

Chapter 1. INTRODUCTION

1.1 Capabilities

The Remote Communication Program (RCP) can best be described as a user friendly way of using a personal computer (PC) to communicate remotely with ABB protective relays and associated products by way of pull-down menus. By coupling a computer with the correct communications hardware, it is then possible to perform many relay functions. Examples include:

- Making settings
- Retrieving status, including target data
- Retrieving present settings
- Retrieving metering data

To summarize some of RCPs other features:

Simple and quick installation

- Easy to learn
- Security - such as multiple password queries
- Both color and monochrome capability
- Allows screen information to be saved in a file
- Allows invocation of DOS commands from within the program
- Relay settings can be saved to a file
- On-line help Multiple product integration within one program
- Macro feature for creating automatic run sequences

1.2 Minimum System Requirements

To run the program requires an IBM AT, PS/2 or true Compatible with a minimum of 640 Kbytes of RAM, 1 hard disk drive, Version 3.3 or higher of MS-DOS, and a Graphics Card. Also required for remote communications is a Hayes-Compatible Modem and an RS-232 serial cable (see section on RS-232C Cable Requirements in Appendix A).

1.3 Package Contents

The main package contains:

- documentation
- one 3.5" disk

This disk contains the latest installation program for RCP. At any time, the user can dial the bulletin board in Coral Springs for the most up-to-date version. The number is (800)-338-0581 or (305)-755-3250.

1.4 Manual Organization

If RCP is already installed and running. Chapters 2 and 3 can be skipped. It is recommended that the remaining chapters be read. Chapters 6, 7 and 8 take you through an actual example. Chapter 9 describes the advanced feature of automating command sequences.

Alpha character inputs can be either upper or lower case except where noted otherwise.

The type of text used throughout the manual helps to distinguish whether it is screen output or user input. Screen output will appear in bold as follows:

**Enter addr in hex (e.g. 1B2)
or type bye when finished:**

User input appears in bold italics as below:

001

Appendix A, B and C at the back of this manual give additional information on the following topics:

- Appendix A: The Device Connection Table gives possible setup combinations of PONI's BIRT's, modems, computers, etc. and the type of cable requirements that are needed.
- Appendix B: Appendix B gives a list of suggested modem settings. It also names a reference document that can be obtained that further explains modems and available settings.
- Appendix C: Appendix C provides an explanation of the INCOM protocol as it exists on the network and the 10 byte ASCII protocol as sent via an RS-232 connection.

Chapter 2. GETTING STARTED

2.1 Making Backups

it is recommended that backup copies of the diskettes be made as soon as possible to insure against loss in case of damage to the original. Follow the step-by-step procedure given here under the heading that describes your system. A working knowledge of MS-DOS¹ is assumed but in some of the commands are unfamiliar then a review of your MS-DOS manual may be necessary.

For a two-diskette drive system:

Method 1 should be used if the backup does not need to be bootable. Method 2 will copy the DOS file named COMMAND.COM and the required system files onto the backup to make it bootable.

Method 1:

These instructions assume that the original diskette is in drive A, and that the DOS system prompt A> is on the screen.

1. Put a blank formatted diskette in drive B.
2. Type the following: **copy *.* b:** this command tells DOS to copy everything on the diskette in drive A (the source) to the diskette in drive B (the target).
3. When finished put the original program diskette in a safe place.

Method 2:

This method will create a bootable or working copy of the program diskette.

1. The WRELCOM diskette should be in drive A and the DOS prompt should be A>.
2. Put a blank new diskette in drive B:
3. Type the following: **format b: /s** The blank diskette in drive B will be formatted and the /s option tells DOS to copy the necessary Operating System files. **BE SURE TO INCLUDE THE B: DRIVE DESIGNATION IN ORDER TO AVOID LOSING DATA.**
4. Insert the WRELCOM diskette in drive A.
5. The next command copies all the files on the original diskette, which should be in drive A onto the newly formatted diskette in the B drive: **copy *.* b:**
6. When finished, put the original program diskette in a safe place.

For a single diskette drive system:

Method 1 should be used if the backup does not need to be bootable. Method 2 will copy the DOS file named COMMAND.COM and the required system files onto the backup to make it bootable.

Method 1:

These instructions assume that the operating system diskette is in drive A and that the DOS system prompt A> is on the screen.

Type the following: **diskcopy**

1. When prompted for the source, insert the WRELCOM original diskette.
2. When prompted for the target diskette, remove the Source diskette (the original) from A and insert a new blank, for-

1. MS-DOS is a Registered Trademark of Microsoft Corporation.

matted diskette in drive A. This will become the Target.

3. When finished put the original program diskette in a safe place.

Method 2:

1. This procedure should be used to make bootable or working diskettes.
2. Insert the operating system diskette in drive A and type: *format a: /s*
3. Insert a blank diskette in drive A when prompted to do so.
4. When finished formatting replace the newly formatted diskette with the original program diskette and type the command *copy a:*. * b:*
5. Even if there is no disk drive B the operating system will still prompt for a disk to be inserted into drive B. At this time remove the original diskette from drive A and then replace with the blank diskette. This swapping in and out may take several times. When finished put the original program diskette in a safe place.

When finished put the original program diskette in a safe place.

2.2 RS-232C Cable Requirements

Before running the program refer to Appendix A (Device Connection Table) for typical connections between hardware products.

2.3 Installation

To install the software, follow these steps:

Place the RCP Installation diskette in the floppy drive.

At the DOS prompt, enter the name of the drive the disk is in. For example, if you placed the master disk in drive A, type the command *A:* and press enter key.

Type the command *install* and press enter key.

From this point on, the installation software prompts you to enter the information it needs to install the software on your system. When the installation program prompts for a destination directory, enter *WRELCOM*. When the installation process is complete, the DOS prompt displays

Chapter 3. RUNNING THE SETUP PROGRAM

To initialize certain parameters such as monitor type, passwords, baud and communication port (COM) designations, run this program first.

If using a fixed disk system, begin by changing to the WRELCOM directory, if not already there, with the command:

cd c:\WRELCOM and press enter key

Next enter the program name *SETUP* and press enter key.

3.1 Information required

The initial screen is an introductory message explaining the purpose of SETUP and what information will be requested. They are repeated here for reference:

1. Monitor type - monochrome or color
2. COM Port designation (1,2,3 or 4)
3. Baud of the communication medium
4. Whether the communication medium is via RS-232C direct to the relay (point-to-point) or via Modem
5. Two passwords - one for initializing the program and one for making relay settings
6. Your Company Name

It also explains that the parameters that are chosen now will be automatically stored in a file called INIT.CFG. This file contains security-sensitive parameters (password designations) that are encrypted before being stored to the disk.

The introductory screen points out that the SETUP program is the only way to go back in and change passwords. it is recommended that the program SETUP.EXE be removed from the working disk and be kept in a safe place.

SETUP.EXE is not required once the INIT.CFG file is created, It is good practice to change passwords periodically for security purposes.

3.2 Defining parameters

Press the enter key to begin the program. The first selection for monitor type is self-explanatory, as well as the Serial port number, baud and type of connection. Passwords exceeding 15 characters or including spaces are not allowed. Other than these limitations, passwords can consist of alpha and numeric characters and can include underscores or other special characters. The company name is requested because it will show up on the initial screen of Remote Configuration Program (Fig. 4-1). Type it exactly as you would like it to appear, including capitalization. This name can be up to 60 characters in length.

When asked for verification of selected settings type either Y or N since it is not necessary to spell out yes or no even though either is acceptable.

The final screen is a summary of parameters chosen that allows a review of choices made with the capability to go back and make changes as needed.

When all the parameters are defined correctly, type Y in response to Are these settings correct?. Setup creates or modifies the INIT.CFG file and finishes with instructions to return to the operating system.

Chapter 4. RUNNING THE REMOTE COMMUNICATION PROGRAM

If this is a first-time installation, the sections on making backups, cable requirements and running SETUP should be reviewed.

The disk and subdirectory where the program resides should be the current directory. On a fixed disk system for example, change to the WRELCOM directory with the command:

```
cd c:\WRELCOM
```

Start the program with command: **RCP** and press enter key.

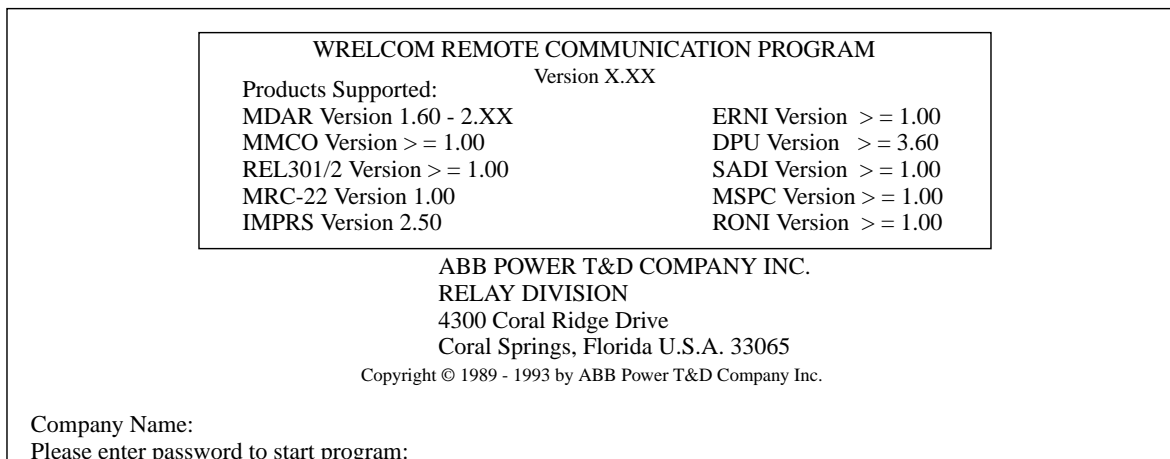


Figure 4-1

4.1 Initial Screen

The initial screen (Fig. 4-1) includes the program, version number and products supported. Versions of RCP will change as new relays and/or relay versions are added to the software. For a description of the features/changes added to each version, at the DOS prompt, type **README.RCP**.

4.2 Main Screen

Once a valid password is received, the program begins. The first step is to become familiar with the main screen (Fig. 4-2). The very top line is called the Top Level Commands which includes:

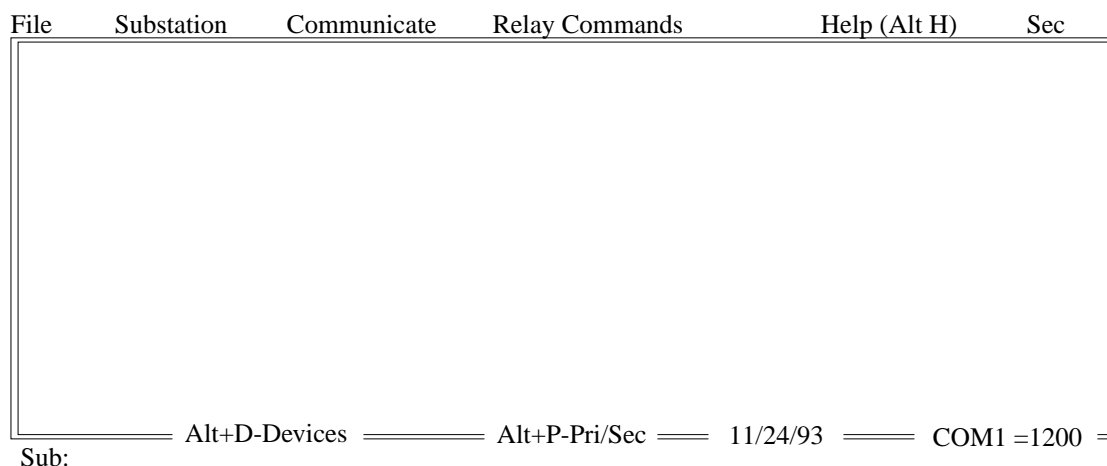


Figure 4-2

Also on the top line appears the word SEC. This applies only to the MDAR, MSPC, and REL 301/302 Relays and indicates that all values that appear are Current and Voltage transformer secondary values. It is possible to view primary values by toggling between the two, by using Alt+P.

On the very bottom line of the screen is the word Sub: for Substation. This is the Substation name that will be filled in by the user later. Other fields will also be filled in later and will include device addresses, names and short descriptions.

The lower right corner tells which COM port was selected during SETUP and its baud. Also shown is today's date as retrieved from the operating systems date stamp.

Each of the Top Level Commands are covered in more detail in the next chapter.

4.3 Using the pull-down menus

Each of the Top Level Commands uses a feature called Pull-down menus. These menus are accessed by holding down the Alt (usually located on either side of the space bar) key and then typing the first letter of the command. For example, to select the menu for File commands, the keystroke sequence is Alt+F.

IF AT ANY TIME EITHER A MENU OR PROMPT FOR INPUT IS SELECTED IN ERROR, THE ESC KEY CAN BE USED TO CANCEL THE COMMAND AND ELIMINATE THE PULL-DOWN MENU.

Selecting the pull-down menu will display further possible selections with a highlight bar across the top choice. From here it is possible to select the command one of two ways. At first it may be easier to use the up and down arrow keys on the keyboard until the user becomes more comfortable with the menus. The other method is to simply type the first letter of the command name such as S to Save a screen from the File menu.

Chapter 5. TOP LEVEL COMMANDS

Most of the following command descriptions are also available from the on screen help feature (Alt+H).

5.1 File commands (Alt+F)

See Figure 5-1 for reference to the File commands.

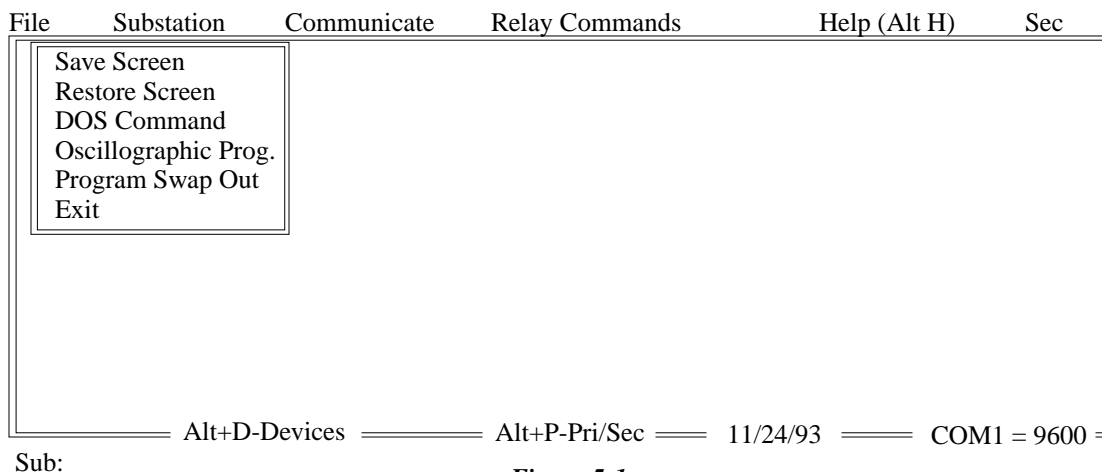


Figure 5-1

Save Screen

Enables you to save the data-filled screen as an ASCII text file with the 25th line serving as the heading. After making this selection you will be prompted for a file name which should follow the same file-naming guidelines as the computers operating system except that the 3-character extension has to be .SAV. If not included as part of the file name the program will add it automatically. Any other extensions will produce an error message.

Restore Screen

This command is the complement of the Save Screen command where the user is prompted for a previously saved screen file name. Again no need to remember to use the .SAV extension.

DOS Command

The user is prompted for an operating system command. This allows any DOS command to be executed and is especially useful for directory listings, copying files, etc. To return to the program, use the ESC key at the Enter DOS Command prompt or press any key when prompted after the command execution.

Oscillographic Prog.

Calls up the OSCAR oscillographic program.

Program Swap Out

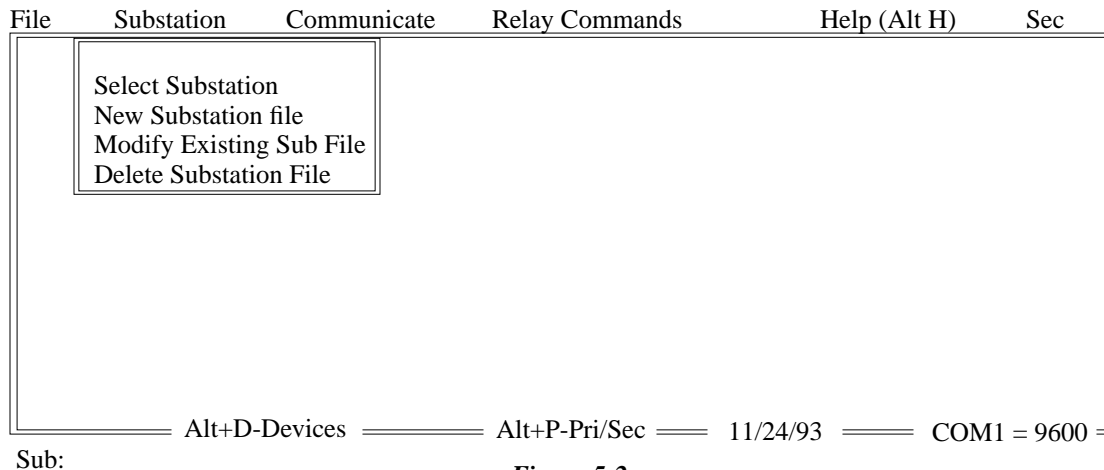
Shells to DOS, allowing the user to execute multiple commands. Type EXIT to return to the RCP program.

Exit

Exits the RCP program and returns to DOS.

5.2 Substation commands (Alt+S)

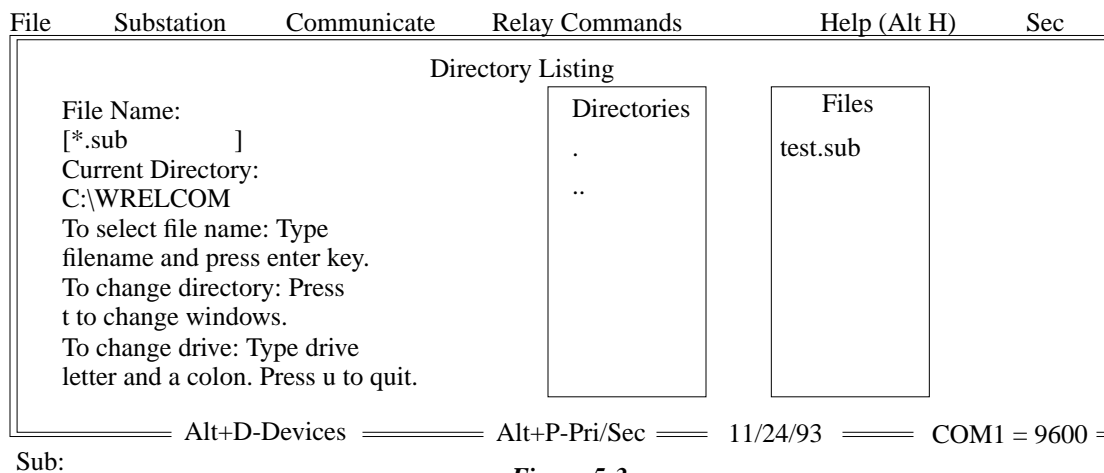
See Figure 5-2 for reference to the Substation commands.

*Figure 5-2*

Select Substation

This selection prompts you for a name of a previously defined substation file. The dialog box shown in Figure 5-3 aids in the selection of a file. The file name may be entered directly under the File Name: field. Or, you may use the tab key to move to the Directories box to change directories. Then tab to the Files box and use the arrow keys to highlight the desired file name, followed by the Enter key to select it. All Substation files have .SUB as the file name extension.

The Substation file will include substation name, device names, addresses (if networked), and a short description of the devices. If the devices are at a remote location (i.e. via Modem) the logon sequence/phone number will also be included.

*Figure 5-3*

New Substation

Gives the user the opportunity to create a new substation file by first requesting a substation name (not limited by the eight character DOS convention) and then whether the Device is connected via an RS-232C or INCOM PONI.

From here depending on whether the devices are networked or not the questions will vary. If networked, the program will ask for a 3-digit hexadecimal address, a device type (e.g. MDAR), and an optional short description limited to approximately 38 characters (e.g. Line 232, BKR 2A). The program will continue asking for additional devices until finished.

Regardless of whether the device connection is via an RS-232C or INCOM PONI the logon sequence/phone number will be requested. This input is optional and will only be used if the devices are being accessed via Modem. To bypass, push enter key.

The last input is the file name which must conform to the DOS file-naming convention. Be sure to either leave off the 3-character extension or make .SUB. If connection is via an RS-232C PONI only one device can be entered and the 3-digit hexadecimal address is not requested.

Modify Substation

This gives the user the ability to change any of the existing Substation information. If the devices are networked it also gives the ability to add or delete any of the devices. As in the Select Substation command, the dialog box shown in Figure 5-3 allows selection of a substation file.

Delete Substation

Deletes the Substation file from the Directory. The name of the file must be typed in at the prompt.

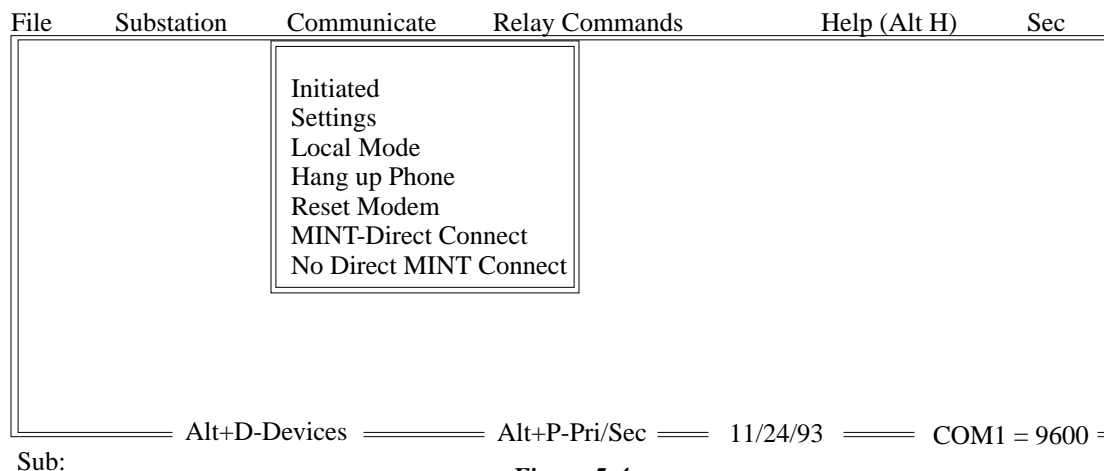


Figure 5-4

Initiate

Utilizes the communication settings originally defined in the SETUP program and initializes the communication port to the redefined baud, word length of 8 bits, 2 stop bits, and no parity. This command is used only after a substation has been selected (See Select Substation). If communication is to be via Modem, the next question determines if the phone number stored in the Substation file should be dialed automatically. If the answer is No, the port will still be initiated but the phone connection will not yet be established.

Settings

This allows temporary changes to the original SETUP file INIT.CFG, which established the baud, communication channels and COM ports. Once the program is exited these new settings are lost.

Local Mode

Gives the user direct access to the modem. The modem is software-initialized to be in the Control Mode (communication from computer to modem and vice-versa only), and to return English codes in response to the Hayes-Compatible command set. Examples include:

- AT Attention
- ATDT, 5551212 Attention, dial tone and dial number 555-1212 after a slight pause.
- AT O Go to Data Mode
- AT H0 Hang up phone connection

Hang Up Phone

This command causes the modem to go off-line (hang-up).

Reset Modem

This sends a RESET command (ATZ) to the modem. The modem will revert to its power-up settings.

MINT-Direct Connect

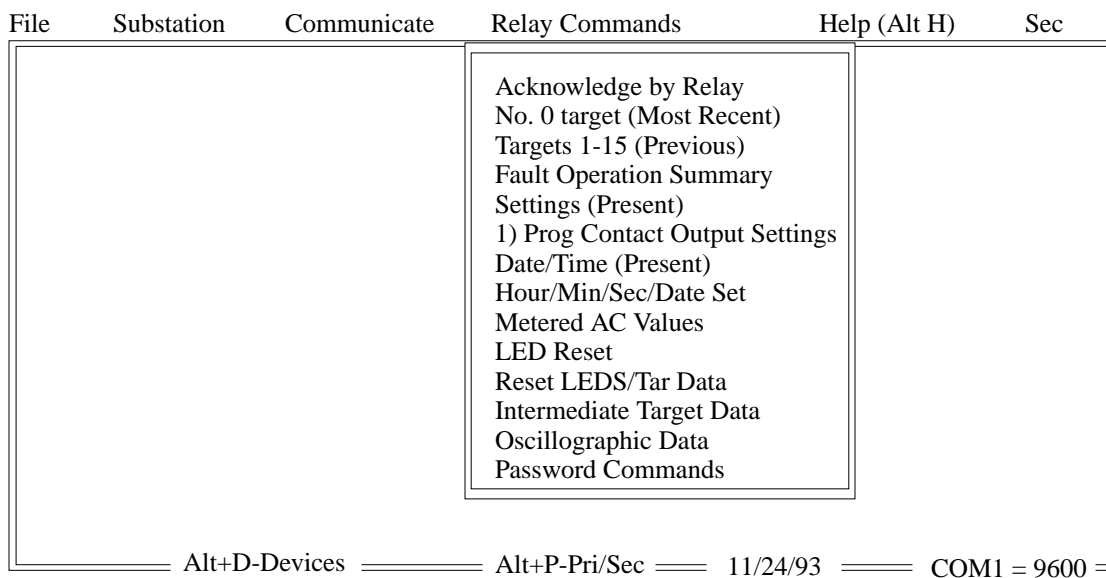
Choosing this option sets several of the hardware handshaking lines of the COM port so they do not conflict with the operation of the MINT. This is necessary only if a direct computer-to-MINT connection is used. This is not necessary for a direct PONI, BIRT or MINT-II connection.

No Direct MINT Connect

This option resets the COM port to its normal handshake line configuration.

5.3 Relay commands (Alt+R)

See Figure 5-5 for reference to the Relay commands.



Sub:

Figure 5-5

This menu (Fig. 5-5) is applicable only after a Substation is selected, a device has been chosen and the COM port is initiated. It displays the commands pertinent to the device chosen.

5.4 Help (Alt+H)

When selected a brief description of each of the commands is given. To return to the main program press Q.

If a hard copy of the Help file is desired, make sure a printer is connected and on line. From DOS enter the command type

gen.hlp > prn

Two remaining options are present here.

5.5 Primary and Secondary Values (Alt+P)

Alt+P

Toggles between secondary values SEC and primary values PRI. This keystroke sequence applies only to MDAR, MSPC and the REL 301/302, and is useful for obtaining primary or secondary values of both target and metering information.

5.6 **Displaying substation device list (Alt+D)**

Alt+D

If a substation file has multiple devices, each device having its own specific INCOM address, a need often arises to quickly display the file and select a new address. Rather than select the Substation File again and retype the file name to get the display, Alt+D repaints the currently opened substation file including the device list. Using the up and down arrow keys, highlight the desired device and hit enter.

File	Substation	Communicate	Relay Commands	Help (Alt H)	Sec
		<u>ADDR</u>	<u>DEVICE</u>	<u>DESCRIPTION</u>	
		001	MDAR	Line 104, BKR 3A	
		002	MMCO	Line 132, BKR 6A	
		003	ERNI	KD-10, Line 104	
===== Alt+D-Devices ===== Alt+P-Pri/Sec ===== 11/24/93 ===== COM1 = 9600 =====					
Sub: SHETLAND SUBSTATION					

Figure 5-6

Chapter 6. SETTING UP A SUBSTATION

Select from the Top Level Commands Substation (Alt+S). The following choices will be displayed:

- Select Substation
- New Substation File
- Modify Existing Sub File
- Delete Substation File

Lets assume for the moment that we have a completely new substation file to create. Select New Substation File. The first request for input is for a Substation name which can be up to 25 characters long and can include special characters and spaces.

6.1 Information required

Information that will be required depends on whether point-to-point communications (RS-232C PONI) or networked communications (INCOM PONI) is used. The following information is requested:

Point-to-Point Communications (RS-232C PONI)

1. Substation name
2. Phone number of substation if PONI is connected via Modem.
3. Type of device to which PONI is connected (e.g. MDAR, MMCO, etc.).
4. Optional description of device if helpful.

Networked Communications (NET or INCOM PONI)

When the devices (e.g. MDAR, MMCO, etc.) are networked via the INCOM or NET PONI they will be connected either to IMAC or the BIRT, MINT or MINT-II. Information requested includes:

1. Substation Name
2. Phone number of substation if the BIRT, MINT, MINT-II or IMAC is connected via Modem.
3. Type and address of each device on the network.

Examples include:

001	MDAR
00F	MMCO
100	ERNI

The address can be found on the NET or INCOM PONI and is a hexadecimal number. An address 001 can be set as:

A2 = 0
A1 = 0
A0 = 1

The decimal equivalent of a hexadecimal number (for information only) is:

$$(A2 * 256) + (A1 * 16) + A0$$

This enables 4096 combinations although 000 should not be used since it is reserved for the master device (i.e. IMAC, BIRT, MINT or MINT-II).

4. Optional description of each device.

6.2 Creating the file

Lets take as an example that we have three different devices at Shetland Substation. All devices are tied to the network via NET PONIs and a BIRT acts as the translator between the 10 byte ASCII protocol and the network protocol. The BIRT is operating at 1200 baud and the relays are set to the following addresses:

Address	Device	Description
001	MDAR	Line 104, BKR 3A
002	MMCO	Line 132, BKR 6A
003	ERNI	KD-10, Line 104

File	Substation	Communicate	Relay Commands	Help (Alt H)	Sec
Enter Substation Name: Shetland Substation 1. RS-232 Point-to-Point (one relay) 2. Networked relays through IMAC or MINT (multiple relays) 3. Quit Enter 1, 2, or 3 from above					
Alt+D-Devices Alt+P-Pri/Sec 11/24/93 COM1 = 1200					

Sub:

Figure 6-1

After we have entered the substation name, Shetland Substation, the following appears:

- 1 RS-232C point-to-point (one relay)**
- 2. Networked relays through IMAC or MINT (multiple relays)**
- 3. Quit**

Enter 1,2, or 3 from above:

Since our substation contains a network with multiple devices, we should choose 2. Choice 1 would be for 1 device with an RS-232C PONI and Choice 3 would be to quit this process.

File	Substation	Communicate	Relay Commands	Help (Alt H)	Sec												
<table> <tr> <th>ADDR</th> <th>DEV</th> <th>DESCRIPTION</th> </tr> <tr> <td>----</td> <td>----</td> <td>-----</td> </tr> </table>						ADDR	DEV	DESCRIPTION	----	----	-----						
ADDR	DEV	DESCRIPTION															
----	----	-----															
Enter addr in hex (e.g. 1B2) or type bye when finished: 001 Enter relay type:																	
<table> <tr> <td>1 MDAR</td> <td>2 ERNI</td> <td>3 MSPC</td> <td>7 MRC</td> <td>9 REL 301/2</td> <td>11 FOCUS</td> </tr> <tr> <td>2 MMCO</td> <td>4 DPU</td> <td>6 RONI</td> <td>8 SADI</td> <td>10 IMPRS</td> <td></td> </tr> </table>						1 MDAR	2 ERNI	3 MSPC	7 MRC	9 REL 301/2	11 FOCUS	2 MMCO	4 DPU	6 RONI	8 SADI	10 IMPRS	
1 MDAR	2 ERNI	3 MSPC	7 MRC	9 REL 301/2	11 FOCUS												
2 MMCO	4 DPU	6 RONI	8 SADI	10 IMPRS													
select one of the above																	
Alt+D-Devices Alt+P-Pri/Sec 11/24/93 COM1 = 1200																	

Sub:

Figure 6-2

Next appears the message:

**Enter addr in hex (e.g. 1B2)
or type bye when finished:**

Here is where we can enter the first device, MDAR. Enter 001, not just 1, as three characters are required. The choice for relay type now appears.

Enter relay type:
1 MDAR 2 ERNI 3 MSPC 7 MRC 9 REL 301/2 11 FOCUS
2 MMCO 4 DPU 6 RONI 8 SADI 10 IMPRS

Select one of the above:

Enter *I* and press the enter key.

Enter the description for device:

Here is where we enter:

Line 104, BKR 3A

After entering the description, we are asked:

Is all information correct?

We can answer *Y* or *N*.

If the information we had entered is correct the data will now appear in the right half of the screen. Use the same procedure and enter our MMCO at address 001 and the ERNI at address 003.

After entering our MMCO and ERNI, we are finished. To end the process, type:

bye

Next appears the request for the logon sequence:

**Type in any logon sequence
(i.e. ATDT + phone number):**

In our fictitious example, the phone number of our substation is 555-1212. We also want to add the Modem command sequence, ATDT, (note the capital letters here). The comma causes the Modem to pause before dialing the number. Enter

ATDT,555-1212

The next prompt asks for a file name:

Enter name for file (or A to Abort)

The extension .sub is not needed, therefore enter

TEST

This saves a substation file TEST.SUB on the disk drive in the current directory. If you would like it to reside in a different directory be sure to specify the path name.

Chapter 7. Modifying a Substation File

In the previous chapter, a substation file called TEST.SUB was created. In this chapter we will modify the description of the MDAR relay to read Line 234, BKR 5A.

7.1 Retrieving the file

First call up the substation menu by using the Alt +S key combination and then selecting:

Modify Existing sub File

by using the *arrow keys* or by simply typing *M*.

We're next asked:

Sub file name to modify?:

Type in:

TEST

7.2 Making changes

Displayed on the right half of the screen is a large window containing the headings for address, device and description with no entries. The question is asked:

The present logon sequence is:

ATDT,5551212

Do you wish to change it?

Here, since we don't want to change this entry, type *N* (for No)

Next, the present substation name appears, Shetland Substation, (not the substation file name) and we also have the option of changing this entry. Type *N* here also as we do not wish to change this.

File	Substation	Communicate	Relay Commands	Help (Alt H)	Sec												
			<table border="1"> <thead> <tr> <th>ADDR</th> <th>DEV</th> <th>DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>001</td> <td>MDAR</td> <td>Line 104, BKR 3A</td> </tr> <tr> <td>002</td> <td>MMCO</td> <td>Line 132, BKR 6A</td> </tr> <tr> <td>003</td> <td>ERNI</td> <td>KD-10, Line 104</td> </tr> </tbody> </table>	ADDR	DEV	DESCRIPTION	001	MDAR	Line 104, BKR 3A	002	MMCO	Line 132, BKR 6A	003	ERNI	KD-10, Line 104		
ADDR	DEV	DESCRIPTION															
001	MDAR	Line 104, BKR 3A															
002	MMCO	Line 132, BKR 6A															
003	ERNI	KD-10, Line 104															
1. Add Device 2. Modify Device 3. Delete Device 4. Quit and Save 5. Abort Process Select one of the above																	
Sub: _____ Alt+D-Devices _____ Alt+P-Pri/Sec _____ 11/24/93 _____ COM1 = 1200 _____																	

Figure 7-1

The window in the right half of the screen shows the data that was supplied in the previous chapter and we are presented with several options:

1. Add Device

2. Modify Device
3. Delete Device
4. Quit and Save
5. Abort Process

Select one of the above:

We would like to modify address 001. Type 2 and press the enter key.

A highlighted bar now appears in the window at right. Use the up or down arrow keys to scroll up and down within the window until the correct address to modify is highlighted. Note that the selections in this window cannot be made by typing the first letter or number as is the case with other pull down menus.

After having chosen MDAR at address 001 as the device to modify, press the enter key.

Device being modified:
001 MDAR Line 104, BKR 3A
Enter addr in hex (e.g. 1B2)
or type bye when finished:

The above text appears on the screen indicating the information that we would like to change. Keep the address and device type the same but change the description.

To keep the same address, type: *001* and press the enter key.

File	Substation	Communicate	Relay Commands	Help (Alt H)	Sec												
			<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">ADDR</th> <th style="text-align: left;">DEV</th> <th style="text-align: left;">DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>001</td> <td>MDAR</td> <td>Line 104, BKR 3A</td> </tr> <tr> <td>002</td> <td>MMCO</td> <td>Line 132, BKR 6A</td> </tr> <tr> <td>003</td> <td>ERNI</td> <td>KD-10, Line 104</td> </tr> </tbody> </table>	ADDR	DEV	DESCRIPTION	001	MDAR	Line 104, BKR 3A	002	MMCO	Line 132, BKR 6A	003	ERNI	KD-10, Line 104		
ADDR	DEV	DESCRIPTION															
001	MDAR	Line 104, BKR 3A															
002	MMCO	Line 132, BKR 6A															
003	ERNI	KD-10, Line 104															
<p>Enter relay type:</p> <table style="width: 100%; border: none;"> <tr> <td>1 MDAR</td> <td>2 ERNI</td> <td>3 MSPC</td> <td>7 MRC</td> <td>9 REL 301/2</td> <td>11 FOCUS</td> </tr> <tr> <td>2 MMCO</td> <td>4 DPU</td> <td>6 RONI</td> <td>8 SADI</td> <td>10 IMPRS</td> <td></td> </tr> </table> <p>select one of the above</p> <p style="text-align: center;">Alt+D-Devices Alt+P-Pri/Sec 11/24/93 COM1 = 1200</p>						1 MDAR	2 ERNI	3 MSPC	7 MRC	9 REL 301/2	11 FOCUS	2 MMCO	4 DPU	6 RONI	8 SADI	10 IMPRS	
1 MDAR	2 ERNI	3 MSPC	7 MRC	9 REL 301/2	11 FOCUS												
2 MMCO	4 DPU	6 RONI	8 SADI	10 IMPRS													

Sub:

Figure 7-2

The response is:

Enter relay type:
1 MDAR 2 ERNI 3 MSPC 7 MRC 9 REL 301/2 11 FOCUS
2 MMCO 4 DPU 6 RONI 8 SADI 10 IMPRS
Select one of the above:

select *1* to keep MDAR as the device type.

We now have the chance to modify the description. Type:

Line 234, BKR 5A

If everything is correct type *Y* (for Yes) to the question

Is all info correct?

If the answer is Y, the left hand part of the screen clears and displays:

Add Device
Modify Device
Delete Device
Quit and Save
Abort Process
Select on of the above:

The one device description is modified so we're now ready to quit by selecting **4**. This saves any changes to the filename TEST.SUB.

A simple modification to our TEST.SUB substation file is now completed and were ready to start a complete session of interacting with our relays.

Chapter 8 Communicating With Your Relay

In the last two chapters, a substation file containing the devices in the Shetland Substation was created and then modified. We're now ready to interact with the relays. First, a couple of reminders:

In our setup file, we specified a COM port, baud and type of connection (RS-232C direct or through a Modem). Are these settings still OK? (See Appendix B)

1. Is the relay turned on, as well as the Modem (if used)? What about the BIRT, MINT, MINT-II or IMAC (if used)?
2. If the relays are networked, are all networked PONIs set to the proper address?
3. Are all cables and wiring correct? (See Appendix A)
4. If all is well with 1-4 above, we are ready to get started.

8.1 General procedure

The steps for getting data from the relays are:

1. Select a Substation File and open it.
2. Select a device from that file. Initiate the COM port to the desired settings.
3. Dial the substation number through the Modem (if used).
4. Ask the relay for data from the available command list for that type of relay.

8.2 Options

Additional steps might be:

1. Save a particular screen of data to an ASCII text file for retrieval later.
2. Make setting changes to a particular relay.
3. Create a settings file for future downloading to a relay.

8.3 Selecting the substation

Let's start our process by opening up the TEST.SUB substation file created in Chapters 6 and 7. First select a substation: Press **Alt+S** (See Fig. 5-2) to bring down the menu.

After choosing Select Substation, type **TEST** in response to:

Enter substation file name:

The entries in our substation file now appear in a window in the right half of the screen with the first entry highlighted. Notice also that the substation name appears at the bottom of the screen.

Choose the first entry at address 001. The following method is the same regardless of relay type selected.

After choosing a particular address/device, it appears at the bottom of the screen to the right of the substation name. This information is important because any time a screen is saved to a file the relay data gets tagged with this address, device and substation.

File	Substation	Communicate	Relay Commands	Help (Alt H)	Sec												
			<table><tr><td>ADDR</td><td>DEV</td><td>DESCRIPTION</td></tr><tr><td>001</td><td>MDAR</td><td>Line 104, BKR 3A</td></tr><tr><td>002</td><td>MMCO</td><td>Line 132, BKR 6A</td></tr><tr><td>003</td><td>ERNI</td><td>KD-10, Line 104</td></tr></table>			ADDR	DEV	DESCRIPTION	001	MDAR	Line 104, BKR 3A	002	MMCO	Line 132, BKR 6A	003	ERNI	KD-10, Line 104
ADDR	DEV	DESCRIPTION															
001	MDAR	Line 104, BKR 3A															
002	MMCO	Line 132, BKR 6A															
003	ERNI	KD-10, Line 104															
Alt+D-Devices			Alt+P-Pri/Sec	11/24/93	COM1 = 1200												
Sub: SHETLAND SUBSTATION																	

Figure 8-1

8.4 Communication

Next we need to initiate the communication port on the computer by pressing Alt+C (See Fig. 5-4). Then select initiate by pressing **I**.

The initiate command must be used for all communication sessions and will result in the following display:

Communication port initiated successfully...

As in our example, where communication is via modem, the program will respond with:

**Dial Number ATDT,5551212
(Y/N)?**

This gives the opportunity to allow the program to dial the phone number to the Modem directly. The Settings option allows us to change the COM port, baud and direct RS-232C/Modem selections, originally made while executing the SETUP program (See Fig. 8-2). These changes are temporary and are lost when the program is exited. To make permanent changes, run SETUP

The Local Mode option is used for direct control of a Hayes¹-Compatible Modem, logging in to an IMAC, or conversing with an ASCII device connected to a SADI. If the option L (for Local Mode) is selected, the user can select either RS-232 or Modem. If Modem is selected, the screen is saved and cleared, and commands are sent to the Modem to assure that it is in command mode and responds with English responses. At the bottom of the screen appears:

Going to Cmd mode. For Data mode, type AT 0 <cr>. Press F6 - function key mode

The Modem will eventually respond with OK. Press F6 to get to function key mode. Now at the bottom of the screen, the line:

F2 - Return F3 - On F4 - Off -- File Capture

Also appears. Pressing F3 gives the user the ability to capture all incoming text to a file.

The second option, RS-232 saves the screen, clears it and gives the user the list of function keys on the bottom of the screen:

¹ Hayes is a Registered Trademark of Hayes Microcomputer Products, Inc.

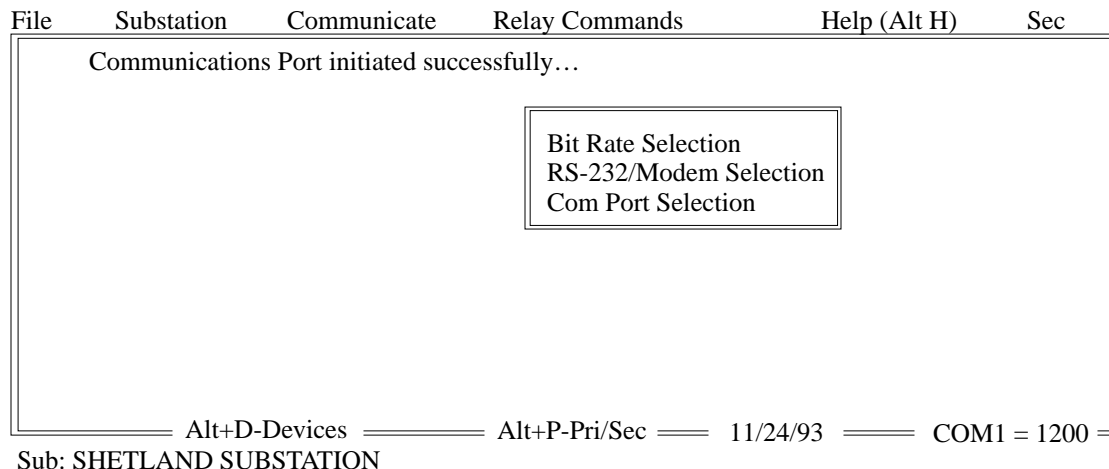


Figure 8-2

F2 - Return F3 - On F4 - Off -- File Capture

The difference between the two options in Local Mode (RS-232 and Modem) is in choosing Modem, the program instructs the Modem to return to command mode and insures that the Modem properly responds. When choosing RS-232, no interaction with the Modem is performed.

8.5 Relay command definitions

The Relay Commands menu can be invoked by typing *Alt+R* (See Fig. 5-5).

The menu of commands that appears is dependent on the relay device selected (shown on the bottom line of the screen).

Once the command menu is displayed, select an entry by using the up or down arrow keys or the first letter of the command. After selecting a command, the following sequence will occur:

1. A screen display appears indicating the type of data that should be returned.
2. The message is sent through to the COM port of the relay.
3. The program waits for the proper amount of data or for an error condition.
4. The returned data is checked for errors, converted into a usable format and displayed on the screen.

The menus for MDAR, MMCO, ERNI and future relays will depend on the type of device they are and what data each can send back.

- The MDAR menu of commands is shown in Fig. 5-5.
- The MMCO menu of commands is:
 - Acknowledge by Relay
 - Check Status of Relay
 - No. 0 Target (Most Recent)
 - Targets 1-15 (Previous)
 - Fault Operation Summary Settings (Present) Date/Time (Present)
 - Hour/Min/Sec/Date set
 - Metered AC Values
 - LED Reset
 - Reset LEDs/TAR Data
 - Password Commands

The ERNI Menu of commands is:

- Acknowledge by Relay
- Contact Status - Present
- Target Information (1-25)
- Second Buffer Targets (26-50)
- Reset Target Data

A general review of the commands may be helpful.

Acknowledge by Relay

Displays the ABB location where the product was made, the product type, whether the settings pushbutton was activated at the relay since the last time the relay was reset, status information (NORMAL/ALARM), number of fault targets since last reset, and a confirmation that the relay responded correctly (ACKNOWLEDGE).

Check Status by Relay

Returns the current status of the Internal hardware of the relay.

Target Information

Returns target data from past events stored in the devices memory.

Settings

Gives the present setting information as stored in EEPROM in the device.

Time functions

Returns date and time stored within the device or allows time and date updating.

Metered values

Returns current and voltage (where applicable) measurements.

Reset of Data and/or LEDs

Allows remote reset of target data and flashing LEDs.

Intermediate target data

Retrieves the data detailing the last delta voltage or delta current condition. This data is displayed on the screen versus time in cycles.

Password Commands

Those commands or requests that are limited to those who know the password to change settings as defined when the SETUP program was run.

For a listing of the mnemonics for the settings data, target data, etc. refer to the appropriate Instruction Leaflet for the particular relay in question.

8.6 Changing settings

The Remote Communication Program allows the user to change settings provided the proper password is entered. From the Relay Commands menu, select Password Commands:, give the password and then select Update/Change Settings. there are three options for changing settings:

- Get Settings From Relay
- Load Settings From File
- Make New Settings File

Get Settings From Relay

Retrieves present settings from the relay and displays the values on the screen. Load Settings From File Allows the user to load a file with a file extension (.set for MDAR, .sct for MMCO) and download the settings directly to the relay.

Make New Settings File

Gives the user a choice as to which options he has in a particular relay and displays only those settings pertaining to those options.

When any one of these choices are picked, a settings screen appears (Fig. 8-3). by moving the cursor up, down, right or left, we can access the desired setting to change.

File	Substation	Communicate	Relay Commands	Help (Alt H)	Sec
Type q or Q to quit changes: MDAR Settings ...					
OSC = TRIP	WFEN = NO		GANG = 40 DEG.	LLT = NO	
FDAT = TRIP	3TRM = NO		ZR = 0.10	LOPB = NO	
CTR = 30	BLKT = 0 msec		LV = 40 VOLTS	LOIB = NO	
VTR = 100			IL = 0.50 AMPS	AL2S = NO	
FREQ = 60 Hz	PLTP = OUT	OHMS	IM = 0.50 AMPS		
CTYP = 5 AMP	PLTG = OUT	OHMS	IOS = 0.50 AMPS		
RP = NO PRI	Z1P = OUT	OHMS	IOM = 0.50 AMPS		
XPUD = 0.300/DT	Z1G = OUT	OHMS	ITP = OUT AMPS		
DTYP = MILES	T1 = 0		ITG = OUT AMPS		
TTYP = OFF	Z2P = OUT	OHMS	OSB = NO		
62T = 0.30 SEC	T2P = BLK	SEC	OSOT = 400 MSEC		
PTRI = NO	Z2G = OUT	OHMS	RT = 1.00 OHMS		
Z1RI = NO	T2G = BLK	SEC	RU = 3.00 OHMS		
Z2RI = NO	Z3P = OUT	OHMS	DIRU = ZSEQ		
Z3RI = NO	T3P = BLK	SEC	GBCV = OUT		
BFRB = NO	Z3G = OUT	OHMS	GBPU = 0.50 AMPS		
PLT = NO	T3G = BLK	SEC	GTC = 1		
STYP = 3ZNP	Z3FR = FWD		GDIR = NO		
FDGT = BLK cycl	PANG = 40	DEG.	CIR = OUT		
Alt+D-Devices Alt+P-Pri/Sec 11/24/93 COM1 = 1200					
Sub: SHETLAND SUBSTATION					

Figure 8-3

When the Enter key is pressed, the setting to the right of the cursor appears in the top right window showing the minimum value of the setting. Using the up or down arrow keys change the setting in incremental values that are valid to the relay. The Page Up or Page Down keys can be used to increment or decrement at a faster rate.

When the particular setting is chosen, pressing the Enter key displays the new setting in the proper location and highlighted to indicate that it has been changed. Alternately, the Esc key can be used to retain the current (unchanged) setting.

During this process of changing settings, no data is actually sent to the relay yet. When finished with all the changes type:

Q (for Quit)

Y (Are changes correct (A=Abort)(Y/N/A)?)

Y or **N** (Save settings to a File (Y/N)?)

If the data is saved to a file, the three-character extension for the filename is not required (.set is automatically appended to MDAR settings files and .sct to MMCO files).

Y (Send Settings to the Relay?)

Responding yes to the above question and matching a password, previously set for the particular relay, will update all settings of the relay.

A confirmation from the relay is returned and a set of new settings data is requested from the relay and displayed.

8.7 Exiting the program

Type: **Alt+F** (File) (See Figure 5-1). Then use the up and down arrow keys or type **E** (exit). The program returns to DOS.

Chapter 9 AUTOMATING COMMANDS

In this chapter we will discuss a method by which the Remote Communication Program can obtain its input from a command file rather than the keyboard. This will allow us to automate the process of, for example, getting fault target data from the relay. Pursuing this thought, let's design a command file that obtains the fault target data from the relay and saves it to a file. Well use our same TEST.SUB substation file created in Chapters 6 and 7 and access data from the MDAR at address 001.

9.1 Creating command files

The command file can be written on a text editor such as the DOS EDIT program or any word processor. If using a word processor be sure to save the resulting output file as an ASCII text file.

Let's review the steps to retrieve and store fault target data from a particular device.

1. Type in the password to enter the program.
2. Select the substation name and device.
3. Initiate communications.
4. Interrogate the relay through the Relay Commands menu to send back the No. 1 target (Most Recent).
5. Save the resulting screen output to a file.
6. Exit the program.

One other thing before we get started. To select any Main Menu heading when using a command file, simply use the first letter of the title rather than the **Alt+S** key sequence. For example, the command **S** would cause the Substation menu to appear as follows:

```

Select Substation
New Substation
Modify Existing Sub File
Delete Substation File

```

To choose Select Substation from this menu, 0 selects the first entry in the list or 1 for the second, etc. any other Top Level Command and subsequent menu selection can be accessed in a similar manner.

1. Command file cannot be used to automate the following:
2. Making a New Substation File (under Substation Menu)
3. Modifying a Substation File (under Substation Menu)
4. Initiating a DOS command (under File Menu)
5. Changing particular settings of a relay when not specifically using an existing settings file.

The following is a listing of the sample command file to retrieve and save the most recent target from the MDAR at address 001 with an explanation to the right. The line numbers are used for clarity only and are not part of the program.

1. Your_Password (Password to gain access to the program)
2. S (Substation Main Menu)
3. O (First menu choice - Select Substation)
4. TEST (Our substation file name is TEST.SUB)
5. O (First menu choice - 001 MDAR Line 234, BKR 5A)

6. C (Communicate Main Menu)
7. O (First menu choice - Initiate)
8. R (Relay Commands Main Menu)
9. 2 (Third menu choice - No. 1 Target (Most Recent))
10. F (File Main Menu)
11. O (First menu choice - Save Screen)
12. TEMP (Screen will be saved to file named TEMP.SAV)
13. F (File Main Menu)
14. 3 (Fourth menu choice - Exit)

In the Communicate Local mode entries, function keys are required to be pressed before returning to the main program. As an example, F2 returns to main program. In this case, insert the line:

@f 2

and the program will take this input as the function key F2.

This sequence runs the command file and exits back to DOS. Alternately, the user could insert @* as the last line. This tells the program to revert back to keyboard input.

9.2 Running command files

If we save this command file as TAR.CMD, we can run the program from the operating system prompt (make sure were in the WRELCOM directory) by typing:

RCP < TAR.CMD

Once initiated, the Remote Communication Program executes the instructions from the file TAR.CMD which contains the keystroke sequences to obtain and save the fault target data.

A good idea when creating command files is to manually go through, step by step, writing down the keystroke sequences before creating the command file.

One other point to make is if a file is saved using Save Screen, and a file with the same name already exists, the message:

Overwrite Existing File (Y/N)?

will appear. The Y or N answer must also be in the command file in the appropriate sequence.

The example command file allowed us to retrieve and store target data. Command files can be used to get metering data, settings data, etc., from any or all of our relays. Utilizing the command line, RCP < TAR.CMD gives us the opportunity to incorporate WRELCOM functions into other programs. As an example, from within a BASIC program, the statement:

shell (C:\WRELCOM\RCP < TAR.CMD)

allows us to shell to the operating system, perform the commands in the file TAR.CMD, and return to the BASIC program. Other programming languages have similar capabilities.

The ability to access the Remote Communication Program through a command file especially within another program gives the user expanded flexibility in automating relaying processes.

Glossary of Terms

ERNI —	(Existing Relay Network Interface) - Allows monitoring of contact status (with time tagging) via the network, for devices not originally designed with communication capability.
IMAC —	(INCOM-based Multi Access Controller) - dedicated substation computer operable in four modes - Learn, Interactive, Unattended and Remote.
INCOM —	(Integrated COMmunications) - Local Area Network based on the VSLI INCOM chip capable of networking up to 2500 devices.
MDAR -	ABB digital distance relay system, INCOM compatible. I.L. 40-385.BIRT -(Basic Interface to Remote Terminals) - allows access via 10 byte ASCII protocol or via ASCII text mode to the network.
MINT or MINT-II —	(Master INCOM Network Translator) - Allows access to network via RS-232C port utilizing The WRELCOM family of software.
MMCO —	ABB multiphase overcurrent relay, INCOM compatible, I.L. 41-121 or PB41-121.
PONI —	(Product Operated Network Interface) - Two types, allowing a product to communicate via RS-232 (RS-232 or RS PONI), or networked PONIs (NET or INCOM PONI).
WRELCOM -	PC software family used to access data from INCOM-based products.

Appendix A

Connection Type	Cable Connection	PONI/BIRT/ MINT Pins Reqd.	Cable Connector Types	PONI/BIRT/MINT Settings	Notes
Device <-> West RS-232 PONI <-> Computer	Straight Cable	2, 3,7	To PONI: 25 pin DTE To Computer: 9 or 25 pin DCE	1200 bps only	-----
Device <-> West RS-232 PONI <-> Modem	Null Modem Cable	2, 3,7	To PONI: 25 pin DTE To Modem: 25 pin DTE	1200 bps only	-----
Device <-> ABB RS-PONI <-> Computer	Null Modem Cable	2, 3,5	To PONI: 9 pin DCE To Computer: 9 or 25 pin DCE	300/1200/2400/4800/ 9600 bps	See IL 40-610 for settings
Device <-> ABB RS-PONI <-> Modem	Straight Cable	2, 3,5	To PONI: 9 pin DCE To Modem: 25 pin DTE	300/1200/2400/4800/ 9600 bps	See IL 40-610 for settings
Device <-> West MINT <-> Computer	Device <-> MINT: Shielded Twisted Pair MINT <-> Computer: Straight Cable	2, 3,7	To Mint: 25 pin DTE To Computer: 9 or 25 pin DCE	1200/2400 bps	-----
Device <-> West MINT <-> Modem	Device <-> MINT: Shielded Twisted Pair MINT <-> Modem: Null Modem Cable	2, 3,7	To Mint: 25 pin DTE To Modem: 25 pin DCE	1200/2400 bps	-----
Device <-> West Mint-II <-> Computer	Device <-> MINT-II: Shielded Twisted Pair MINT <-> Computer: Straight Cable	2, 3,7	To Mint-II: 25 pin DTE To Computer: 9 or 25 pin DCE	1200/2400/9600/ 19.2k bps	See Westinghouse I.L.17466 for settings
Device <-> West Mint-II <-> Modem	Device <-> MINT-II: Shielded Twisted Pair MINT <-> Modem: Null Modem Cable	2, 3,7	To Mint-II: 25 pin DTE To Modem: 25 pin DTE	1200/2400/9600/ 19.2k bps	See Westinghouse I.L.17466 for settings
Device <-> ABB BIRT <-> Computer	Device <-> BIRT: Shielded Twisted Pair BIRT <-> Computer: Straight Cable	2, 3,7	To BIRT: 25 pin DTE To Computer: 9 or 25 pin DCE	1200/2400/9600/ 19.2k bps	See IL 40-614 for settings
Device <-> ABB BIRT <-> Modem	Device <-> BIRT: Shielded Twisted Pair BIRT <-> Modem: Null Modem Cable	2, 3,7	To BIRT: 25 pin DTE To Modem: 9 or 25 pin DCE	1200/2400/9600/ 19.2k bps	See IL 40-614 for settings
Device <-> West INCOM PONI <-> BIRT/MINT/MINT-II	Device <-> BIRT/MINT/ MINT-II: Shielded Twisted Pair	-----	-----	1200 ASK On-Off 9600 FSK Freq-Shift	See Westinghouse I.L.17466 for settings
Device <-> ABB NET-PONI <-> BIRT/MINT/MINT-II	Device <-> BIRT/MINT/ MINT-II: Shielded Twisted Pair	-----	-----	1200 ASK On-Off 9600 FSK Freq-Shift	See IL 40-611 for settings

Although all PONI's and the BIRT/MINT/MINT-II will operate with a 3-wire cable (transmit, receive and signal ground), they will operate with the standard off-the-shelf cables.

Straight Cable		Null Modem Cable	
From DB25 Pin	to DB25 Pin	From DB25 Pin	to DB25 Pin
1	1	1	1
2	2	2	3
3	3	3	2
4	4	4	5
5	5	5	4
6	6	6	20
7	7	7	7
8	8	8	8
20	20	20	6

RS-232 Standard pin definitions are defined from the viewpoint of the DTE (Data Terminal Equipment) Device. These signal names are as follows (Not all RS-232 Standard signals are shown on the next page.

DB25 Pin #	DB9 Pin #	Signal Description	To DCE	From DCE
1	-	Protective Ground (Chassis)		
2	3	Transmitted Data	X	
3	2	Received Data		X
4	7	Request to Send	X	
5	8	Clear to Send		X
6	6	Data set Ready		X
7	5	Signal Ground (common return)	X	X
8	1	Received Line Signal Detector		X
20	4	Data Terminal Ready	X	
22	9	Ring/Calling Indicator		X

Appendix B

These are the recommended settings for the Hayes Smartmodem 2400 modem. Other types of modems typically have the same basic settings. Refer to your particular modem manual for a discussion of any differences.

ACTIVE PROFILE

- B1** Select Communication Standard, U.S. Domestic Industry Standard
- E0** Command State Character Echo Disabled. (E0 - Characters aren't echoed back)
- L2** Speaker Volume Level Selection (L2 - Medium Volume)
- M1** Speaker On/Off Selection (M1 - On)
- N1** Negotiation of Handshake Options.
- Q0** Result Code Display Options (Q0 - Result Codes Enabled)
- TS** Select Tone Dialing Method (T - modem sends DTMF tones when dialing)
- V1** Result Code Format Options (V1 - Result codes sent as words)
- W0** Negotiation Progress message SelectionX4Call Progress Options (X4 - Busy and dial tone detection are enabled)
- Y0** Long Space Disconnect Options (Y0 - Disable long space disconnect)
- &C1** Data Carrier Detect Options (&C1 - DCD active during disconnect)
- &D2** Data Terminal Options. (&D2 - DTR disconnects modem)
- &G0** Guard Tone Selection (&G0 Guard Tone Disabled)
- &J0** Jack Type Selection (&J0 - suitable for RJ-11, RJ-41S or RJ-45S jacks)
- &K3** Local Flow Control Options
- &Q0** Asynchronous Mode *****
- &R0** RTS/CTS Options
- &S0** Data Set Ready Options (&S0 -DSR always active)
- &T4** Test Options
- &X0** Synchronous Transmit Clock Source
- &Y0** Select Stored Profile for Reset (&Y0 - Select Profile 0)

***** Putting the modem in &Q5, (error-control) tends to cause time-outs.

Register Settings:

S00:002	S01:000	S02:043	S03:01	3S04:010	S05:008	S06:002
S07:060	S08:002	S09:006				
S10:020	S11:060	S12:050	S18:000	S25:005	S26:001	S36:007
S37:000	S38:020	S44:003				
S46:002	S48:007	S49:008	S50:016	S63:010	S64:001	

You can view the modem settings from the RCP software by pressing **Alt+C** and Local Mode, RS-232. The screen will clear and now whatever is typed will be sent out the COM port to the connected modem, or directly to the modem (if internal to the computer). type **AT &V** and the modems current settings will be displayed. To change a setting, (for example, to

change the speaker volume of the modem, type **AT L3** for loudest, and **AT L0** for lowest). To set the modem for auto-answer, type **AT S0=2**, where 2 is the number of rings before it will answer. Some modems are picky about spaces, so some may require **ATS0=2**. To save any changes to the modems NOVRAM (provided it can store settings to non-volatile memory), type **AT &W**. Refer to your modem manual for a discussion of all settings. A more thorough reference guide (free) entitled Technical Reference for Hayes Modem Users can be obtained from:

Hayes Microcomputer Products, Inc.
705 Westech Drive
Norcross, Georgia 30092

Notes:

The COM port settings to communicate to the RS-232 PONI, BIRT or the MINT/MINT-II are 8 bit, no parity, and 2 stop bits. These are automatically set by the RCP communication program. The RS-232 PONI (old Westinghouse version) can only be set for 300 or 1200 bps, therefore set RCP COM port bit rate to 1200. The ABB RS-PONI and BIRT can be set for 300/1200/2400/4800/9600 bps. The MINT can be set to 300/1200/2400. MINT-II can be set to 1200/2400/4800/9600/19.2K bps. If setting the modem at the substation, set the following settings different from above:

Q1 — Result Code Display Options (Q1 - Result Codes DISABLED)

&D0 — Data Terminal Ready Options (&D0 - DTR always ignored)

If connected from a computer directly to a mint, select MINT-DIRECT CONNECT, from the COMMUNICATE menu (Alt+C) in the RCP program.I.L. 40-603

Appendix C

The **IN**tegrated **CO**mmunication Network provides two-way serial communication between one master device and many slave devices. INCOM is intended to permit a variety of products to communicate with a central controller. The master device may transmit INCOM messages at any time, and all messages transmitted from a slave device are received by the master device. A slave device may only respond to requests from a master device.

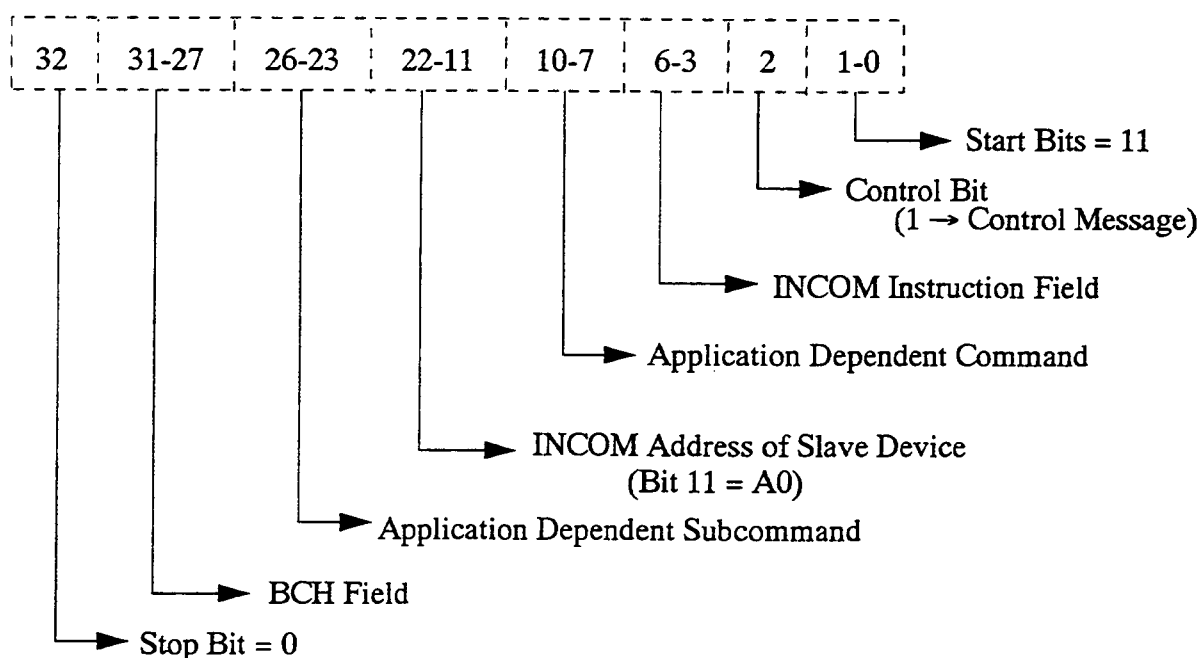
A summary of the INCOM chip operation is included for reference purposes. Descriptions are included for the microprocessor interface, message formats, and message transmission and reception.

1.1 INCOM Network Message Formats

An INCOM network message is 33 bits long and contains address, control, command, and data information. Network messages are either command or data messages. INCOM command messages are transmitted from the network master to a slave. The product is considered a slave in the master-slave environment covered by this specification. INCOM data messages are used to transmit setting or control information from the master to the slave. Data messages also transmit requested product information from the slave to the master.

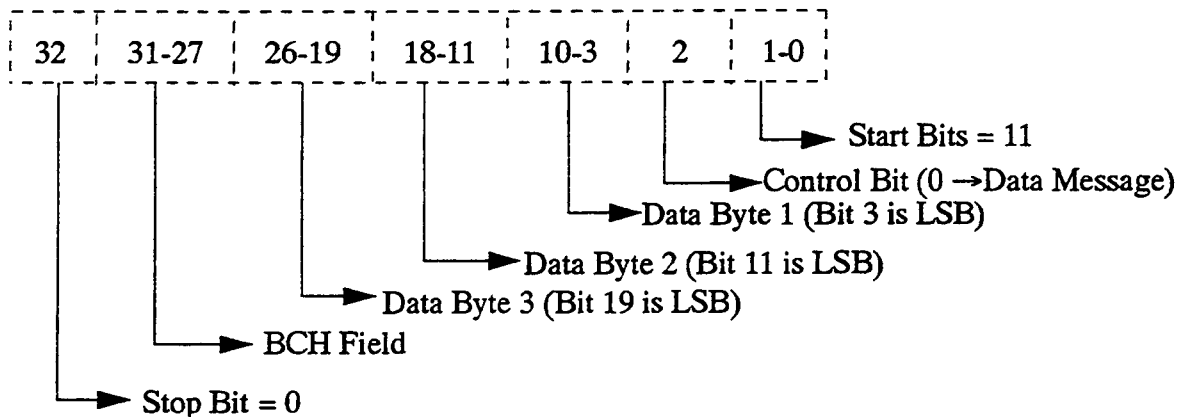
1.1.1 INCOM Command Messages

There are two types of INCOM commands. The first type of command either initiates some action in the product or requests the product to send data to the master. The second type of command notifies the product to prepare to receive data from the master. The format for an INCOM network command message follows.



1.1.2 INCOM Data Messages

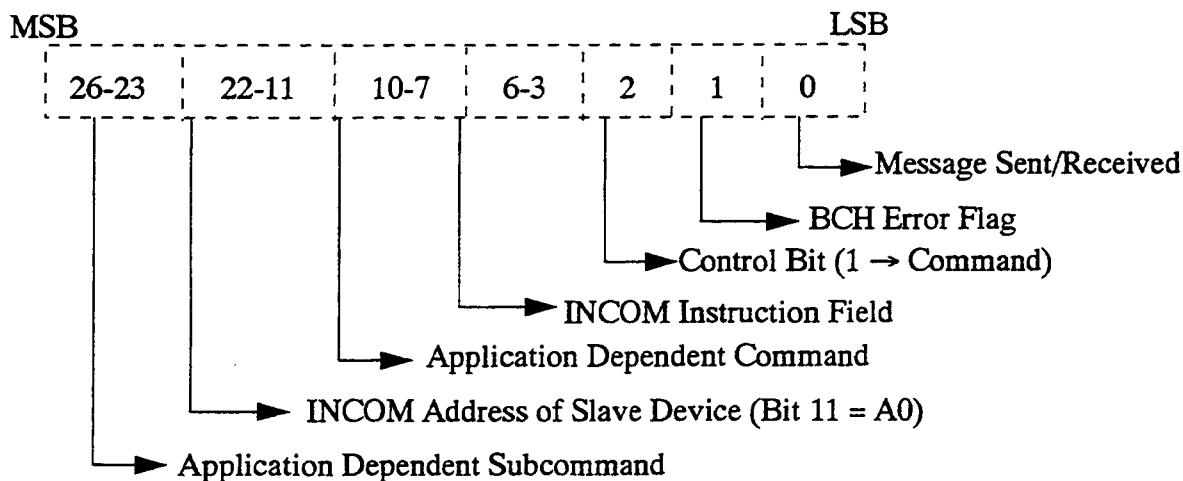
INCOM data messages transmit data from the product to the master or from the master to the product. The transmission of one or many data messages may be initiated by an INCOM command. The INCOM data message contains three bytes of data in the following format.

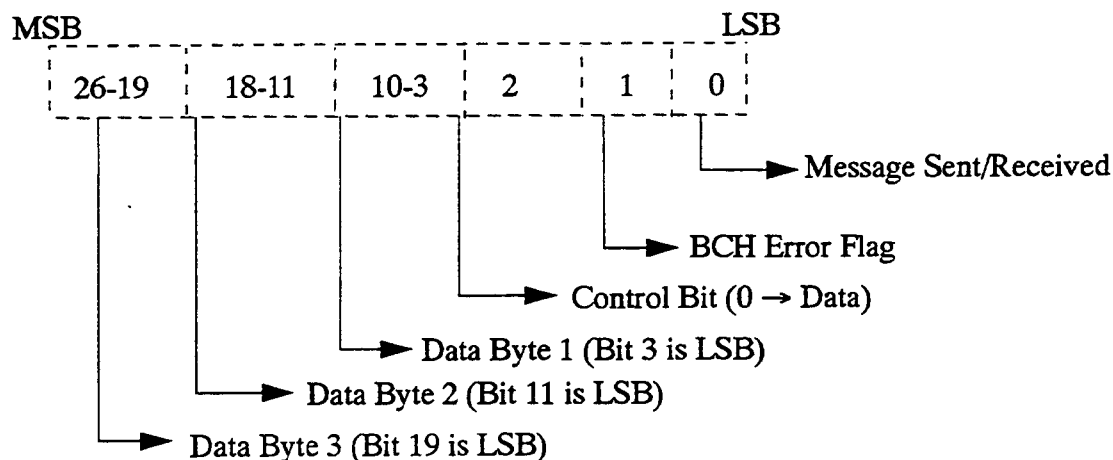


1.2 INCOM Chip to P Message Formats

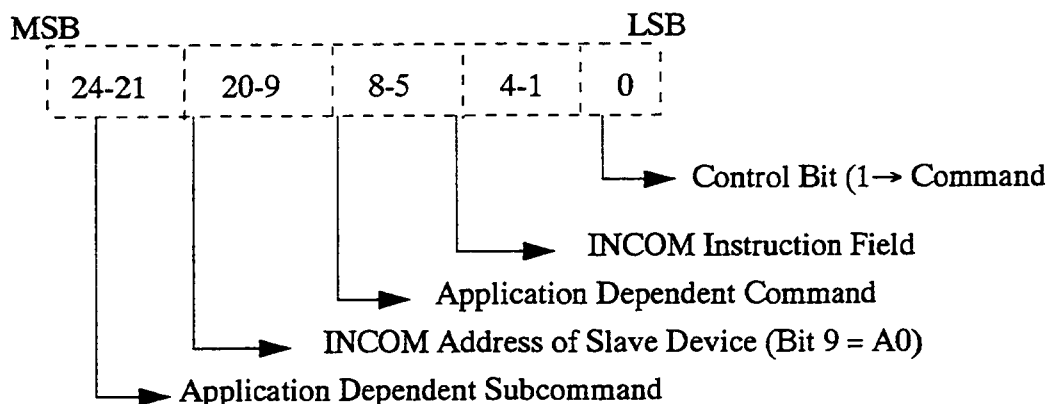
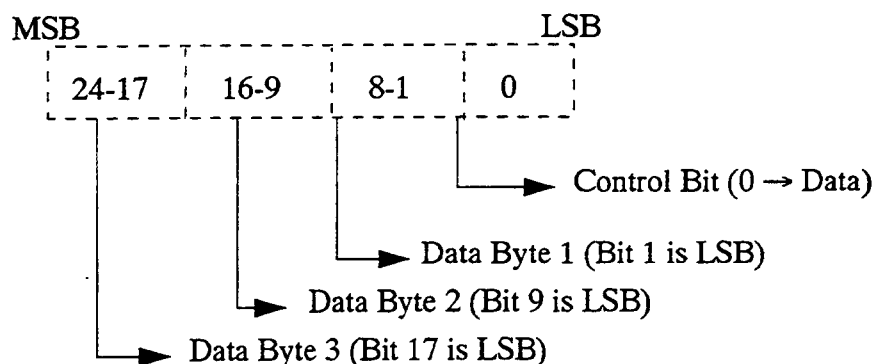
The messages transmitted from the INCOM chip to the microprocessor are 27 bits long. The start and stop bits are stripped from the 33-bit network message, and the BCH field is condensed to a single flag. The LSB indicates if the last message was sent or received. The bit definitions for incoming command and data messages are shown.

Command Message:



Data Message:**1.3 P to INCOM chip Message Formats**

The messages transmitted from the microprocessor to the INCOM chip are 25 bits long. The bit definitions for outgoing command and data messages are shown.

Command Message:**Data Message:**

1.4 INCOM Chip Microprocessor Interface

The INCOM chip contains a 5-line microprocessor interface. The five lines are defined below:

BUSY*	INCOM chip output. Active when INCOM chip RX or TX is active.
INT	INCOM chip output. Active high when INCOM chip has completed reception or transmission of a message.
R/W*	INCOM chip input. Normally high except when the micro is writing a message to the INCOM chip. Low to high transition transfers control from the micro back to the INCOM chip.
SCK	INCOM chip serial clock input. Used by the micro to control clocking data into or out of the serial shift register. A logic one on SCK clears INT and holds it low. Therefore, SCK is normally low.
DATA	Bidirectional data pin.

The microprocessor interface to a PONI uses a 9-pin D connector with the following pin out:

1	+24V
2	GND
3	SCK
4	DATA
5	INT
6	R/W*
7	BUSY*
8	
9	

1.5 INCOM Chip Message Reception

Message reception from the network to the product proceeds as follows:

- BUSY* goes low when demodulator RXON signal is high during reception.
- The first 27 bits (B0-B26) are loaded into the serial shift register. There are two start bits (B0, B1) which are logic one. B2 is the control bit, which is a logic one for a command message and a logic zero for a data message. Bits B3 through B26 comprise a three byte buffer. If B2 is a logic one, the buffer bits contain a command message. If B2 is a logic zero, the buffer bits contain a data message.
- Bits B27 through B31 contain the BCH error checking code.
- Bit B32 is a stop bit (logic zero) which sets the RX/TX register.
- Transmission of the stop bit forces the RX/TX register high. The chip examines the control register (B2). If B2 is set, the chip compares its address with the demodulated address (B11 - B22). If the two agree, the chip decodes the instruction (B3 - B6).
- If the instruction is an Enable Interface command (INST = 3), the INT pin goes high and buffer control switches to the micro. No further network transmissions will be demodulated and placed into the serial shift register until the micro relinquishes control of the buffer.

- With the R/W* pin normally high, the DATA pin contains the state of the RX/TX register. A logic one on the DATA line indicates that a network message has been received.
- The micro clocks the SCK pin to read data from the INCOM shift register. 27 bits are clocked out on the DATA pin. The first bit is the state of the RX/TX register, which is a logic one if a message has been received. The next bit is the BCH error flag, which is a logic one if a transmission error has been detected. The control bit is next, followed by the 24 buffer bits.
- A logic one on SCK clears INT and holds it low. For this reason, SCK should normally be a logic zero.
- The micro switches control back to the network by pulling R/W* low then high.
- The INCOM chip will load the next network transmission demodulated by the chip into its serial shift register.

1.6 INCOM Chip Message TRansmission

Message transmission from the product out to the network proceeds as follows:

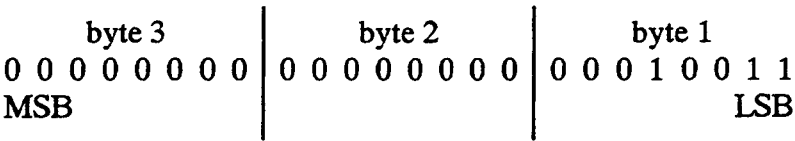
- When the micro interface is enabled, the micro may write data into the INCOM serial shift register for transmission onto the network.
- The R/W* line must be pulled low to tie the DATA line to the buffer control subsystem of the INCOM chip.
- Data from the micro is placed on DATA and clocked into the INCOM chip on the positive clock edges of SCK. 25 bits are clocked in, beginning with the control bit followed by the 24 buffer bits starting with the LSB.
- The micro sets the R/W* line high to signal the INCOM chip to transmit a message out to the network. The INCOM chip will only transmit a message if it sees SCK pulses while R/W* is low.
- The INCOM chip clocks the start bits, and the control bit and buffer bits just loaded from the micro into the modulator and out of the chip. The BCH code is computed and transmitted, followed by the stop bit.
- BUSY* goes low when modulator TXON signal is high during transmission.
- Transmission of the stop bit forces the RX/TX register low and sets the INT pin high. A low on the DATA line indicates that the serial shift register in the chip is empty following transmission of a message.
- The micro may load another message into the INCOM chip.

1.7 The Acknowledge (ACK) Reply

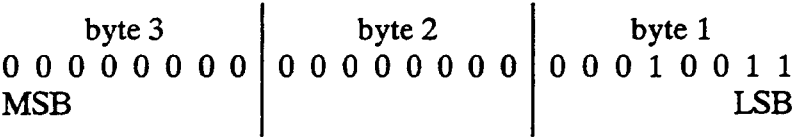
Some INCOM commands require the product to transmit an acknowledge (ACK) message. The positive acknowledge indicates that the product accepted the present command or the data transmission was completed successfully. This message has its control bit set to a one; therefore, it is not considered a data message. The format of the ACK message is shown below:

1.8 The Negative Acknowledge (NACK) Reply

The relay may transmit a negative acknowledge (NACK) rather than an ACK in response to certain



communication failures. The negative acknowledge indicates that the product has not accepted the command or data transmission. This message has its control bit set to a one; therefore, it is not considered a data message. The format of the NACK message is shown below:



1.9 Product Commands

Each product has a specific set of commands and responses. Refer to the particular product command set document for information.

2. RS232 10 Byte Protocol

The Ten Byte RS232C Protocol contains all the information contained within the 33 bit INCOM message. Any application operating on the INCOM network may be controlled by a Master using the 10 byte Protocol if the 10 byte messages are translated to INCOM messages and if responses on the INCOM network are in turn translated into equivalent 10 byte responses.

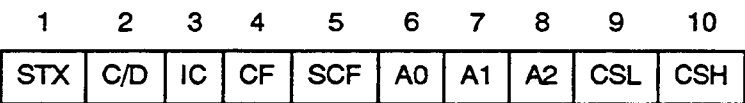
Products that can translate from the 10 byte to INCOM protocols and back again are the IMAC, BIRT, and MINT.

2.1 10 Byte Protocol Structure

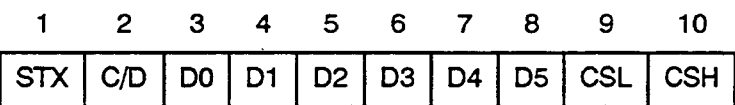
Information is sent to and received from the master device (IMAC, BIRT, OR MINT) in ten byte messages of two types, Control and Data. Each nibble of the message is ASCII encoded.

The messages start with the ASCII control character STX (2). If a message is started and another STX is received, the previously started message is discarded, and a new message is started. The remainder of the bytes in the ten byte message are ASCII encoded Hexadecimal Nibbles. (E.g., the nibble 0011B = 3 is sent as 33H the ASCII code for "3".)

The Format of a Command Message is:



The Format for a Data Message is:



2.2 Relationship To INCOM

There is a one-to-one relationship between the INCOM protocol and the RS232 10 byte Protocol. The 33 bits for an INCOM message are sent from left to right as are the 10 bytes of the RS232 10 byte version. The bytes of the 10 byte protocol are ASCII encoded hexadecimal for the similarly labeled fields. The major difference between the two expressions is the placement of the SCF field next to the CF field in the 10 byte RS232 protocol.

Command INCOM Message

1	2	3	4-7	8-11	12-23	24-27	28-32	33
S	S	C/D*	IC	CF	ADDRESS	CSF	BCH	S

= 1

Data INCOM Message

1	2	3	4-27	28-32	33
S	S	C/D*	DATA	BCH	S

= 0

C/D* is referred to as the Control Bit.

2.3 Command Message Elements

STX is the ASCII start of text character (00000010B=2). Every message starts with STX. The use of STX assures proper framing of the message. If an STX is received by the master prior to reception of ten ASCII bytes, the previous message is aborted and a new one started. Since this is an ASCII control character, 2 = 00000010B is actually sent, not ASCII "2", 32H.

C/D* specifies whether the message is a CONTROL message or a DATA message. On transmission by the master, C/D is "1" (31H) for control or "0" (30H) for data. On reception by the Master, C/D is "0" for data and "2" for control. The reason for this is to allow the encoding of a BCH error when receiving messages from the INCOM Network. In that case, a control message with BCH error will have C/D = "3, and a data message with BCH error will have C/D = "1.

TRANSMISSION

Data to be encoded	encoded as	description
0	"0" = 30H	Data Message
1	"1" = 31H	Control Message

RECEPTION

Data To Be Encoded

Bit 1	Bit 0	Encoded as	Description
C/D*	BCH Error		
0	0	"0" = 30H	Data message with no BCH error

0	1	"1" = 31H	Data message with BCH error
1	0	"2" = 32H	Command message with no BCH error
1	1	"3" = 33H	Command message with BCH error

The BCH error bit within the RS232 10 byte protocol is not functional for communication directly to a product. It is only used (and even necessary) in network communication as with an INCOM Network protocol translator such as the IMAC, BIRT, or MINT.

The INCOM Command (IC) is received and used by the INCOM integrated circuit itself rather than by a microprocessor attached to the integrated circuit. It determines the action of the INCOM integrated circuit for the command message just received.

There are two INCOM Command situations:

1. Direct RS232 to product (RS232 PONI Connection). IC is superfluous for direct RS232 to product communication, since no INCOM integrated circuit is involved. However it must be present.
2. Expanded Mode Slave. In the case of "expanded mode Slave INCOM operation", IC is "3", the INCOM Command for Enable INCOM Interface. When an INCOM integrated Circuit configured as an EXPANDED MODE SLAVE receives a COMMAND message addressed to it with IC=3, it will become enabled to originate message transmission. The INCOM interface will remain enabled until reception of a command with another address or until explicitly disabled by the INCOM Command for Disabled INCOM Interface, 2.

CF is the Command Field, the general class of command for the expanded mode slave microprocessor based products.

SCF is the Sub Command Field, the specific command within the general class for the expanded mode slave micro-processor based products.

The operative content of each message to an expanded mode slave is contained in the Command and Subcommand.

The use of CF and SCF is product dependent. See the product sections.

A2, A1, A0 are the ASCII encoded hexadecimal INCOM address nibbles which comprise the 12 bit INCOM address. For single channel RS232 to product communication, these bytes are superfluous, however they must be there to preserve the 10 byte protocol structure of the message.

e.g., address 1ABH is sent as A0 = "B", A1 = "A", and A2 = "1".

CSL and CSH are the ASCII encoded low and high nibbles of the checksum. The original data is added to the reconstructed checksum byte and the result should be 0. The manner of computing the checksum is demonstrated in the following example:

As an example, we can choose to send a command with C/D* = 1, CF = 0, and SCF = 8 to a device at address 0FFH.

The complement which is included in the address is:

HEX	DEC	FUNCTION	SENT AS	ASCII
2	2	STX	2	STX CTL-B
1	1	C/D*	31H	"1"
3	3	INCOM Enable Interface Command	33H	"3"
0	0	Command Field	30H	"0"
8	8	Sub-Command Field	38H	"8"
0	0	A0, Low Address Nibble	30H	"0"
F	15	A1, Middle Address Nibble	46H	"F"
F	15	A2, High Address Nibble	46H	"F"

2CH 44 Checksum of message

$$CS = 256 - \sum(STX \rightarrow A2)$$

$$CSL = (CS \% 16)$$

$$CSH = (CS - CSL) / 16$$

$$CS = 121_{10}$$

$$CSH = 13_{10}$$

$$CSL = 4_{10}$$

Thus the RS232 message transmitted is:

STX	"1"	"3"	"0"	"8"	"0"	"F"	"F"	"4"	"D"
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

OR

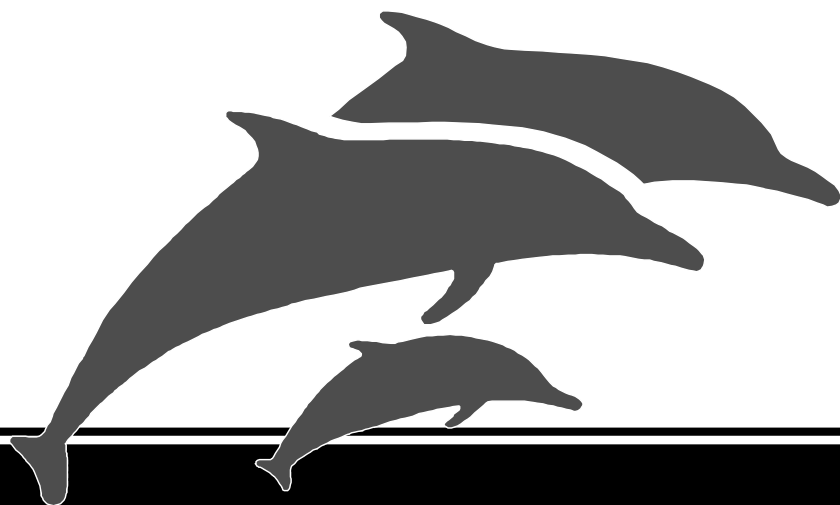
2	31H	33H	30H	38H	30H	46H	46H	34H	44H
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Instruction Leaflet

40-603

RCP Remote Communication Program USER'S GUIDE



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