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REMOTE CONSOLE UNIT (RCU) FOR  
"PDP\*" 11/40 MINICOMPUTER  
METHOD OF OPERATION  
INFORMATION SYSTEMS

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## 1. INTRODUCTION

### 1.01 Purpose

This practice contains the standard method of operation of the Remote Console Unit (RCU) for the Digital Equipment Corporation PDP 11/40 minicomputers. For a quick reference, refer to User's Manual (BR 007-560-259).

### 1.02 Reason for Reissue

This section is reissued due to divestiture.

## 2. GENERAL

The RCU is a microprocessor-based interface to PDP 11/40 minicomputers that permits remote diagnostic and monitor capability. The RCU was primarily designed as a maintenance tool for the telephone company Minicomputer Maintenance and Operations Center (MMOCs) and also as an operations tool for software development organizations. Maintenance and operations personnel communicate with the RCU via a dial-up line using a data set and a standard receive/transmit American Standard Code for Information Interchange (ASCII) terminal. Complete PDP 11/40 system console and terminal emulation is achieved.

An RCU kit consists of a circuit pack (CP-3) FE81NE0025, power supply and mounting hardware, communications cable (EIA/DC LOW/TTY), power cables, Light Emitting Diode (LED)/Key switch bracket, and miscellaneous hardware.

### 2.01 Baud Rate Switches

The two baud rate switches SW-4 and SW-5 located on the RCU CP-3 correspond to the speed options for the remote and local terminals, respectively. The SW-4 and SW-5 are two 10-position thumbwheel switches located in the middle upper half of the CP-3. (See Figure 1). Table A lists the switch positions and their respective speeds.

### CAUTION

The remote terminal speed must be greater than or equal to the local terminal speed. The SW-4 switch should never be set to a baud rate lower than SW-5.

### 2.02 Modem Option Switched

The modem option switches SW-2 and SW-3 are two quad Single-Pole Double Throw (SPDT) dip switches located directly to the right of SW-4 and SW-5. (Refer to BR 007-560-258 for recommended switch positions and various optional operating parameters.)

### 2.03 LED/Key Switches

The LED/Key switch bracket contains three LED indicators, a Local/Remote mode control key switch, and a DISCONNECT CARRIER button connector. The LEDs consist of (from top to bottom) a REMOTE LED, a CARRIER DETECT LED, and an RCU ACTIVE LED (operates at approximately 60 beats per minute). See CP-3 layout (Figure 1) for bracket location. The Local/Remote mode control key switch (Chicago Lock Company, No. 4235, using a keyed-alike design to that of the console key switch used on the PDP 11/40) is located below the LEDs. (Refer to Figure 1). Its function is to allow the local personnel control of RCU Local/Remote mode capabilities. (Refer to paragraph 4.04). The

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DISCONNECT CARRIER button located between the LEDs and the key switch on the RCU front panel allows the local personnel to drop the remote user from the line automatically.

3. DESCRIPTION OF TERMS

The following list describes terms associated with the RCU PDP 11/40.

- (a) **Remote Terminal:** The standard receive/ transmit ASCII terminal located anywhere with a dial-up line and data set (or acoustic coupler).
- (b) **Local Terminal:** The minicomputer "system console." It is the standard ASCII terminal (usually a DECWRITER\* terminal) used by the associated minicomputer.
- (c) **Switch Register:** The bank of switches designated SWR17-SWR00 located on the minicomputer front console.
- (d) **Remote Mode:** The operating state of the RCU when the Local/Remote mode control key switch is in REMOTE.
- (e) **Local Mode:** The operating state of the RCU when the Local/Remote mode control key switch is in LOCAL.
- (f) **Locking Switch:** The switch located on the minicomputer front console that can be locked in two positions is the HALT/ENABLE switch.
- (g) **Momentary Switches:** The switches located on the minicomputer front console that can be momentarily switched to one additional position. They are the CONT, LOAD, START, EXAM, and DEP switches.

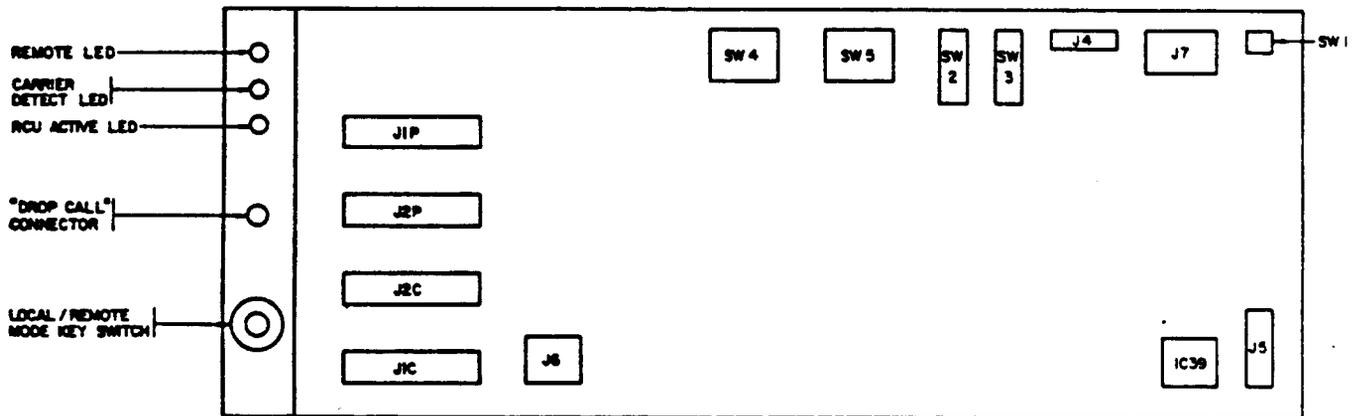


Figure 1. RCU CP-3 Layout

\* Trademark of Digital Equipment Corporation.

## 4. METHOD OF OPERATION

### 4.01 Establishing Contact With The RCU

The remote user contacts the RCU via the telephone network using the telephone number preassigned to the RCU. The RCU supports full duplex ASCII terminals.

The data set connected to the RCU and also the data set (or acoustic coupler) connected to the remote terminal must have the following features: binary, full duplex, asynchronous, a standard RS232C interface, and be capable of operating within the RCU speed guidelines. (See paragraph 2.01 and Table A.) Several data set types and their significant operating parameters for interface to the RCU are listed in Table B.

The RCU ignores bit parity from the remote terminal during RCU command entry. The RCU remains transparent to character structure during direct communication between the remote terminal and the minicomputer and the local terminal and the minicomputer.

### 4.02 Password

The RCU is equipped with a special access code for security purposes. When a connection has been established, the system types login. The user must then type the password followed by the RETURN key. If the password was erroneously entered, the RCU will type login incorrect and again prompt the user with another login.

The RCU system has a 1-minute login time-out period at which time, if the remote user has not successfully logged in, the RCU will drop the calling party. The RCU accomplishes this by holding the Data Terminal Ready (DTR) lead from its connecting data set to a low logic level for approximately 10 seconds. The caller can also be dropped by a local person (e.g., at the RCU front panel below the actual minicomputer switch console) pressing the DISCONNECT CARRIER button. This can be done at any point during the remote user's contact with the RCU.

For security reasons, the RCU is not provided with a login password at the manufacturing location. The password must be programmed by the installation personnel during installation of the RCU. (Refer to BR 007-560-258.) The password is physically located on a 2000- by 8-bit Ultraviolet Erasable Programmable Read-Only Memory (UVEPROM) integrated circuit (IC39) (similar to the INTEL Company, No. 2716. The IC39 is a Dual In-Line Package (DIP) located in a zero-insertion socket on CP-3 (Figure 1). The password is local user changeable. The device (IC39) has the password loaded in memory locations (addresses) 000H through 3ffH. (An "H" following a number signifies that the number is hexadecimal.) The password characters must conform to the ASCII format. [DEL(7fH), @(40H), DC3(13H), CR(0dH), and LF(0aH) are all exceptions in the ASCII format and should not be used in the password.] The parity bit, or the most significant bit, must be left as zero. There should be no hexadecimal character code greater than 7eH entered. The reason is that the RCU will only accept 7-bit ASCII from the remote terminal during login entries. The password may be up to 1000 characters but not less than 6, with an additional last character entered being a 00H. A recommended practice is to keep the character count within a reasonable range to allow time to type in characters before the login period time out. (Refer to Appendix 1 for step-by-step procedures to change password.)

## CAUTION

The last character entered of the password must be 00H. The password entered must be a minimum of 6 characters, difficult to guess, and unique to the RCU- installed processor, eg,

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password entered on UVEPROM.

DEVICE HEX ADDRESS	ASCII HEX CODE ENTERED	ASCII CHARACTER
000H	65H	e
001H	78H	x
002H	61H	a
003H	6dH	m
004H	70H	p
005H	6cH	l
006H	65H	e
007H	00H	

Password entered at remote terminal: example (nonechoing)

(followed by the RETURN key).

The IC39 is a standard 2716-type UVEPROM (INTEL Company or equivalent).

On an input line from the remote terminal, the character @ or DEL (delete) "kills" all the characters typed before it. The leading prompt is then typed again by the RCU. Tab characters are interpreted as white space (code 20H). The RCU makes provision for terminals with a "new line" function. All input "line feed" characters directed to the RCU during command code entry are changed to "carriage return" characters, and a "carriage return" and "line feed" pair is echoed to the terminal.

When logged in successfully, the RCU will respond with:

RCU System - ADE release 1.0.0 - [\*] Remote Console Unit for the PDP 11/40

<CONSOLE UNDER [†] CONTROL>

All Users: type "table" ‡

[Command: \*]

#### 4.03 Minicomputer Identification Option

The RCU is provided with an option to type out the code of the minicomputer associated with it. This code can be any series of characters to a maximum of 10 characters. This code automatically substitutes the RCU command entry prompt which defaults to Command:

If the minicomputer identification option is chosen, the code must be entered in much the same way the password is changed. (See paragraph 4.02.) The code is physically located on the same 2000-by-8-bit

† Depending on the position of the Local/Remote mode control key switch, [/(dg)] will state either LOCAL or REMOTE.

‡ Typing "table" prints a complete table of command codes available.

\* Identification of the associated minicomputer can be stated in [\*] if option was chosen during installation of the RCU. (Refer to BR 007-560-258.) In addition, the minicomputer identification will substitute the prompt "Command." (See paragraph 4.03.)

UVEPROM (IC39) as the password. This user changeable device has allocated space where the code will be entered in device memory locations (addresses) 400H through 409H. The code must conform to the ASCII format. (Characters DEL and @ or 7fH and 40H are exceptions in the ASCII format and should not be entered as code.) As with the password, there should be no hexadecimal character code greater than 7eH entered. Again, the last additional character entered must be 00H. Refer to BR 007-560-257 Appendix 1 for step-by-step procedures to change prompt-ID, e.g., code entered on UVEPROM:

DEVICE HEX ADDRESS	ASCII HEX CODE ENTERED	ASCII CHARACTER
400H	41H	A
401H	44H	D
402H	45H	E
403H	31H	1
405H	00H	

Above code entered yields following printout:

RCU System - ADE release 1.0.0 - ADE1 Remote Console Unit for the PDP 11/40

<CONSOLE UNDER [\*] CONTROL>

All Users: type "table"

ADE1:

If the default prompt is chosen, the hexadecimal code at location 400H must be ffH. The RCU has been previously set to the default prompt at the manufacturing location.

#### 4.04 Local Controls and Indicators

The RCU system contains two primary local control features. They both are accessible at the RCU front panel.

The first is the Local/Remote mode control key switch (Figure 1). It allows the local personnel to limit selectively the remote user (caller) to a listening-only mode just by turning the key to the LOCAL position. This position allows the remote user to receive selectively the same information transmitted to the local terminal by the minicomputer. Also the remote user can obtain "snapshot" views of the minicomputer front console LED indicators. Alternately, the local personnel can turn the key to the REMOTE position allowing the remote user to have complete control of the minicomputer front console and the local terminal. Specifically, the remote user can selectively transmit to the minicomputer as though the remote terminal were actually the local terminal. The local terminal is now in a receive-only mode. The local console's switches are disabled. Also, the remote user can set any of the switches on the minicomputer front console. The remote user can effectively boot the system or perform any switch action normally performed at the front console.

The second control accessible to the local personnel is a DISCONNECT CARRIER pushbutton switch (Figure 1). It is designed primarily as a security feature. If the need arises, anyone at the RCU front

\* Depending on the position of the Local/Remote mode control key switch, [\*] will state either LOCAL or REMOTE.

panel may drop a remote user from the line simply by pressing a button. (Refer to Part 5, Security Provisions.)

The RCU system contains three visual indicators which are visible through the bezel window on the RCU front panel (Figure 1). These three LEDs are situated in a vertical pattern. They are red.

The top LED is the REMOTE mode LED. The OFF state is the Local mode condition and the ON state is the Remote mode condition. The LED is a hard-wired connection to the Local/ Remote mode control key switch.

The lower LED is the RCU ACTIVE LED. It provides a visual "heartbeat" of the RCU system. The RCU microprocessor (the BELLMAC\*-8 microprocessor) toggles a flip-flop based circuit 60 times a minute. The toggling LED driven from this circuit serves as an indicator of sanity of the microprocessor.

The middle LED is the CARRIER DETECT LED. It provides visual confirmation that a remote user is in contact with the RCU. The ON state indicates that a caller is on the line and conversely the OFF state indicates that the line is not seized. This LED is a hard-wired connection to the Carrier Detect (CD) lead from the connecting data set.

#### **4.05 Command Entry Syntax**

After successfully logging in, the remote user receives a command prompt (default prompt is "Command") after which he/she may enter commands at will.

On an input line from a terminal, the character @ or DEL (delete) "kills" all the characters typed before it. The leading prompt is then typed again by the RCU. The character # or BS (backspace) erases the last character typed. Successive uses of # or BS will erase characters back to, but not beyond, the beginning of the line. Tab characters are interpreted as white space (code 20H). The RCU makes provision for terminals with a "new line" function. All input "line feed" characters directed to the RCU are changed to "carriage return" characters, and a "carriage return" and "line feed" pair is echoed to the terminal.

The ASCII DC3 control character can be used to temporarily stop output. It is useful with a cathode-ray tube (CRT) terminal to prevent output from disappearing before it can be read. Output is resumed when any character is typed.

The RCU ignores bit parity from the remote terminal when any character is typed.

The RCU ignores bit parity from the remote terminal during RCU command entry.

The RCU will accept any unambiguous abbreviations of the commands.

The following control switch commands can be used to examine or change the generic portion of the processor's memory. When the "dep," "cont," "exam," or "load adrs" commands are implemented, the RCU will automatically continue by doing the "lights" command (paragraph 4.01). The following commands can only be accessed while in the Remote mode.

---

\* Trademark of Western Electric Company.

Command	Function
start	<p>Allows the remote user to activate the START switch. The RCU will type to the remote user:</p> <p>*START switch depressed</p> <p>If the minicomputer CPU is in the RUN state, the START switch has no effect. If the program has stopped, activating the START switch causes a System Reset signal to occur; the program will then continue only if the HALT/ ENABLE switch is in ENABLE. When the Remote HALT/ENABLE switch position is set to HALT, activating the START switch clears the computer system. The RCU will then type to the remote user:</p> <p>&lt;INIT&gt;</p> <p>When the Remote switch is set to ENABLE, activating the START switch automatically transfers the remote terminal into the listening mode. (Refer to paragraph 4.06 for further information regarding listening mode.)</p>
dep	<p>Allows the remote user to activate the DEP switch. Causes the current contents of the switch register to be deposited into the address specified by the current contents of the address display. The RCU will type to the remote user:</p> <p>*DEPOSIT switch activated</p>
cont	<p>Allows the remote user to activate the CONT switch. Causes the minicomputer processor to continue operation from the point at which it stopped. This switch has no effect when the minicomputer processor is in the RUN state. If the program stops, this switch provides a restart without a system reset. The RCU will type to the remote user:</p> <p>*CONTINUE switch depressed</p>
exam	<p>Allows the remote user to activate the EXAM switch. Causes the contents of the current location specified in the address display to be displayed in the Data Display Register when the Data Select switch is in the DATA PATHS position. The RCU will type to the remote user:</p> <p>*EXAM switch depressed</p>

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Command	Function
load adrs	Allows the remote user to activate the LOAD ADRS switch. Transfers the contents of the switch register into the address displayed. The RCU will type to the remote user:  *LOAD ADDRESS switch depressed
halt or enable	Allows the remote user to activate the HALT/ENABLE switch.  <b>HALT:</b> Causes the minicomputer processor to stop. The RCU will query the remote user by typing to the remote user:  Are you sure? (y or n):  If the remote users types "y" (upper or lower case), the RCU will activate the <b>HALT</b> switch. The RCU will then type the remote user:  *HALT switch depressed  If any character besides "y" is typed, the RCU will ignore the command.  <b>ENABLE:</b> Allows the minicomputer processor to perform normal operations under program control. The RCU will type to the remote user:  *ENABLE switch activated

#### 4.06 Remote and Local Access Commands

The command swr [] allows the remote user to set the Remote Switch Register. The command "swr" followed by [ ] (zero to a maximum of six octal digits entered at the remote terminal) sets the Remote Switch Register equal to []. The digits entered [] are right justified and the remaining leftmost digits default to zero. The RCU will type to the remote user:

REMOTE SWR = []

e.g., "swr77" yields: (RCU printout)

REMOTE SWR = 000077

While the Remote Switch Register can be set in Local or Remote modes, it is the effective Console Switch Register only in Remote mode. The Local Console Switch Register is disabled while the RCU is in the Remote mode.

The command "listening" allows the terminal of the remote user to be in direct communication with the minicomputer. The RCU transmits characters from the remote terminal to the minicomputer without changing character format. Table C best illustrates the various communication modes and conditions of the remote terminal while in the listening mode.

The following procedures must be entered by the remote user in the specified order.

- (1) To exit the listening mode:
  - Start a new line.
  - Press "% " key.
  - Press control-g.
- (2) To temporarily exit the listening mode (i.e., to execute an RCU command):
  - Start a new line.
  - Press "% " key.
  - Enter RCU command.
  - Press carriage return.\*
- (3) To transmit a % to the minicomputer as the first character on a new line, precede this character with another %.

#### CAUTION

Upon entering a % on a new line, the remote terminal receive capability terminates. The information transmitted to the local terminal by the minicomputer will not be received by the remote terminal. It will be reestablished automatically when returning from an RCU command [as in (2) above] or when entering another % [as in (3) above].

When in the listening mode, if the remote user attempts to prompt the minicomputer (e.g, start a new line) while in Local mode, the RCU will return the message:

<CONSOLE UNDER LOCAL CONTROL> - remote terminal can receive only.

The command "switches" informs the remote user of the most updated Local and Remote mode switch settings. The RCU will print out who has control of the console functions. The RCU will print out locking and rotary switch status of both LOCAL and REMOTE settings. The Remote Switch Register settings are also displayed. The format is displayed below:

<CONSOLE UNDER [\*] CONTROL>

---

\* The RCU will prompt the user with another % when the preset RCU command ends.

LOCAL        REMOTE  
  ENABLE     HALT  
REMOTE SWR = 000000

The command "lights" informs the remote user of the most updated address and data bus LED status. The Remote Switch Register is also displayed. The format is displayed below:

ADRS = 177777  
DATA = 177777  
REMOTE SWR = 000000

The command "misc lmp" will inform the remote user if the following lamps are lit:

- RUN
- USER
- BUS
- CONSOLE
- PROCESSOR
- VIRTUAL

**NOTE** - If the console key switch position is set to panel lock, PANEL LOCK will be displayed.

#### 4.07 Miscellaneous Commands

The command "reset" can be accessed in Remote mode only. It resets all remote locking switches (excluding the Remote Switch Register) to the position on the actual console as scanned by the RCU. The RCU will type to the remote user:

<REMOTE RESET>

The "switches" routine (paragraph 4.06) is performed following the above printout.

The command "table" can be accessed in both the Local and Remote modes. It causes the RCU to type out to the remote user a complete table of command codes available. The RCU will type to the remote user:

Command Set (access)

---

\* Depending on the Local/Remote mode control key switch position on the RCU front panel, this will say either LOCAL or REMOTE.

(Remote Only)

start  
dep  
cont  
exam  
load adrs  
halt - enable  
reset

(Remote and Local)

swr  
table  
lights  
listening  
misc lmp  
switches

The command "." repeats the previously entered command. It will operate in both Local and Remote modes except when present conditions (e.g., Local/Remote mode control key switch in LOCAL position) restrict previous commands (commands entered in the Remote mode) to be repeated.

**4.08 Switch Status Notes**

When a command that is only permitted to be entered in the Remote mode is entered in the Local mode, the RCU will type to the remote user:

? - <CONSOLE UNDER LOCAL CONTROL>

If the Local/Remote mode control key switch is set to REMOTE, the remote switch settings will remain as the remote user has left them regardless of the transition of carrier presence.

When switching the Local/Remote mode control key switch from the Remote to Local, the remote switch settings (except the Remote Switch Register) are automatically reset to whatever state the RCU scanned on the actual console.

**5. SECURITY PROVISIONS**

The following are security precautions:

- (a) Required implementation features for password:
  - (1) The password must have a character length minimum equal to six.
  - (2) The password must be unique to the system.
  - (3) The password should not be guessed easily.
- (b) Local/Remote mode control key switch position:
  - (1) Do **not** leave the Local/Remote mode control key switch in the REMOTE position unless required by authorized maintenance and/or operations personnel.
  - (2) Leave the Local/Remote mode control key switch in the LOCAL position at all times except when required.

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(c) Data set configuration:

- (1) The telephone number associated with the data set should be unpublished.
- (2) The data set should be set to a make-busy state when the RCU is not in use by authorized personnel.

The following are security enhancements:

- (a) An Led located on the RCU front panel lights when the Local/Remote mode control key switch is in the REMOTE position. This LED is designated REMOTE.
- (b) Another LED located on the RCU front panel lights when anyone is in direct communication with the RCU. This LED is designated CARRIER DETECT.
- (c) A pushbutton switch located on the RCU front panel (below the LEDs) drops any caller who is in direct communications with the RCU. This switch is designated DISCONNECT CARRIER.

If the security of the RCU is compromised or unauthorized use of the RCU is expected, then the following actions are recommended:

- (a) Depress the DISCONNECT CARRIER pushbutton switch (located on the RCU front panel). The CARRIER DETECT LED (also located on the RCU front panel) should go dim.
- (b) Switch the Local/Remote mode control key switch to the LOCAL position.
- (c) Reconfigure the data set to a make-busy state so as to not accept any callers.
- (d) Report incident to the Security Department.
- (e) Change the RCU password. (Refer BR 007-560-257 Appendix 1).
- (f) Change the telephone number associated with the RCU. (Make sure the telephone number is unpublished).

**TABLE A**  
**SW-4-REMOTE TERMINAL**  
**SW-5-LOCAL TERMINAL**

SWITCH POSITION	BAUD RATE (BPS)
5	110
6	150
7	300
8	600
9	1200
0	1800
1	2400
2	3600
3	4800
4	9600

**TABLE B**  
**RECOMMENDED BELL SYSTEM DATA SET TYPES FOR INTERFACE WITH RCU**

DATA SET TYPES	103J	113D	202T	212A
Data Rates (BPS) for RCU Operation*	110,150, 300	110,150, 300	110,150 300,600 1200,1800	110,150 300,1200
Channel Types-Wire	2-Wire	2-Wire	4-Wire	
Line Interface	Switched	Switched	Private	Switched

**TABLE C**  
**TERMINAL CAPABILITIES IN LOCAL AND REMOTE MODES**

LOCAL/REMOTE MODE KEY SWITCH POSITION	MINICOMPUTER TERMINAL CAPABILITY	REMOTE TERMINAL CAPABILITY
LOCAL	Receive + Transmit	Receive Only
REMOTE	Receive Only	Receive + Transmit

\* The RCU remote terminal speed must be greater than or equal to the local terminal speed.