/time trigger 1: minute - value 2	6.6.4	0	0	Alarm block 1: end hour - V2

Obviously this is not an exhaustive list of the programming options but it should start to give you an idea of what is possible using very little programming.

Suppose we need to turn a transmitter on every day at 5:30 am in April and that action sequence 3 is programmed to perform this task. We will use date/time trigger 1 but any unused date/time trigger will work.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0632	Date/time trigger 1: action sequence	6.6.4	0	3	Alarm block 1: block indicator
0633	Date/time trigger 1: month	6.6.4	0	4	Alarm block 1: alarm
0634	Date/time trigger 1: day - value 1	6.6.4	0	15	Alarm block 1: month
0635	Date/time trigger 1: day - value 2	6.6.4	0	15	Alarm block 1: day of week
0636	Date/time trigger 1: hour - value 1	6.6.4	0	0	Alarm block 1: start hour - V1
0637	Date/time trigger 1: hour - value 2	6.6.4	0	5	Alarm block 1: start hour - V2
0638	Date/time trigger 1: minute - value 1	6.6.4	0	3	Alarm block 1: end hour - V1
0639	Date/time trigger 1: minute - value 2	6.6.4	0	0	Alarm block 1: end hour - V2

We can alter this example to turn the transmitter on only on weekdays, not on weekends, with the programming change shown below.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0632	Date/time trigger 1: action sequence	6.6.4	0	3	Alarm block 1: block indicator
0633	Date/time trigger 1: month	6.6.4	0	4	Alarm block 1: alarm
0634	Date/time trigger 1: day - value 1	6.6.4	0	15	Alarm block 1: month
0635	Date/time trigger 1: day - value 2	6.6.4	0	13	Alarm block 1: day of week
0636	Date/time trigger 1: hour - value 1	6.6.4	0	0	Alarm block 1: start hour - V1
0637	Date/time trigger 1: hour - value 2	6.6.4	0	5	Alarm block 1: start hour - V2
0638	Date/time trigger 1: minute - value 1	6.6.4	0	3	Alarm block 1: end hour - V1
0639	Date/time trigger 1: minute - value 2	6.6.4	0	0	Alarm block 1: end hour - V2

Suppose we need to turn the transmitter off every day at 6:30 pm in April and that action sequence 4 is programmed to perform this task. Date/time trigger 2 will trigger the action sequence. The programming is shown below.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0624	Date/time trigger 2: action sequence	6.6.4	0	4	Alarm block 2: block indicator
0625	Date/time trigger 2: month	6.6.4	0	4	Alarm block 2: alarm
0626	Date/time trigger 2: day - value 1	6.6.4	0	15	Alarm block 2: month
0627	Date/time trigger 2: day - value 2	6.6.4	0	15	Alarm block 2: day of week
0628	Date/time trigger 2: hour - value 1	6.6.4	0	1	Alarm block 2: start hour - V1
0629	Date/time trigger 2: hour - value 2	6.6.4	0	8	Alarm block 2: start hour - V2
0630	Date/time trigger 2: minute - value 1	6.6.4	0	3	Alarm block 2: end hour - V1
0631	Date/time trigger 2: minute - value 2	6.6.4	0	0	Alarm block 2: end hour - V2

Again, this is not an exhaustive list. But using the special trigger options it is easy to create recurring events without a lot of programming.

6.7.7 Telemetry Auto-scan Data Interval

The telemetry auto-scan data feature provides logging data at fixed intervals. It is a timed event that operates very much like a date/time trigger event but it is a very specialized case. First, it is not programmed in the same area of memory as the other date/time triggers. Second, it has a fixed set of timing options. And third, it has a fixed function and that is to send data readings to an external device.

The programming options for this feature are easy. Find the number of relay panels that are installed in the system in the table below and program V1 from the table at address 1012 in the programming address table.

V1	Number of relay panels installed
0*	Feature disabled
1	1 relay panel—8 telemetry channels maximum
2	2 relay panels—16 telemetry channels maximum
3	3 relay panels—24 telemetry channels maximum
4	4 relay panels—32 telemetry channels maximum
5	5 relay panels—40 telemetry channels maximum
6	6 relay panels—48 telemetry channels maximum
7	7 relay panels—56 telemetry channels maximum
8	8 relay panels—64 telemetry channels maximum

* This is the default setting.

The timing interval, the time between sets of telemetry readings, is calculated automatically. It is a function of the number of telemetry channels available. The interval will be between 1 and 4 minutes.

The function performs a telemetry auto-scan in data mode. The scan starts with channel 00 and ends with the user-adjustable auto-scan stop channel.

6.7.8 Telemetry Auto-scan Stop Channel

The *auto-scan stop channel*, mentioned above, tells the RFC-1 at what channel to stop during an automatic logging sequence. The auto-scan stop channel is located at memory addresses 1010-1011.

Set the stop channel by programming the first digit of the stop channel at memory location 1010 and the second digit at memory location 1011. Program a zero at address 1010 if the channel number is less than 10, such as 01, 02, 03, etc. Valid channel numbers for the stop channel are 01-63.

6.8 Communication

WARNING!

Incorrect communication 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.

6.8.1 Programming Telephone Numbers

The six telephone numbers stored in the RFC-1 are designated as Telephone Number A-F. Each telephone number contains up to twelve digits. If more digits are required telephone numbers can be chained together for more digits. It is not necessary to use all the digits in a number. Telephone numbers A through D are easily programmed with the commands 86, 87, 88 and 89 respectively. Refer to section 5 for more information on these commands.

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

In addition to the digits to dial, telephone numbers in the RFC-1 have a dialing mode setting and a programmable number of call 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 call mode or an optional pager site ID digit.
- The fourteenth memory location determines how many attempts are made when calling the number.

Starting with the first address of the selected telephone number, program one digit of the telephone number at each successive address. If all twelve digits are not needed, enter the value 10 for unused digits at the trailing end of the number. The RFC-1 recognizes 10 as an unused digit in a telephone number.

- To dial the ✻ key, program the value 11 in the number where the ✻ should occur.
- To dial the # key, program the value 12 in the number where the # should occur.

When dialing in voice mode using *pulse* dialing, the ✻ and # digits will be translated into a short pause because these characters do not exist on rotary telephones.

- Programming the value 13 inserts a one-second pause in a telephone number.
- Programming the value 14 inserts a two-second pause in a telephone number.

When dialing in voice mode using *pulse* dialing, both values insert a one-second pause. When dialing in data mode both values insert a two second pause.

Special instructions apply when programming numbers for pagers that may take precedence over the rules above.

6.8.2 Extending Telephone Numbers

When more than twelve digits are needed for a single call, two (or more) telephone numbers can be chained together to form one longer telephone number. Program the final digit of a telephone number with the value 15 as an indicator to continue dialing the next telephone number. Program the first digit of the next telephone number with a 10 (blank) to keep the RFC-1 from dialing the extended number as part of the calling rotation.

In the example below, telephone numbers B and C are chained together for a long dialing sequence. The extra digits and pauses are used to show a case in which extra digits would be needed when dialing a number. In this example, the *Notes* column provides details for the value programmed at each address.

			- Programming -		
Addr	Description	Section	Default	Current	Alternate Use / Notes
0654	Telephone number B: value 1	6.8.1	10	9	dial 9 for an outside line
0655	Telephone number B: value 2	6.8.1	10	14	pause 2 seconds
0656	Telephone number B: value 3	6.8.1	10	14	pause 2 seconds more
0657	Telephone number B: value 4	6.8.1	10	1	dial 1 for long distance
0658	Telephone number B: value 5	6.8.1	10	13	pause 1 second
0659	Telephone number B: value 6	6.8.1	10	6	area code is 615
0660	Telephone number B: value 7	6.8.1	10	1	“
0661	Telephone number B: value 8	6.8.1	10	5	“
0662	Telephone number B: value 9	6.8.1	10	5	number is 555-1212
0663	Telephone number B: value 10	6.8.1	10	5	“
0664	Telephone number B: value 11	6.8.1	10	5	“
0665	Telephone number B: value 12	6.8.1	10	15	chain to next telephone number
0666	Telephone number B: call mode--voice/data/pager ID	6.8.4	0	0	call in voice mode
0667	Telephone number B: call attempts	6.8.3	3	3	make three call attempts max
0668	Telephone number C: value 1	6.8.1	10	10	make this number appear blank
0669	Telephone number C: value 2	6.8.1	10	1	finish the telephone number
0670	Telephone number C: value 3	6.8.1	10	2	“
0671	Telephone number C: value 4	6.8.1	10	1	“
0672	Telephone number C: value 5	6.8.1	10	2	“
0673	Telephone number C: value 6	6.8.1	10	10	unused digits, fill with value 10
0674	Telephone number C: value 7	6.8.1	10	10	“
0675	Telephone number C: value 8	6.8.1	10	10	“
0676	Telephone number C: value 9	6.8.1	10	10	“
0677	Telephone number C: value 10	6.8.1	10	10	“
0678	Telephone number C: value 11	6.8.1	10	10	“
0679	Telephone number C: value 12	6.8.1	10	10	“
0680	Telephone number C: call mode--voice/data/pager ID	6.8.4	0	0	call mode is set above
0681	Telephone number C: call attempts	6.8.3	3	0	call attempts are set above

The call mode and call attempts of a long dialing sequence are determined by the settings for the first number in the chain. The settings in the extended numbers are ignored and should be set to 0.

6.8.3 Setting the Call Attempts

Telephone numbers can be called more than once in the event that a number is busy on the first attempt. Each telephone number A-F has a call attempt setting. This sets the maximum number of times the number will be dialed. If a user clears the alarm then calls are stopped.

Call attempts can be set from 1 to 4. Values greater than 4 will be result in a maximum of 4 calls. The factory setting is two attempts for each number.

6.8.4 Setting the Call Mode

Each telephone number has an associated dialing mode. This setting determines how the number is dialed: in voice mode, data mode or pager mode. There are two pager modes: pager mode and legacy pager mode. Pager mode supports many features of modern paging systems. Legacy pager mode sends a single digit repeatedly to the paging terminal for rudimentary site identification.

Select the call mode from the table below and program the associated V1 at the appropriate address to set the call mode for a telephone number. Some call modes require special programming. Details are provided below.

V1	Call Mode	V1	Call Mode
0 *	Voice mode	8	Legacy pager mode with site ID digit 4
1	Data mode to modem	9	Legacy pager mode with site ID digit 5
2	Pager mode to text pager using data terminal	10	Legacy pager mode with site ID digit 6
3	Pager mode to text pager using DTMF tones	11	Legacy pager mode with site ID digit 7
4	Legacy pager mode with site ID digit 0	12	Legacy pager mode with site ID digit 8
5	Legacy pager mode with site ID digit 1	13	Legacy pager mode with site ID digit 9
6	Legacy pager mode with site ID digit 2	14	Legacy pager mode with site ID digit ✻
7	Legacy pager mode with site ID digit 3	15	Legacy pager mode with site ID digit #

* This is the default setting.

Many paging systems use the ✻ and # keys as control keys. Items 14 and 15 may not work with all paging systems.

6.8.4.1 Calling Voice Numbers

Voice mode is the default setting for all calls. In a voice call, the RFC-1 dials the telephone and speaks a message to alert station personnel of the condition that triggered the call. The message consists of the site identification phrase followed by a brief message that describes the condition such as, “telemetry alarm” or “power failure”. No extra hardware is required for voice mode calling.

6.8.4.2 Calling a Data Number

Data mode calls are used when the RFC-1 is performing a remote logging function to a personal computer or other remote terminal. Data calls require a modem accessory for the RFC-1 such as the MA-2 Modem Adapter.

In a data call, the RFC-1 establishes a data connection between its modem and the modem at the associated telephone number. Once a connection is made, communication takes place using ASCII data. This data stream can be captured by a software terminal program on a personal computer and logged to a file or sent to a printer.

An alarm call in data mode will send a message consisting of the date and time, the site identification phrase and a brief alarm message. It will look similar to the sample below.

```
Date: 01/01/2006
Time: 04:38:29
Site: This is RFC1B
Telemetry Alarm Channel 00: 107.2 Percent Power
```

6.8.4.3 Calling Pagers in Voice Mode

The RFC-1 can call a text pager in data mode or in voice/DTMF mode. Calling a pager in voice mode does not require extra hardware. The pager message will consist of a programmable site ID number and, optionally, the number of the telemetry channel that triggered the alarm.

The RFC-1 must be set to dial using DTMF tones rather than pulse dialing to call a pager in this mode. This setting is discussed in section 6.8.5.

Calling a pager in voice mode requires the RFC-1 to call the pager and send extra digits as if a person was paging. Some paging systems recognize keystrokes immediately on answering. Other paging systems require keystrokes to navigate a menu system before paging. The RFC-1 should be able to interact with either type of system with proper programming. Paging systems with menus require commands and pauses to be simulated in the ID described below.

Calling a text-based pager with the RFC-1 requires programming two telephone numbers. The first number is the telephone number of the pager. It can be programmed as telephone number A, B, C or D. The second number is the site ID that will be sent to the pager. This can be the telephone number at the transmitter site or any other series of numbers that will uniquely identify the site. *The site ID number must be programmed at telephone number E.*

There are special rules for programming the site ID number. *The first digit must be 10 of the site ID number must be 10.* This stops the standard calling routines from dialing the site ID number. All remaining digits of telephone number E are programmed with the digits that will be sent to the pager. If the paging terminal has a menu, those keystrokes should be programmed here as well.

- To dial the ✻ key, program the value 11 in the site ID number where the ✻ should occur.
- To dial the # key, program the value 12 in the site ID number where the # should occur.
- To insert a pause, program the value 13 in the site ID number where the pause should occur.

Some paging systems require the sender to terminate the entry, in this case the site ID, by pressing the # key. Program the value 12 as the last digit of the site ID to send the #. The paging system will interpret this tone as the end of the sequence and terminate the call. Most systems will time out and send the page even without the # key.

If the value 11 (✻) is programmed as a digit in the site ID, the RFC-1 will send a dash and the number of the channel that triggered the alarm. Some paging systems ignore the ✻ key in which case these characters may be dropped.

In the example below, the telephone number for the pager is 555-1212 and the site ID that will be sent to the pager is 615-228-3500. The optional ✻ command is being used to add the channel number to the display and the # key is being sent to terminate the page.

Addr	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0682	Telephone number D: value 1	6.7.1	10	5	pager number 555-1212
0683	Telephone number D: value 2	6.7.1	10	5	_____
0684	Telephone number D: value 3	6.7.1	10	5	_____
0685	Telephone number D: value 4	6.7.1	10	1	_____
0686	Telephone number D: value 5	6.7.1	10	2	_____
0687	Telephone number D: value 6	6.7.1	10	1	_____
0688	Telephone number D: value 7	6.7.1	10	2	_____
0689	Telephone number D: value 8	6.7.1	10	10	unused digits, fill with value 10
0690	Telephone number D: value 9	6.7.1	10	10	
0691	Telephone number D: value 10	6.7.1	10	10	
0692	Telephone number D: value 11	6.7.1	10	10	
0693	Telephone number D: value 12	6.7.1	10	10	
0694	Telephone number D: voice/data/pager ID	6.7.2	0	2	pager call, data mode
0695	Telephone number D: call attempts	6.7.3	3	1	one call attempt
0696	Telephone number E: value 1	6.7.1	10	10	Pager ID or terminal phone: 10
0697	Telephone number E: value 2	6.7.1	10	6	Pager ID or terminal phone: V1
0698	Telephone number E: value 3	6.7.1	10	1	Pager ID or terminal phone: V2
0699	Telephone number E: value 4	6.7.1	10	5	Pager ID or terminal phone: V3
0700	Telephone number E: value 5	6.7.1	10	2	Pager ID or terminal phone: V5
0701	Telephone number E: value 6	6.7.1	10	2	Pager ID or terminal phone: V6
0702	Telephone number E: value 7	6.7.1	10	8	Pager ID or terminal phone: V7
0703	Telephone number E: value 8	6.7.1	10	3	Pager ID or terminal phone: V8
0704	Telephone number E: value 9	6.7.1	10	5	Pager ID or terminal phone: V9
0705	Telephone number E: value 10	6.7.1	10	0	Pager ID or terminal phone: V10
0706	Telephone number E: value 11	6.7.1	10	0	Pager ID or terminal phone: V11
0707	Telephone number E: value 12	6.7.1	10	11	Pager ID or terminal phone: V12
0708	Telephone number E: voice/data/pager ID	6.7.2	0	12	Pager ID or terminal phone: V13
0709	Telephone number E: call attempts	6.7.3	3	10	Pager ID or terminal phone: V14

RFC-1 versions prior to 6.00 had limited paging capability. In legacy pager mode, the RFC-1 dials the pager and sends a single digit repeatedly to the paging terminal. The result is a pager display filled with a single digit. The digit that is sent is programmable and serves as a site ID number. The site ID number is programmable as part of the call mode setting of the telephone number. See the table above with call mode settings for details.

Legacy pager mode is included for backward compatibility. If telephone number E is already in use then legacy pager mode can be used as an alternative. Legacy paging mode cannot respond to paging system menus.

6.8.4.4 Calling Pagers in Data Mode

The RFC-1 can also send full text messages to a pager by calling a paging terminal in data mode. This type of call provides the most information of the available paging options but it has a more involved setup. Text paging requires a data modem accessory, model MA-2 Modem Adapter, and an access number to a data based paging terminal.

The RFC-1 sends text messages to a paging terminal using the TAP protocol in automatic message mode. This is a standard protocol used by many service providers. Setting up the RFC-1 to send text messages requires a data access number from the paging service provider and the baud rate and data protocol of the paging terminal. The baud rate adjustment of the RFC-1 has special settings to accommodate paging terminals. The baud rate and data format settings are discussed later in this section.

In this mode, the RFC-1 calls the paging terminal via modem. After the modems establish a connection, the RFC-1 sends a specially coded message to the paging terminal. The message includes the pager ID number to identify the message recipient and the message to be delivered to the pager.

As in voice mode paging, data mode paging requires two telephone numbers. The first number is the paging terminal number—the telephone number to the modem bank of the service provider. It can be programmed at telephone number A, B, C or D. The second number is the pager ID—this is typically the telephone number of pager. *The pager ID must be programmed at telephone number location E.*

There are special rules for programming the pager ID number. *The first digit of the pager ID number must be 10.* This stops the standard calling routines from dialing the site ID number. The remaining digits of telephone number E are used to store the pager ID number. Unused digits should be filled with the value 10.

Some paging systems require a 10-digit pager ID and others require only 7 digits. This is determined by the pager service provider. Program the pager ID number according to the requirements of the service provider. As with all other telephone numbers, fill unused digits in the pager ID with the value 10.

In the example below, the telephone number for the paging data terminal is 555-1212 and the telephone number of the pager that will receive the message is 615-228-3500.

			- Programming -		
Addr	Description	Section	Default	Current	Alternate Use / Notes
0682	Telephone number D: value 1	6.7.1	10	5	paging data terminal 555-1212
0683	Telephone number D: value 2	6.7.1	10	5	_____
0684	Telephone number D: value 3	6.7.1	10	5	_____
0685	Telephone number D: value 4	6.7.1	10	1	_____
0686	Telephone number D: value 5	6.7.1	10	2	_____
0687	Telephone number D: value 6	6.7.1	10	1	_____
0688	Telephone number D: value 7	6.7.1	10	2	_____
0689	Telephone number D: value 8	6.7.1	10	10	unused digits, fill with value 10
0690	Telephone number D: value 9	6.7.1	10	10	
0691	Telephone number D: value 10	6.7.1	10	10	
0692	Telephone number D: value 11	6.7.1	10	10	
0693	Telephone number D: value 12	6.7.1	10	10	
0694	Telephone number D: voice/data/pager ID	6.7.2	0	3	pager call, voice mode
0695	Telephone number D: call attempts	6.7.3	3	1	one call attempt
0696	Telephone number E: value 1	6.7.1	10	10	Pager ID or terminal phone: 10
0697	Telephone number E: value 2	6.7.1	10	6	Pager ID or terminal phone: V1
0698	Telephone number E: value 3	6.7.1	10	1	Pager ID or terminal phone: V2
0699	Telephone number E: value 4	6.7.1	10	5	Pager ID or terminal phone: V3
0700	Telephone number E: value 5	6.7.1	10	2	Pager ID or terminal phone: V4
0701	Telephone number E: value 6	6.7.1	10	2	Pager ID or terminal phone: V5
0702	Telephone number E: value 7	6.7.1	10	8	Pager ID or terminal phone: V6
0703	Telephone number E: value 8	6.7.1	10	3	Pager ID or terminal phone: V7
0704	Telephone number E: value 9	6.7.1	10	5	Pager ID or terminal phone: V8
0705	Telephone number E: value 10	6.7.1	10	0	Pager ID or terminal phone: V9
0706	Telephone number E: value 11	6.7.1	10	0	Pager ID or terminal phone: V10
0707	Telephone number E: value 12	6.7.1	10	10	Pager ID or terminal phone: V11
0708	Telephone number E: voice/data/pager ID	6.7.2	0	10	Pager ID or terminal phone: V12
0709	Telephone number E: call attempts	6.7.3	3	10	Pager ID or terminal phone: V13

When an alarm call is made to a pager in this mode, the pager receives a message that contains the RFC-1 site ID phrase followed by the phrase “Telemetry Alarm” then the channel number that caused the alarm and the value of the channel at the time of the alarm. No time/date information is sent since most pagers place a time/date stamp on the message when it is received.

6.8.5 Tone / Pulse Dialing

The original RFC-1 hardware with the mechanical sounding voice only pulse dials. Later models that use the human-male sounding speech-processor perform tone dialing using the speech-processor. The tones are designed to compensate for component tolerances. More recent models have a dedicated hardware for generating DTMF tones.

Use of the dedicated tone generator is recommended if hardware supports this feature. This is the factory default setting on new systems that have appropriate hardware.

The speech-processor generated tones are a workable substitute for a dedicated tone generator in most cases. There are a few telephone line emulation devices do not accept them. Pulse dialing should work with all POTS lines and can be used in situations where the imprecise DTMF tones do not work reliably.

V1	Dialing Method
0	Pulse
1	Tones generated by speech processor
2	Tones generated by dedicated hardware

Program the value from the column V1 into memory address 0999 set the dialing method. Tones generated by dedicated hardware are the preferred option *if your hardware supports this option*.

6.8.6 Alarm Call Message Duration

When making an alarm call in voice mode the RFC-1 will repeat the alarm message for a predetermined time-period. This time-period is adjustable. Select the message duration from the table below and program the corresponding V1 at address 1003.

V1	Alarm Call Duration	V1	Alarm Call Duration
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	14	140 seconds
7	70 seconds	15	150 seconds

* This is the default setting.

6.8.7 Alarm Call Pause Duration

When making alarm calls in voice mode the RFC-1 will pause between calls to allow an operator to contact the system. This time-period is adjustable. Select the pause duration from the table below and program the corresponding V1 at address 1004.

V1	Alarm Call Pause Duration	V1	Alarm Call Pause Duration
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	14	140 seconds
7	70 seconds	15	150 seconds

* This is the default setting.

6.8.8 Ring Sensitivity and Hang-up Detection

Attention!

Previous versions of the RFC-1 used a different, non-linear scale for the ring sensitivity adjustment. The scale below is only appropriate for systems running version 6.0 or higher. Using this data table to adjust earlier versions can cause unexpected and undesirable behavior.

In previous versions of the RFC-1 the ring sensitivity setting shared a memory location with the dedicated control port feature. The dedicated control port adjustment has been combined with the communication mode at address 1002. In version 6, ring sensitivity is combined with the pulse hang-up detection disable setting.

Modern communication systems offer a variety of devices that provide the services of a traditional phone system. Many of these devices generate a ring signal that not the same as the ring signal generated by a standard telephone line. In some cases, it is necessary to adjust the RFC-1 so that it recognizes the ring signal.

The adjustment only affects ring detection. It has no effect on outbound dialing or on DTMF tone detection.

Select the ring sensitivity setting from the table below and program the corresponding V1 at address 1014. Higher values have more aggressive ring detection. *Do not select a value of V1 higher than 7 unless you have a very specific need.*

V1	Sensitivity	Hang-up Detector	V1	Hang-up Detector	Description
0	-3	enabled	8	disabled	Slow ring detect—high noise immunity
1	-2	enabled	9	disabled	
2	-1	enabled	10	disabled	
3 *	0	enabled	11	disabled	Typical operating value—POTS line setting
4	+1	enabled	12	disabled	
5	+2	enabled	13	disabled	
6	+3	enabled	14	disabled	
7	+4	enabled	15	disabled	Quick ring detect—low noise immunity

* This is the default setting.

Devices that emulate a telephone line often require this adjustment. Devices include cellular phone docking stations and broadband voice line interfaces. Any device that regenerates the incoming ring signal may require increasing the ring sensitivity. The setting V1=7 usually works with these devices.

This adjustment also provides a method to disable the hang-up detector in the RFC-1. The hang-up pulse 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 command, 99, is issued or until the idle system timer expires—2.5 minutes in the factory setting. See below.

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.

6.8.9 Communication Mode

This adjustment sets the mode for incoming calls only. It has no effect on outgoing telephone calls.

The communication mode determines what type of connections the RFC-1 receives for monitoring and control. It also determines whether the connection is part-time or full-time. A dial-up connection is typically part-time; the connection is broken at the end of the call. A data connection can be part-time or full-time over a dedicated line.

The default communication mode for the RFC-1 is dial-up, voice connection. This is what the device was originally designed to do and it is capable of operating this way with no additional hardware. The RFC-1 can operate over an RS-232 serial data connection with additional hardware accessories. When used this way the RFC-1 responds to the same commands as it does over a dial-up voice connection.

Remote data collection is possible through action sequence programming and date/time triggers. See action sequence programming for more details.

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Voice mode and data mode are not mutually exclusive but only one communication port can be active at a time. The RFC-1 can switch between the two modes seamlessly. When dial-up connections are used, the RFC-1 can be programmed to answer in one mode, and then try the other mode if the first connection is not successful.

The RFC-1 also offers a dedicated control mode. When this feature is enabled, the RFC-1 remains active on the selected port—it does not disconnect as it does at the end of a dial-up connection. Use of a dedicated port does not limit use of the RFC-1 to only the dedicated port. If a dial-up connection occurs, the RFC-1 can suspend the dedicated session and accept the dial-up connection. The RFC-1 will resume communication on the dedicated connection when the dial-up connection is complete.

For example, the RFC-1 can support a dedicated data connection for normal operation. In an emergency, an engineer can call the RFC-1 in voice mode and operate the system normally. The RFC-1 will resume data communication when the call is complete.

V1	Dial-up Primary Mode	Dial-up Secondary Mode	Dedicated Control Mode
0 *	Voice	None	None
1	Data	None	None
2	Voice	Data	None
3	Data	Voice	None
4	Voice	None	Voice
5	Data	None	Voice
6	Voice	Data	Voice

* This is the default setting.

When the dedicated control mode is enabled over a voice connection, the RFC-1 activates the local phone port whenever it is not busy with a call. Using this mode requires a full-time, voice-grade audio link and a DTMF tone generator. The audio link transmits commands via DTMF tones to the RFC-1. Responses are sent back to the remote site over the audio link. Details of the audio link are discussed in the installation section of this document.

When voice is the primary dial-up mode and data is the secondary mode, the main security code must be entered to activate voice mode. This must occur before the RFC-1 security code timer expires. The RFC-1 will switch to data mode if the timer expires before the code is entered. The time is set at address 1016—the incorrect security code lockout time. The default setting of 10 seconds works well in most cases.

If data is the primary mode, the RFC-1 will switch to voice mode if the data device does not connect in a timely manner. This is a safety measure to avoid being locked out of the system in an emergency.

6.8.10 Data Communication Settings

References in this section to paging terminals are strictly for full-text paging in data mode. This adjustment has no effect on voice mode paging.

The data communication setting is determined by the device(s) that the RFC-1 will connect to in data mode. This adjustment sets the data format for incoming and outgoing connections. The RFC-1 has two data communication settings, one for standard data connections and another for paging terminals. The same adjustment controls both.

The data format for all data connections that are not paging terminals is 8 data bits, no parity and 1 stop bit (8,N,1). The TAP protocol that the RFC-1 uses for data communication with paging terminals specifies a connection at 300 baud, 7 data bits, even parity and 1 stop bit (7,E,1). This format is available for compliance with the specification but most paging systems will operate at 2400 baud, 8,N,1.

There are four standard data protocol options and four pager data protocol options in the table below. Each of the options repeats so that all 16 combinations are available. If the RFC-1 will not be used to connect to a paging terminal then the *Pager Protocol* setting can be disregarded. In this case, there are only four options to choose from so the choice is limited to values 0 through 3.

In the table below, find the pair of columns that matches both the required data protocol and pager protocol. Program the value from column V1 at memory address 1005 to set the baud rate and data protocols accordingly.

V1	Data Protocol	Pager Protocol	V1	Data Protocol	Pager Protocol
0	9600 baud, 8,N,1	2400 baud, 8,N,1	8	9600 baud, 8,N,1	2400 baud, 7,E,1
1 *	2400 baud, 8,N,1	2400 baud, 8,N,1	9	2400 baud, 8,N,1	2400 baud, 7,E,1
2	1200 baud, 8,N,1	2400 baud, 8,N,1	10	1200 baud, 8,N,1	2400 baud, 7,E,1
3	300 baud, 8,N,1	2400 baud, 8,N,1	11	300 baud, 8,N,1	2400 baud, 7,E,1
4	9600 baud, 8,N,1	300 baud, 8,N,1	12	9600 baud, 8,N,1	300 baud, 7,E,1
5	2400 baud, 8,N,1	300 baud, 8,N,1	13	2400 baud, 8,N,1	300 baud, 7,E,1
6	1200 baud, 8,N,1	300 baud, 8,N,1	14	1200 baud, 8,N,1	300 baud, 7,E,1
7	300 baud, 8,N,1	300 baud, 8,N,1	15	300 baud, 8,N,1	300 baud, 7,E,1

* This is the default setting.

The parallel printer options for the RFC-1 found in the RAK-1 and the PA-1 or PA-2 convert serial data from the RFC-1 to parallel data suitable for a parallel printer. The serial data input on these devices operates at 2400 baud 8,N,1. If any of these options are used then the data protocol should be at a compatible setting. The factory setting works well with these devices.

The modem adapter options MA-1 and MA-2 have a maximum speed of 2400 baud. The factory setting works well with these devices. Faster settings are meant for direct serial connections using the RS-232 serial data adapter.

There are no high-speed data rates available. The RFC-1 does not generate a data stream fast enough to require a high-speed link. Furthermore, the RFC-1 does not perform data compression or error correction.

6.8.11 Manual Communication Mode Change

For testing purposes, the RFC-1 can shift between voice and data modes with commands from the local phone or terminal keyboard. These commands require no special programming. Issue the command 84 from normal operating mode. The RFC-1 will respond with the prompt, “enter one digit command”.

- Enter 0 to switch to voice mode immediately
- Enter 1 to switch to data mode immediately
- Enter ✻ to abort the command

This command has other options for backing up system data. See the next section for details.

6.8.12 Saving and Restoring System Settings

If the RFC-1 has a data accessory attached, the system settings can be copied to the connected device. If the device is a printer then a formatted list of the settings can be printed. If the device is a modem or terminal, software can collect the data and store it to a file. Depending on the data format selected, the file can be printed or saved as a backup and used to restore the system settings should it become necessary.

These commands require no special programming. Issue the command 84 from normal operating mode. The RFC-1 will respond with the prompt, “enter one digit command”.

- Enter 2 to perform a legacy data dump—all user memory is copied to the data port in a simple table
- Enter 3 to perform an annotated data dump—all user memory is copied to the data port with descriptions
- Enter 4 to perform an save/restore data dump—all user memory is copied to the data port in a special format
- Enter ✳ to abort this command

The command can be issued from either the local phone or from the keyboard if a terminal is attached and data mode is active. The data stream will be sent to the data port in either case. The command has no voice mode equivalent.

Pressing the local control button or the ESC key, if a terminal is attached, will halt the memory dump. Memory is not modified or cleared by this procedure; the contents are copied to the data port in the appropriate format. See Restore Factory Settings to clear the system memory.

Legacy Data Dump

The legacy data dump is a simple table consisting of a starting address followed by the 8 data bytes from the next 8 memory addresses. It is included for backward compatibility. A short sample is shown below.

```
0000 00 03 02 00 00 03 02 00
0008 00 03 02 00 00 03 02 00
…
1016  01 00 08 00 00 03 02 00
```

Annotated Data Dump

The annotated data dump displays the data address range, followed by the data and a brief description of the data. Data is ordered by address but broken down by function and displayed in variable length lines. This dump is most informative and easiest to read. This format is the best for printing a copy of the system settings.

```
0000 - 0003  00 03 02 00  Channel 00
0004 - 0007  00 03 02 00  Channel 01
…
1017 - 1023  00 08 00 00 03 02 00  Memory D
```

Save/Restore Data Dump

The save/restore data dump copies the memory contents to the data port in a format that should be captured by a computer. The dump is a continuous feed of data from every address in order from 0000 to 1023. Each data byte is followed by a "#" character. There are spaces in the data stream but there are no addresses, no comments and no carriage returns or line feeds. A short sample is shown below.

```
00 # 03 # 02 # 00 # 00 # 03 # 02 # 00 # 00 # 03 # 02 # 00 # 00 # 03 # 02 # 00 #
00 # 03 # 02 # 00 # 00 # 03 # 02 # 00 # 00 # 03 # 02 # 00 # 00 # 03 # 02 # 00 #
…
00 # 00 # 00 # 07 # 00 # 00 # 04 # 06 # 01 # 00 # 08 # 00 # 00 # 03 # 02 # 00 #
*
```

The # character after each value is included so that the captured data can be used to reprogram the RFC-1. Use a terminal program such as HyperTerminal to capture the data stream and save it to a file. The file must be a pure text file with no line breaks or other formatting information.

To restore the RFC-1 settings, connect to the system, enter programming mode and transmit the file to the RFC-1 in text mode. The RFC-1 will interpret the text as if a user is entering programming commands from the terminal keyboard. The final ✻ character terminates programming mode.

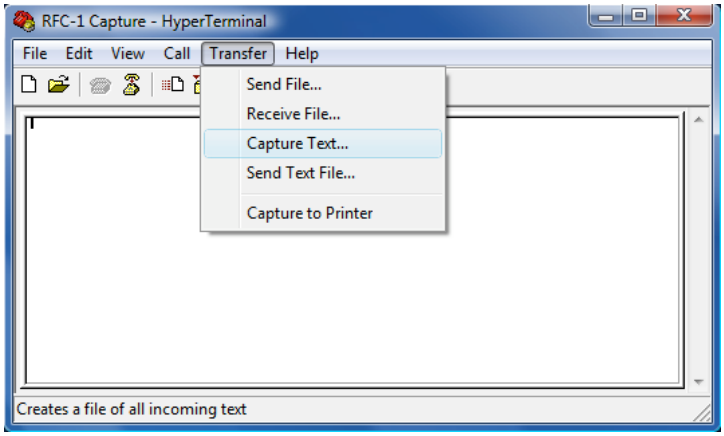
6.8.13 Terminal Emulation Software

HyperTerminal is no longer included with the Windows operating system. The software is available for download but it appears that the software is no longer free for private use. Users of Windows Vista and Windows 7 may be able to download and use an earlier version of the software.

Other programs are available that can be used in place of HyperTerminal. TeraTerm is a good substitute that is open-source and easily downloaded

6.8.14 Backing-up System Settings

The following instructions assume that you know how to connect and operate the RFC-1 in data mode with the installed data accessory. The examples use HyperTerminal in Windows. Other software and other computer platforms will work. Use appropriate terminal emulation software that is for the operating system.



Using HyperTerminal to capture the RFC-1/B settings

To backup the system settings, connect the terminal to the data port. The connection method will vary depending on the data accessory used. If a direct connection is used, follow the instructions below from the beginning. If a remote connection is used, establish a connection to the RFC-1 as you normally would then skip to step 3 below.

1. Connect the terminal, start the terminal software and open a connection on the appropriate port. If the factory settings are used then the data format is 2400 baud 8,N,1. Flow control should be set to none or software.

2. Connect to the RFC-1 with the local telephone.

3. In the HyperTerminal menu bar, select Transfer > Capture Text. A dialog window will open that prompts for a filename. Select a folder where the data should be stored and provide an appropriate filename. Use the default extension .txt because this will be a pure text file.

4. Access the RFC-1 and enter the command 84. The RFC-1 will prompt for a “one-digit command”. Enter 4 to start the data dump.

5. The RFC-1 will begin sending data. The data will appear in the terminal window and it will be captured to the text file that was specified above. This will take several seconds.

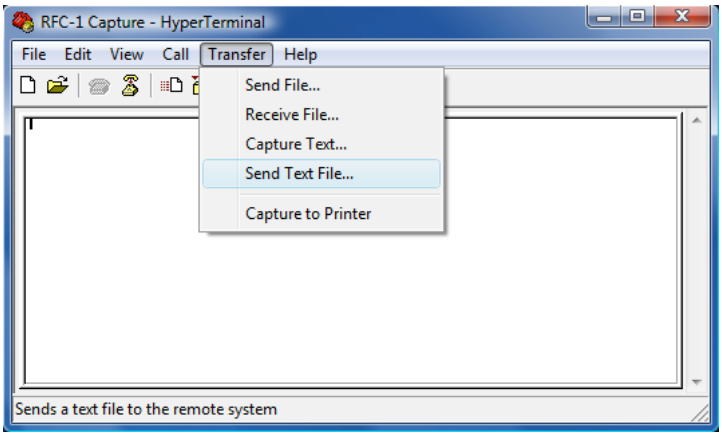
6. The RFC-1 will say “OK” when the dump is complete. The final character in the dump will be a ⁜.

7. In the HyperTerminal menu bar, select Transfer > Capture Text > Stop. This closes the file and stops HyperTerminal from adding any more data to it. The final character in the file must be the ⁜.

8. The process is complete. The file contains the data backup suitable for reprogramming the RFC-1.

6.8.15 Restoring System Settings

The following instructions assume that you know how to connect and operate the RFC-1 in data mode with the installed data accessory. The examples use HyperTerminal in Windows. Other software and other computer platforms will work. Use appropriate terminal emulation software that is for the operating system.



Using HyperTerminal to restore the RFC-1/B settings

To restoring the system settings, connect the terminal to the data port. The connection method will vary depending on the data accessory used. If a direct connection is used, follow the instructions below from the beginning. If a remote connection is used, establish a connection to the RFC-1 as you normally would then skip to step 3 below.

1. Connect the terminal, start the terminal software and open a connection on the appropriate port. If the factory settings are used then the data format is 2400 baud 8,N,1. Flow control should be set to none or software.

2. Connect to the RFC-1 with the local telephone.

3. Access the RFC-1 and enter the command 80 to use programming mode. At the prompt, enter the advanced programming security code. When prompted for a “four-digit address”, enter “0000”. This initiates programming mode in the RFC-1 starting at the first memory address.

4. In the HyperTerminal menu bar, select Transfer > Send Text File. A dialog window will open to select a file. Select the file that contains the RFC-1 backup data created with the procedure above.

5. HyperTerminal will begin transmitting the text. To the RFC-1 it appears that a user is typing new data values at the keyboard each followed by the # key. The transfer will program all 1024 memory locations of the RFC-1 and then send a final ✻ character to exit programming mode. At this point the process is complete and the word “exit” should be the final word on the terminal. The RFC-1 will be in normal operating mode waiting for further commands.

6. Take control of the system or enter 99 and disconnect.

6.9 Security Codes

There are four security codes in the RFC-1. They are: the main security code, the control security code, the basic programming security code and the advanced security code. The easiest way to read and reprogram the security codes is using the prompted commands 72, 73, 74 and 75. They are described in section 5 of this document.

For security reasons, the prompted commands only work from the local phone. If it becomes necessary to change the security codes from a remote location, the codes can be changed in programming mode.

6.9.1 Security Code Programming

All of the security codes can be changed in programming mode—including two extra control security codes that are not discussed in basic operation. Security codes are stored at memory addresses 0948-0983 in the address 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 at each memory address. If a shorter code is used, fill the unused spaces at the end with the value 10. A code will be disabled if it programmed entirely with the value 10.

6.9.2 Control Security Code Mapping

Up to this point all references to control security codes mention a single control security code. There are, in fact, three control security codes in the RFC-1. They are referred to as control security code A, B and C. Each block of channels, in other words each relay panel, can be assigned one of the three control security codes. In the factory settings control security code A is assigned to all relay panels. This is appropriate for most installations.

Using multiple control security codes allows critical and non-critical functions to be wired to separate relay panels and given different codes. Only personnel who are allowed access to critical functions should be given that security code.

Use of multiple control security codes also allows a single RFC-1 to control up to three transmitters with an extra degree of security. If each transmitter is connected to a different relay panel then a different control security code can be assigned to each transmitter. Only the main security code is needed to take readings. But controlling a transmitter requires the control security code assigned to that transmitter's relay panel.

To assign a control security code to a block of channels, select the code A, B or C from the table below and program the value in column V1 at the memory address for the corresponding channel block. These assignments are made at memory address 0976-0983 in the address table.

V1	Control Security Code
1 *	Assign control security code A
2	Assign control security code B
3	Assign control security code C

* This is the default setting.

6.9.3 Incorrect Code Lockout / Communication Mode Switch Delay

The RFC-1 disconnects when an incorrect security code is given. This is a security measure to stop an intruder from making repeated attempts at guessing a code. The RFC-1 will ignore incoming calls for a short time period after a code fails. This feature can be used to thwart attempts to guess the RFC-1 security code.

The duration of time that calls are ignored is adjustable. The factory setting is short enough so that an authorized user should not have a problem contacting the system if a code is entered incorrectly. The time period can be made longer should the need arise. This lockout period only applies to calls, not connection through the local phone.

Select a lockout time from the table below and program the value from column V1 at memory address 1016 to adjust the security code lockout time.

V1	Security Code Lockout & Com. Mode Switch	V1	Security Code Lockout & Com. Mode Switch
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	14	140 seconds
7	70 seconds	15	150 seconds

* This is the default setting.

This setting also determines the length of time the RFC-1 waits before switching communication mode from voice mode to data mode. See communication mode programming for more details.

6.10 Site ID and Other Options

The section provides information on features that do not fall into any of the topics that have already been covered.

6.10.1 Site Identification Phrase

The site identification phrase is what the RFC-1 uses to identify itself. This is the phrase that is spoken, or printed, when the RFC-1 comes online or when it calls out with an alarm notification. The factory setting is "This is RFC-1/B".

The site ID phrase can be programmed with any six words from the word table in Appendix B. Each word in the table is identified by a two-digit code. The site ID phrase occupies memory locations 0984-0995 in the address table. Each word occupies two consecutive memory locations. Program the code pairs for the selected words starting at memory address 0984. *Do not program more than six words.*

Attempting to program more than six words can cause undesirable behavior. The addresses following the site ID phrase control other system functions—specifically, the system hardware version at address 0996. If the wrong data is programmed at this address, the RFC-1 seizes the telephone line making it impossible to call the system.

If all six words are not used, program the unused words with “voice pause 1”. Do not use the longer voice pauses or unintended features may activate. See below for details.

If word 6, stored at addresses 0994-0995, is programmed with "voice pause 5", the RFC-1 will not prompt for a security code when it answers a call. This may be useful when sharing the telephone line with other equipment.

If word 6, stored at addresses 0994-0995, is programmed with "voice pause 4", the RFC-1 adds an extra 2 second pause before it prompts for a security code. Some telephone networks have a longer delay before making a connection. The added pause should ensure that the operator hears the security code prompt.

6.10.2 Hardware Version

Incorrect hardware version settings can cause undesirable system behavior. If incorrect data is programmed, the RFC-1 seizes the telephone line making it impossible to call the system. Do not change this setting unless you are certain that it is required for your installation.

The hardware revision is set at the factory and does not normally require adjustment. If the firmware is upgraded in the field then it may be necessary to adjust this setting.

RFC-1 hardware revisions 1.05 and earlier use a telephone line interface module labeled "XECOM". A firmware adjustment is required to support this device when firmware is upgraded. Dial-up connections will not operate until this adjustment is made from the local phone. *Most systems do not require this adjustment.*

Program the value from column V1 in the table below at memory address 0996 to adjust the hardware version.

V1	PCB Revisions	Description
0	1.00-1.05	"XECOM" DAA module for telephone line interface
1	1.06-1.99 & 2-9	Discrete parts for telephone line interface
2	10-15	ISD2590P speech processor (imprecise tone dial)
3	16	HT9200 tone generator added

The hardware version can only be determined by looking at the system board. If the hardware version cannot be determined from the descriptions above, V1=1 is usually a safe setting.

6.10.3 Inactive System Timeout

As a precaution, the RFC-1 will disconnect after a predetermined period of inactivity—no commands received through either tones or serial data. Find the maximum period of inactivity allowed in the table below. Program the value from column V1 at memory address 1000 to adjust the time-period for the inactive system timeout.

V1	Idle system time-out	V1	Idle system time-out
0	30 seconds	8	32.5 minutes
1	60 seconds	9	41 minutes
2 *	2.5 minutes	10	50.0 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

* This is the default setting.

6.11 Operating Commands / Programming Notes

It may be helpful 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 some common system settings.

Command	Function	Factory Setting	Current Setting
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	Auto-scan channels	n/a	n/a
66	Enable control functions	66	n/a
70	Set calendar	00/00/0000	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	Firmware Version	6.xx	n/a
80	Advanced Programming Mode	n/a	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	**********	_____
89	Telephone Number D	**********	_____
90	Alarm A	64 / 2040 / 1020	____ / _____ / _____
91	Alarm B	64 / 2040 / 1020	____ / _____ / _____
92	Alarm C	64 / 2040 / 1020	____ / _____ / _____
93	Alarm D	64 / 2040 / 1020	____ / _____ / _____
94	Alarm E	64 / 2040 / 1020	____ / _____ / _____
95	Alarm F	64 / 2040 / 1020	____ / _____ / _____
96	Alarm G	64 / 2040 / 1020	____ / _____ / _____
97	Alarm H	64 / 2040 / 1020	____ / _____ / _____
98	Hang-up and ignore	n/a	n/a
99	Hang-up	n/a	n/a

Section 7 — Programming Examples

WARNING!

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

You must be familiar with setup and operation of the RFC-1 for the information in this section to be useful. Unintended or random changes from incorrect use of programming mode can cause erratic behavior in the RFC-1.

7.1 Telemetry Channel—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.

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 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 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. Use the address table to find the starting address for the channel to be programmed.

7.2 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”. Any words or letters from the Word Table can be used.

16. Enter the advanced programming mode: 80
17. Enter the advanced programming security code: 4150
18. Enter the starting address from the address table for the Site ID Phrase: 0984
19. Find the word “hello” in the word table and get the values V1 and V2: V1=3, V2=8
20. Enter V1 for the word “hello”: 3
21. Press the # key to enter this value and increment to the next address in memory
22. Enter V2 for the word “hello”: 8
23. Press the # key to write this value and increment to the next address in memory
24. Find the words “this is” in the word table and get the values V1 and V2: V1=7, V2=11
25. Enter V1 for the words “this is”: 7
26. Press the # key to enter this value and increment to the next address in memory
27. Enter V2 for the words “this is”: 11
28. Press the # key to write this value and increment to the next address in memory
29. Find the word “Curly” in the word table and get the values V1 and V2: V1=2, V2=4
30. Enter V1 for the word “Curly”: 2
31. Press the # key to enter this value and increment to the next address in memory
32. Enter V2 for the word “Curly”: 4
33. Press the # key to write this value and increment to the next address in memory
34. Find the “25ms voice pause” in the word table and get the values V1 and V2: V1=10, V2=5
35. Enter V1 for the “25ms voice pause”: 10
36. Press the # key to enter this value and increment to the next address in memory
37. Enter V2 for the “25ms voice pause”: 5
38. Press the # key to write this value and increment to the next address in memory
39. Find the “25ms voice pause” in the word table and get the values V1 and V2: V1=10, V2=5
40. Enter V1 for the “25ms voice pause”: 10
41. Press the # key to enter this value and increment to the next address in memory
42. Enter V2 for the “25ms voice pause”: 5
43. Press the # key to write this value and increment to the next address in memory
44. Find the “25ms voice pause” in the word table and get the values V1 and V2: V1=10, V2=5
45. Enter V1 for the “25ms voice pause”: 10
46. Press the # key to enter this value and increment to the next address in memory
47. Enter V2 for the “25ms voice pause”: 5
48. Press the # key to write this value and increment to the next address in memory
49. 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 because “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 fun, try replacing one of the voice pauses with “nyuk, nyuk, nyuk” from the Word Table.

7.3 Action Sequence

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.

The commands used by action sequences are documented in Section 6 of this manual. The commands in the example come from tables in Section 6.5.

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. Find the action sequence 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. Find the action sequence 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, 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 Date/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.

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
5. Press the # key to enter this value and increment to the next address in memory
6. Enter up to two digits for the month in which this trigger should function: 15 (every month)
7. Press the # key to write this value and increment to the next address in memory
8. Enter the first digit for the date in which this trigger should function: 15 (every day)
9. Press the # key to write this value and increment to the next address in memory
10. Enter the second digit for the date in which this trigger should function: 15 (every day)
11. Press the # key to write this value and increment to the next address in memory
12. Enter the first digit for the hour at which this trigger should function: 0
13. Press the # key to write this value and increment to the next address in memory
14. Enter the second digit for the hour at which this trigger should function: 6
15. Press the # key to write this value and increment to the next address in memory
16. Enter the first digit for the minute at which this trigger should function: 0
17. Press the # key to write this value and increment to the next address in memory
18. Enter the second digit for the minute at which this trigger should function: 0
19. Press the # key to write this value and increment to the next address in memory
20. Press the ✳ key to exit the programming mode

Section 6 describes the use of the value 15 in a date/time trigger to perform an event every month and/or every day.

The clock and calendar must be set before the time trigger can function. Issue the commands 70 and 71 in the operating mode, *not while in programming mode*, and the RFC-1 will prompt for the time and date.

7.5 Alarm Limits—Analog Channel

In this example we will program Alarm A to monitor telemetry channel 03 with 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. The normal reading on this channel is approximately 100.0.

In this example, we will use the fixed, factory programmed action sequence 9. It is programmed to call all programmed telephone numbers in sequence. When programming alarm limits, ignore the decimal point and enter four significant digits. If a channel reading does not have four digits, pad the left side of the number with zeros until the reading is four digits long. This is the channel reading to use for setting the alarm limits.

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 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: 9 (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

Alarms A-H in the RFC-1 can be reprogrammed using the basic programming commands 90-97 respectively. Only the channel number and limits can be changed with the basic programming commands. Changing the trigger rule and action sequence require using the advanced programming mode.

In the factory default settings, all alarms trigger action sequence 9, which is programmed to call all available telephone numbers. In later examples we will program telephone numbers to complete the alarm setup.

There is a master on/off switch for the telemetry alarm system. Adjust this setting with the command 82. A value of 0 disables all telemetry alarms and the value 1 enables the telemetry alarms.

7.6 Alarm Limits—Status Channel

In this example we will program Alarm B to monitor telemetry channel 05 for the loss of voltage on a status channel. The alarm will have an upper limit of “9999” and a lower limit of “0500”. This might be the case if an audio failsafe is monitoring presence of an audio signal. The output of the failsafe is connected so that 5 volts DC is applied to the telemetry input when audio is present and 0 volts DC is applied when audio fails.

In this case the upper limit is not needed. The upper limit 9999 is used because it is so high it will never be able to trip this alarm. The lower limit does the work in this example but the value is not critical—any value from 0100 to 1000 would work.

When the channel reading goes from “status on” to “status off”, the equivalent analog reading goes from above 2000 to 0. The midpoint of that range (~1000) is where the status reading actually changes. So the value 0500 is selected because it is below the trip point and large enough so that it must be crossed as the analog data drops to 0000.

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 B: 0864
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: 5
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: 7 (lower limit crossing only, 5 also works)
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: 9 (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: 9
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: 9
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: 9
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: 9
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: 5
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 reverse of this alarm would trigger when 5 volts DC is applied and the channel reading is “status on”. The alarm limits would be “1500” for the upper limit, “0000” for the lower limit and either trigger rule 5 or 6 would work.

The telemetry channel requires no special programming—it uses the auto-status feature of the RFC-1. The channel is calibrated so that it reads “status on” when the voltage is applied and “status off” when the voltage is removed.

7.7 Voice Mode Telephone Number

In this example we will program Telephone Number A with a voice number to call when an alarm occurs. We will use the fictitious telephone number 615-555-1212. Since this telephone number is only 10 digits long and the RFC-1 can dial up to 12 digits, we will pad the end of the number with the value 10 to represent an unused digit. Since this is a voice number and it might be busy, we will set the number of call attempts to 2.

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 Telephone Number A: 0640
4. Enter the first digit of the telephone number: 6
5. Press the # key to write this value and increment to the next address in memory
6. Enter the second digit of the telephone number: 1
7. Press the # key to write this value and increment to the next address in memory
8. Enter the third digit of the telephone number: 5
9. Press the # key to write this value and increment to the next address in memory
10. Enter the fourth digit of the telephone number: 5
11. Press the # key to write this value and increment to the next address in memory
12. Enter the fifth digit of the telephone number: 5
13. Press the # key to write this value and increment to the next address in memory
14. Enter the sixth digit of the telephone number: 5
15. Press the # key to write this value and increment to the next address in memory
16. Enter the seventh digit of the telephone number: 1
17. Press the # key to write this value and increment to the next address in memory
18. Enter the eighth digit of the telephone number: 2
19. Press the # key to write this value and increment to the next address in memory
20. Enter the ninth digit of the telephone number: 1
21. Press the # key to write this value and increment to the next address in memory
22. Enter the tenth digit of the telephone number: 2
23. Press the # key to write this value and increment to the next address in memory
24. Enter the eleventh digit of the telephone number (unused): 10
25. Press the # key to write this value and increment to the next address in memory
26. Enter the twelfth digit of the telephone number (unused): 10
27. Press the # key to write this value and increment to the next address in memory
28. Enter the calling mode for this telephone number (voice): 0
29. Press the # key to write this value and increment to the next address in memory
30. Enter the number of call attempts for this telephone number: 3
31. Press the # key to write this value and increment to the next address in memory
32. Press the ✳ key to exit the programming mode

Telephone numbers A-D can be programmed through basic programming commands 86-89 respectively. The calling mode and number of attempts are not adjustable through basic programming but the factory settings are appropriate for most installations. The factory setting for all telephone numbers is for voice mode and two call attempts.

7.8 Text Pager—Voice Mode

In this example we will program Telephone Number B with a voice pager number to call when an alarm occurs. We will use the fictitious telephone number 555-1212 for the pager number. Text pager calls require a site ID number to be programmed at Telephone Number E. We will use 228-3500 for the site ID number. Unused digits will be filled with the value 10. And because this telephone number dials a paging system, which is not likely to be busy, we will set the call attempts to 1.

The RFC-1 can optionally send the channel number that caused the alarm when it sends a message to a text pager in voice mode. Programming the value 11 *after* the site ID number activates this feature. This feature may not be compatible with all paging systems. In this example, we will include this option.

Some paging systems require the user to send the # key to terminate the message. The RFC-1 can send the # key by programming the value 12 as the last digit of the site ID number. This feature is not necessary for all paging systems. In this example, we will include this option.

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 telephone number B: 0654
4. Enter the first digit of the telephone number: 5
5. Press the # key to write this value and increment to the next address in memory
6. Enter the second digit of the telephone number: 5
7. Press the # key to write this value and increment to the next address in memory
8. Enter the third digit of the telephone number: 5
9. Press the # key to write this value and increment to the next address in memory
10. Enter the fourth digit of the telephone number: 1
11. Press the # key to write this value and increment to the next address in memory
12. Enter the fifth digit of the telephone number: 2
13. Press the # key to write this value and increment to the next address in memory
14. Enter the sixth digit of the telephone number: 1
15. Press the # key to write this value and increment to the next address in memory
16. Enter the seventh digit of the telephone number: 2
17. Press the # key to write this value and increment to the next address in memory
18. Enter the eighth digit of the telephone number (unused): 10
19. Press the # key to write this value and increment to the next address in memory
20. Enter the ninth digit of the telephone number (unused): 10
21. Press the # key to write this value and increment to the next address in memory
22. Enter the tenth digit of the telephone number (unused): 10
23. Press the # key to write this value and increment to the next address in memory
24. Enter the eleventh digit of the telephone number (unused): 10
25. Press the # key to write this value and increment to the next address in memory
26. Enter the twelfth digit of the telephone number (unused): 10
27. Press the # key to write this value and increment to the next address in memory
28. Enter the calling mode for this telephone number (text pager in voice mode): 3
29. Press the # key to write this value and increment to the next address in memory
30. Enter the number of call attempts for this telephone number: 1
31. Press the # key to write this value and increment to the next address in memory

This example continues on the next page.

The pager number is programmed. Jump to a new address to program the site ID number. This is the telephone number of the site where the RFC-1 is installed. Any number that helps you identify the specific site should work but many paging systems require a telephone number.

32. Jump to a new address in advanced programming mode: 80
33. Enter the starting address from the address table for Telephone Number E: 0696
34. Enter the first digit of the telephone number: 10
35. Press the # key to write this value and increment to the next address in memory
36. Enter the second digit of the telephone number: 2
37. Press the # key to write this value and increment to the next address in memory
38. Enter the third digit of the telephone number: 2
39. Press the # key to write this value and increment to the next address in memory
40. Enter the fourth digit of the telephone number: 8
41. Press the # key to write this value and increment to the next address in memory
42. Enter the fifth digit of the telephone number: 3
43. Press the # key to write this value and increment to the next address in memory
44. Enter the sixth digit of the telephone number: 5
45. Press the # key to write this value and increment to the next address in memory
46. Enter the seventh digit of the telephone number: 0
47. Press the # key to write this value and increment to the next address in memory
48. Enter the eighth digit of the telephone number: 0
49. Press the # key to write this value and increment to the next address in memory
50. Enter the ninth digit of the telephone number (optional alarm channel display): 11
51. Press the # key to write this value and increment to the next address in memory
52. Enter the tenth digit of the telephone number (optional # key terminator): 12
53. Press the # key to write this value and increment to the next address in memory
54. Enter the eleventh digit of the telephone number (unused): 10
55. Press the # key to write this value and increment to the next address in memory
56. Enter the twelfth digit of the telephone number (unused): 10
57. Press the # key to write this value and increment to the next address in memory
58. Press the ✳ key to exit the programming mode

The first digit of the site ID number at memory address 0696 must be 10. This stops the calling routine from dialing the site ID as a contact telephone number. It would be useless to have the site call itself to report an alarm.

It is not necessary to program any specific values for the call mode or number of attempts for telephone number E (addresses 0708 or 0709). They are ignored when this area is used to store a site ID for paging.

7.9 Logging Readings—Local Printer

In this example we will program Action Sequence 3 to print a set of readings on a local printer (connected to a PA-1/2 or an RAK-1) and we will program Date/Time Trigger 2 to activate the action sequence hourly at 10 minutes past the hour to automatically log the transmitter readings.

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 3: 0756
4. From Section 6, find the command for local printing and get V1 and V2: V1=8, V2=8
5. Enter V1 for the local print command: 8
6. Press the # key to enter this value and increment to the next address in memory
7. Enter V2 for the local print command: 8
8. Press the # key to write this value and increment to the next address in memory

The action sequence is programmed. Jump to a new address to program the date/time trigger.

9. Enter the advanced programming mode command to jump to a new address: 80
10. Enter the starting address from the address table for Date/Time Trigger 2: 0624
11. Enter the number of the action sequence that should be triggered: 3 (programmed above)
12. Press the # key to enter this value and increment to the next address in memory
13. Enter up to two digits for the month in which this trigger should function: 15 (every month)
14. Press the # key to write this value and increment to the next address in memory
15. Enter the first digit for the date in which this trigger should function: 15 (every day)
16. Press the # key to write this value and increment to the next address in memory
17. Enter the second digit for the date in which this trigger should function: 15 (every day)
18. Press the # key to write this value and increment to the next address in memory
19. Enter the first digit for the hour at which this trigger should function: 15 (every hour)
20. Press the # key to write this value and increment to the next address in memory
21. Enter the second digit for the hour at which this trigger should function: 15 (every hour)
22. Press the # key to write this value and increment to the next address in memory
23. Enter the first digit for the minute at which this trigger should function: 1
24. Press the # key to write this value and increment to the next address in memory
25. Enter the second digit for the minute at which this trigger should function: 0
26. Press the # key to write this value and increment to the next address in memory
27. Press the ✳ key to exit the programming mode

Printing to a remote printer is similar except that the action sequence command is 8-9 and a telephone number must be programmed at Telephone Number F. See Section 6 for details.

Section 6 describes the use of the value 15 in a date/time trigger to perform an event every month and/or every day.

Readings will be printed from channel 00 to the auto-scan stop channel. The auto-scan stop channel is programmed at addresses 1010-1011. The default setting is channel 07.

The clock and calendar must be set before the time trigger can function. Issue the commands 70 and 71 in the operating mode, *not while in programming mode*, and the RFC-1 will prompt for the time and date.

7.10 Tower Light Alarm

In this example we will program an alarm to monitor a telemetry channel that has a sample from a tower lighting system. We will use channel 06 as our telemetry input. It is programmed to read “100.0 percent” when all lights are operating properly—this is a direct reading from the telemetry sample programmed with the unit word “percent”.

Alarm C will be programmed to monitor channel 06 for 10 percent over and 10 percent under. Adjust the alarm limits to suit your system.

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 C: 0876
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: 6
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
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
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: 1
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: 0
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

Alarms A-H in the RFC-1 can be reprogrammed using the basic programming commands 90-97 respectively. Only the channel number and limits can be changed with the basic programming commands. Changing the trigger rule and action sequence require using the advanced programming mode. This example could also have been programmed with the command 92 since both the trigger rule and action sequence use the default values.

In the factory default settings, all alarms trigger action sequence 9, which is programmed to call all available telephone numbers.

There is a master on/off switch for the telemetry alarm system. Adjust this setting with the command 82. A value of 0 disables all telemetry alarms and the value 1 enables the telemetry alarms.

In the next example we will program an alarm block that disables the tower light alarm during daylight hours.

7.11 Tower Light Alarm Block—Daylight Hours

In this example we will program an alarm block that disables the telemetry alarm programmed in the previous example. In this case we want to block the tower light alarm so that it is not active during daylight hours. The block is not necessary if you are using an ACM-2 AC Current Monitor and have a daylight sensor connected to the appropriate inputs. The daylight sensor is the preferred method but the alarm block is effective if programmed properly.

Alarm blocks share memory space with the date/time triggers. The alarm block will be programmed at Date/Time Trigger 2. We will block the alarm from 6 am to 6 pm every day of the week during the month of April. These are fictitious times chosen for the example. Choose times appropriate for your installation and region.

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 2: 0624
4. Enter the value that indicates that this is an alarm block rather than a time trigger: 15
5. Press the # key to enter this value and increment to the next address in memory
6. Enter the number representing the alarm to block (1=A, 2=B, 3=C, etc.): 3
7. Press the # key to enter this value and increment to the next address in memory
8. Enter up to two digits for the month in which this block should be active: 4 (April)
9. Press the # key to write this value and increment to the next address in memory
10. Enter the day of the week on which this block should be active: 15 (every day)
11. Press the # key to write this value and increment to the next address in memory
12. Enter the first digit of the hour at which this alarm block starts: 0
13. Press the # key to write this value and increment to the next address in memory
14. Enter the second digit of the hour at which this alarm block starts: 6
15. Press the # key to write this value and increment to the next address in memory
16. Enter the first digit of the minute at which this alarm block ends: 1
17. Press the # key to write this value and increment to the next address in memory
18. Enter the second digit of the minute at which this alarm block ends: 8
19. Press the # key to write this value and increment to the next address in memory
20. Press the ✳ key to exit the programming mode

The ability to block an alarm during a specific month or on certain days of the week was added in software version 6. Alarm blocks are available in previous versions but they are active every day of the year. The programming section of this manual details the options available for blocking alarms.

The alarm channel is scanned even when it is blocked but when the system tries to trigger an alarm during the blocked hours it is bypassed.

Section 8 — Troubleshooting and Factory Service

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 cannot 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 and 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. This problem can be caused by many component failures. 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. The calibration pot may be turned all the way down. These pots are 22 turns from end to end. They do not stop turning at the ends. A clutch 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. The system will need to be repaired by a knowledgeable technician.

Problem: One or more telemetry channels always reads "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. A clutch 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. 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: The telephone line may be shorted or the telephone line is too long and is receiving 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 intermittently 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.

Line level can also be a factor particularly with cellular phones. The tone detector in the RFC-1 is not adjustable but passing more signal into the detector can be helpful in this situation. Possible adjustments to the system vary by board revision. A very detailed discussion is available on our website: http://www.sinesystems.com.

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. Connect 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 momentary activation.

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

Terms are subject to change without prior notice.

8.2.1 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.

Warranty Service

There is no charge for repair service on items covered under warranty. The customer is responsible for payment of shipping charges to return equipment to Sine Systems for service. Damage due to negligence, lightning or other acts of nature are not considered warranty issues.

Service Policy

Sine Systems offers same day repair service on all of our products. We typically repair and return products within 24 hours of arrival whenever it is feasible to do so. Because we offer immediate service, we do not provide loaner equipment. If we cannot immediately repair a product, we may offer other options at our discretion.

Sine Systems does not require prior authorization on repairs. See the factory repair service page on our website, www.sinesystems.com, for details on returning products for service. Sine Systems is not responsible for items lost in transport or delivered to an incorrect address.

8.2.2 Return Policy

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

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

30 days

Items may be returned within thirty days from the date that they ship from our factory. Sine Systems will apply a full refund, less shipping charges, provided that the equipment is in new condition. There must be no cosmetic damage, all accessories must be included and unopened and all manuals must be included and undamaged. If any items are missing, damaged or opened, a 5% restocking fee will be applied.

60 days

Items may be returned within sixty days from the date that they ship from our factory. Sine Systems will apply 15% restocking fee. This fee covers the cost of returning the items to new condition, replacing accessories, replacing manuals and re-packaging. These items must eventually be sold as reconditioned instead of new.

Beyond 60 days

After sixty days, Sine Systems will recondition the equipment according to our repair policy but we will not accept it for return or exchange.

Section 9 — Specifications

9.1 RFC-I Remote Facilities Controller

9.1.1 Connections

Relay panel: 16-conductor 0.1" pitch pin/plug
Telephone: RJ-11C modular connector
Local phone: RJ-11C modular connector

9.1.2 Indicators

Power: green LED

9.1.3 Power

Voltage: 12 Volts AC supplied by wall-plug transformer
Current: 250mA nominal, ~750mA maximum

9.1.4 Dimensions

Size: 19" (w) x 6.5" (d) x 1.75" (h)
Weight: 1.5 lbs.

9.1.5 Environmental

This device does not generate a significant amount of heat. It should only be installed indoors in a dry environment. This device 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

9.2.1 Connections

Relay panel: input/output via 16-conductor 0.1" pitch pin/plug
Telemetry input: 2-position removable screw-terminal connectors
Control output: 3-position removable screw-terminal connectors
Power input: 2-position removable screw-terminal connector

9.2.2 Power

Voltage: 10 volts DC unregulated supplied by RFC-1

9.2.3 Dimensions

Size: 19" (w) x 2.0" (d) x 3.5" (h)
Weight: 1.5 lbs.

9.2.4 Telemetry

Minimum input: 1 VDC to attain a full-scale reading
Maximum input: 10 VDC absolute maximum
Typical input: 0-5 VDC range
Offset input: 30 VDC offset from ground
Impedance: -50K ohms
Resolution: 1 part in 1020 minimum with accuracy of 0.5% of programmed full scale

9.2.5 Control

Relay contacts: 120 VAC, 5 amps resistive / 2 amps inductive absolute maximum

Appendix A — Programming Address Table

Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0000	Channel 00: telemetry units or status format - value 1	6.3.2	0	____	Date/time 80: action sequence
0001	Channel 00: telemetry units or status format - value 2	6.3.2	3	____	Date/time 80: month
0002	Channel 00: full scale and decimal point	6.3.3	2	____	Date/time 80: date - value 1
0003	Channel 00: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 80: date - value 2
0004	Channel 01: telemetry units or status format - value 1	6.3.2	0	____	Date/time 80: hour - value 1
0005	Channel 01: telemetry units or status format - value 2	6.3.2	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
0007	Channel 01: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 80: minute - value 2
0008	Channel 02: telemetry units or status format - value 1	6.3.2	0	____	Date/time 79: action sequence
0009	Channel 02: telemetry units or status format - value 2	6.3.2	3	____	Date/time 79: month
0010	Channel 02: full scale and decimal point	6.3.3	2	____	Date/time 79: date - value 1
0011	Channel 02: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 79: date - value 2
0012	Channel 03: telemetry units or status format - value 1	6.3.2	0	____	Date/time 79: hour - value 1
0013	Channel 03: telemetry units or status format - value 2	6.3.2	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
0015	Channel 03: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 79: minute - value 2
0016	Channel 04: telemetry units or status format - value 1	6.3.2	0	____	Date/time 78: action sequence
0017	Channel 04: telemetry units or status format - value 2	6.3.2	3	____	Date/time 78: month
0018	Channel 04: full scale and decimal point	6.3.3	2	____	Date/time 78: date - value 1
0019	Channel 04: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 78: date - value 2
0020	Channel 05: telemetry units or status format - value 1	6.3.2	0	____	Date/time 78: hour - value 1
0021	Channel 05: telemetry units or status format - value 2	6.3.2	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
0023	Channel 05: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 78: minute - value 2
0024	Channel 06: telemetry units or status format - value 1	6.3.2	0	____	Date/time 77: action sequence
0025	Channel 06: telemetry units or status format - value 2	6.3.2	3	____	Date/time 77: month
0026	Channel 06: full scale and decimal point	6.3.3	2	____	Date/time 77: date - value 1
0027	Channel 06: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 77: date - value 2
0028	Channel 07: telemetry units or status format - value 1	6.3.2	0	____	Date/time 77: hour - value 1
0029	Channel 07: telemetry units or status format - value 2	6.3.2	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
0031	Channel 07: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 77: minute - value 2
0032	Channel 08: telemetry units or status format - value 1	6.3.2	0	____	Date/time 76: action sequence
0033	Channel 08: telemetry units or status format - value 2	6.3.2	3	____	Date/time 76: month
0034	Channel 08: full scale and decimal point	6.3.3	2	____	Date/time 76: date - value 1
0035	Channel 08: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 76: date - value 2
0036	Channel 09: telemetry units or status format - value 1	6.3.2	0	____	Date/time 76: hour - value 1
0037	Channel 09: telemetry units or status format - value 2	6.3.2	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
0039	Channel 09: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 76: minute - value 2
0040	Channel 10: telemetry units or status format - value 1	6.3.2	0	____	Date/time 75: action sequence
0041	Channel 10: telemetry units or status format - value 2	6.3.2	3	____	Date/time 75: month
0042	Channel 10: full scale and decimal point	6.3.3	2	____	Date/time 75: date - value 1
0043	Channel 10: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 75: date - value 2
0044	Channel 11: telemetry units or status format - value 1	6.3.2	0	____	Date/time 75: hour - value 1
0045	Channel 11: telemetry units or status format - value 2	6.3.2	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
0047	Channel 11: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 75: minute - value 2

Appendix A — Programming Address Table

Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0048	Channel 12: telemetry units or status format - value 1	6.3.2	0	____	Date/time 74: action sequence
0049	Channel 12: telemetry units or status format - value 2	6.3.2	3	____	Date/time 74: month
0050	Channel 12: full scale and decimal point	6.3.3	2	____	Date/time 74: date - value 1
0051	Channel 12: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 74: date - value 2
0052	Channel 13: telemetry units or status format - value 1	6.3.2	0	____	Date/time 74: hour - value 1
0053	Channel 13: telemetry units or status format - value 2	6.3.2	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
0055	Channel 13: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 74: minute - value 2
0056	Channel 14: telemetry units or status format - value 1	6.3.2	0	____	Date/time 73: action sequence
0057	Channel 14: telemetry units or status format - value 2	6.3.2	3	____	Date/time 73: month
0058	Channel 14: full scale and decimal point	6.3.3	2	____	Date/time 73: date - value 1
0059	Channel 14: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 73: date - value 2
0060	Channel 15: telemetry units or status format - value 1	6.3.2	0	____	Date/time 73: hour - value 1
0061	Channel 15: telemetry units or status format - value 2	6.3.2	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
0063	Channel 15: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 73: minute - value 2
0064	Channel 16: telemetry units or status format - value 1	6.3.2	0	____	Date/time 72: action sequence
0065	Channel 16: telemetry units or status format - value 2	6.3.2	3	____	Date/time 72: month
0066	Channel 16: full scale and decimal point	6.3.3	2	____	Date/time 72: date - value 1
0067	Channel 16: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 72: date - value 2
0068	Channel 17: telemetry units or status format - value 1	6.3.2	0	____	Date/time 72: hour - value 1
0069	Channel 17: telemetry units or status format - value 2	6.3.2	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
0071	Channel 17: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 72: minute - value 2
0072	Channel 18: telemetry units or status format - value 1	6.3.2	0	____	Date/time 71: action sequence
0073	Channel 18: telemetry units or status format - value 2	6.3.2	3	____	Date/time 71: month
0074	Channel 18: full scale and decimal point	6.3.3	2	____	Date/time 71: date - value 1
0075	Channel 18: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 71: date - value 2
0076	Channel 19: telemetry units or status format - value 1	6.3.2	0	____	Date/time 71: hour - value 1
0077	Channel 19: telemetry units or status format - value 2	6.3.2	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
0079	Channel 19: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 71: minute - value 2
0080	Channel 20: telemetry units or status format - value 1	6.3.2	0	____	Date/time 70: action sequence
0081	Channel 20: telemetry units or status format - value 2	6.3.2	3	____	Date/time 70: month
0082	Channel 20: full scale and decimal point	6.3.3	2	____	Date/time 70: date - value 1
0083	Channel 20: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 70: date - value 2
0084	Channel 21: telemetry units or status format - value 1	6.3.2	0	____	Date/time 70: hour - value 1
0085	Channel 21: telemetry units or status format - value 2	6.3.2	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
0087	Channel 21: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 70: minute - value 2
0088	Channel 22: telemetry units or status format - value 1	6.3.2	0	____	Date/time 69: action sequence
0089	Channel 22: telemetry units or status format - value 2	6.3.2	3	____	Date/time 69: month
0090	Channel 22: full scale and decimal point	6.3.3	2	____	Date/time 69: date - value 1
0091	Channel 22: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 69: date - value 2
0092	Channel 23: telemetry units or status format - value 1	6.3.2	0	____	Date/time 69: hour - value 1
0093	Channel 23: telemetry units or status format - value 2	6.3.2	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
0095	Channel 23: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 69: minute - value 2

Appendix A — Programming Address Table

Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0096	Channel 24: telemetry units or status format - value 1	6.3.2	0	____	Date/time 68: action sequence
0097	Channel 24: telemetry units or status format - value 2	6.3.2	3	____	Date/time 68: month
0098	Channel 24: full scale and decimal point	6.3.3	2	____	Date/time 68: date - value 1
0099	Channel 24: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 68: date - value 2
0100	Channel 25: telemetry units or status format - value 1	6.3.2	0	____	Date/time 68: hour - value 1
0101	Channel 25: telemetry units or status format - value 2	6.3.2	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
0103	Channel 25: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 68: minute - value 2
0104	Channel 26: telemetry units or status format - value 1	6.3.2	0	____	Date/time 67: action sequence
0105	Channel 26: telemetry units or status format - value 2	6.3.2	3	____	Date/time 67: month
0106	Channel 26: full scale and decimal point	6.3.3	2	____	Date/time 67: date - value 1
0107	Channel 26: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 67: date - value 2
0108	Channel 27: telemetry units or status format - value 1	6.3.2	0	____	Date/time 67: hour - value 1
0109	Channel 27: telemetry units or status format - value 2	6.3.2	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
0111	Channel 27: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 67: minute - value 2
0112	Channel 28: telemetry units or status format - value 1	6.3.2	0	____	Date/time 66: action sequence
0113	Channel 28: telemetry units or status format - value 2	6.3.2	3	____	Date/time 66: month
0114	Channel 28: full scale and decimal point	6.3.3	2	____	Date/time 66: date - value 1
0115	Channel 28: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 66: date - value 2
0116	Channel 29: telemetry units or status format - value 1	6.3.2	0	____	Date/time 66: hour - value 1
0117	Channel 29: telemetry units or status format - value 2	6.3.2	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
0119	Channel 29: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 66: minute - value 2
0120	Channel 30: telemetry units or status format - value 1	6.3.2	0	____	Date/time 65: action sequence
0121	Channel 30: telemetry units or status format - value 2	6.3.2	3	____	Date/time 65: month
0122	Channel 30: full scale and decimal point	6.3.3	2	____	Date/time 65: date - value 1
0123	Channel 30: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 65: date - value 2
0124	Channel 31: telemetry units or status format - value 1	6.3.2	0	____	Date/time 65: hour - value 1
0125	Channel 31: telemetry units or status format - value 2	6.3.2	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
0127	Channel 31: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 65: minute - value 2
0128	Channel 32: telemetry units or status format - value 1	6.3.2	0	____	Date/time 64: action sequence
0129	Channel 32: telemetry units or status format - value 2	6.3.2	3	____	Date/time 64: month
0130	Channel 32: full scale and decimal point	6.3.3	2	____	Date/time 64: date - value 1
0131	Channel 32: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 64: date - value 2
0132	Channel 33: telemetry units or status format - value 1	6.3.2	0	____	Date/time 64: hour - value 1
0133	Channel 33: telemetry units or status format - value 2	6.3.2	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
0135	Channel 33: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 64: minute - value 2
0136	Channel 34: telemetry units or status format - value 1	6.3.2	0	____	Date/time 63: action sequence
0137	Channel 34: telemetry units or status format - value 2	6.3.2	3	____	Date/time 63: month
0138	Channel 34: full scale and decimal point	6.3.3	2	____	Date/time 63: date - value 1
0139	Channel 34: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 63: date - value 2
0140	Channel 35: telemetry units or status format - value 1	6.3.2	0	____	Date/time 63: hour - value 1
0141	Channel 35: telemetry units or status format - value 2	6.3.2	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
0143	Channel 35: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 63: minute - value 2

Appendix A — Programming Address Table

Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0144	Channel 36: telemetry units or status format - value 1	6.3.2	0	____	Date/time 62: action sequence
0145	Channel 36: telemetry units or status format - value 2	6.3.2	3	____	Date/time 62: month
0146	Channel 36: full scale and decimal point	6.3.3	2	____	Date/time 62: date - value 1
0147	Channel 36: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 62: date - value 2
0148	Channel 37: telemetry units or status format - value 1	6.3.2	0	____	Date/time 62: hour - value 1
0149	Channel 37: telemetry units or status format - value 2	6.3.2	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
0151	Channel 37: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 62: minute - value 2
0152	Channel 38: telemetry units or status format - value 1	6.3.2	0	____	Date/time 61: action sequence
0153	Channel 38: telemetry units or status format - value 2	6.3.2	3	____	Date/time 61: month
0154	Channel 38: full scale and decimal point	6.3.3	2	____	Date/time 61: date - value 1
0155	Channel 38: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 61: date - value 2
0156	Channel 39: telemetry units or status format - value 1	6.3.2	0	____	Date/time 61: hour - value 1
0157	Channel 39: telemetry units or status format - value 2	6.3.2	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
0159	Channel 39: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 61: minute - value 2
0160	Channel 40: telemetry units or status format - value 1	6.3.2	0	____	Date/time 60: action sequence
0161	Channel 40: telemetry units or status format - value 2	6.3.2	3	____	Date/time 60: month
0162	Channel 40: full scale and decimal point	6.3.3	2	____	Date/time 60: date - value 1
0163	Channel 40: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 60: date - value 2
0164	Channel 41: telemetry units or status format - value 1	6.3.2	0	____	Date/time 60: hour - value 1
0165	Channel 41: telemetry units or status format - value 2	6.3.2	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
0167	Channel 41: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 60: minute - value 2
0168	Channel 42: telemetry units or status format - value 1	6.3.2	0	____	Date/time 59: action sequence
0169	Channel 42: telemetry units or status format - value 2	6.3.2	3	____	Date/time 59: month
0170	Channel 42: full scale and decimal point	6.3.3	2	____	Date/time 59: date - value 1
0171	Channel 42: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 59: date - value 2
0172	Channel 43: telemetry units or status format - value 1	6.3.2	0	____	Date/time 59: hour - value 1
0173	Channel 43: telemetry units or status format - value 2	6.3.2	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
0175	Channel 43: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 59: minute - value 2
0176	Channel 44: telemetry units or status format - value 1	6.3.2	0	____	Date/time 58: action sequence
0177	Channel 44: telemetry units or status format - value 2	6.3.2	3	____	Date/time 58: month
0178	Channel 44: full scale and decimal point	6.3.3	2	____	Date/time 58: date - value 1
0179	Channel 44: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 58: date - value 2
0180	Channel 45: telemetry units or status format - value 1	6.3.2	0	____	Date/time 58: hour - value 1
0181	Channel 45: telemetry units or status format - value 2	6.3.2	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
0183	Channel 45: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 58: minute - value 2
0184	Channel 46: telemetry units or status format - value 1	6.3.2	0	____	Date/time 57: action sequence
0185	Channel 46: telemetry units or status format - value 2	6.3.2	3	____	Date/time 57: month
0186	Channel 46: full scale and decimal point	6.3.3	2	____	Date/time 57: date - value 1
0187	Channel 46: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 57: date - value 2
0188	Channel 47: telemetry units or status format - value 1	6.3.2	0	____	Date/time 57: hour - value 1
0189	Channel 47: telemetry units or status format - value 2	6.3.2	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
0191	Channel 47: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 57: minute - value 2

Appendix A — Programming Address Table

Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0192	Channel 48: telemetry units or status format - value 1	6.3.2	0	____	Date/time 56: action sequence
0193	Channel 48: telemetry units or status format - value 2	6.3.2	3	____	Date/time 56: month
0194	Channel 48: full scale and decimal point	6.3.3	2	____	Date/time 56: date - value 1
0195	Channel 48: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 56: date - value 2
0196	Channel 49: telemetry units or status format - value 1	6.3.2	0	____	Date/time 56: hour - value 1
0197	Channel 49: telemetry units or status format - value 2	6.3.2	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
0199	Channel 49: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 56: minute - value 2
0200	Channel 50: telemetry units or status format - value 1	6.3.2	0	____	Date/time 55: action sequence
0201	Channel 50: telemetry units or status format - value 2	6.3.2	3	____	Date/time 55: month
0202	Channel 50: full scale and decimal point	6.3.3	2	____	Date/time 55: date - value 1
0203	Channel 50: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 55: date - value 2
0204	Channel 51: telemetry units or status format - value 1	6.3.2	0	____	Date/time 55: hour - value 1
0205	Channel 51: telemetry units or status format - value 2	6.3.2	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
0207	Channel 51: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 55: minute - value 2
0208	Channel 52: telemetry units or status format - value 1	6.3.2	0	____	Date/time 54: action sequence
0209	Channel 52: telemetry units or status format - value 2	6.3.2	3	____	Date/time 54: month
0210	Channel 52: full scale and decimal point	6.3.3	2	____	Date/time 54: date - value 1
0211	Channel 52: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 54: date - value 2
0212	Channel 53: telemetry units or status format - value 1	6.3.2	0	____	Date/time 54: hour - value 1
0213	Channel 53: telemetry units or status format - value 2	6.3.2	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
0215	Channel 53: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 54: minute - value 2
0216	Channel 54: telemetry units or status format - value 1	6.3.2	0	____	Date/time 53: action sequence
0217	Channel 54: telemetry units or status format - value 2	6.3.2	3	____	Date/time 53: month
0218	Channel 54: full scale and decimal point	6.3.3	2	____	Date/time 53: date - value 1
0219	Channel 54: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 53: date - value 2
0220	Channel 55: telemetry units or status format - value 1	6.3.2	0	____	Date/time 53: hour - value 1
0221	Channel 55: telemetry units or status format - value 2	6.3.2	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
0223	Channel 55: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 53: minute - value 2
0224	Channel 56: telemetry units or status format - value 1	6.3.2	0	____	Date/time 52: action sequence
0225	Channel 56: telemetry units or status format - value 2	6.3.2	3	____	Date/time 52: month
0226	Channel 56: full scale and decimal point	6.3.3	2	____	Date/time 52: date - value 1
0227	Channel 56: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 52: date - value 2
0228	Channel 57: telemetry units or status format - value 1	6.3.2	0	____	Date/time 52: hour - value 1
0229	Channel 57: telemetry units or status format - value 2	6.3.2	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
0231	Channel 57: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 52: minute - value 2
0232	Channel 58: telemetry units or status format - value 1	6.3.2	0	____	Date/time 51: action sequence
0233	Channel 58: telemetry units or status format - value 2	6.3.2	3	____	Date/time 51: month
0234	Channel 58: full scale and decimal point	6.3.3	2	____	Date/time 51: date - value 1
0235	Channel 58: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 51: date - value 2
0236	Channel 59: telemetry units or status format - value 1	6.3.2	0	____	Date/time 51: hour - value 1
0237	Channel 59: telemetry units or status format - value 2	6.3.2	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
0239	Channel 59: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 51: minute - value 2

Appendix A — Programming Address Table

Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0240	Channel 60: telemetry units or status format - value 1	6.3.2	0	____	Date/time 50: action sequence
0241	Channel 60: telemetry units or status format - value 2	6.3.2	3	____	Date/time 50: month
0242	Channel 60: full scale and decimal point	6.3.3	2	____	Date/time 50: date - value 1
0243	Channel 60: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 50: date - value 2
0244	Channel 61: telemetry units or status format - value 1	6.3.2	0	____	Date/time 50: hour - value 1
0245	Channel 61: telemetry units or status format - value 2	6.3.2	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
0247	Channel 61: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 50: minute - value 2
0248	Channel 62: telemetry units or status format - value 1	6.3.2	0	____	Date/time 49: action sequence
0249	Channel 62: telemetry units or status format - value 2	6.3.2	3	____	Date/time 49: month
0250	Channel 62: full scale and decimal point	6.3.3	2	____	Date/time 49: date - value 1
0251	Channel 62: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 49: date - value 2
0252	Channel 63: telemetry units or status format - value 1	6.3.2	0	____	Date/time 49: hour - value 1
0253	Channel 63: telemetry units or status format - value 2	6.3.2	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
0255	Channel 63: linear/log/indirect and auto relay	6.3.4	0	____	Date/time 49: minute - value 2
0256	Date/time 48: action sequence	6.7.4	0	____	Alarm block 48: block indicator
0257	Date/time 48: month	6.7.4	0	____	Alarm block 48: alarm
0258	Date/time 48: date - value 1	6.7.4	0	____	Alarm block 48: month
0259	Date/time 48: date - value 2	6.7.4	0	____	Alarm block 48: day(s) of week
0260	Date/time 48: hour - value 1	6.7.4	0	____	Alarm block 48: start hour - V1
0261	Date/time 48: hour - value 2	6.7.4	0	____	Alarm block 48: start hour - V2
0262	Date/time 48: minute - value 1	6.7.4	0	____	Alarm block 48: end hour - V1
0263	Date/time 48: minute - value 2	6.7.4	0	____	Alarm block 48: end hour - V2
0264	Date/time 47: action sequence	6.7.4	0	____	Alarm block 47: block indicator
0265	Date/time 47: month	6.7.4	0	____	Alarm block 47: alarm
0266	Date/time 47: date - value 1	6.7.4	0	____	Alarm block 47: month
0267	Date/time 47: date - value 2	6.7.4	0	____	Alarm block 47: day(s) of week
0268	Date/time 47: hour - value 1	6.7.4	0	____	Alarm block 47: start hour - V1
0269	Date/time 47: hour - value 2	6.7.4	0	____	Alarm block 47: start hour - V2
0270	Date/time 47: minute - value 1	6.7.4	0	____	Alarm block 47: end hour - V1
0271	Date/time 47: minute - value 2	6.7.4	0	____	Alarm block 47: end hour - V2
0272	Date/time 46: action sequence	6.7.4	0	____	Alarm block 46: block indicator
0273	Date/time 46: month	6.7.4	0	____	Alarm block 46: alarm
0274	Date/time 46: date - value 1	6.7.4	0	____	Alarm block 46: month
0275	Date/time 46: date - value 2	6.7.4	0	____	Alarm block 46: day(s) of week
0276	Date/time 46: hour - value 1	6.7.4	0	____	Alarm block 46: start hour - V1
0277	Date/time 46: hour - value 2	6.7.4	0	____	Alarm block 46: start hour - V2
0278	Date/time 46: minute - value 1	6.7.4	0	____	Alarm block 46: end hour - V1
0279	Date/time 46: minute - value 2	6.7.4	0	____	Alarm block 46: end hour - V2
0280	Date/time 45: action sequence	6.7.4	0	____	Alarm block 45: block indicator
0281	Date/time 45: month	6.7.4	0	____	Alarm block 45: alarm
0282	Date/time 45: date - value 1	6.7.4	0	____	Alarm block 45: month
0283	Date/time 45: date - value 2	6.7.4	0	____	Alarm block 45: day(s) of week
0284	Date/time 45: hour - value 1	6.7.4	0	____	Alarm block 45: start hour - V1
0285	Date/time 45: hour - value 2	6.7.4	0	____	Alarm block 45: start hour - V2
0286	Date/time 45: minute - value 1	6.7.4	0	____	Alarm block 45: end hour - V1
0287	Date/time 45: minute - value 2	6.7.4	0	____	Alarm block 45: end hour - V2

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0288	Date/time 44: action sequence	6.7.4	0	____	Alarm block 44: block indicator
0289	Date/time 44: month	6.7.4	0	____	Alarm block 44: alarm
0290	Date/time 44: date - value 1	6.7.4	0	____	Alarm block 44: month
0291	Date/time 44: date - value 2	6.7.4	0	____	Alarm block 44: day(s) of week
0292	Date/time 44: hour - value 1	6.7.4	0	____	Alarm block 44: start hour - V1
0293	Date/time 44: hour - value 2	6.7.4	0	____	Alarm block 44: start hour - V2
0294	Date/time 44: minute - value 1	6.7.4	0	____	Alarm block 44: end hour - V1
0295	Date/time 44: minute - value 2	6.7.4	0	____	Alarm block 44: end hour - V2
0296	Date/time 43: action sequence	6.7.4	0	____	Alarm block 43: block indicator
0297	Date/time 43: month	6.7.4	0	____	Alarm block 43: alarm
0298	Date/time 43: date - value 1	6.7.4	0	____	Alarm block 43: month
0299	Date/time 43: date - value 2	6.7.4	0	____	Alarm block 43: day(s) of week
0300	Date/time 43: hour - value 1	6.7.4	0	____	Alarm block 43: start hour - V1
0301	Date/time 43: hour - value 2	6.7.4	0	____	Alarm block 43: start hour - V2
0302	Date/time 43: minute - value 1	6.7.4	0	____	Alarm block 43: end hour - V1
0303	Date/time 43: minute - value 2	6.7.4	0	____	Alarm block 43: end hour - V2
0304	Date/time 42: action sequence	6.7.4	0	____	Alarm block 42: block indicator
0305	Date/time 42: month	6.7.4	0	____	Alarm block 42: alarm
0306	Date/time 42: date - value 1	6.7.4	0	____	Alarm block 42: month
0307	Date/time 42: date - value 2	6.7.4	0	____	Alarm block 42: day(s) of week
0308	Date/time 42: hour - value 1	6.7.4	0	____	Alarm block 42: start hour - V1
0309	Date/time 42: hour - value 2	6.7.4	0	____	Alarm block 42: start hour - V2
0310	Date/time 42: minute - value 1	6.7.4	0	____	Alarm block 42: end hour - V1
0311	Date/time 42: minute - value 2	6.7.4	0	____	Alarm block 42: end hour - V2
0312	Date/time 41: action sequence	6.7.4	0	____	Alarm block 41: block indicator
0313	Date/time 41: month	6.7.4	0	____	Alarm block 41: alarm
0314	Date/time 41: date - value 1	6.7.4	0	____	Alarm block 41: month
0315	Date/time 41: date - value 2	6.7.4	0	____	Alarm block 41: day(s) of week
0316	Date/time 41: hour - value 1	6.7.4	0	____	Alarm block 41: start hour - V1
0317	Date/time 41: hour - value 2	6.7.4	0	____	Alarm block 41: start hour - V2
0318	Date/time 41: minute - value 1	6.7.4	0	____	Alarm block 41: end hour - V1
0319	Date/time 41: minute - value 2	6.7.4	0	____	Alarm block 41: end hour - V2
0320	Date/time 40: action sequence	6.7.4	0	____	Alarm block 40: block indicator
0321	Date/time 40: month	6.7.4	0	____	Alarm block 40: alarm
0322	Date/time 40: date - value 1	6.7.4	0	____	Alarm block 40: month
0323	Date/time 40: date - value 2	6.7.4	0	____	Alarm block 40: day(s) of week
0324	Date/time 40: hour - value 1	6.7.4	0	____	Alarm block 40: start hour - V1
0325	Date/time 40: hour - value 2	6.7.4	0	____	Alarm block 40: start hour - V2
0326	Date/time 40: minute - value 1	6.7.4	0	____	Alarm block 40: end hour - V1
0327	Date/time 40: minute - value 2	6.7.4	0	____	Alarm block 40: end hour - V2
0328	Date/time 39: action sequence	6.7.4	0	____	Alarm block 39: block indicator
0329	Date/time 39: month	6.7.4	0	____	Alarm block 39: alarm
0330	Date/time 39: date - value 1	6.7.4	0	____	Alarm block 39: month
0331	Date/time 39: date - value 2	6.7.4	0	____	Alarm block 39: day(s) of week
0332	Date/time 39: hour - value 1	6.7.4	0	____	Alarm block 39: start hour - V1
0333	Date/time 39: hour - value 2	6.7.4	0	____	Alarm block 39: start hour - V2
0334	Date/time 39: minute - value 1	6.7.4	0	____	Alarm block 39: end hour - V1
0335	Date/time 39: minute - value 2	6.7.4	0	____	Alarm block 39: end hour - V2

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0336	Date/time 38: action sequence	6.7.4	0	____	Alarm block 38: block indicator
0337	Date/time 38: month	6.7.4	0	____	Alarm block 38: alarm
0338	Date/time 38: date - value 1	6.7.4	0	____	Alarm block 38: month
0339	Date/time 38: date - value 2	6.7.4	0	____	Alarm block 38: day(s) of week
0340	Date/time 38: hour - value 1	6.7.4	0	____	Alarm block 38: start hour - V1
0341	Date/time 38: hour - value 2	6.7.4	0	____	Alarm block 38: start hour - V2
0342	Date/time 38: minute - value 1	6.7.4	0	____	Alarm block 38: end hour - V1
0343	Date/time 38: minute - value 2	6.7.4	0	____	Alarm block 38: end hour - V2
0344	Date/time 37: action sequence	6.7.4	0	____	Alarm block 37: block indicator
0345	Date/time 37: month	6.7.4	0	____	Alarm block 37: alarm
0346	Date/time 37: date - value 1	6.7.4	0	____	Alarm block 37: month
0347	Date/time 37: date - value 2	6.7.4	0	____	Alarm block 37: day(s) of week
0348	Date/time 37: hour - value 1	6.7.4	0	____	Alarm block 37: start hour - V1
0349	Date/time 37: hour - value 2	6.7.4	0	____	Alarm block 37: start hour - V2
0350	Date/time 37: minute - value 1	6.7.4	0	____	Alarm block 37: end hour - V1
0351	Date/time 37: minute - value 2	6.7.4	0	____	Alarm block 37: end hour - V2
0352	Date/time 36: action sequence	6.7.4	0	____	Alarm block 36: block indicator
0353	Date/time 36: month	6.7.4	0	____	Alarm block 36: alarm
0354	Date/time 36: date - value 1	6.7.4	0	____	Alarm block 36: month
0355	Date/time 36: date - value 2	6.7.4	0	____	Alarm block 36: day(s) of week
0356	Date/time 36: hour - value 1	6.7.4	0	____	Alarm block 36: start hour - V1
0357	Date/time 36: hour - value 2	6.7.4	0	____	Alarm block 36: start hour - V2
0358	Date/time 36: minute - value 1	6.7.4	0	____	Alarm block 36: end hour - V1
0359	Date/time 36: minute - value 2	6.7.4	0	____	Alarm block 36: end hour - V2
0360	Date/time 35: action sequence	6.7.4	0	____	Alarm block 35: block indicator
0361	Date/time 35: month	6.7.4	0	____	Alarm block 35: alarm
0362	Date/time 35: date - value 1	6.7.4	0	____	Alarm block 35: month
0363	Date/time 35: date - value 2	6.7.4	0	____	Alarm block 35: day(s) of week
0364	Date/time 35: hour - value 1	6.7.4	0	____	Alarm block 35: start hour - V1
0365	Date/time 35: hour - value 2	6.7.4	0	____	Alarm block 35: start hour - V2
0366	Date/time 35: minute - value 1	6.7.4	0	____	Alarm block 35: end hour - V1
0367	Date/time 35: minute - value 2	6.7.4	0	____	Alarm block 35: end hour - V2
0368	Date/time 34: action sequence	6.7.4	0	____	Alarm block 34: block indicator
0369	Date/time 34: month	6.7.4	0	____	Alarm block 34: alarm
0370	Date/time 34: date - value 1	6.7.4	0	____	Alarm block 34: month
0371	Date/time 34: date - value 2	6.7.4	0	____	Alarm block 34: day(s) of week
0372	Date/time 34: hour - value 1	6.7.4	0	____	Alarm block 34: start hour - V1
0373	Date/time 34: hour - value 2	6.7.4	0	____	Alarm block 34: start hour - V2
0374	Date/time 34: minute - value 1	6.7.4	0	____	Alarm block 34: end hour - V1
0375	Date/time 34: minute - value 2	6.7.4	0	____	Alarm block 34: end hour - V2
0376	Date/time 33: action sequence	6.7.4	0	____	Alarm block 33: block indicator
0377	Date/time 33: month	6.7.4	0	____	Alarm block 33: alarm
0378	Date/time 33: date - value 1	6.7.4	0	____	Alarm block 33: month
0379	Date/time 33: date - value 2	6.7.4	0	____	Alarm block 33: day(s) of week
0380	Date/time 33: hour - value 1	6.7.4	0	____	Alarm block 33: start hour - V1
0381	Date/time 33: hour - value 2	6.7.4	0	____	Alarm block 33: start hour - V2
0382	Date/time 33: minute - value 1	6.7.4	0	____	Alarm block 33: end hour - V1
0383	Date/time 33: minute - value 2	6.7.4	0	____	Alarm block 33: end hour - V2

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0384	Date/time 32: action sequence	6.7.4	0	____	Alarm block 32: block indicator
0385	Date/time 32: month	6.7.4	0	____	Alarm block 32: alarm
0386	Date/time 32: date - value 1	6.7.4	0	____	Alarm block 32: month
0387	Date/time 32: date - value 2	6.7.4	0	____	Alarm block 32: day(s) of week
0388	Date/time 32: hour - value 1	6.7.4	0	____	Alarm block 32: start hour - V1
0389	Date/time 32: hour - value 2	6.7.4	0	____	Alarm block 32: start hour - V2
0390	Date/time 32: minute - value 1	6.7.4	0	____	Alarm block 32: end hour - V1
0391	Date/time 32: minute - value 2	6.7.4	0	____	Alarm block 32: end hour - V2
0392	Date/time 31: action sequence	6.7.4	0	____	Alarm block 31: block indicator
0393	Date/time 31: month	6.7.4	0	____	Alarm block 31: alarm
0394	Date/time 31: date - value 1	6.7.4	0	____	Alarm block 31: month
0395	Date/time 31: date - value 2	6.7.4	0	____	Alarm block 31: day(s) of week
0396	Date/time 31: hour - value 1	6.7.4	0	____	Alarm block 31: start hour - V1
0397	Date/time 31: hour - value 2	6.7.4	0	____	Alarm block 31: start hour - V2
0398	Date/time 31: minute - value 1	6.7.4	0	____	Alarm block 31: end hour - V1
0399	Date/time 31: minute - value 2	6.7.4	0	____	Alarm block 31: end hour - V2
0400	Date/time 30: action sequence	6.7.4	0	____	Alarm block 30: block indicator
0401	Date/time 30: month	6.7.4	0	____	Alarm block 30: alarm
0402	Date/time 30: date - value 1	6.7.4	0	____	Alarm block 30: month
0403	Date/time 30: date - value 2	6.7.4	0	____	Alarm block 30: day(s) of week
0404	Date/time 30: hour - value 1	6.7.4	0	____	Alarm block 30: start hour - V1
0405	Date/time 30: hour - value 2	6.7.4	0	____	Alarm block 30: start hour - V2
0406	Date/time 30: minute - value 1	6.7.4	0	____	Alarm block 30: end hour - V1
0407	Date/time 30: minute - value 2	6.7.4	0	____	Alarm block 30: end hour - V2
0408	Date/time 29: action sequence	6.7.4	0	____	Alarm block 29: block indicator
0409	Date/time 29: month	6.7.4	0	____	Alarm block 29: alarm
0410	Date/time 29: date - value 1	6.7.4	0	____	Alarm block 29: month
0411	Date/time 29: date - value 2	6.7.4	0	____	Alarm block 29: day(s) of week
0412	Date/time 29: hour - value 1	6.7.4	0	____	Alarm block 29: start hour - V1
0413	Date/time 29: hour - value 2	6.7.4	0	____	Alarm block 29: start hour - V2
0414	Date/time 29: minute - value 1	6.7.4	0	____	Alarm block 29: end hour - V1
0415	Date/time 29: minute - value 2	6.7.4	0	____	Alarm block 29: end hour - V2
0416	Date/time 28: action sequence	6.7.4	0	____	Alarm block 28: block indicator
0417	Date/time 28: month	6.7.4	0	____	Alarm block 28: alarm
0418	Date/time 28: date - value 1	6.7.4	0	____	Alarm block 28: month
0419	Date/time 28: date - value 2	6.7.4	0	____	Alarm block 28: day(s) of week
0420	Date/time 28: hour - value 1	6.7.4	0	____	Alarm block 28: start hour - V1
0421	Date/time 28: hour - value 2	6.7.4	0	____	Alarm block 28: start hour - V2
0422	Date/time 28: minute - value 1	6.7.4	0	____	Alarm block 28: end hour - V1
0423	Date/time 28: minute - value 2	6.7.4	0	____	Alarm block 28: end hour - V2
0424	Date/time 27: action sequence	6.7.4	0	____	Alarm block 27: block indicator
0425	Date/time 27: month	6.7.4	0	____	Alarm block 27: alarm
0426	Date/time 27: date - value 1	6.7.4	0	____	Alarm block 27: month
0427	Date/time 27: date - value 2	6.7.4	0	____	Alarm block 27: day(s) of week
0428	Date/time 27: hour - value 1	6.7.4	0	____	Alarm block 27: start hour - V1
0429	Date/time 27: hour - value 2	6.7.4	0	____	Alarm block 27: start hour - V2
0430	Date/time 27: minute - value 1	6.7.4	0	____	Alarm block 27: end hour - V1
0431	Date/time 27: minute - value 2	6.7.4	0	____	Alarm block 27: end hour - V2

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0432	Date/time 26: action sequence	6.7.4	0	____	Alarm block 26: block indicator
0433	Date/time 26: month	6.7.4	0	____	Alarm block 26: alarm
0434	Date/time 26: date - value 1	6.7.4	0	____	Alarm block 26: month
0435	Date/time 26: date - value 2	6.7.4	0	____	Alarm block 26: day(s) of week
0436	Date/time 26: hour - value 1	6.7.4	0	____	Alarm block 26: start hour - V1
0437	Date/time 26: hour - value 2	6.7.4	0	____	Alarm block 26: start hour - V2
0438	Date/time 26: minute - value 1	6.7.4	0	____	Alarm block 26: end hour - V1
0439	Date/time 26: minute - value 2	6.7.4	0	____	Alarm block 26: end hour - V2
0440	Date/time 25: action sequence	6.7.4	0	____	Alarm block 25: block indicator
0441	Date/time 25: month	6.7.4	0	____	Alarm block 25: alarm
0442	Date/time 25: date - value 1	6.7.4	0	____	Alarm block 25: month
0443	Date/time 25: date - value 2	6.7.4	0	____	Alarm block 25: day(s) of week
0444	Date/time 25: hour - value 1	6.7.4	0	____	Alarm block 25: start hour - V1
0445	Date/time 25: hour - value 2	6.7.4	0	____	Alarm block 25: start hour - V2
0446	Date/time 25: minute - value 1	6.7.4	0	____	Alarm block 25: end hour - V1
0447	Date/time 25: minute - value 2	6.7.4	0	____	Alarm block 25: end hour - V2
0448	Date/time 24: action sequence	6.7.4	0	____	Alarm block 24: block indicator
0449	Date/time 24: month	6.7.4	0	____	Alarm block 24: alarm
0450	Date/time 24: date - value 1	6.7.4	0	____	Alarm block 24: month
0451	Date/time 24: date - value 2	6.7.4	0	____	Alarm block 24: day(s) of week
0452	Date/time 24: hour - value 1	6.7.4	0	____	Alarm block 24: start hour - V1
0453	Date/time 24: hour - value 2	6.7.4	0	____	Alarm block 24: start hour - V2
0454	Date/time 24: minute - value 1	6.7.4	0	____	Alarm block 24: end hour - V1
0455	Date/time 24: minute - value 2	6.7.4	0	____	Alarm block 24: end hour - V2
0456	Date/time 23: action sequence	6.7.4	0	____	Alarm block 23: block indicator
0457	Date/time 23: month	6.7.4	0	____	Alarm block 23: alarm
0458	Date/time 23: date - value 1	6.7.4	0	____	Alarm block 23: month
0459	Date/time 23: date - value 2	6.7.4	0	____	Alarm block 23: day(s) of week
0460	Date/time 23: hour - value 1	6.7.4	0	____	Alarm block 23: start hour - V1
0461	Date/time 23: hour - value 2	6.7.4	0	____	Alarm block 23: start hour - V2
0462	Date/time 23: minute - value 1	6.7.4	0	____	Alarm block 23: end hour - V1
0463	Date/time 23: minute - value 2	6.7.4	0	____	Alarm block 23: end hour - V2
0464	Date/time 22: action sequence	6.7.4	0	____	Alarm block 22: block indicator
0465	Date/time 22: month	6.7.4	0	____	Alarm block 22: alarm
0466	Date/time 22: date - value 1	6.7.4	0	____	Alarm block 22: month
0467	Date/time 22: date - value 2	6.7.4	0	____	Alarm block 22: day(s) of week
0468	Date/time 22: hour - value 1	6.7.4	0	____	Alarm block 22: start hour - V1
0469	Date/time 22: hour - value 2	6.7.4	0	____	Alarm block 22: start hour - V2
0470	Date/time 22: minute - value 1	6.7.4	0	____	Alarm block 22: end hour - V1
0471	Date/time 22: minute - value 2	6.7.4	0	____	Alarm block 22: end hour - V2
0472	Date/time 21: action sequence	6.7.4	0	____	Alarm block 21: block indicator
0473	Date/time 21: month	6.7.4	0	____	Alarm block 21: alarm
0474	Date/time 21: date - value 1	6.7.4	0	____	Alarm block 21: month
0475	Date/time 21: date - value 2	6.7.4	0	____	Alarm block 21: day(s) of week
0476	Date/time 21: hour - value 1	6.7.4	0	____	Alarm block 21: start hour - V1
0477	Date/time 21: hour - value 2	6.7.4	0	____	Alarm block 21: start hour - V2
0478	Date/time 21: minute - value 1	6.7.4	0	____	Alarm block 21: end hour - V1
0479	Date/time 21: minute - value 2	6.7.4	0	____	Alarm block 21: end hour - V2

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0480	Date/time 20: action sequence	6.7.4	0	____	Alarm block 20: block indicator
0481	Date/time 20: month	6.7.4	0	____	Alarm block 20: alarm
0482	Date/time 20: date - value 1	6.7.4	0	____	Alarm block 20: month
0483	Date/time 20: date - value 2	6.7.4	0	____	Alarm block 20: day(s) of week
0484	Date/time 20: hour - value 1	6.7.4	0	____	Alarm block 20: start hour - V1
0485	Date/time 20: hour - value 2	6.7.4	0	____	Alarm block 20: start hour - V2
0486	Date/time 20: minute - value 1	6.7.4	0	____	Alarm block 20: end hour - V1
0487	Date/time 20: minute - value 2	6.7.4	0	____	Alarm block 20: end hour - V2
0488	Date/time 19: action sequence	6.7.4	0	____	Alarm block 19: block indicator
0489	Date/time 19: month	6.7.4	0	____	Alarm block 19: alarm
0490	Date/time 19: date - value 1	6.7.4	0	____	Alarm block 19: month
0491	Date/time 19: date - value 2	6.7.4	0	____	Alarm block 19: day(s) of week
0492	Date/time 19: hour - value 1	6.7.4	0	____	Alarm block 19: start hour - V1
0493	Date/time 19: hour - value 2	6.7.4	0	____	Alarm block 19: start hour - V2
0494	Date/time 19: minute - value 1	6.7.4	0	____	Alarm block 19: end hour - V1
0495	Date/time 19: minute - value 2	6.7.4	0	____	Alarm block 19: end hour - V2
0496	Date/time 18: action sequence	6.7.4	0	____	Alarm block 18: block indicator
0497	Date/time 18: month	6.7.4	0	____	Alarm block 18: alarm
0498	Date/time 18: date - value 1	6.7.4	0	____	Alarm block 18: month
0499	Date/time 18: date - value 2	6.7.4	0	____	Alarm block 18: day(s) of week
0500	Date/time 18: hour - value 1	6.7.4	0	____	Alarm block 18: start hour - V1
0501	Date/time 18: hour - value 2	6.7.4	0	____	Alarm block 18: start hour - V2
0502	Date/time 18: minute - value 1	6.7.4	0	____	Alarm block 18: end hour - V1
0503	Date/time 18: minute - value 2	6.7.4	0	____	Alarm block 18: end hour - V2
0504	Date/time 17: action sequence	6.7.4	0	____	Alarm block 17: block indicator
0505	Date/time 17: month	6.7.4	0	____	Alarm block 17: alarm
0506	Date/time 17: date - value 1	6.7.4	0	____	Alarm block 17: month
0507	Date/time 17: date - value 2	6.7.4	0	____	Alarm block 17: day(s) of week
0508	Date/time 17: hour - value 1	6.7.4	0	____	Alarm block 17: start hour - V1
0509	Date/time 17: hour - value 2	6.7.4	0	____	Alarm block 17: start hour - V2
0510	Date/time 17: minute - value 1	6.7.4	0	____	Alarm block 17: end hour - V1
0511	Date/time 17: minute - value 2	6.7.4	0	____	Alarm block 17: end hour - V2
0512	Date/time 16: action sequence	6.7.4	0	____	Alarm block 16: block indicator
0513	Date/time 16: month	6.7.4	0	____	Alarm block 16: alarm
0514	Date/time 16: date - value 1	6.7.4	0	____	Alarm block 16: month
0515	Date/time 16: date - value 2	6.7.4	0	____	Alarm block 16: day(s) of week
0516	Date/time 16: hour - value 1	6.7.4	0	____	Alarm block 16: start hour - V1
0517	Date/time 16: hour - value 2	6.7.4	0	____	Alarm block 16: start hour - V2
0518	Date/time 16: minute - value 1	6.7.4	0	____	Alarm block 16: end hour - V1
0519	Date/time 16: minute - value 2	6.7.4	0	____	Alarm block 16: end hour - V2
0520	Date/time 15: action sequence	6.7.4	0	____	Alarm block 15: block indicator
0521	Date/time 15: month	6.7.4	0	____	Alarm block 15: alarm
0522	Date/time 15: date - value 1	6.7.4	0	____	Alarm block 15: month
0523	Date/time 15: date - value 2	6.7.4	0	____	Alarm block 15: day(s) of week
0524	Date/time 15: hour - value 1	6.7.4	0	____	Alarm block 15: start hour - V1
0525	Date/time 15: hour - value 2	6.7.4	0	____	Alarm block 15: start hour - V2
0526	Date/time 15: minute - value 1	6.7.4	0	____	Alarm block 15: end hour - V1
0527	Date/time 15: minute - value 2	6.7.4	0	____	Alarm block 15: end hour - V2

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0528	Date/time 14: action sequence	6.7.4	0	____	Alarm block 14: block indicator
0529	Date/time 14: month	6.7.4	0	____	Alarm block 14: alarm
0530	Date/time 14: date - value 1	6.7.4	0	____	Alarm block 14: month
0531	Date/time 14: date - value 2	6.7.4	0	____	Alarm block 14: day(s) of week
0532	Date/time 14: hour - value 1	6.7.4	0	____	Alarm block 14: start hour - V1
0533	Date/time 14: hour - value 2	6.7.4	0	____	Alarm block 14: start hour - V2
0534	Date/time 14: minute - value 1	6.7.4	0	____	Alarm block 14: end hour - V1
0535	Date/time 14: minute - value 2	6.7.4	0	____	Alarm block 14: end hour - V2
0536	Date/time 13: action sequence	6.7.4	0	____	Alarm block 13: block indicator
0537	Date/time 13: month	6.7.4	0	____	Alarm block 13: alarm
0538	Date/time 13: date - value 1	6.7.4	0	____	Alarm block 13: month
0539	Date/time 13: date - value 2	6.7.4	0	____	Alarm block 13: day(s) of week
0540	Date/time 13: hour - value 1	6.7.4	0	____	Alarm block 13: start hour - V1
0541	Date/time 13: hour - value 2	6.7.4	0	____	Alarm block 13: start hour - V2
0542	Date/time 13: minute - value 1	6.7.4	0	____	Alarm block 13: end hour - V1
0543	Date/time 13: minute - value 2	6.7.4	0	____	Alarm block 13: end hour - V2
0544	Date/time 12: action sequence	6.7.4	0	____	Alarm block 12: block indicator
0545	Date/time 12: month	6.7.4	0	____	Alarm block 12: alarm
0546	Date/time 12: date - value 1	6.7.4	0	____	Alarm block 12: month
0547	Date/time 12: date - value 2	6.7.4	0	____	Alarm block 12: day(s) of week
0548	Date/time 12: hour - value 1	6.7.4	0	____	Alarm block 12: start hour - V1
0549	Date/time 12: hour - value 2	6.7.4	0	____	Alarm block 12: start hour - V2
0550	Date/time 12: minute - value 1	6.7.4	0	____	Alarm block 12: end hour - V1
0551	Date/time 12: minute - value 2	6.7.4	0	____	Alarm block 12: end hour - V2
0552	Date/time 11: action sequence	6.7.4	0	____	Alarm block 11: block indicator
0553	Date/time 11: month	6.7.4	0	____	Alarm block 11: alarm
0554	Date/time 11: date - value 1	6.7.4	0	____	Alarm block 11: month
0555	Date/time 11: date - value 2	6.7.4	0	____	Alarm block 11: day(s) of week
0556	Date/time 11: hour - value 1	6.7.4	0	____	Alarm block 11: start hour - V1
0557	Date/time 11: hour - value 2	6.7.4	0	____	Alarm block 11: start hour - V2
0558	Date/time 11: minute - value 1	6.7.4	0	____	Alarm block 11: end hour - V1
0559	Date/time 11: minute - value 2	6.7.4	0	____	Alarm block 11: end hour - V2
0560	Date/time 10: action sequence	6.7.4	0	____	Alarm block 10: block indicator
0561	Date/time 10: month	6.7.4	0	____	Alarm block 10: alarm
0562	Date/time 10: date - value 1	6.7.4	0	____	Alarm block 10: month
0563	Date/time 10: date - value 2	6.7.4	0	____	Alarm block 10: day(s) of week
0564	Date/time 10: hour - value 1	6.7.4	0	____	Alarm block 10: start hour - V1
0565	Date/time 10: hour - value 2	6.7.4	0	____	Alarm block 10: start hour - V2
0566	Date/time 10: minute - value 1	6.7.4	0	____	Alarm block 10: end hour - V1
0567	Date/time 10: minute - value 2	6.7.4	0	____	Alarm block 10: end hour - V2
0568	Date/time 9: action sequence	6.7.4	0	____	Alarm block 9: block indicator
0569	Date/time 9: month	6.7.4	0	____	Alarm block 9: alarm
0570	Date/time 9: date - value 1	6.7.4	0	____	Alarm block 9: month
0571	Date/time 9: date - value 2	6.7.4	0	____	Alarm block 9: day(s) of week
0572	Date/time 9: hour - value 1	6.7.4	0	____	Alarm block 9: start hour - V1
0573	Date/time 9: hour - value 2	6.7.4	0	____	Alarm block 9: start hour - V2
0574	Date/time 9: minute - value 1	6.7.4	0	____	Alarm block 9: end hour - V1
0575	Date/time 9: minute - value 2	6.7.4	0	____	Alarm block 9: end hour - V2

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0576	Date/time 8: action sequence	6.7.4	0	____	Alarm block 8: block indicator
0577	Date/time 8: month	6.7.4	0	____	Alarm block 8: alarm
0578	Date/time 8: date - value 1	6.7.4	0	____	Alarm block 8: month
0579	Date/time 8: date - value 2	6.7.4	0	____	Alarm block 8: day(s) of week
0580	Date/time 8: hour - value 1	6.7.4	0	____	Alarm block 8: start hour - V1
0581	Date/time 8: hour - value 2	6.7.4	0	____	Alarm block 8: start hour - V2
0582	Date/time 8: minute - value 1	6.7.4	0	____	Alarm block 8: end hour - V1
0583	Date/time 8: minute - value 2	6.7.4	0	____	Alarm block 8: end hour - V2
0584	Date/time 7: action sequence	6.7.4	0	____	Alarm block 7: block indicator
0585	Date/time 7: month	6.7.4	0	____	Alarm block 7: alarm
0586	Date/time 7: date - value 1	6.7.4	0	____	Alarm block 7: month
0587	Date/time 7: date - value 2	6.7.4	0	____	Alarm block 7: day(s) of week
0588	Date/time 7: hour - value 1	6.7.4	0	____	Alarm block 7: start hour - V1
0589	Date/time 7: hour - value 2	6.7.4	0	____	Alarm block 7: start hour - V2
0590	Date/time 7: minute - value 1	6.7.4	0	____	Alarm block 7: end hour - V1
0591	Date/time 7: minute - value 2	6.7.4	0	____	Alarm block 7: end hour - V2
0592	Date/time 6: action sequence	6.7.4	0	____	Alarm block 6: block indicator
0593	Date/time 6: month	6.7.4	0	____	Alarm block 6: alarm
0594	Date/time 6: date - value 1	6.7.4	0	____	Alarm block 6: month
0595	Date/time 6: date - value 2	6.7.4	0	____	Alarm block 6: day(s) of week
0596	Date/time 6: hour - value 1	6.7.4	0	____	Alarm block 6: start hour - V1
0597	Date/time 6: hour - value 2	6.7.4	0	____	Alarm block 6: start hour - V2
0598	Date/time 6: minute - value 1	6.7.4	0	____	Alarm block 6: end hour - V1
0599	Date/time 6: minute - value 2	6.7.4	0	____	Alarm block 6: end hour - V2
0600	Date/time 5: action sequence	6.7.4	0	____	Alarm block 5: block indicator
0601	Date/time 5: month	6.7.4	0	____	Alarm block 5: alarm
0602	Date/time 5: date - value 1	6.7.4	0	____	Alarm block 5: month
0603	Date/time 5: date - value 2	6.7.4	0	____	Alarm block 5: day(s) of week
0604	Date/time 5: hour - value 1	6.7.4	0	____	Alarm block 5: start hour - V1
0605	Date/time 5: hour - value 2	6.7.4	0	____	Alarm block 5: start hour - V2
0606	Date/time 5: minute - value 1	6.7.4	0	____	Alarm block 5: end hour - V1
0607	Date/time 5: minute - value 2	6.7.4	0	____	Alarm block 5: end hour - V2
0608	Date/time 4: action sequence	6.7.4	0	____	Alarm block 4: block indicator
0609	Date/time 4: month	6.7.4	0	____	Alarm block 4: alarm
0610	Date/time 4: date - value 1	6.7.4	0	____	Alarm block 4: month
0611	Date/time 4: date - value 2	6.7.4	0	____	Alarm block 4: day(s) of week
0612	Date/time 4: hour - value 1	6.7.4	0	____	Alarm block 4: start hour - V1
0613	Date/time 4: hour - value 2	6.7.4	0	____	Alarm block 4: start hour - V2
0614	Date/time 4: minute - value 1	6.7.4	0	____	Alarm block 4: end hour - V1
0615	Date/time 4: minute - value 2	6.7.4	0	____	Alarm block 4: end hour - V2
0616	Date/time 3: action sequence	6.7.4	0	____	Alarm block 3: block indicator
0617	Date/time 3: month	6.7.4	0	____	Alarm block 3: alarm
0618	Date/time 3: date - value 1	6.7.4	0	____	Alarm block 3: month
0619	Date/time 3: date - value 2	6.7.4	0	____	Alarm block 3: day(s) of week
0620	Date/time 3: hour - value 1	6.7.4	0	____	Alarm block 3: start hour - V1
0621	Date/time 3: hour - value 2	6.7.4	0	____	Alarm block 3: start hour - V2
0622	Date/time 3: minute - value 1	6.7.4	0	____	Alarm block 3: end hour - V1
0623	Date/time 3: minute - value 2	6.7.4	0	____	Alarm block 3: end hour - V2

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0624	Date/time 2: action sequence	6.7.4	0	____	Alarm block 2: block indicator
0625	Date/time 2: month	6.7.4	0	____	Alarm block 2: alarm
0626	Date/time 2: date - value 1	6.7.4	0	____	Alarm block 2: month
0627	Date/time 2: date - value 2	6.7.4	0	____	Alarm block 2: day(s) of week
0628	Date/time 2: hour - value 1	6.7.4	0	____	Alarm block 2: start hour - V1
0629	Date/time 2: hour - value 2	6.7.4	0	____	Alarm block 2: start hour - V2
0630	Date/time 2: minute - value 1	6.7.4	0	____	Alarm block 2: end hour - V1
0631	Date/time 2: minute - value 2	6.7.4	0	____	Alarm block 2: end hour - V2
0632	Date/time 1: action sequence	6.7.4	0	____	Alarm block 1: block indicator
0633	Date/time 1: month	6.7.4	0	____	Alarm block 1: alarm
0634	Date/time 1: date - value 1	6.7.4	0	____	Alarm block 1: month
0635	Date/time 1: date - value 2	6.7.4	0	____	Alarm block 1: day(s) of week
0636	Date/time 1: hour - value 1	6.7.4	0	____	Alarm block 1: start hour - V1
0637	Date/time 1: hour - value 2	6.7.4	0	____	Alarm block 1: start hour - V2
0638	Date/time 1: minute - value 1	6.7.4	0	____	Alarm block 1: end hour - V1
0639	Date/time 1: minute - value 2	6.7.4	0	____	Alarm block 1: end hour - V2
0640	Telephone number A: value 1	6.8.1	10	____	_____
0641	Telephone number A: value 2	6.8.1	10	____	_____
0642	Telephone number A: value 3	6.8.1	10	____	_____
0643	Telephone number A: value 4	6.8.1	10	____	_____
0644	Telephone number A: value 5	6.8.1	10	____	_____
0645	Telephone number A: value 6	6.8.1	10	____	_____
0646	Telephone number A: value 7	6.8.1	10	____	_____
0647	Telephone number A: value 8	6.8.1	10	____	_____
0648	Telephone number A: value 9	6.8.1	10	____	_____
0649	Telephone number A: value 10	6.8.1	10	____	_____
0650	Telephone number A: value 11	6.8.1	10	____	_____
0651	Telephone number A: value 12	6.8.1	10	____	_____
0652	Telephone number A: voice/data/pager ID	6.8.4	0	____	_____
0653	Telephone number A: call attempts	6.8.3	2	____	_____
0654	Telephone number B: value 1	6.8.1	10	____	_____
0655	Telephone number B: value 2	6.8.1	10	____	_____
0656	Telephone number B: value 3	6.8.1	10	____	_____
0657	Telephone number B: value 4	6.8.1	10	____	_____
0658	Telephone number B: value 5	6.8.1	10	____	_____
0659	Telephone number B: value 6	6.8.1	10	____	_____
0660	Telephone number B: value 7	6.8.1	10	____	_____
0661	Telephone number B: value 8	6.8.1	10	____	_____
0662	Telephone number B: value 9	6.8.1	10	____	_____
0663	Telephone number B: value 10	6.8.1	10	____	_____
0664	Telephone number B: value 11	6.8.1	10	____	_____
0665	Telephone number B: value 12	6.8.1	10	____	_____
0666	Telephone number B: voice/data/pager ID	6.8.4	0	____	_____
0667	Telephone number B: call attempts	6.8.3	2	____	_____
0668	Telephone number C: value 1	6.8.1	10	____	_____
0669	Telephone number C: value 2	6.8.1	10	____	_____
0670	Telephone number C: value 3	6.8.1	10	____	_____
0671	Telephone number C: value 4	6.8.1	10	____	_____

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0672	Telephone number C: value 5	6.8.1	10	____	_____
0673	Telephone number C: value 6	6.8.1	10	____	_____
0674	Telephone number C: value 7	6.8.1	10	____	_____
0675	Telephone number C: value 8	6.8.1	10	____	_____
0676	Telephone number C: value 9	6.8.1	10	____	_____
0677	Telephone number C: value 10	6.8.1	10	____	_____
0678	Telephone number C: value 11	6.8.1	10	____	_____
0679	Telephone number C: value 12	6.8.1	10	____	_____
0680	Telephone number C: voice/data/pager ID	6.8.4	0	____	_____
0681	Telephone number C: call attempts	6.8.3	2	____	_____
0682	Telephone number D: value 1	6.8.1	10	____	_____
0683	Telephone number D: value 2	6.8.1	10	____	_____
0684	Telephone number D: value 3	6.8.1	10	____	_____
0685	Telephone number D: value 4	6.8.1	10	____	_____
0686	Telephone number D: value 5	6.8.1	10	____	_____
0687	Telephone number D: value 6	6.8.1	10	____	_____
0688	Telephone number D: value 7	6.8.1	10	____	_____
0689	Telephone number D: value 8	6.8.1	10	____	_____
0690	Telephone number D: value 9	6.8.1	10	____	_____
0691	Telephone number D: value 10	6.8.1	10	____	_____
0692	Telephone number D: value 11	6.8.1	10	____	_____
0693	Telephone number D: value 12	6.8.1	10	____	_____
0694	Telephone number D: voice/data/pager ID	6.8.4	0	____	_____
0695	Telephone number D: call attempts	6.8.3	2	____	_____
0696	Telephone number E: value 1	6.8.1	10	____	Pager ID or terminal phone: 10
0697	Telephone number E: value 2	6.8.1	10	____	Pager ID or terminal phone: V1
0698	Telephone number E: value 3	6.8.1	10	____	Pager ID or terminal phone: V2
0699	Telephone number E: value 4	6.8.1	10	____	Pager ID or terminal phone: V3
0700	Telephone number E: value 5	6.8.1	10	____	Pager ID or terminal phone: V4
0701	Telephone number E: value 6	6.8.1	10	____	Pager ID or terminal phone: V5
0702	Telephone number E: value 7	6.8.1	10	____	Pager ID or terminal phone: V6
0703	Telephone number E: value 8	6.8.1	10	____	Pager ID or terminal phone: V7
0704	Telephone number E: value 9	6.8.1	10	____	Pager ID or terminal phone: V8
0705	Telephone number E: value 10	6.8.1	10	____	Pager ID or terminal phone: V9
0706	Telephone number E: value 11	6.8.1	10	____	Pager ID or terminal phone: V10
0707	Telephone number E: value 12	6.8.1	10	____	Pager ID or terminal phone: V11
0708	Telephone number E: voice/data/pager ID	6.8.4	0	____	Pager ID or terminal phone: V12
0709	Telephone number E: call attempts	6.8.3	2	____	Pager ID or terminal phone: V13
0710	Telephone number F: value 1	6.8.1	10	____	Remote print phone num: 10
0711	Telephone number F: value 2	6.8.1	10	____	Remote print phone num: V1
0712	Telephone number F: value 3	6.8.1	10	____	Remote print phone num: V2
0713	Telephone number F: value 4	6.8.1	10	____	Remote print phone num: V3
0714	Telephone number F: value 5	6.8.1	10	____	Remote print phone num: V4
0715	Telephone number F: value 6	6.8.1	10	____	Remote print phone num: V5
0716	Telephone number F: value 7	6.8.1	10	____	Remote print phone num: V6
0717	Telephone number F: value 8	6.8.1	10	____	Remote print phone num: V7
0718	Telephone number F: value 9	6.8.1	10	____	Remote print phone num: V8
0719	Telephone number F: value 10	6.8.1	10	____	Remote print phone num: V9
0720	Telephone number F: value 11	6.8.1	10	____	Remote print phone num: V10

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0721	Telephone number F: value 12	6.8.1	10	____	Remote print phone num: V11
0722	Telephone number F: voice/data/pager ID	6.8.4	0	____	Remote print phone num: V12
0723	Telephone number F: call attempts	6.8.3	2	____	Remote print phone num: V13
0724	Action Sequence 1: step 1 - value 1	6.5.2	15	____	_____
0725	Action Sequence 1: step 1 - value 2	6.5.2	15	____	_____
0726	Action Sequence 1: step 2 - value 1	6.5.2	15	____	_____
0727	Action Sequence 1: step 2 - value 2	6.5.2	15	____	_____
0728	Action Sequence 1: step 3 - value 1	6.5.2	15	____	_____
0729	Action Sequence 1: step 3 - value 2	6.5.2	15	____	_____
0730	Action Sequence 1: step 4 - value 1	6.5.2	15	____	_____
0731	Action Sequence 1: step 4 - value 2	6.5.2	15	____	_____
0732	Action Sequence 1: step 5 - value 1	6.5.2	15	____	_____
0733	Action Sequence 1: step 5 - value 2	6.5.2	15	____	_____
0734	Action Sequence 1: step 6 - value 1	6.5.2	15	____	_____
0735	Action Sequence 1: step 6 - value 2	6.5.2	15	____	_____
0736	Action Sequence 1: step 7 - value 1	6.5.2	15	____	_____
0737	Action Sequence 1: step 7 - value 2	6.5.2	15	____	_____
0738	Action Sequence 1: step 8 - value 1	6.5.2	15	____	_____
0739	Action Sequence 1: step 8 - value 2	6.5.2	15	____	_____
0740	Action Sequence 2: step 1 - value 1	6.5.2	15	____	_____
0741	Action Sequence 2: step 1 - value 2	6.5.2	15	____	_____
0742	Action Sequence 2: step 2 - value 1	6.5.2	15	____	_____
0743	Action Sequence 2: step 2 - value 2	6.5.2	15	____	_____
0744	Action Sequence 2: step 3 - value 1	6.5.2	15	____	_____
0745	Action Sequence 2: step 3 - value 2	6.5.2	15	____	_____
0746	Action Sequence 2: step 4 - value 1	6.5.2	15	____	_____
0747	Action Sequence 2: step 4 - value 2	6.5.2	15	____	_____
0748	Action Sequence 2: step 5 - value 1	6.5.2	15	____	_____
0749	Action Sequence 2: step 5 - value 2	6.5.2	15	____	_____
0750	Action Sequence 2: step 6 - value 1	6.5.2	15	____	_____
0751	Action Sequence 2: step 6 - value 2	6.5.2	15	____	_____
0752	Action Sequence 2: step 7 - value 1	6.5.2	15	____	_____
0753	Action Sequence 2: step 7 - value 2	6.5.2	15	____	_____
0754	Action Sequence 2: step 8 - value 1	6.5.2	15	____	_____
0755	Action Sequence 2: step 8 - value 2	6.5.2	15	____	_____
0756	Action Sequence 3: step 1 - value 1	6.5.2	15	____	_____
0757	Action Sequence 3: step 1 - value 2	6.5.2	15	____	_____
0758	Action Sequence 3: step 2 - value 1	6.5.2	15	____	_____
0759	Action Sequence 3: step 2 - value 2	6.5.2	15	____	_____
0760	Action Sequence 3: step 3 - value 1	6.5.2	15	____	_____
0761	Action Sequence 3: step 3 - value 2	6.5.2	15	____	_____
0762	Action Sequence 3: step 4 - value 1	6.5.2	15	____	_____
0763	Action Sequence 3: step 4 - value 2	6.5.2	15	____	_____
0764	Action Sequence 3: step 5 - value 1	6.5.2	15	____	_____
0765	Action Sequence 3: step 5 - value 2	6.5.2	15	____	_____
0766	Action Sequence 3: step 6 - value 1	6.5.2	15	____	_____
0767	Action Sequence 3: step 6 - value 2	6.5.2	15	____	_____
0768	Action Sequence 3: step 7 - value 1	6.5.2	15	____	_____

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0769	Action Sequence 3: step 7 - value 2	6.5.2	15	____	_____
0770	Action Sequence 3: step 8 - value 1	6.5.2	15	____	_____
0771	Action Sequence 3: step 8 - value 2	6.5.2	15	____	_____
0772	Action Sequence 4: step 1 - value 1	6.5.2	15	____	_____
0773	Action Sequence 4: step 1 - value 2	6.5.2	15	____	_____
0774	Action Sequence 4: step 2 - value 1	6.5.2	15	____	_____
0775	Action Sequence 4: step 2 - value 2	6.5.2	15	____	_____
0776	Action Sequence 4: step 3 - value 1	6.5.2	15	____	_____
0777	Action Sequence 4: step 3 - value 2	6.5.2	15	____	_____
0778	Action Sequence 4: step 4 - value 1	6.5.2	15	____	_____
0779	Action Sequence 4: step 4 - value 2	6.5.2	15	____	_____
0780	Action Sequence 4: step 5 - value 1	6.5.2	15	____	_____
0781	Action Sequence 4: step 5 - value 2	6.5.2	15	____	_____
0782	Action Sequence 4: step 6 - value 1	6.5.2	15	____	_____
0783	Action Sequence 4: step 6 - value 2	6.5.2	15	____	_____
0784	Action Sequence 4: step 7 - value 1	6.5.2	15	____	_____
0785	Action Sequence 4: step 7 - value 2	6.5.2	15	____	_____
0786	Action Sequence 4: step 8 - value 1	6.5.2	15	____	_____
0787	Action Sequence 4: step 8 - value 2	6.5.2	15	____	_____
0788	Action Sequence 5: step 1 - value 1	6.5.2	15	____	_____
0789	Action Sequence 5: step 1 - value 2	6.5.2	15	____	_____
0790	Action Sequence 5: step 2 - value 1	6.5.2	15	____	_____
0791	Action Sequence 5: step 2 - value 2	6.5.2	15	____	_____
0792	Action Sequence 5: step 3 - value 1	6.5.2	15	____	_____
0793	Action Sequence 5: step 3 - value 2	6.5.2	15	____	_____
0794	Action Sequence 5: step 4 - value 1	6.5.2	15	____	_____
0795	Action Sequence 5: step 4 - value 2	6.5.2	15	____	_____
0796	Action Sequence 5: step 5 - value 1	6.5.2	15	____	_____
0797	Action Sequence 5: step 5 - value 2	6.5.2	15	____	_____
0798	Action Sequence 5: step 6 - value 1	6.5.2	15	____	_____
0799	Action Sequence 5: step 6 - value 2	6.5.2	15	____	_____
0800	Action Sequence 5: step 7 - value 1	6.5.2	15	____	_____
0801	Action Sequence 5: step 7 - value 2	6.5.2	15	____	_____
0802	Action Sequence 5: step 8 - value 1	6.5.2	15	____	_____
0803	Action Sequence 5: step 8 - value 2	6.5.2	15	____	_____
0804	Action Sequence 6: step 1 - value 1	6.5.2	15	____	_____
0805	Action Sequence 6: step 1 - value 2	6.5.2	15	____	_____
0806	Action Sequence 6: step 2 - value 1	6.5.2	15	____	_____
0807	Action Sequence 6: step 2 - value 2	6.5.2	15	____	_____
0808	Action Sequence 6: step 3 - value 1	6.5.2	15	____	_____
0809	Action Sequence 6: step 3 - value 2	6.5.2	15	____	_____
0810	Action Sequence 6: step 4 - value 1	6.5.2	15	____	_____
0811	Action Sequence 6: step 4 - value 2	6.5.2	15	____	_____
0812	Action Sequence 6: step 5 - value 1	6.5.2	15	____	_____
0813	Action Sequence 6: step 5 - value 2	6.5.2	15	____	_____
0814	Action Sequence 6: step 6 - value 1	6.5.2	15	____	_____
0815	Action Sequence 6: step 6 - value 2	6.5.2	15	____	_____
0816	Action Sequence 6: step 7 - value 1	6.5.2	15	____	_____
0817	Action Sequence 6: step 7 - value 2	6.5.2	15	____	_____

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0818	Action Sequence 6: step 8 - value 1	6.5.2	15	____	_____
0819	Action Sequence 6: step 8 - value 2	6.5.2	15	____	_____
0820	Action Sequence 7: step 1 - value 1	6.5.2	15	____	_____
0821	Action Sequence 7: step 1 - value 2	6.5.2	15	____	_____
0822	Action Sequence 7: step 2 - value 1	6.5.2	15	____	_____
0823	Action Sequence 7: step 2 - value 2	6.5.2	15	____	_____
0824	Action Sequence 7: step 3 - value 1	6.5.2	15	____	_____
0825	Action Sequence 7: step 3 - value 2	6.5.2	15	____	_____
0826	Action Sequence 7: step 4 - value 1	6.5.2	15	____	_____
0827	Action Sequence 7: step 4 - value 2	6.5.2	15	____	_____
0828	Action Sequence 7: step 5 - value 1	6.5.2	15	____	_____
0829	Action Sequence 7: step 5 - value 2	6.5.2	15	____	_____
0830	Action Sequence 7: step 6 - value 1	6.5.2	15	____	_____
0831	Action Sequence 7: step 6 - value 2	6.5.2	15	____	_____
0832	Action Sequence 7: step 7 - value 1	6.5.2	15	____	_____
0833	Action Sequence 7: step 7 - value 2	6.5.2	15	____	_____
0834	Action Sequence 7: step 8 - value 1	6.5.2	15	____	_____
0835	Action Sequence 7: step 8 - value 2	6.5.2	15	____	_____
0836	Action Sequence 8: step 1 - value 1	6.5.2	15	____	_____
0837	Action Sequence 8: step 1 - value 2	6.5.2	15	____	_____
0838	Action Sequence 8: step 2 - value 1	6.5.2	15	____	_____
0839	Action Sequence 8: step 2 - value 2	6.5.2	15	____	_____
0840	Action Sequence 8: step 3 - value 1	6.5.2	15	____	_____
0841	Action Sequence 8: step 3 - value 2	6.5.2	15	____	_____
0842	Action Sequence 8: step 4 - value 1	6.5.2	15	____	_____
0843	Action Sequence 8: step 4 - value 2	6.5.2	15	____	_____
0844	Action Sequence 8: step 5 - value 1	6.5.2	15	____	_____
0845	Action Sequence 8: step 5 - value 2	6.5.2	15	____	_____
0846	Action Sequence 8: step 6 - value 1	6.5.2	15	____	_____
0847	Action Sequence 8: step 6 - value 2	6.5.2	15	____	_____
0848	Action Sequence 8: step 7 - value 1	6.5.2	15	____	_____
0849	Action Sequence 8: step 7 - value 2	6.5.2	15	____	_____
0850	Action Sequence 8: step 8 - value 1	6.5.2	15	____	_____
0851	Action Sequence 8: step 8 - value 2	6.5.2	15	____	_____
0852	Alarm A: channel number - value 1	6.6.2	6	____	_____
0853	Alarm A: channel number - value 2	6.6.2	4	____	_____
0854	Alarm A: trigger rule	6.6.3	5	____	_____
0855	Alarm A: action sequence	6.6.4	9	____	_____
0856	Alarm A: upper limit - value 1	6.6.5	2	____	_____
0857	Alarm A: upper limit - value 2	6.6.5	0	____	_____
0858	Alarm A: upper limit - value 3	6.6.5	4	____	_____
0859	Alarm A: upper limit - value 4	6.6.5	0	____	_____
0860	Alarm A: lower limit - value 1	6.6.5	1	____	_____
0861	Alarm A: lower limit - value 2	6.6.5	0	____	_____
0862	Alarm A: lower limit - value 3	6.6.5	2	____	_____
0863	Alarm A: lower limit - value 4	6.6.5	0	____	_____

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0864	Alarm B: channel number - value 1	6.6.2	6	____	_____
0865	Alarm B: channel number - value 2	6.6.2	4	____	_____
0866	Alarm B: trigger rule	6.6.3	5	____	_____
0867	Alarm B: action sequence	6.6.4	9	____	_____
0868	Alarm B: upper limit - value 1	6.6.5	2	____	_____
0869	Alarm B: upper limit - value 2	6.6.5	0	____	_____
0870	Alarm B: upper limit - value 3	6.6.5	4	____	_____
0871	Alarm B: upper limit - value 4	6.6.5	0	____	_____
0872	Alarm B: lower limit - value 1	6.6.5	1	____	_____
0873	Alarm B: lower limit - value 2	6.6.5	0	____	_____
0874	Alarm B: lower limit - value 3	6.6.5	2	____	_____
0875	Alarm B: lower limit - value 4	6.6.5	0	____	_____
0876	Alarm C: channel number - value 1	6.6.2	6	____	_____
0877	Alarm C: channel number - value 2	6.6.2	4	____	_____
0878	Alarm C: trigger rule	6.6.3	5	____	_____
0879	Alarm C: action sequence	6.6.4	9	____	_____
0880	Alarm C: upper limit - value 1	6.6.5	2	____	_____
0881	Alarm C: upper limit - value 2	6.6.5	0	____	_____
0882	Alarm C: upper limit - value 3	6.6.5	4	____	_____
0883	Alarm C: upper limit - value 4	6.6.5	0	____	_____
0884	Alarm C: lower limit - value 1	6.6.5	1	____	_____
0885	Alarm C: lower limit - value 2	6.6.5	0	____	_____
0886	Alarm C: lower limit - value 3	6.6.5	2	____	_____
0887	Alarm C: lower limit - value 4	6.6.5	0	____	_____
0888	Alarm D: channel number - value 1	6.6.2	6	____	_____
0889	Alarm D: channel number - value 2	6.6.2	4	____	_____
0890	Alarm D: trigger rule	6.6.3	5	____	_____
0891	Alarm D: action sequence	6.6.4	9	____	_____
0892	Alarm D: upper limit - value 1	6.6.5	2	____	_____
0893	Alarm D: upper limit - value 2	6.6.5	0	____	_____
0894	Alarm D: upper limit - value 3	6.6.5	4	____	_____
0895	Alarm D: upper limit - value 4	6.6.5	0	____	_____
0896	Alarm D: lower limit - value 1	6.6.5	1	____	_____
0897	Alarm D: lower limit - value 2	6.6.5	0	____	_____
0898	Alarm D: lower limit - value 3	6.6.5	2	____	_____
0899	Alarm D: lower limit - value 4	6.6.5	0	____	_____
0900	Alarm E: channel number - value 1	6.6.2	6	____	_____
0901	Alarm E: channel number - value 2	6.6.2	4	____	_____
0902	Alarm E: trigger rule	6.6.3	5	____	_____
0903	Alarm E: action sequence	6.6.4	9	____	_____
0904	Alarm E: upper limit - value 1	6.6.5	2	____	_____
0905	Alarm E: upper limit - value 2	6.6.5	0	____	_____
0906	Alarm E: upper limit - value 3	6.6.5	4	____	_____
0907	Alarm E: upper limit - value 4	6.6.5	0	____	_____
0908	Alarm E: lower limit - value 1	6.6.5	1	____	_____
0909	Alarm E: lower limit - value 2	6.6.5	0	____	_____
0910	Alarm E: lower limit - value 3	6.6.5	2	____	_____
0911	Alarm E: lower limit - value 4	6.6.5	0	____	_____

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0912	Alarm F: channel number - value 1	6.6.2	6	____	_____
0913	Alarm F: channel number - value 2	6.6.2	4	____	_____
0914	Alarm F: trigger rule	6.6.3	5	____	_____
0915	Alarm F: action sequence	6.6.4	9	____	_____
0916	Alarm F: upper limit - value 1	6.6.5	2	____	_____
0917	Alarm F: upper limit - value 2	6.6.5	0	____	_____
0918	Alarm F: upper limit - value 3	6.6.5	4	____	_____
0919	Alarm F: upper limit - value 4	6.6.5	0	____	_____
0920	Alarm F: lower limit - value 1	6.6.5	1	____	_____
0921	Alarm F: lower limit - value 2	6.6.5	0	____	_____
0922	Alarm F: lower limit - value 3	6.6.5	2	____	_____
0923	Alarm F: lower limit - value 4	6.6.5	0	____	_____
0924	Alarm G: channel number - value 1	6.6.2	6	____	_____
0925	Alarm G: channel number - value 2	6.6.2	4	____	_____
0926	Alarm G: trigger rule	6.6.3	5	____	_____
0927	Alarm G: action sequence	6.6.4	9	____	_____
0928	Alarm G: upper limit - value 1	6.6.5	2	____	_____
0929	Alarm G: upper limit - value 2	6.6.5	0	____	_____
0930	Alarm G: upper limit - value 3	6.6.5	4	____	_____
0931	Alarm G: upper limit - value 4	6.6.5	0	____	_____
0932	Alarm G: lower limit - value 1	6.6.5	1	____	_____
0933	Alarm G: lower limit - value 2	6.6.5	0	____	_____
0934	Alarm G: lower limit - value 3	6.6.5	2	____	_____
0935	Alarm G: lower limit - value 4	6.6.5	0	____	_____
0936	Alarm H: channel number - value 1	6.6.2	6	____	_____
0937	Alarm H: channel number - value 2	6.6.2	4	____	_____
0938	Alarm H: trigger rule	6.6.3	5	____	_____
0939	Alarm H: action sequence	6.6.4	9	____	_____
0940	Alarm H: upper limit - value 1	6.6.5	2	____	_____
0941	Alarm H: upper limit - value 2	6.6.5	0	____	_____
0942	Alarm H: upper limit - value 3	6.6.5	4	____	_____
0943	Alarm H: upper limit - value 4	6.6.5	0	____	_____
0944	Alarm H: lower limit - value 1	6.6.5	1	____	_____
0945	Alarm H: lower limit - value 2	6.6.5	0	____	_____
0946	Alarm H: lower limit - value 3	6.6.5	2	____	_____
0947	Alarm H: lower limit - value 4	6.6.5	0	____	_____
0948	Main security code - value 1	6.9.1	1	____	_____
0949	Main security code - value 2	6.9.1	2	____	_____
0950	Main security code - value 3	6.9.1	3	____	_____
0951	Main security code - value 4	6.9.1	4	____	_____
0952	Main security code - value 5	6.9.1	5	____	_____
0953	Main security code - value 6	6.9.1	6	____	_____
0954	Main security code - value 7	6.9.1	7	____	_____
0955	Main security code - value 8	6.9.1	8	____	_____
0956	Control security code A - value 1	6.9.1	6	____	_____
0957	Control security code A - value 2	6.9.1	6	____	_____
0958	Control security code A - value 3	6.9.1	10	____	_____
0959	Control security code A - value 4	6.9.1	10	____	_____

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Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0960	Control security code B - value 1	6.9.1	6	____	_____
0961	Control security code B - value 2	6.9.1	6	____	_____
0962	Control security code B - value 3	6.9.1	10	____	_____
0963	Control security code B - value 4	6.9.1	10	____	_____
0964	Control security code C - value 1	6.9.1	6	____	_____
0965	Control security code C - value 2	6.9.1	6	____	_____
0966	Control security code C - value 3	6.9.1	10	____	_____
0967	Control security code C - value 4	6.9.1	10	____	_____
0968	Basic programming security code - value 1	6.9.1	4	____	_____
0969	Basic programming security code - value 2	6.9.1	0	____	_____
0970	Basic programming security code - value 3	6.9.1	8	____	_____
0971	Basic programming security code - value 4	6.9.1	8	____	_____
0972	Advanced programming security code - value 1	6.9.1	4	____	_____
0973	Advanced programming security code - value 2	6.9.1	1	____	_____
0974	Advanced programming security code - value 3	6.9.1	5	____	_____
0975	Advanced programming security code - value 4	6.9.1	0	____	_____
0976	Control security code for channels 00-07	6.9.2	1	____	_____
0977	Control security code for channels 08-15	6.9.2	1	____	_____
0978	Control security code for channels 16-23	6.9.2	1	____	_____
0979	Control security code for channels 24-31	6.9.2	1	____	_____
0980	Control security code for channels 32-39	6.9.2	1	____	_____
0981	Control security code for channels 40-47	6.9.2	1	____	_____
0982	Control security code for channels 48-55	6.9.2	1	____	_____
0983	Control security code for channels 56-63	6.9.2	1	____	_____
0984	Site ID phrase: word 1 - value 1	6.10.1	7	____	_____
0985	Site ID phrase: word 1 - value 2	6.10.1	11	____	_____
0986	Site ID phrase: word 2 - value 1	6.10.1	9	____	_____
0987	Site ID phrase: word 2 - value 2	6.10.1	8	____	_____
0988	Site ID phrase: word 3 - value 1	6.10.1	8	____	_____
0989	Site ID phrase: word 3 - value 2	6.10.1	12	____	_____
0990	Site ID phrase: word 4 - value 1	6.10.1	8	____	_____
0991	Site ID phrase: word 4 - value 2	6.10.1	9	____	_____
0992	Site ID phrase: word 5 - value 1	6.10.1	0	____	_____
0993	Site ID phrase: word 5 - value 2	6.10.1	1	____	_____
0994	Site ID phrase: word 6 - value 1	6.10.1	8	____	_____
0995	Site ID phrase: word 6 - value 2	6.10.1	8	____	_____

Appendix A — Programming Address Table

Address	Description	Section	- Programming - Default	Current	Alternate Use / Notes
0996	Hardware version	6.10.2	3	____	_____
0997	Telemetry settling time	6.3.8	2	____	_____
0998	Telemetry leading zero suppression	6.3.7	1	____	_____
0999	Telephone dialing mode (tone/pulse)	6.8.5	1	____	_____
1000	Inactive system timeout	6.10.3	0	____	_____
1001	Answer ring number	5.6.2	2	____	_____
1002	Communication mode (data/voice)	6.8.9	3	____	_____
1003	Telephone call alarm message duration	6.5.5	2	____	_____
1004	Telephone call pause between calls duration	6.5.5	4	____	_____
1005	Serial data protocol and baud rate	6.8.10	0	____	_____
1006	Control relay minimum operate time	6.5.3	1	____	_____
1007	Action sequence delay between steps	6.5.4	1	____	_____
1008	Action sequence at power-on action (power failure alarm)	6.4.8	10	____	_____
1009	Telemetry alarm system enable/disable	6.6.6	0	____	_____
1010	Telemetry auto-scan stop channel – tens digit	6.7.8	0	____	_____
1011	Telemetry auto-scan stop channel – ones digit	6.7.8	7	____	_____
1012	Telemetry auto-scan data interval	6.7.7	2	____	_____
1013	Telemetry alarm scan interval and sequence	6.6.7	0	____	_____
1014	Telephone ring detection sensitivity	6.8.8	3	____	_____
1015	Shared memory selector (telemetry labels/time triggers)	6.7.3	6	____	_____
1016	Security code failure lockout time	6.9.3	1	____	_____
1017	Daylight savings time auto-adjust enable/disable	6.4.4	0	____	_____
1018	Clock speed adjustment—value 1	6.4.5	8	____	_____
1019	Clock speed adjustment—value 2	6.4.5	0	____	_____
1020	Default telemetry units or status format—value 1	6.3.2	0	____	_____
1021	Default telemetry units or status format—value 2	6.3.2	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.

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