Model RFC-1

Remote Control System

— Software Instruction Book —

This instruction book contains valid documentation for RFC-1 software version 2.03

SINE SYSTEMS

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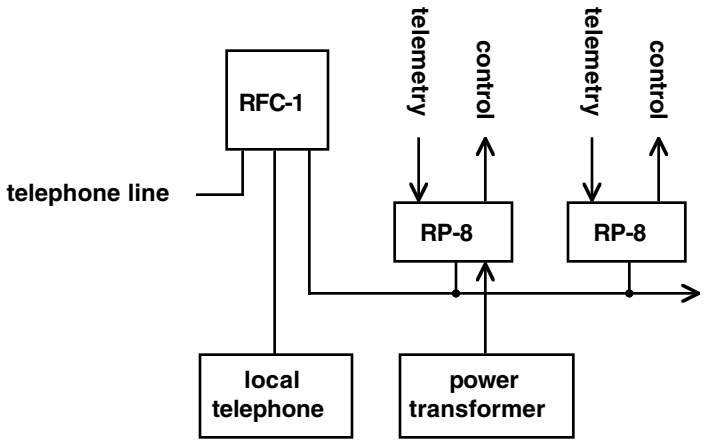
Section 10 — Equipment Description

The RFC-1 is the central unit for a system which was designed to monitor and control a remote facility by means of an ordinary telephone. The remote operator controls the RFC-1 and requests telemetry information by means of a telephone keypad and the RFC-1 gives telemetry and status information to the operator by means of a synthesized voice output. Numerous references will be made in this manual concerning the application of the RFC-1 in controlling remote broadcast transmitting facilities. While this is a common use, it is not by any means the only application of the RFC-1. The RFC-1 is suitable for many other industrial and commercial applications.

The RFC-1 is connected directly to a regular telephone line and a local telephone; and to the equipment to be monitored and controlled through RP-8 relay "interface" panels. The RFC-1 will automatically "answer" a telephone call after a preset number of rings and then allow the user, after entering a security code, to telemeter or control the facility. The RFC-1 is also capable of monitoring up to six designated telemetry channels and originating a telephone call to report anomalous readings. The following is a block diagram for a typical system:

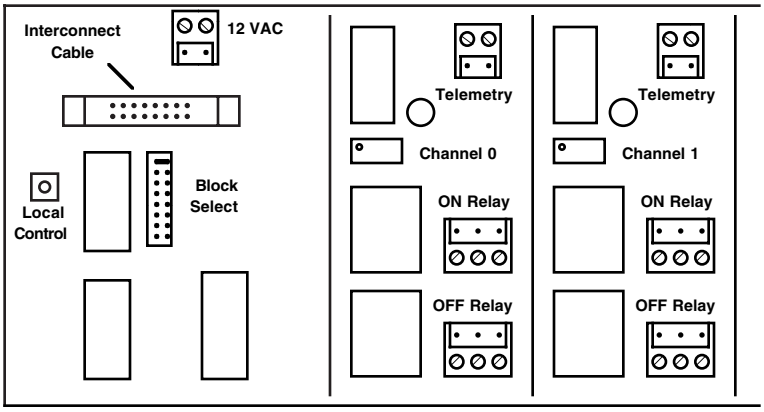


The RFC-1 is "modem-sized" (6" x 7" x 1.75") and can be mounted in any convenient location such as on a wall, on a desk top, or it may be rack mounted with an optional kit. The RFC-1 is connected to a telephone line and a local telephone with modular jacks located on the front panel. It is connected in "daisy chain" fashion with 16 conductor ribbon cables to one or more RP-8 relay panels. These panels contain the necessary relays and interface hardware to connect up to 8 channels of telemetry and control. The RP-8 panels are 3.5" high and 19" wide and are designed to mount in a standard 19" equipment rack. Two panels are shown in the illustration but anywhere from one to eight panels can be connected for a maximum system size of 64 channels. A 12 volt AC "wall plug" transformer is supplied with the RFC-1 which connects to any one of the RP-8 panels and provides power to the entire system.

The system was designed in this way to allow the user to purchase only the hardware necessary for their particular application. As few as eight channels can be installed initially and system expansion up to 64 channels is easily accomplished later

with the addition of more RP-8 panels. The interconnection cable used between the RFC-1 and the RP-8 panels uses insulation displacement connectors which can be field installed in just a few seconds without special tools. Also, it is easy to add connectors to an existing cable for purposes of system expansion. The RFC-1 is supplied with eight feet of interconnection cable and one connector. An additional connector is supplied with each RP-8 panel.

Each RP-8 panel contains 8 reed relays for telemetry selection and 16 relays for control output (8 ON/8 OFF) each rated at 5 amperes resistive/2 amperes inductive. The following illustration shows a partial view of the rear of an RP-8 panel:



Each RP-8 panel has a movable "Block Select" jumper plug which is used to select the block of channels assigned to that panel. The blocks are: 0-7, 8-15, 16-23, 24-31, 32-39, 40-47, 48-55, and 56-63. There is also a "Local Control" pushbutton, accessible from the front of the panel, which allows all control and telemetry functions to be accessed from the local telephone.

All telemetry and control connections are made to the relay panels by means of "pluggable" screw terminal blocks. These removable blocks can be installed so the wires emerge from the relay panel either horizontally or vertically and simplify both installation and future modification or testing. To remove them, simply pull them off.

Telemetry calibration is accomplished with a 22 turn cermet potentiometer, accessible from the front of the relay panel, for each telemetry channel. Calibration is done in the local control mode by adjusting the potentiometers for the desired telemetry indication.

The RFC-1 has an ingenious way of making any channel either a telemetry channel or a "status" channel. Telemetry is measured over a range of 0000 to 2040. If a reading is between 0003 and 2039, the telemetry reading is spoken as four digits. If the telemetry reading is 0002 or lower, the words "Status: Off" are spoken. If the telemetry reading is 2040 (full scale or higher) the words "Status On" are spoken. Using this system, it is easy to monitor either an analog telemetry source or a source that is either "on" or "off."

To restrict remote operation of the RFC-1 to authorized personnel only, the correct entry of an eight digit security code is required before any access is granted to telemetry or control. This code can be set to any one of 100,000,000 possible combinations with the "local" (on site) telephone. The degree of security attained by the use of an eight digit

security code is quite high. Working 24 hours a day, seven days a week it would take over 316 years to attempt all possible codes. As a safeguard against unintentional control actions by persons who know the security code, an additional two digit code is required before control authority is granted.

Provisions are included in the RFC-1 to allow the user to alter the number of rings required before it answers a call. This can be set to any number from 1 to 9 from either the local, or an outside telephone.

A "telephone alarm" feature is included in the RFC-1/B which allows it to originate a telephone call and report anomalous telemetry conditions. This optional feature allows up to six channels to be designated for monitoring. The alarm limits can be specified from a selection of four ranges. The designation of alarm channels, the alarm limits, and the telephone number to be called (up to 11 digits) can be programmed either locally or from an outside telephone.

The RFC-1's "ring number," security code and all "telephone alarm" programming are stored in a nonvolatile section of the internal microprocessor's memory. This memory remains intact during power outages and does not require the use of a back-up battery or "memory" capacitor.

Section 11 — Operation

Telemetry/Control From A Remote Telephone

Remote operation of the RFC-1 is normally accomplished with a DTMF (dual tone multi-frequency or Touch Tone®) telephone connected to a DTMF dialed telephone line. However, where DTMF service is not available, the initial call can be made with a rotary (pulse) dialing telephone as long as some method of generating DTMF tones is available once the RFC-1 answers the call. This could be done by using a telephone with switchable tone/pulse dialing or it could be done with a acoustically coupled DTMF keypad.

The RFC-1 will answer a call after a predetermined number of rings. Upon answering, after a two second delay (required by FCC rules), the RFC-1 will speak the word "Enter." This is the prompt to enter the security code. The prompt "Enter" (as opposed to "Enter Security Code") was made deliberately vague to keep from tempting malicious entry into the system by other than authorized operating personnel. Successfully guessing the security code is a very remote possibility (one try has a 1 in 100,000,000 chance of success) but the repeated attempts to guess the code would tie up the line and block legitimate use. After the word "Enter" is spoken, the eight digit security code should be entered. If it is entered correctly, "OK" is spoken and access to system telemetry is granted. If the security code is not entered or incorrectly entered, the RFC-1 cannot be operated and hangs up the line 90 seconds later.

With telemetry authorization granted, the user may access any of the 64 possible telemetry channels by pushing the two digit code for that channel on the telephone keypad. For example, to obtain telemetry on channel "07" the operator should push "07" on the keypad. The RFC-1 will then speak "Channel 07" followed by the telemetry information for that channel. This would be either four digits of telemetry data or the words "Status: On" or "Status: Off." Telemetry information is spoken in three circumstances: 1) after the channel is changed, 2) after a control function is used, and 3) automatically when the telemetry data significantly (more than 10% of full scale) changes. The latter feature is very useful when you are waiting for some event to happen. For example suppose that the filaments of a transmitter had just been turned on and the plate voltage was turned on. When the plate voltage "On" command is given, the initial telemetry indication is "Status: Off" because the filament time delay has not had sufficient time to operate. With no further action on the part of the operator, the RFC-1 will speak the plate voltage telemetry data when the plate voltage turns on. This feature is also useful for monitoring "variable" status sources such as the flashing of tower lights, for example.

At any time during the telephone call, telemetry authorization can be upgraded to control authorization by pushing the code "66" on the telephone keypad. When this is done, the RFC-1 speaks "OK" and all control functions are then authorized for the remainder of the call. "Off" commands are sent by pushing the "*" key on the keypad and "On" commands are sent with the "#" key. The RFC-1 control channel and the telemetry channel are always the same. For example, suppose that a transmitter's plate voltage control and telemetry were assigned to channel "07" of the RFC-1. To obtain telemetry for plate voltage, the operator would push "07" on the keypad. To turn the plate voltage off, the operator would push "*" on the keypad. To turn it back on the operator would push "#." The control functions for that channel can be operated as many times as desired until

a new channel is entered. Each time a control function is entered a new telemetry reading is made. All two-digit codes below "64" are assumed by the RFC-1 to be channel selections. If an unused channel is selected, the telemetry will be read as "Status: Off" and control actions will have no effect.

The control relays at the remote facility operate for as long as the "*" or "#" keys are pressed. If you want the control relay to operate for ten seconds, hold the appropriate key down for ten seconds. Also, it is important to remember that once control authorization is granted the "*" and "#" are "live" at all times. Pushing either of these keys will initiate a control function (if connected) for the last selected channel and therefore appropriate care should be exercised.

Control is enabled as soon as the channel is selected. It is not necessary to wait for the telemetry reading before a control action is made. This feature is useful when it is desired that a series of control actions be taken rapidly. For example, if it is desired to turn one transmitter off, switch an antenna relay and turn another transmitter on, the key sequence (01*08*05#, for example) could be initiated as rapidly as the operator's fingers could hit the keys. It is not necessary to wait for the channel number or telemetry readings to be spoken.

When a telemetry/control session is finished, push "99". The RFC-1 will speak "Goodbye" and then hang-up. Alternately, simply hang up the telephone and the RFC-1 will hang-up about 90 seconds later. The RFC-1 will automatically hang up whenever 90 seconds elapses without receiving a DTMF tone. The RFC-1 warns that this is about to happen by speaking "Goodbye" 5 seconds before it hangs up. If the operator wants to continue, any key must be pushed within the next five seconds. Because of the latter attribute, the only disadvantage in not using the "99" code is that it will take 90 seconds before the RFC-1 hangs up and frees the line for another call.

Telephone Alarm System (the basics)

The RFC-1 has a "telephone alarm" feature which allows it to originate a telephone call to report telemetry conditions which have departed from preset limits. Up to six channels can be designated for automatic monitoring and alarm limits can be selected from a menu of four ranges. A telephone number up to eleven digits long can be programmed for calling. Instructions for programming the various features of the telephone alarm system will be discussed in the "Programming" section.

The operation of the telephone alarm system is controlled by programming the "Telephone Alarm Status." The Telephone Alarm Status can be programmed to the following five values:

0 Telephone Alarm System disabled.
1 Telephone Alarm System enabled. Telemetry brackets: +10%/-20%
2 Telephone Alarm System enabled. Telemetry brackets: +5%/-10%
3 Telephone Alarm System enabled. Telemetry brackets: +3.3%/-6.6%
4 Telephone Alarm System enabled. Telemetry brackets: +2.5%/-5%

As can be seen, the Telephone Alarm System is disabled by programming a "0" and enabled by programming 1, 2, 3 or 4 for "Telephone Alarm Status." The only difference in programming the latter four numbers is the width of the "telemetry brackets." To

understand the meaning of this, an overview of the Telephone Alarm System is first necessary. The Telephone Alarm System is inhibited from operating during a telemetry/control session.

At the end of each telemetry/control session, the value for the "Telephone Alarm Status" is consulted. If it is "0", no action is taken and the RFC-1 simply hangs up. If it is 1, 2, 3, or 4 the up to six channels which have been designated as Alarm Channels are scanned one at a time and the telemetry values for all six channels are stored for reference. This procedure takes about six seconds and it is done about 10 seconds after termination of the telemetry/control session. From this point on, each of the designated Alarm Channels is checked once every 80 seconds. Each time it is checked, it is compared to the reference value made for that channel at the end of the last telemetry/control session. As long as the value is within the "telemetry bracket" defined by the "Telemetry Alarm Status" no action is taken. If readings outside the telemetry bracket are encountered, the RFC-1 calls the programmed telephone number. It then speaks the eight digit security code and the channel number that was responsible for the alarm, repeatedly, for 60 seconds and then hangs up. The RFC-1 then waits 90 seconds, then repeats the sequence until the number has been called three times. When the RFC-1 calls, it does not know if the line is ringing, if it is busy or if someone answers, unless it hears DTMF tones. It simply goes through the sequence three times. If someone does answer an RFC-1 alarm call, the alarm may be terminated and the normal operating mode can be entered by selecting any channel number. Control can be enabled by pushing "66". Upon termination of the telemetry/control session, (unless the Telephone Alarm Status is set to "0") the RFC-1 will record new reference values for the Alarm Channels and then begin scanning the channels every 80 seconds. If the RFC-1 goes through the entire three-call sequence without hearing a DTMF response, it will then automatically record new reference values for the selected Alarm Channels and then begin scanning these channels every 80 seconds checking for compliance with the newly recorded reference values.

Telephone Alarm System (the finer points)

The Telephone Alarm System can be thought of as a system which reports any change in conditions that existed at the end of the last telemetry/control session. This allows complete freedom of operation without the need for a complicated system of status checks and interlocks. It also greatly simplifies the setup and operation of the RFC-1. As an illustration of this, suppose that there is a site with a main and an auxiliary FM transmitter. Power output for each transmitter is telemetered on different channels and both channels are designated as Alarm Channels. During the last telemetry/control session the main transmitter was on and the auxiliary was off. Because the recorded reference value for the auxiliary transmitter power output was zero, this would not cause an alarm as long as it continued to be zero. Now suppose the main transmitter failed. The RFC-1 initiates an alarm call, an operator answers the call and after not being able to get the main back on, turns on the auxiliary. When this telemetry/control session ends, new reference values for the Alarm Channels are recorded and are checked every 80 seconds. Now, the reference value recorded for the main transmitter is zero so the fact that it is off will not cause an alarm. An alarm would be initiated, however, if the auxiliary transmitter were to fail.

This system is not without its limitations, however. For example, the application of power to the RFC-1 after a power interruption is treated exactly like the end of a

telemetry/control session. Approximately 10 seconds after power is re-applied , the Telephone Alarm Status is checked. If it is 1, 2, 3 or 4, the Alarm Channels are scanned and new reference values are recorded. If a transmitter went off when the power went off and did not come back on, an alarm would not be reported since new reference readings were made with the transmitter off. This potential situation can be averted by instructing the RFC-1 to report all power failures. This is done by programming "85" into an Alarm Channel and is discussed in the programming section.

Switching transmitters or changing operating conditions by a means other than the RFC-1 (for example, direct manual control or control by another remote control operating in "parallel" with the RFC-1) will cause an alarm. The only way to avoid this situation is to disable the Telephone Alarm System in the RFC-1 temporarily while making the changes or make the changes with the RFC-1 instead.

Keep in mind that the Telephone Alarm System is not "instant" in its operation. Since Alarm Channels are scanned once every 80 seconds, if a transmitter happens to go off right after a scan, it will be almost 80 seconds before an alarm is initiated.

Telemetry readings in the RFC-1 are made over a range of 0000 to 2040. If the reference reading for a channel is 0099 or less, percentage telemetry brackets are not used and specific fixed trip points are used instead. These points are 0000 (low) and 0120 (high). In other words, if the reference reading was less than 100, an alarm would not be initiated unless a scanned reading for that channel exceeds 0120. All reference readings above 0099 are evaluated on a percentage basis as determined by the Telemetry Alarm Status. The Telemetry Alarm Status sets the telemetry brackets for all Alarm Channels. There is no provision for evaluating different Alarm Channels with different telemetry brackets.

Once an alarms starts, it makes no difference whether the telemetry reading are in or out of brackets. The alarm will continue until three call attempts are made or until it is cancelled by entering a channel number.

If the Telephone Alarm System is enabled by appropriate programming, the RFC-1 will be unresponsive to pressing either the "Local Calibrate" pushbutton or to ringing on the telephone line during the 6 seconds or so that it takes to complete the initial reference scan of the Alarm Channels. This occurs 10 seconds after power-up and after each telemetry/control session, either local or remote. Also, during a call origination, the RFC-1 will be unresponsive to pressing the "Local Calibrate" pushbutton. If the RFC-1 is set to alarm on power failure by programming "85" as one of the Alarm Channels and it is necessary to temporarily disconnect power to the unit, an alarm can be avoided by pushing the Local Control pushbutton within the first 10 seconds after power is reapplied.

When the RFC-1 makes an alarm call, it gives its Security Code and the channel number which caused the alarm. The reporting of the Security Code is to enable the site to be identified in cases where more than one RFC-1 could potentially call a particular telephone number.

Programming Telephone Alarm Functions

All telephone alarm functions may be programmed either from the local telephone or remotely.

To program the "Telephone Alarm Status," push "82" (TA) on the telephone keypad. The RFC-1 responds with, "Enter Telephone Alarm Status." Then push either 0, 1, 2, 3 or 4. Entry of higher numbers will be interpreted as "4". The RFC-1 will then respond "OK" to indicate that the programming has been accepted.

To program the telephone number to be called for alarm notification, push "86" (TN) on the telephone keypad. The RFC-1 responds with, "Enter Telephone Number." Eleven keys must then be pushed. If the telephone number is shorter than eleven digits, fill in the extra digits with the "*" key. After eleven key strokes are entered, the RFC-1 will respond with "OK" to indicate that the programming has been accepted.

Up to six channels in a system can be designated as Alarm Channels. The designated channels are stored by pushing 91, 92, 93, 94, 95, or 96, "Alarm Channel A" through "Alarm Channel F" respectively. When one of these two digit codes is entered, the RFC-1 will respond with "Enter Channel Number." The desired channel should then be entered. Remember to enter it as two digits: 03, for example. After entry, the RFC-1 speaks "OK" to indicate that the programming has been accepted. Program unused Alarm channels with "64". Program one Alarm Channel as "85" (any one) to instruct the RFC-1 to call after a power failure. Note that Alarm Channels and the Telephone Number may be pre-programmed but will not be utilized unless the Telephone Alarm Status is set to 1, 2, 3 or 4.

Security Code Programming

To program the Security Code, push "72" or "SC" on the telephone keypad. When this code is entered the RFC-1 responds with "Enter Security Code." The operator should then enter the eight digits of the desired security code. The RFC-1 will then respond with "OK" to indicate that the programming has been accepted. The security code can be changed only from the local telephone. If "72" is entered from a remote telephone, the RFC-1 will respond with "Error."

Ring Number Programming

To program the Ring Number (number of rings required before the RFC-1 answers the telephone), push "76" or "RN" on the telephone keypad. When this code is entered the RFC-1 responds with "Enter Ring Number." The operator should then enter a single digit from 1 to 9 which corresponds to the desired number of rings before the RFC-1 answers the call. After the single digit is entered, the RFC-1 responds with "OK" to indicate that the programming has been accepted.

Software Version

To determine the software version contained in the RFC-1, push "78" or "SV" on the telephone keypad. When this code is entered the RFC-1 speaks the number of the software version contained in its microprocessor.

Summary Of All Control Codes

00-63		Selects the desired channel for telemetry and control
*		"OFF" command for the currently selected channel
#		"ON" command for the currently selected channel
66 for	(OM)	Enters the operate mode. This enables the control (OFF/ON) functions the remainder of the call.
72	(SC)	Used to enter a new security code. Enter 8 digits. <u>This function is restricted to use from the local telephone only</u>.
76	(RN)	Ring Number. Enter one digit (1-9). Number of rings required before RFC-1 answers telephone.
78	(SV)	Causes the RFC-1 to speak the software version residing in its microprocessor.
82	(TA)	Telephone Alarm Status. Enter one of the following digits: 0 Telephone Alarm System disabled. 1 Telephone Alarm System enabled. Telemetry brackets: +10%/-20% 2 Telephone Alarm System enabled. Telemetry brackets: +5%/-10% 3 Telephone Alarm System enabled. Telemetry brackets: +3.3%/-6.6% 4 Telephone Alarm System enabled. Telemetry brackets: +2.5%/-5%
86	(TN)	Telephone Number called by the Telephone Alarm System. Enter 11 digits. Fill extra spaces with "*".
91		Alarm Channel A. Enter 2 digits of the desired channel number.
92		Alarm Channel B. Enter 2 digits of the desired channel number.
93		Alarm Channel C. Enter 2 digits of the desired channel number.
94		Alarm Channel D. Enter 2 digits of the desired channel number.
95		Alarm Channel E. Enter 2 digits of the desired channel number.
96		Alarm Channel F. Enter 2 digits of the desired channel number. Enter two digits of channel number. Enter "64" for "blank entry". Enter "85" in any Alarm Channel for alarm on power failure.
99		Causes the RFC-1 to say "Goodbye" and hang-up.

The entry of any other two digit codes causes the RFC-1 to speak "Error."

Programming Record/Factory Programming

It is suggested that a table be recorded of all "normal" programming for the RFC-1. This serves not only as a reminder of the current programming but it also acts as a handy guide to remember how to change programming. Here is an example, which includes the data programmed initially at the factory:

72	Security Code	12345678
76	Ring Number	4
82	Telephone Alarm Status	0
86	Telephone Number	* * * * * * * * * *
91	Alarm Channel A	64
92	Alarm Channel B	64
93	Alarm Channel C	64
94	Alarm Channel D	64
95	Alarm Channel E	64
96	Alarm Channel F	64

Channel Assignment Table

To allow efficient operation, a table of information should be kept at the normal control point which documents the various control and telemetry channels. In the case of broadcast transmitter control, this is a legal requirement as well. The following is an example of such a table:

Channel:

00 Telemetry: FM Transmitter #1 Filaments
Scale: Status
Control: FM Transmitter #1 Filaments; *=OFF, #=ON

01 Telemetry: FM Transmitter #1 Plate Voltage
Scale: Multiply reading by 10 volts to obtain actual value
Control: FM Transmitter #1 Plate Voltage; *=OFF, #=ON

02 Telemetry: FM Transmitter #1 Plate Current
Scale: Divide reading by 100 amperes to obtain actual reading
Control: none

03 Telemetry: FM Transmitter #1 Power Output
Scale: 0948=minimum legal power, 1000=exact, 1024=maximum legal power
Control: FM Transmitter #1 Power Control; *=Lower, #=Raise

Recording Telemetry Data

This is an example of a table that might be used to record telemetry data:

Channel→	01	02	03	05	06	
Source→	FM#1 Plate V	FM#1 Plate A	FM#1 Power	FM#2 Plate V	FM#2 Plate A	F P
Time↓						
10:05A	0940	0410	1000			
11:55A	0941	0412	1005			
2:08P	0942	0413	1006			
4:05P	0941	0412	1004			
5:03P	0941	0412	1004			

Here, the data is recorded only as the four digits spoken by the RFC-1. A separate table of multipliers and units for each column can be included at a single location in the log book. This makes routine data collection a very simple operation with no decimal points, multipliers or units to record.

Local Operation

Local operation of the RFC-1 is identical to remote operation except for the following: The operator should push the "Local Control" pushbutton located behind the small hole on the right-hand end of the RP-8 relay panels. This can be pushed with a pencil point or the screwdriver used for telemetry calibration. When pushed, the RFC-1 switches to the local telephone and speaks "OK." The system is now entered just past the point where the security code would have been entered if remote operation were taking place. In other words, it is not necessary to enter the security code. Telemetry authorization is available immediately and control authorization can be obtained by pushing "66." All the codes and restrictions discussed in the "Remote Operation" section will be in effect.

For RFC-1/B hardware versions 2.00 and later, if the unit is in the local control mode and an incoming call occurs, the RFC-1 will speak "Ring" when the line is ringing. To answer the call, push "99".

The most common use for the local control mode will be the calibration of the telemetry channels. Here is a suggestion to make this a little easier. First, do not enter the Operate Mode (66). After a channel is selected, it will then be possible to repeat the telemetry reading by simply pushing one key: "*" or "#". The RFC-1 will speak "Error" each time as a reminder that it is not in the control mode but it will follow with the telemetry reading.

The RFC-1 has a full scale telemetry value of "2040" so if you are telemetering "17.46 amps," for example, you'll probably want to set the RFC-1 to read "1746." If, however, you are telemetering "22.3 amperes," you'll need to set the RFC-1 to "0223." Always take

advantage of as much of the scale reading as possible. For example, if you use "0100" as a calibration for "100% power", you are only using the bottom 5% of the scale and only 1% resolution will result. If you use "1000" as a calibration, 0.1% resolution is obtained and the long term accuracy will be enhanced.

"**Quick Card**"

To save time and avoid the pressure of trying to remember the control codes in an emergency situation, it is suggested that a "Quick Card" be prepared and carried by key operating personnel. Such a card could be plastic laminated for durability. Here is an example of what could be included on the card:

555-1234 [Enter]
12345678 [OK] 66 [OK]

66 Operate Mode
76 Ring Number
82 Tel. Alarm Status
0=off
1= +10% / -20%
2= +5% / -10%
3= +3.3% / -6.6%
4= +2.5% / -5%
86 Telephone Number
91 Alarm Chan. A
|
96 Alarm Chan. F
(chan. #, 64, or 85)

00 FM1 Fils; off/on
01 FM1 Plate Volts; off/on
02 FM1 Plate Amps
03 FM1 Power; lower/raise
04 FM2 Fils; off/on
05 FM2 Plate Volts; off/on
06 FM2 Plate Amps
07 FM2 Power; lower/raise
08 Ant. Relay; FM2* / FM1#
09 Building Power
10 Generator; manual off/on
(all; off=*, on=#)

To switch from FM1 to FM2:
01* 08* 04# 05#

To switch from FM2 to FM1:
05* 08# 00# 01#

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