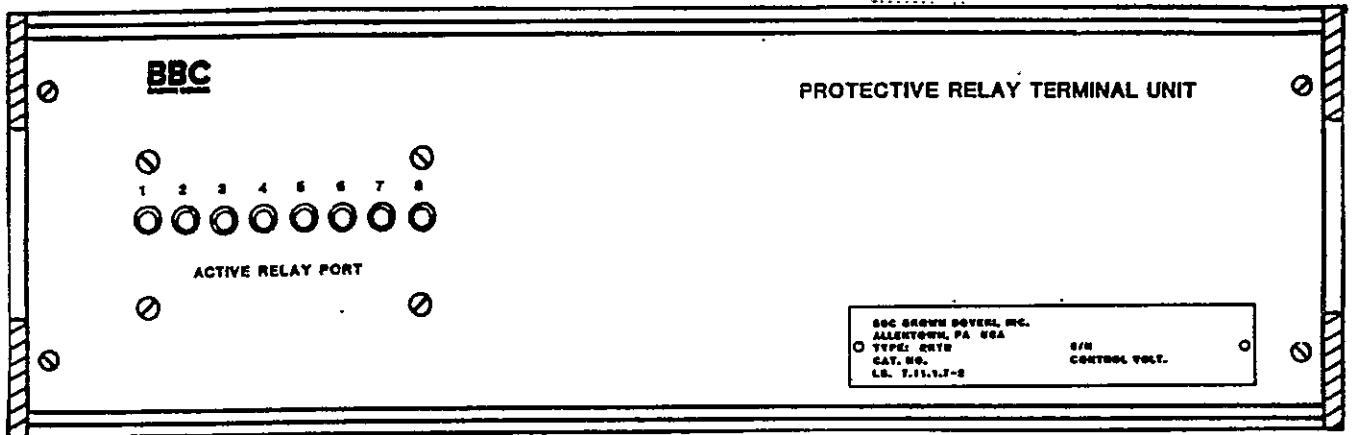


LARRY L.

BBC
BROWN BOVERI

IB 7.11.1.7-2
Instructions

Protective Relay Terminal Unit



BBC Brown Boveri, Inc.

TABLE OF CONTENTS

INTRODUCTION.Page 2

PRTU TYPICAL EXTERNAL CONNECTION DIAGRAM.Page 3

INITIAL CHECKOUT.Page 4

 EQUIPMENT REQUIRED.Page 4

 CHECKOUT PROCEDURE.Page 4

OPERATIONPage 5

 INTRODUCTION.Page 5

 SERIAL PORT CONNECTIONS AND CONFIGURATIONS.Page 5

 COMMUNICATION FORMAT.Page 6

 COMMUNICATION PROTOCOL.Page 6

MODEM COMMUNICATIONS.Page 7

COMMANDS.Page 8

 COMMAND CHARACTERISTICSPage 8

 STARTUPPage 8

 COMMAND FORMAT.Page 8

 COMMAND DESCRIPTIONS.Page 9

 Access Level 0 CommandPage 9

 Access Level 1 and 2 Commands.Page 9

TROUBLESHOOTING GUIDEPage 11

TROUBLESHOOTING TABLEPage 11

BBC PROTECTIVE RELAY TERMINAL UNIT COMMAND SUMMARY. . .Page 12

PROTECTIVE RELAY TERMINAL UNIT FRONT PANEL DRAWING. . .Page 13

PROTECTIVE RELAY TERMINAL UNIT REAR PANEL DRAWING . . .Page 14

INTRODUCTION

The Protective Relay Terminal Unit (PRTU) provides for substation communication between up to eight BBC Distribution Protection Unit (DPU) protective relays, or other devices communicating via the RS-232-C standard, a LOCAL port, and a MODEM port. The PRTU receives and saves messages transmitted by the DPU relays. The messages are immediately sent to the LOCAL port, and are also saved in the PRTU for later retrieval through the MODEM port.

The PRTU scans its eight ports looking for data. If a relay has data, such as an automatically generated event report, then the PRTU accepts the data. The PRTU routes the data to the LOCAL port for logging on a local terminal or on a remote device communicating on a dedicated line. The PRTU also saves the data, so that it is accessible through the MODEM port, which may use a non-dedicated line. Once the data is transferred from the DPU relay to the PRTU, the PRTU resumes its scanning with the next port.

Many devices communicating via the RS-232-C interface include means to stop and start their data transmission. The two most common means of "handshaking" are by a hardware control line or lines, and by special characters. The handshake characters most commonly used are the ASCII XON and XOFF symbols. The BBC DPU acknowledges the XON/XOFF characters for control of its data flow, and the PRTU uses XON/XOFF control to the DPU relays.

The scanning process of the PRTU is achieved by allowing one relay at a time to transmit its data to the PRTU. It does this by telling all relays except one, not to transmit data. The PRTU accomplishes this by sending an XOFF to all ports, then sending an XON to one port to become the active port. The relays receiving XOFF cannot transmit data to the PRTU, while the relay receiving XON can transmit data. If the DPU relay has an event to report, then the DPU uses the XON opportunity to transmit its data to the PRTU. The PRTU keeps the DPU relay in the XON state as long as the relay continues to transmit data. When the relay is quiet for a settable time period, or has indicated the end of its transmission, the PRTU sends an XOFF to it. The PRTU then sends XON to the next port, and waits the time period to see if a message is pending. The process continues to scan all ports where DPU relays or other devices are connected. Scanning skips over unused ports.

The PRTU must determine when a message from a device is complete. The PRTU uses a software scheme which takes advantage of the format used by the BBC DPU and some other digital relays. Each message transmitted by the DPU ends in an ASCII ETX symbol. The PRTU uses the ETX symbol to recognize a complete message. If a device does not conclude a message with an ETX, the PRTU waits for a dwell time period after the last character transmitted by the device.

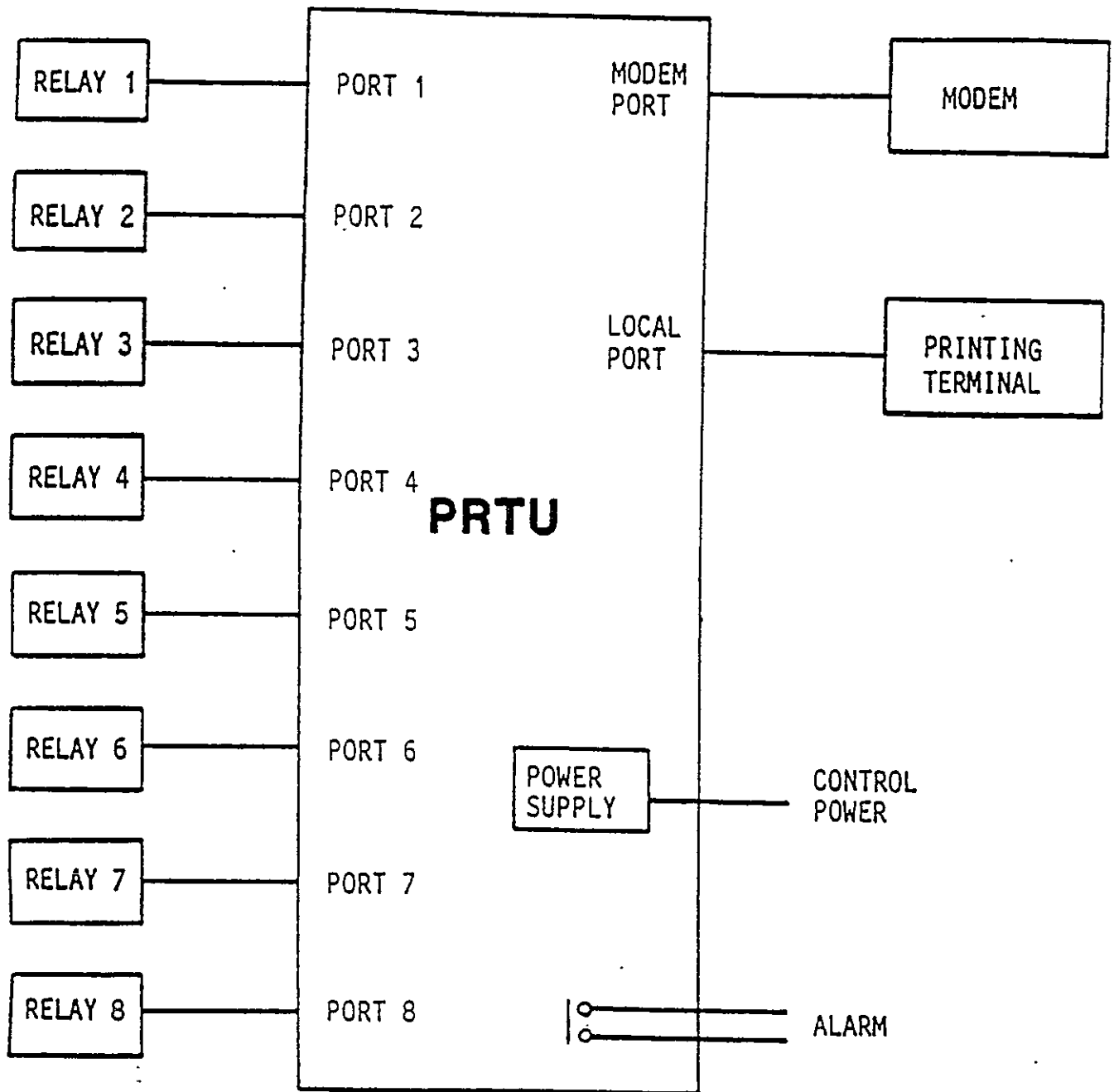
Figure 1 is an external connection diagram for the PRTU, showing eight relay ports, the MODEM port and the LOCAL port. The Alarm contacts provided close if a memory failure is detected, or if power to the PRTU is lost for any reason. The alarm contacts also close momentarily when access is gained to set the PRTU or to clear its event buffers.

Associated with each relay port is a 1400-byte input buffer. When a message is received from a relay, the PRTU stores it in the associated buffer. As soon as the message is complete, the PRTU starts transmitting that message out its LOCAL port. Messages are retained in the port buffers, so that they are remotely-accessible via the MODEM port, using the PRTU's "EVENT" command.

When the buffers are empty, you may communicate with any of the eight relay ports from either the LOCAL or MODEM port, using the PRTU's "PORT" command. For example, if you wish to communicate with the relay at port 5, you would type "PORT 5". The PRTU would then stop its port-scanning process and stay at port 5 so you can communicate with the selected relay. The PRTU resumes scanning upon your command, or after a timeout period of no activity.

The PRTU operates from the station battery, or from AC. Its internal switching power supply provides isolation between the power source and the communications circuits. The alarm contacts and power input circuitry are designed to withstand the substation environment, and meet SWC requirements.

Each data port has two data lines and two control lines. Each of these lines is protected by an 18-volt metal-oxide varistor (MOV) and a passive low-pass filter against induced surges. Cables between PRTU ports and peripheral devices can be up to 50 feet long.



PRTU TYPICAL EXTERNAL CONNECTION DIAGRAM
FIGURE 1

INITIAL CHECKOUT

The initial checkout of the PRTU is intended to familiarize you with the instrument and to ensure that it is operational.

EQUIPMENT REQUIRED

Obtain the equipment listed below to check out the PRTU.

1. Computer terminal with an RS-232-C serial interface for connection to the LOCAL port.
2. A cable to connect the terminal to the PRTU LOCAL port.
3. At least one BBC DPU, or any other device capable of transmitting text and XON/XOFF control characters.
4. A cable to connect the above device to a PRTU RELAY port.

CHECKOUT PROCEDURE

1. Carefully inspect the PRTU for shipping damage.
2. Remove its top cover, by removing the four pan-head screws on the sides.
3. Find the jumper area labeled JMP 109 having two jumpers. When a jumper is placed at 109-1, the Level 1 password is disabled. When a jumper is placed at 109-2, the Level 2 password is disabled. Leave the factory-installed jumpers in place, so that you do not have to use passwords to access the PRTU.
4. Find three other jumper areas: 102, 103, and 111. You select baud rates for the serial ports using these jumpers:

JMP 103 -- RELAY ports
JMP 111 -- LOCAL port
JMP 102 -- MODEM port

Set the baud rate of the RELAY ports to match the rate of the relays to be used. Note that all eight RELAY ports will use the same baud rate. Set the baud rate of the LOCAL port to match the rate of the terminal you intend to use. Ensure that the computer terminal is set to transmit and receive characters in the following format:

eight data bits
two stop bits
no parity

In this initial checkout, the MODEM port is not used, but you may wish to set its baud rate to match that of the modem you intend to use.

5. Replace the top cover of the PRTU.
6. Connect the data cables between the PRTU, the computer terminal and the relay or other device.
7. Connect a safety ground to terminal 1, and power to terminals 2 and 3 on the rear panel terminal block of the PRTU.
8. Power on the instruments connected to the PRTU, and then power on the PRTU. The eight front-panels LEDs should all illuminate briefly, then the LEDs associated with the one or more relay ports having devices connected to them should turn on, one at a time. You should observe a start-up message on the local terminal, which was transmitted by the PRTU. You should also hear the alarm relay pull in, opening its contacts at terminals 4 and 5. Note that if no relays or devices are connected to the RELAY ports, all LEDs will be illuminated.
9. The star (*) prompt at the terminal connected to the LOCAL port indicates that communications with the PRTU are at Access Level 0, the lowest of three access levels. The only allowable command at this level is ACCESS, which gains access to Access Level 1.
10. At the LOCAL terminal, enter the command ACCESS, and press the RETURN key. In response, you should see the Level 1 prompt (**), and a short message indicating that you reached Access Level 1.
11. The PRTU has internal settings for the scan dwell time, and the PORT command timeout interval. To inspect these settings, enter the command "SHOWSET" and press RETURN.

12. To communicate with the device connected to one of the RELAY ports, type the command "PORT", followed by a space, the port number, and RETURN. Press RETURN again, and, assuming that a BBC relay is connected to that port, you should see its prompt. To leave the PORT command, hold down the CONTROL key on your terminal and press "D". You should observe a message informing you that you have left the port command. Execute the port command again, and wait for the port time-out interval. You should again observe the end of port command message.

This completes the initial checkout of the PRTU. If you have difficulty, please check the following:

1. Are the baud rates properly set?
2. Are the data cables appropriate to the devices connected to the PRTU?
3. Is power applied?
4. Are the data cables connected to the proper connectors?

If you have difficulty or if questions arise, you may contact the factory for assistance, or you may wish to study other sections in the manual.

OPERATION

INTRODUCTION

This section describes the serial port connections and message formats.

SERIAL PORT CONNECTIONS AND CONFIGURATIONS

Ten serial port connectors are located on the rear panel of the PRTU. The connectors are labeled:

MODEM PORT
LOCAL PORT
RELAY PORTS (1 through 8)

All ten of these ports adhere to the electrical specifications of the RS-232-C standard, and use round female nine-pin connectors. All ten ports have the same pinout, and the pinout is marked on the rear panel of the PRTU, and is given below:

<u>PIN</u>	<u>FUNCTION</u>
1	Frame ground (shield)
2	TXD (output)
3	RTS (output)
4	RXD (input)
5	CTS (input)
6	+5 volts
7	+12 volts
8	-12 volts
9	Signal ground

Signal and frame grounds connect together on the PRTU circuit board. The functions of the other pins are given below.

TXD Output. The PRTU transmits data out on this pin.

RTS Output. The PRTU asserts this line under normal conditions, but unasserts it whenever associated input buffers are full.

RXD Input. Data are received by the PRTU on this pin.

CTS Input. The PRTU monitors CTS, and transmits characters only if CTS is asserted. The PRTU skips over relay ports where CTS is not asserted, so as not to waste dwell time on unused ports.

+5 volts. This pin connects directly to the +5 volt output of the PRTU power supply. Auxiliary devices, such as modems, may draw up to 1000 mA total from the PRTU +5 volt supply.

+12 volts. This pin connects directly to the +12 volt output of the PRTU power supply. Auxiliary devices, such as modems, may draw up to 100 mA total from the PRTU +12 volt supply.

-12 volts. This pin connects directly to the -12 volt output of the PRTU power supply. Auxiliary devices, such as modems, may draw up to 100 mA total from the PRTU -12 volt supply.

The LOCAL port is intended for local communications, such as CRT printing terminal, or other device. Messages received from the RELAY ports are automatically routed to the LOCAL port, so that a printer connected to the LOCAL port may log all relay messages. You may also communicate with any one of the relay ports from the LOCAL port, using the PORT command.

The MODEM port is intended for remote communications with the help of a modem. Messages received from the RELAY ports are saved in the port buffers. You may retrieve these messages using the EVENT command. Once messages are retrieved, they are cleared from the PORT buffers. Keep in mind that the BBC DPU relay also saves most of the data it transmits, so should you need to obtain another transmission of the event report from a relay, you can do so using the PORT command from the MODEM port or from the LOCAL port.

The RELAY ports are scanned by the PRTU as described later. RELAY ports with unasserted CTS inputs are skipped over in the scanning process.

No direct communications are possible between the LOCAL and MODEM ports.

COMMUNICATION FORMAT

Baud Rate: 300, 1200, 2400 or 9600 baud, jumper selectable:
 JMP 103 -- RELAY ports
 JMP 111 -- LOCAL ports
 JMP 102 -- MODEM ports
 Remove the PRTU top cover for access to these jumpers.

Word format: Eight data bits
 Two stop bits
 No parity

COMMUNICATION PROTOCOL

1. The PRTU responds to commands it receives on either its LOCAL or MODEM port. These commands must have the following format:

<command><CR>,

where the angle brackets enclose the required data. You do not type in these brackets.

Thus a command transmitted to the PRTU must consist of the command name followed by a carriage return.

2. All messages transmitted by the PRTU are of the following format:

<STX><MESSAGE LINE 1><CRLF>
 <MESSAGE LINE 2><CRLF>
 <LAST MESSAGE LINE><CRLF><PROMPT><ETX>

That is, each message begins with the start-of-text character (ASCII 02), and ends with the end-of-text character (ASCII 03), and each line of the message includes a carriage return and line feed at its end.

3. The PRTU uses an XON/XOFF protocol to control data flow between the PRTU and any of its serial ports. Also, the PRTU obeys the same protocol.

XON (ASCII hex 11) is a code character signifying the data transfer is allowed or should start.

XOFF (ASCII hex 13) is a code character signifying that data transfer is not allowed or should stop.

The PRTU sends XOFF to the MODEM or LOCAL port when its input buffer fills above 1/2 full. When the PRTU has read enough characters from its input buffer to bring the level below 1/4 full, the PRTU sends XON to signify that it is once again ready for more data.

The PRTU also uses XON/XOFF to control the data flow through the RELAY ports. Upon power up, the PRTU sends XOFF to all active RELAY ports. (A port is assumed active if its CTS input line is asserted.) All relays receiving the XOFF understand that they should not transmit data until further notice.

The PRTU next begins its scan of the active ports by sending XON to one port, waiting for the dwell time to expire, or for data to be received. When communications are finished with that port, then the PRTU sends XOFF to that port, and sends XON to the next active port. The process continues this way through all of the active ports.

4. The PRTU counts messages sent to its RELAY ports by looking in the RELAY port buffers for ETX (end-of-text) characters. It does not send the buffered message to the LOCAL port until the message is finished, as indicated by receipt of the ETX character. The BBC DPU relay provides the required ETX character. If a device connected to the RELAY port does not send ETX at the end of its message, then the PRTU assumes the message has ended, once no characters are received for the port dwell time.

MODEM COMMUNICATIONS

The Protective Relay Terminal Unit interfaces directly to a commercial-grade telephone modem for automatic-answer dial-up communications applications. A field installation consisting of a PRTU and a modem can be accessed by telephone, with another modem and a computer or terminal.

The modem is a Hayes Smartmodem 300, manufactured by:

Hayes Microcomputer Products, Inc.
5923 Peachtree Industrial Blvd.
Norcross, Georgia 30092

(Users should keep in mind that this modem is a commercial unit, and should not be considered utility-grade equipment. This may be acceptable in some applications, since the functions of the PRTU do not directly depend on the integrity of the modem communications, and since the cost is very reasonable. In applications where the control functions of digital relays attached to the PRTU are important, we recommend the use of industrial-grade communications equipment, such as manufactured by RFL Industries of Boonton, NJ. Please contact BBC or RFL for further details.)

The modem connects to the MODEM port of the PRTU with a cable available from BBC. The modem normally is powered from 120 VAC; however, BBC can modify the modem so that it can be powered from the PRTU.

The modem contains configuration switches inside its front bezel. They must be set to the following positions:

SWITCH	1	2	3	4	5	6	7	8
	UP	UP	DOWN	DOWN	UP	UP	UP	DOWN

The PRTU responds to the control messages sent by the modem to the PRTU. These are RING, CONNECT, NO CARRIER, ERROR and OK. The responses ensure that the modem is programmed to answer after the number of rings specified using the MODEM command.

In applying and using the PRTU and a Hayes Smartmodem in an automatic-answer scheme, keep the following points in mind:

1. When modem communications are underway, execution of any of the commands intended for the modem control functions causes the telephone connection to hang up. These commands should NOT be typed into the MODEM port: RING, CONNECT, NO CARRIER, ERROR and OK.
2. Always use a finite timeout interval, so that if communications are disturbed, the PRTU has a chance to reconfigure the modem and to clear its communications buffers of data and control characters. An interval of five minutes is recommended. (See the INTERVAL command.)
3. Be careful about the number of rings which is programmed using the MODEM command. It can be set up to 255, but large numbers correspond to very long waits.
4. Some communications devices, such as the Radio Shack Model 100 briefcase computer, allow the use of an XON/XOFF communications protocol. We have found that, in general, the PRTU functions quite well with these. However, at times, the Model 100 leaves the PRTU in the XOFF state upon hanging up. The problem here is that you must wait your timeout interval before the XOFF state is cancelled automatically by the PRTU since in that state, the PRTU cannot respond to the modem as it has been told to be silent. We recommend that the Model 100 be used with XON/XOFF disabled when modem communications are employed. Conversely, we have had no difficulty with the Model 100 directly connected to the PRTU and set to employ XON/XOFF.
5. For the same reason, do not hang up after you have stopped a transmission using XOFF (control-S). If you wish to terminate a lengthy transmission, use control-X.
6. When the modem answers the telephone, the PRTU forces it into its control state to ensure it is properly initialized. To do that, the PRTU sends the following string immediately after the connection is established:

*+++

Wait for the PRTU prompt before typing commands.

If you call the modem connected to the PRTU with a Hayes Smartmodem, do not attempt to put your modem in the command mode, as this will also put the remote modem in the command mode. The only escape from this state is to power on and off the remote modem.

7. If modem power is turned off and back on, the modem "forgets" the number of rings to wait before answering. The PRTU programs the modem with the number of rings to wait before the modem should answer. Thus, the modem will answer the first call after its power is restored on the first ring. After that, it will answer on the number of rings you programmed with the MODEM command until the power to the modem is interrupted again. The PRTU retains the number of rings in its nonvolatile memory, so control power interruptions do not disturb that setting.

COMMANDS

COMMAND CHARACTERISTICS

The PRTU responds to commands received by the MODEM or LOCAL serial ports. A two-level password system provides security against unauthorized access.

When the power is first turned on, the instrument is in Access Level 0, and honors only the ACCESS command. "Invalid command" is the response to any other entry. Most commands are available from Access Level 1, which is entered using the ACCESS command and a password. The password is factory-set to BBC1, and may be changed via the PASSWORD command (Access Level 2).

Critical commands, such as for clearing event buffers and changing settings are available only from Access Level 2, which is entered from Access Level 1 using the 2ACCESS command and a different password. The Level-2 password is factory-set to BBC2, and may be changed via the PASSWORD command.

STARTUP

When power is first applied, the instrument transmits the following message to the LOCAL port.

```
BBC Protective Relay Terminal Unit
*
```

You should also hear the ALARM relay pull in, opening its B contact.

To enter Level 1, type the following on a terminal connected to the LOCAL port:

```
ACCESS <CR>
```

Assuming no jumper is installed at JMP 109-1 (password disable for Level 1) the response is:

```
Password: ? @@@@
```

Respond by entering the Level 1 password, e.g. BBC1, followed by a carriage return. The response is:

```
Level 1 access - 1/1/85 00:00:15
```

```
**
```

The two-star sign forms the Access Level 1 prompt. Now, any Level 1 command can be executed.

To enter Access Level 2, a similar procedure is used:

Enter the command 2ACCESS, and listen for the ALARM relay to drop out and pull in. This action pulses the ALARM relay contact closed for about one second, indicating that Level 2 Access is being attempted. Provide the proper password, e.g. BBC2, in response to the prompt for password. In response to the correct password, access to Level 2 is attained, as indicated by the following message and the Level 2 prompt:

```
Level 2 access - 1/1/85 00:00:45
```

```
***
```

(If a jumper is installed at JMP 109-2, then no Level 2 password is required.)

Any Level 2 or Level 1 command can now be executed.

COMMAND FORMAT

Commands consist of three or more characters; only the first three characters of any command need be entered. Upper or lower case characters may be used without distinction. Items in square brackets [...] are optional. Arguments must be separated from the command by spaces, commas, semicolons, colons, or slashes. Commands may be entered any time after an appropriate prompt is received.

COMMAND DESCRIPTIONS

Access Level 0 CommandACCESS

Use ACCESS to gain access to the system from the Level 0 prompt (*). After typing ACCESS <CR>, a prompt for the Level 1 password appears. Enter the password, and press return. Successful access is indicated by the typical response shown below.

```
*ACCESS <CR>
Password: ? BBC1@@ <CR>
Level 1 access - 1/1/85 01:58:37
**
```

The ** prompt indicates you have reached Access Level 1.

If three unsuccessful access attempts are made in a row, the alarm contact is pulsed closed for one second. This feature can be used to alert operations personnel that possible unauthorized access is being attempted, if the alarm contact is connected to a monitoring system, such as SCADA. Should you wish to disable Level 1 password protection, install a jumper at JMP 109-1, which is accessible in the PRTU by removing its top cover.

Access Level 1 and 2 Commands2ACCESS

Use 2ACCESS to gain access to Level 2 from Level 1. After typing 2ACCESS <CR>, a prompt for the Level 2 password appears. Enter the password in the same manner as for the ACCESS command, and press return. Successful access is indicated by the typical response shown below:

```
Level 2 access - 1/1/85 01:58:55
***
```

The *** prompt signifies that Access Level 1 and 2 commands may now be used. The alarm contact is pulsed closed for one second for any Level 2 access attempt, successful or otherwise.

Clear [N]

Messages from the Relay ports are stored in the PRTU RELAY port buffers. This command clears the buffer associated with RELAY port N. It is available only from Access Level 2.

The RELAY port buffers retain the event information they receive from the relays. This information is retained until it is called for using the "EVENT" command, only available from the MODEM port. The PRTU does not allow you to communicate with a RELAY port if data are in the associated buffer.

If data are in the RELAY port buffer, and if you wish to communicate with the relay at that port, using the PORT command, you may use the EVENT command (from the MODEM port) to empty the buffer, or use the CLEAR command from either the MODEM port or the LOCAL port.

DATE [mm/dd/yy]

To read the date kept by the PRTU internal calendar/clock, type DATE <CR>. To set the date, type DATE mm/dd/yy <CR>. For example, to set the date to February 28, 1985, enter:

```
DATE 2/28/85 <CR>
```

When the power is first turned on, the date is 1/1/85.

EVENT [N]

Messages from relays stored in the RELAY port buffers may be withdrawn through the MODEM port using this command.

To obtain the messages from the Nth port, type EVENT N<CF>.

To obtain all messages from all ports, type EVEN <CR>.

If no messages are pending, then the PRTU responds with "No messages pending".

INTERVAL [N]

The LOCAL and MODEM serial ports have timeout intervals, which, when expired, cause control to pass to Access Level 0. This is a safety procedure limiting the possibility of unauthorized personnel using an unattended terminal. The interval is measured from the last command entered. This command is available only from Access Level 2.

The interval may be set from one to 30 minutes. Entering 0 disables automatic timeout. For example, suppose a timeout interval of 10 minutes is desired. Enter INTERVAL 10 <CR>. The response of the system is: "Time out 10 minutes". Entering INTERVAL <CR> displays the timeout interval.

MODEM [N]

The Access Level 2 command is provided to set a Hayes Smartmodem for automatic answer after a settable number of rings, when it is connected to the Modem port. The PRTU responds to MODEM with the programmed number of rings. Typing MODEM followed by a number of 1 to 255 sets the parameter specifying the number of rings to that number. The modem is initialized when the telephone is answered by the PRTU. Thus if the modem has been turned off and back on between calls, it will answer on the first ring on the next call, and on the programmed number of rings thereafter, until the power to the modem is turned off again. The number of rings you select with the MODEM command is stored in nonvolatile memory, and is therefore retained when the control power is off.

Additional details on the use of the Hayes Smartmodem with the PRTU is provided in the MODEM COMMUNICATIONS section of this manual.

PASSWORD (1 or 2) [password]

To inspect the passwords, enter PASSWORD <CR> from Level 2.

To change the password for Access Level 1 to UTAH enter:

PASSWORD 1 UTAH<CR>

The PRTU responds by setting the password, pulsing closed the alarm relay, and transmitting the response "Set".

AFTER ENTERING NEW PASSWORDS, EXECUTE "PASS" TO INSPECT THE NEW PASSWORDS. MAKE SURE THEY ARE WHAT YOU INTENDED. BE SURE TO WRITE DOWN THE PASSWORDS AFTER YOU CHANGE THEM. THERE IS NO COMMUNICATIONS PROCEDURE TO ACCESS THE PRTU WITHOUT THE PASSWORDS.

Passwords consist of up to six numbers, letters, or any other printable character, except the delimiters (space, comma, semicolon, colon, slash). Upper and lower case letters are treated as different letters.

You may operate the PRTU without password protection by installing jumpers on the PRTU circuit board. These jumpers are accessible by removing the PRTU top cover. Installing a jumper at JMP 109-1 disables the Level 1 password. Installing a jumper at JMP 109-2 disables the Level 2 password. With no password protection, you may gain access without knowing the passwords, and then execute the PASSWORD command to discover or change the "forgotten" passwords.

PORT [N]

Use the PORT command to communicate with the relay connected to the Nth port, from either the MODEM or the LOCAL port. For example, to communicate with the relay at RELAY port 3, type: PORT 3 <CR>. Once you are in communications with the relay at that port, you may use any of its commands. See the DPU Instruction Manual for relay commands.

If the RELAY port buffer is not empty, or if the PRTU is addressing that port when you execute the command, then the command is cancelled. To empty a RELAY port buffer, you may use the EVENT command from the MODEM port, or use the CLEAR command from either port.

To terminate PORT communications, hold down the control key and press D. Also, the PORT command automatically terminates at the end of the RELAY port timeout interval set using the SET command.

QUIT

Executing the QUIT command returns control to Access Level 0 from either Access Level 1 or 2, and displays the date and time when QUIT is executed. Use this command when you are done communicating with the PRTU so that unauthorized access is avoided. Note that control returns to Access Level 0 automatically after a settable interval of no activity. See the INTERVAL command.

SET

This Access Level 2 command allows you to set the dwell time for the port scanning process, and to set the PORT command timeout interval. The dwell time setting is settable from one to 27 seconds. The PORT command timeout interval is settable from 1 to 10 minutes.

SHOWSET

Enter SHOWSET to inspect the settings of the PRTU. The settings cannot be modified with this command. The settings are entered using the SET command from Access Level 2.

STATUS

The PRTU performs three self test functions as background tasks to its primary communications functions. You may inspect the status of these three self tests at any time using the STATUS command. Also, any self test failures result in an automatic message transmission to the LOCAL port.

The PRTU random-access memory (RAM) is tested by writing and reading test patterns to each memory location, and checking for agreement. (The contents of a location are temporarily stored in a register in the processor, then restored to the tested memory location, so that the test does not destroy stored data.)

The read-only memory (ROM) is checked by computing a modulo-eight checksum of the program ROMS, and comparing the results against checksums which were computed when the PRTU was manufactured.

The SET self test compares two copies of the PRTU settings, which are stored in an electronically-erasable programmable read-only memory.

TIME [hh:mm:ss]

To read the internal clock, enter TIME <CR>. To set the clock, enter TIME followed by the desired setting. Separate the hours, minutes and seconds with colons, semicolons, spaces, commas or slashes. For examples, to set the clock to 23:30:00, enter: TIME 23 30 00 <CR> or TIME 23:30:00 <CR>, etc.

TROUBLESHOOTING GUIDE

If you experience difficulty, please make the few checks listed below, and then refer to the TROUBLESHOOTING TABLE which follows.

1. Note the control voltage present at the rear-panel terminals.
2. Test the ALARM contacts, to determine if they are open or closed.
3. Inspect, but do not disturb the data cabling.

TROUBLESHOOTING TABLE

LED Indicators Dark

1. Power switch off.
2. Blown fuse.
3. Input power not present.

All LED Indicators Lit

(See Scanning Does Not Commence)

System Does Not Respond to Commands

1. Communications device not connected to system.
2. PRTU or communications device at incorrect baud rate.
3. System is performing an internal function (wait several seconds).
4. Internal or external connector is damaged or loose.
5. System is attempting to transmit information, but cannot due to handshake line conflict. (Check communications cabling.)

No Prompting Message Issued to Terminal upon Power-Up

1. Terminal not connected to system.
2. Wrong baud rate.
3. Improper connection of terminal to system.
4. Terminal not connected to LOCAL port.
5. Port timeout interval set to a value other than zero.
6. Failure of circuit board.

Terminal Displays Meaningless Characters

1. Baud rate incorrectly set.
2. Check terminal configuration.

Self-Test Failure: +15 Volts

1. EPROM failure on circuit card. (Replace EPROMS or substitute card.)

Self-Test Failure: RAM

1. Failure of static RAM IC on circuit card. (Replace RAM or circuit card.)

ALARM Relay Closed

1. Power is off.
2. Blown fuse.
3. Circuit board failure.
4. Improper EPROMS or EPROM failure.
5. Power supply failure. The power supply voltages are easily checked at any one of the port connectors.

Scanning Does Not Inhibit Data Transmissions from Relay

1. Mismatched communications parameters.
2. Device connected to RELAY port does not obey the XON/XOFF protocol.

Scanning Does Not Commence (All LED's On)

1. RELAY port CTS input lines are not asserted.

BBC PROTECTIVE RELAY TERMINAL UNIT COMMAND SUMMARYLEVEL 0

ACCESS Answer password prompt (if enabled) to gain access to Level 1
Three unsuccessful attempts pulses ALARM relay closed

LEVEL 1

2ACCESS Answer password prompt (if enabled) to gain access to Level 2
This command also pulses alarm relay

DATE Show or set date
DATE 2/3/84 sets date to February 3, 1984

EVENT Show event record from modem port
EVENT shows all events
EVENT 5 shows Port 5 events

PORT Communicate with one relay port from local or modem port
PORT 3 connects to relay PORT 3

QUIT Return to Access Level 0

SHOWSET Show settings -- does not affect settings

STATUS Show status of self-tests

TIME Show or set time
TIME 13/32/00 sets time to 1:32:00 PM

Level 2

CLEAR Clear events
CLEAR 1 clears events in relay Port 1 buffer

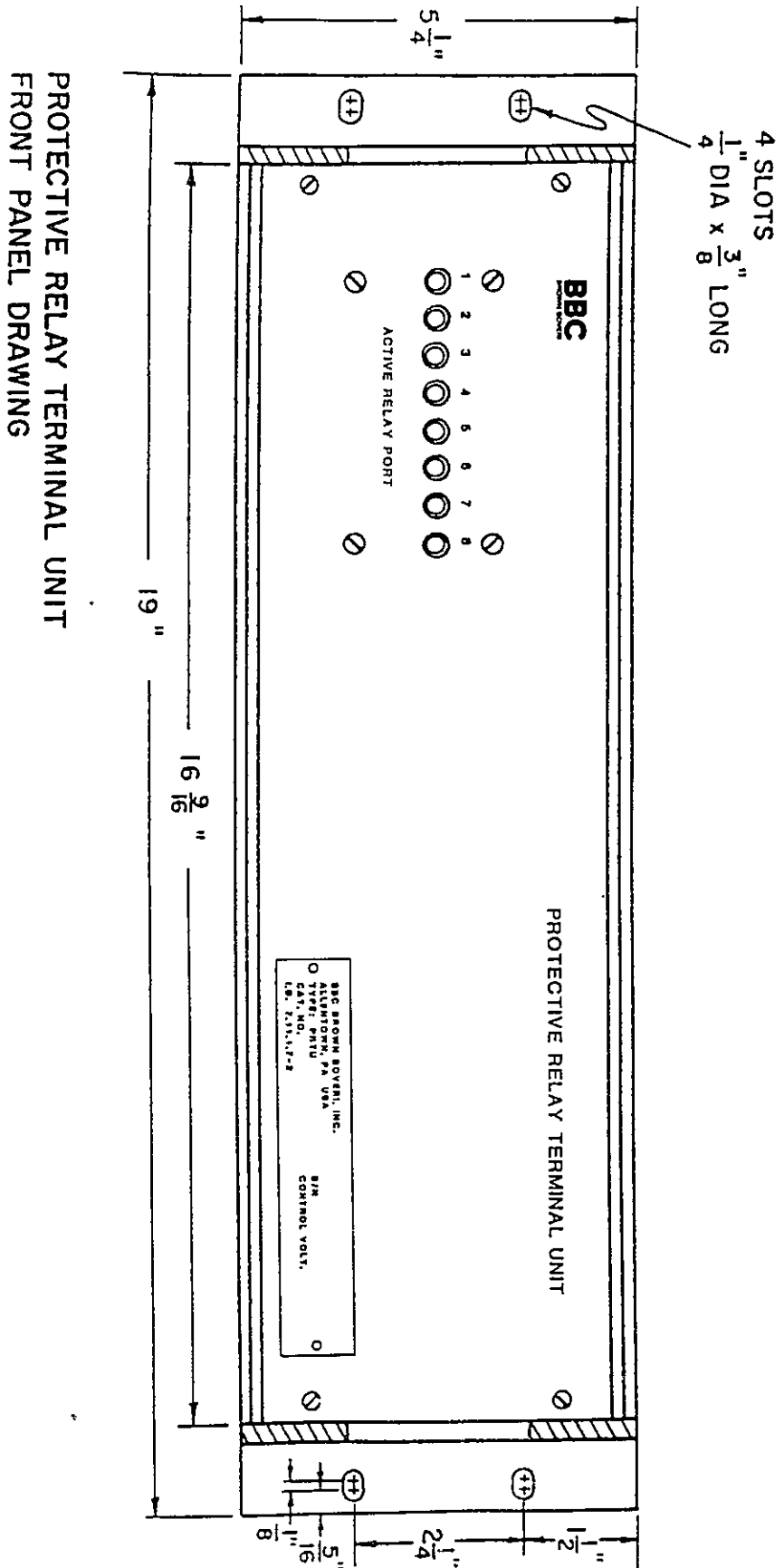
INTERVAL Show or set command timeout interval

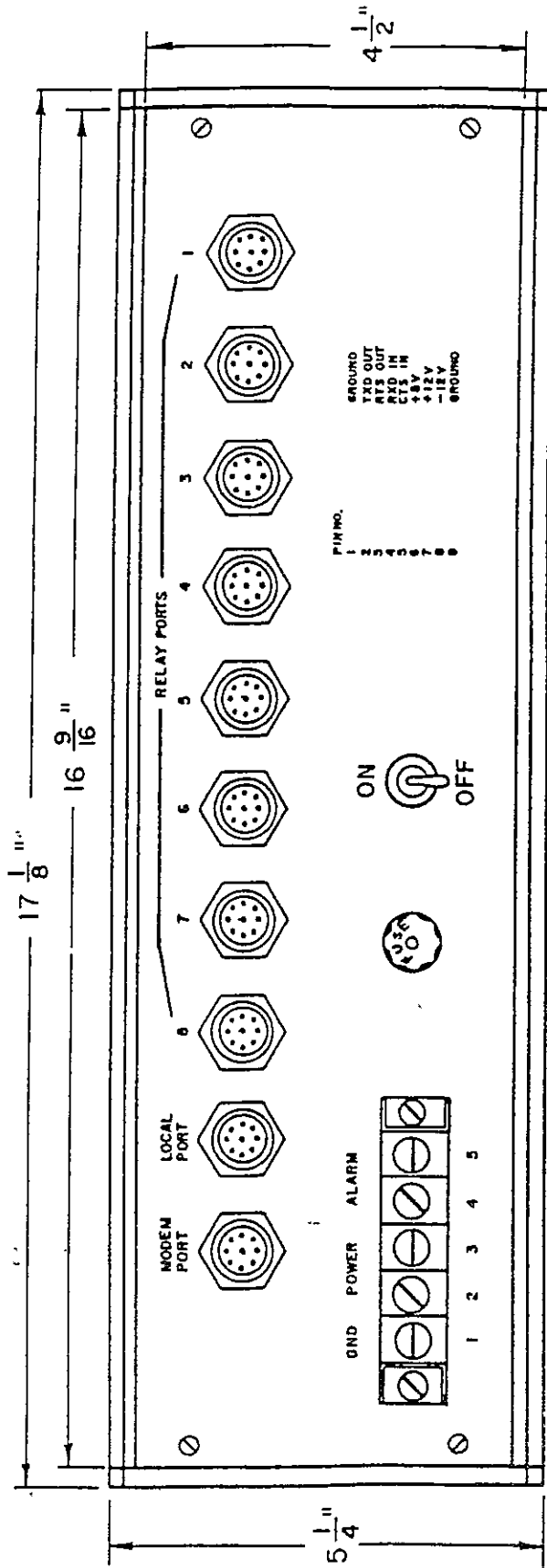
MODEM Show or set number of rings before modem at host port answers

PASSWORD Show or set passwords
PASSWORD 1 BBC1 sets level 1 password to BBC1
PASSWORD 2 BBC2 sets level 2 password to BBC2

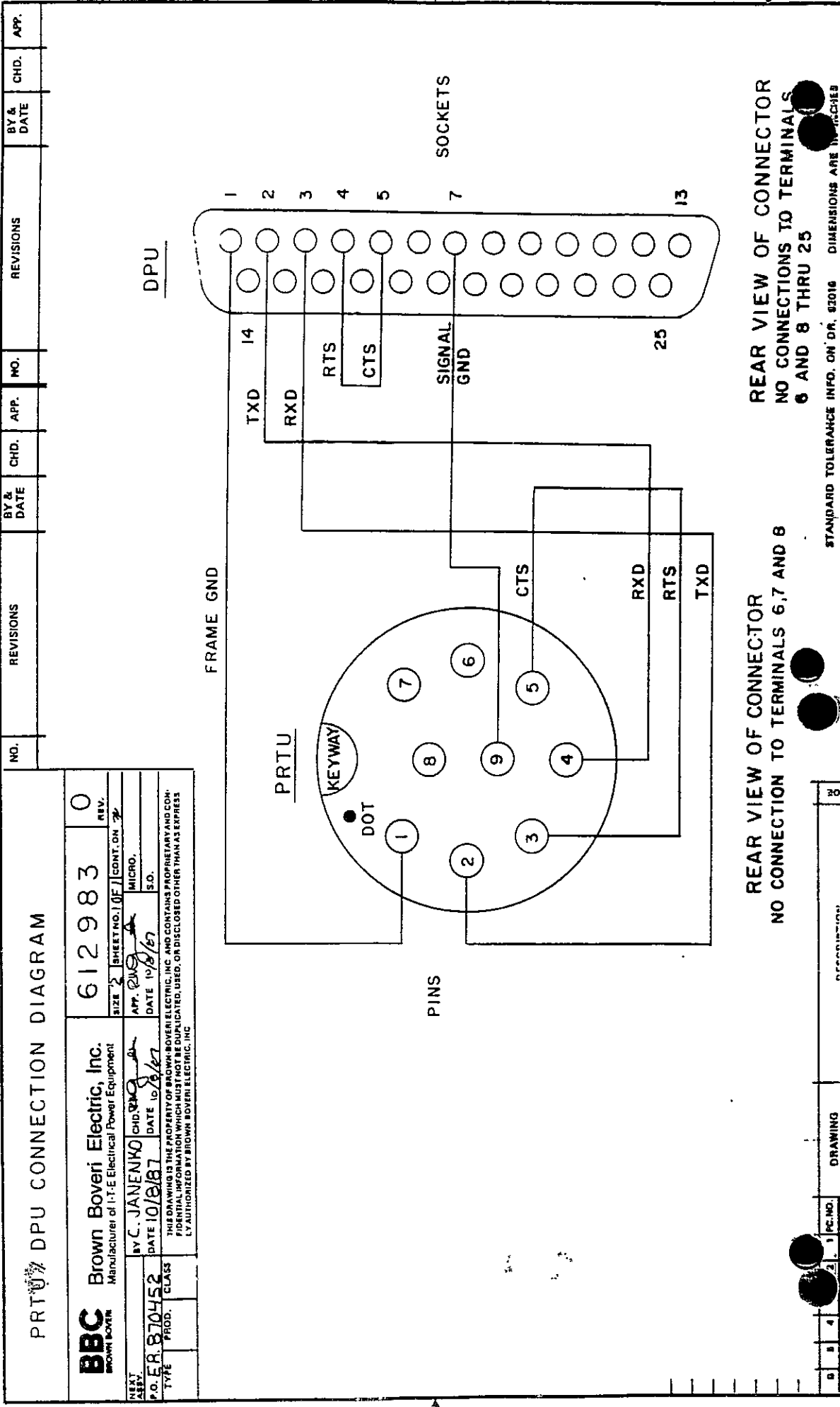
SET Initiate setting procedure
ALARM relay closes when new settings are enabled

PROTECTIVE RELAY TERMINAL UNIT





PROTECTIVE RELAY TERMINAL UNIT
REAR PANEL DRAWING



NO.	REVISIONS	BY & DATE	CHD.	APP.	NO.	REVISIONS	BY & DATE	CHD.	APP.

PRTU DPU CONNECTION DIAGRAM		NO.	REVISIONS	BY & DATE	CHD.	APP.	NO.	REVISIONS	BY & DATE	CHD.	APP.
BBC Brown Boveri Electric, Inc. Manufacturer of I.T.E. Electrical Power Equipment		SIZE 2 SHEET NO. 10F CONT. ON 2 MICRO.		612983 0 REV.							
BY C. JANENIKO DATE 10/18/67		APP. RWS DATE 10/18/67		MICRO.							
P.O. NO. ER 870452 TYPE PROD. CLASS		DATE 10/18/67		MICRO.							
THIS DRAWING IS THE PROPERTY OF BROWN-BOVERI ELECTRIC, INC. AND CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED, OR DISCLOSED OTHER THAN AS EXPRESSLY AUTHORIZED BY BROWN-BOVERI ELECTRIC, INC.											

PRTU DPU CONNECTION DIAGRAM

BBC Brown Boveri Electric, Inc.
 Manufacturer of I.T.E. Electrical Power Equipment

BY C. JANENIKO
 DATE 10/18/67

APP. RWS
 DATE 10/18/67

P.O. NO. ER 870452
 TYPE PROD. CLASS

THIS DRAWING IS THE PROPERTY OF BROWN-BOVERI ELECTRIC, INC. AND CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED, OR DISCLOSED OTHER THAN AS EXPRESSLY AUTHORIZED BY BROWN-BOVERI ELECTRIC, INC.

SIZE 2 SHEET NO. 10F CONT. ON 2
 MICRO.

612983 0
 REV.

BY C. JANENIKO
 DATE 10/18/67

APP. RWS
 DATE 10/18/67

THIS DRAWING IS THE PROPERTY OF BROWN-BOVERI ELECTRIC, INC. AND CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED, OR DISCLOSED OTHER THAN AS EXPRESSLY AUTHORIZED BY BROWN-BOVERI ELECTRIC, INC.

REAR VIEW OF CONNECTOR
 NO CONNECTIONS TO TERMINALS 6 AND 8 THRU 25

REAR VIEW OF CONNECTOR
 NO CONNECTION TO TERMINALS 6,7 AND 8

STANDARD TOLERANCE INFO. ON DR. 82016 DIMENSIONS ARE IN INCHES

1	PC NO.	8
2	DRAWING	8

1

○

○

○

BBC
BROWN BOVERI

BBC Brown Boveri, Inc.
35 North Snowdrift Road
Allentown, PA 18106
Phone: (215) 395-7333

These instructions do not purport to cover all details or variations in equipment nor do they provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser, the matter should be referred to Brown Boveri.