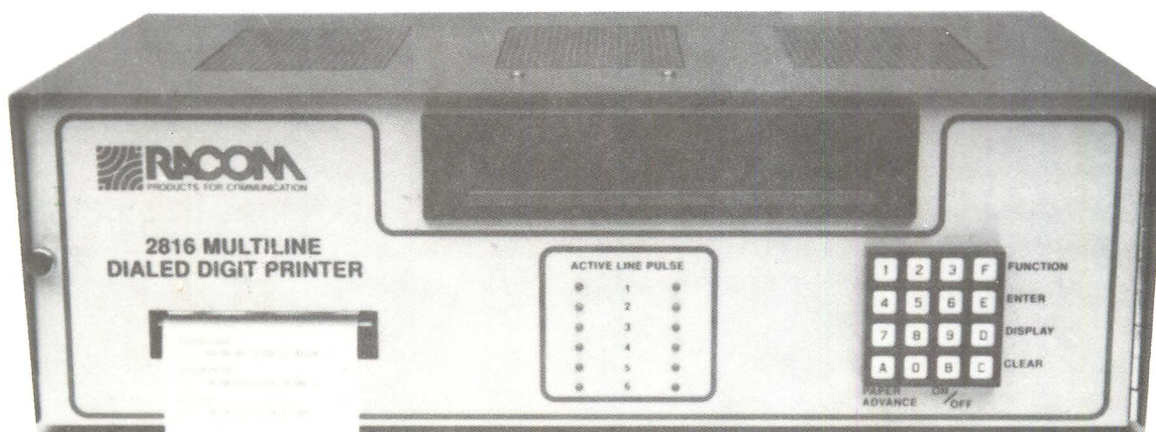


RACOM 2816 **Dialed Digit Printer**

MODEL 2816A (REV. B)
WITH OPTION 4 - DATA OUTPUT



Instruction Manual

EFFECTIVE 8/91

REPLACEMENT ORDER INFORMATION

WRITE TO: RACOM PRODUCTS INC.
PARTS DEPT.
5504 STATE, RD
CLEVELAND, OH 44134
USA
(216)351-1755
(216)351-0392 FAX LINE

PARTS FOR RACOM 2816, 2816C, 2816P DIALED DIGIT PRINTERS

PRINTER RIBBON (EPSON RIBBON BLACK).....\$20.00
PRINTER PAPER (3"ROLLS).....QUANTITY OF SIX ROLLS.\$26.00
EPSON PRINTER MECHANISM...(EPSON M260).....\$210.00
LCD DISPLAY.....\$95.00
KEYPAD & WIRING ASSEMBLY.....\$64.00

ALL PRICES ARE IN UNITED STATES DOLLARS

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE

PRICES INCLUDE SHIPPING TO DOMESTIC ADDRESSES ONLY
INTERNATIONAL ORDERS ARE F.O.B. CLEVELAND, OHIO U.S.A.

PARTS ORDERS ARE TO BE PAID IN FULL PRIOR TO SHIPMENT
UNLESS PRIOR ARRANGEMENTS ARE MADE

NOTICE

WARNING: This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

RACOM PRODUCTS INC.

5504 STATE ROAD
CLEVELAND, OH 44134

EXHIBIT J

This equipment complies with Part 68 of the FCC rules. The label affixed to this equipment contains, among other information, the FCC Registration Number and Ringer Equivalence Number (REN) for this equipment. You must, upon request, provide this information to your telephone company.

The REN is useful to determine the quantity of devices you may connect to your telephone line and still have all of those devices ring when your telephone number is called. In most, but not all areas, the sum of the REN's of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should contact your local telephone company to determine the maximum REN for your calling area.

The following jacks must be ordered from the telephone company in order to interconnect this product with the public communication network: RJ11 or RJ14 or RJ21.

If your telephone equipment causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice is not practical you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC.

Your telephone company may make changes in its facilities, equipment, operations or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

If you have trouble with this equipment, please contact us at the address above for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

This product is not field repairable. However, the maintenance section of this manual describes trouble-shooting steps which one can take in the event of equipment problems.

This equipment may not be used on coin service lines provided by the telephone company.

Connections to party lines are subject to state tariffs. Contact your local telephone company if you plan to use this equipment on party lines.

The installation of this product does not require any connections or changes to the internal wiring of other registered terminal equipment.

The installation of this product does not require any connections or changes which will affect the exterior of other registered terminal equipment.

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

FCC FORM 484

REGISTRATION UNDER PART 68, CONNECTION OF TERMINAL EQUIPMENT TO THE TELEPHONE NETWORK

SUBJECT TO THE PROVISIONS OF PART 68 OF THE COMMISSION'S RULES AND REGULATIONS, REGISTRATION IS HEREBY GRANTED FOR THE EQUIPMENT LISTED HEREIN. ANY CHANGE IN MODEL NUMBER OR TRADE NAME REQUIRES AMENDMENT OF REGISTRATION. EACH PIECE OF EQUIPMENT BEARING THE LISTED TRADE NAME(S) AND MODEL NUMBER(S) SHALL BE LABELED IN ACCORDANCE WITH THE PROVISIONS OF SECTION 68.300.

TELEPHONE EQUIPMENT CONTAINING RADIO-FREQUENCY CIRCUITRY MAY REQUIRE ADDITIONAL EQUIPMENT AUTHORIZATION(S) TO BE ISSUED BY THE COMMISSION PRIOR TO MARKETING SUCH EQUIPMENT IN THE UNITED STATES. FAILURE TO OBTAIN THE REQUIRED EQUIPMENT AUTHORIZATIONS, WHEN REQUIRED, MAY SUBJECT THE REGISTRANT TO FINES AND PENALTIES PROVIDED FOR IN TABLE V, SECTION 501 AND 503 OF THE COMMUNICATIONS ACT OF 1934, AS AMENDED.

FUTURE CORRESPONDENCE CONCERNING THIS GRANT SHOULD REFERENCE THE FILE NUMBER, THE REGISTRATION NUMBER AND DATE OF GRANT.

REGISTRATION NUMBER: A9G9KJ-69439-RT-N FILE NUMBER: 799-CX-90 DATE OF GRANT: 02/06/90 DATE OF ISSUE: 02/21/90

REGISTRANT: RACOM

MANUFACTURER: RACOM

TYPE OF EQUIPMENT: TRAFFIC RECORDERS

NATURE OF APPLICATION: NOTICE - ADD MODEL

TRADE NAME(S) MODEL NUMBER(S)

OTHER REGISTRATION(S) AFFECTED

RACOM PRODUCTS

2816

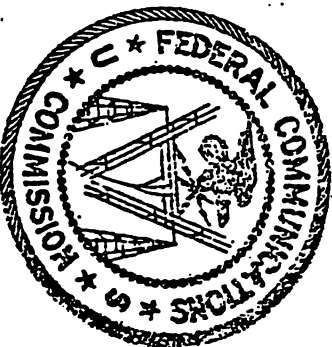


TABLE OF CONTENTS FOR THE RACOM 2816A

SECTION ONE	PAGE
Functional Description	1
Specifications	2
Operation	3
Installation	4
Front Panel Switches and Indicators	5
LCD Display	5
LEDs	5
Keyboard	6
Setting The Electronic Clock	7
Recording And Audio Monitoring	8
Caller Number Delivery (CND) Optional	9
Opening The Front Panel	9
Closing The Front Panel	9
Inked Ribbon Replacement	10
Paper Tape Replacement	10
Telephone Line Loop Type	11
Off Hook Threshold Adjustment (R463)	12
Loop Extender Receiver Optional	12
 SECTION TWO	
Configuration	13
Internal Switches And Controls	13
Access to Internal Switches and Controls	13
Double or Single Space	13
Touch Tone and Dial Pulse Exclusion	14
Print Last Rotary Dialed Digit	14
Touch Tone Acceptance or Dropout Time	14
Rotary Dial Pulses Timeout	14
Dial Pulse Rate Switch	15
Input Invert Switch	15
Voltage Controlled Operation	15
Software Setup	16
Timers	17
Counters	18
Timing	18
Internal Controls Summary	19
Microprocessor Board	19
Line Boards	20
Switches	20
Controls	20

THIS MANUAL IS FOR 2816 MODELS MARKED REVISION B ONLY

SECTION ONE

FUNCTIONAL DESCRIPTION

The RACOM 2816A Multi-line Dialed Digit Printer is a Dialed Number Recorder (DNR) that can provide wire tapping on six telephone lines simultaneously. For each of the six lines it prints out the number called and has connections for audio cassette recorders. The 2816A evolved from the Racom 2800 and 2805 Dialed Digit Printers. The 2816A contains the latest state-of-the-art microprocessor circuitry with plug-in circuit boards.

The RACOM 2816A Multi-line Dialed Digit Printer can easily be connected to most telephone lines by its modular connector to provide a printed record of the following for each of the six lines:

1. Indicate the line.
2. Each telephone number dialed (up to 32 digits).
3. The date and time of the call.
4. The elapsed time of the call.
5. Whether the call was made from a rotary dial or a touch tone telephone.
6. How long an incoming call rang and if it was answered.
7. The origination date and time of the incoming calls.
8. The elapsed time of the incoming calls.
9. Control and status of cassette recorders.
10. The number that is calling when Caller Number Deliver is provided on the telephone line (Optional).

This information can also be displayed on the RACOM 2816s LCD display.

The 2816A has an optional RS232 data output. It also has an optional buffer which can hold up to 750 calls waiting to be sent out through the RS232 data output.

Once connected properly to a telephone line, the RACOM 2816 is fully automatic and requires a minimum amount of attention. The only normal operating maintenance required is changing the paper and inked ribbon.

SPECIFICATIONS

Configuration: Desk Top - Rack Mount
Size: 17.25" Wide x 5.25" High x 12.75" Deep
Weight: 23 lbs.
Power: 120 VAC 60 Hz 90 Watts
230 VAC 50 Hz 90 Watts (Option 5)
Number of Lines: 1 to 6
Memory Capacity: Up to 15 calls waiting to be printed
Data Output: Similar to RS232 and 750 call buffer (optional)
Temperature: 0 degrees to 60 degrees C

Basic Specifications:

Digit Capacity: 32

Telephone Line Input: Balanced and isolated from ground
DC line loading - 10M Ohm
AC line loading - 200K Ohm
idle line voltage - 24 VDC or greater

Telephone line type: loop or ground start

Rotary Dial: dial pulse rate - 8 P.P.S. to 22 P.P.S.
inter digit time - 300 mS
make/break ratio - 60%

Touch-Tone:* digit recognition - 40 mS (adjustable)
inter digit time - 30 mS
dropout time - 10 seconds standard
(adjustable)
sensitivity - 40 mV

Recorder Coupler Outputs: Audio and two relay contacts per line

Audio monitor: Miniature connector for headphone

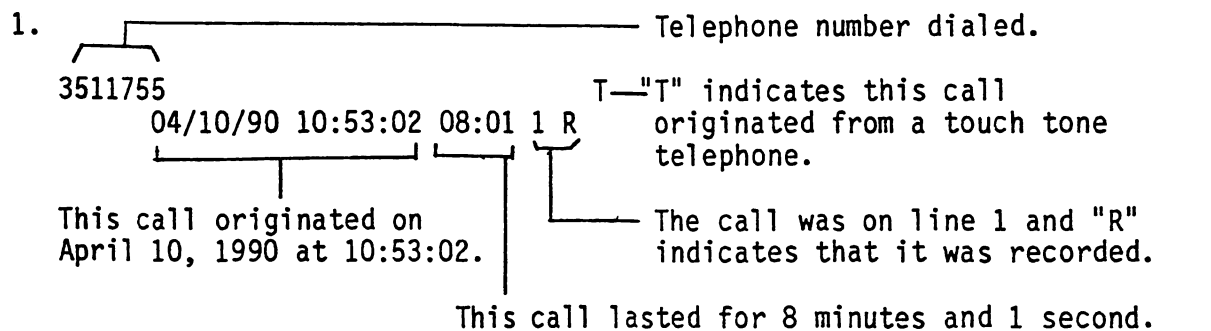
Remote receiver: Dual tone - 852Hz and 1633 Hz (Option L)

* Touch-Tone is a registered trade mark of A. T. & T.

OPERATION

After the unit is in place and the proper telephone line connections have been made, the printer is ready for normal operation. As each call is placed, you will notice the "line active" LED lights up for the line in use, indicating a call is in progress. While the RACOM 2816 registers all of the dialed information at the origination of the call, it does not print the data until the call has been terminated.

The following examples will describe four (4) common call transactions:

1. 

Telephone number dialed.

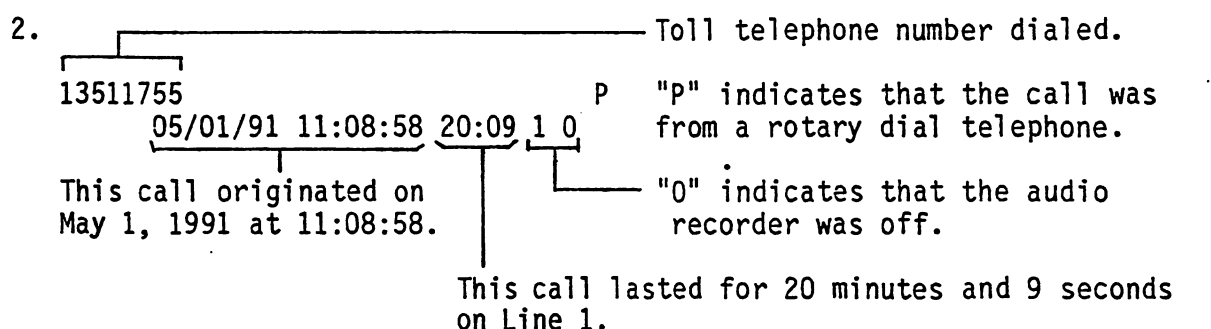
3511755

04/10/90 10:53:02 08:01 1 R

This call originated on April 10, 1990 at 10:53:02.

This call lasted for 8 minutes and 1 second.

The call was on line 1 and "R" indicates that it was recorded.

T—"T" indicates this call originated from a touch tone telephone.
2. 

Toll telephone number dialed.

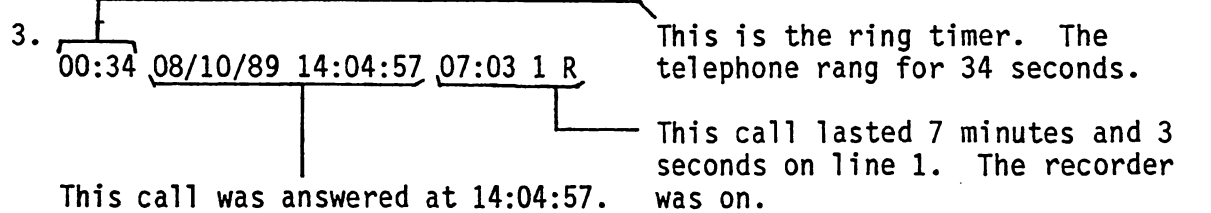
13511755

05/01/91 11:08:58 20:09 1 0

This call originated on May 1, 1991 at 11:08:58.

This call lasted for 20 minutes and 9 seconds on Line 1.

"P" indicates that the call was from a rotary dial telephone.

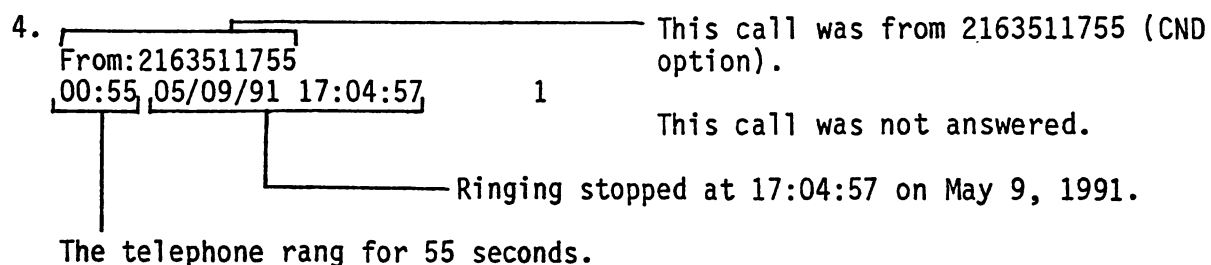
"0" indicates that the audio recorder was off.
3. 

This is the ring timer. The telephone rang for 34 seconds.

00:34

08/10/89 14:04:57 07:03 1 R

This call was answered at 14:04:57.

This call lasted 7 minutes and 3 seconds on line 1. The recorder was on.
4. 

This call was from 2163511755 (CND option).

From: 2163511755

00:55 05/09/91 17:04:57 1

The telephone rang for 55 seconds.

Ringing stopped at 17:04:57 on May 9, 1991.

This call was not answered.

- Note:
1. The RACOM 2816 will accept up to 32 digits. If more than 32 digits are entered, the first 32 digits are printed and the "+" will appear in the 33rd column of the print out.
 2. If the elapsed time of any call exceeds 99 minutes and 59 seconds, the seconds are replaced by an "M" to indicate that the time is in minutes. The elapsed time can then go up to 9999 minutes. It will stop advancing at 9999 minutes.

INSTALLATION

Once the unit is in place or rack mounted, the electrical connections to the rear terminals can be made. For convenience, a telephone instrument connected to the same line as the 2816A should be located nearby. The following connecting arrangement will satisfy the majority of installations of units having input format G.

Line Connections:

The RACOM 2816A Multi-line Dialed Digit Printer is capable of handling up to 6 lines. Each line is assigned a reference digit (1, 2, 3, 4, 5 or 6). All units have line 1. On the back of the unit, there are a number of terminal strips. There is one terminal strip for each line.

Electrical Connections:

1. Determine which terminal strip to use on the back of the 2816A. Then make the following connections to that terminal strip.
2. Connect Pin 5 to an earth ground unless the printer will be plugged into a 120 VAC grounded outlet. (3 wire)
3. The following hookup is a loop start telephone line (Residential or small business line). For other hookups see the section marked Telephone Line Loop Type.
4. Connect the green side (Tip) of the telephone line to terminals 1 and 2.
5. Connect the red side (Ring) of the telephone line to terminals 3 and 4.
6. Plug the 2816A into a standard 120 VAC outlet.
7. Depress On/Off Button to make the printer go on-line.
8. Refer to instructions describing how to set the electronic clock if the time or date is wrong.
9. Lift the handset from a telephone which is connected to the same telephone line as the printer. The "line active" LED should light for that line.
10. Replace the telephone handset and the printer should print the length of time the telephone was off the hook, the day of the month, the time of day and the line number. This information will be printed on all incoming calls.
11. Pick up the handset again and dial a number familiar to you. Wait a few seconds and replace the handset. This time, you will see two (2) lines printed. The first line is the number you dialed and the second is the time related information explained in the previous step. Also notice the letter printed at the end of the dialed number line. A "T" represents a number dialed from a touch-tone phone and a "P" indicates a number dialed from a rotary dial phone.
12. The printer unit is now ready to be placed in service.

FRONT PANEL SWITCHES AND INDICATORS

LCD DISPLAY

The RACOM 2816A has a built-in LCD display. This display gives status of lines and of the unit. It also displays the date and time and is used to set up the unit.

When in the command or system mode, selected by hitting the 0 key, the display will indicate that the unit is on-line. It will display the current date and time and it will give the status of each line. A status of Ac indicates that the line is active. Rg indicates that the line is ringing and two dashes indicates that the line is idle or not used.

The line display may be selected by pressing the digit for the line, 1 to 6. This will display detailed information about the telephone line. It can display the information as the RACOM 2816A is receiving it and before it is printed out. It will also indicate the present status of the line.

When the unit is off line, the display will show when the unit went off line.

During setup, the display is a menu and may be used to edit the unit's operational parameters.

LEDs

There are two LEDs for each line. Here we are discussing line 1. The other lines operate in the same manner with their appropriate LEDs.

Pulse LED:

The "pulse" LED indicates if the line voltage is above or below the printer's threshold voltage. With normal ringing mode operation, this LED is illuminated when the line voltage is low (off hook) and off when the line voltage is high (on hook).

When the phone generates rotary dial pulse, this indicator should flash in sequence with the dial pulses. If it does not, then R463 may need adjustment.

Line Active LED:

The "line active" LED indicates an "off-hook" or line active condition. This LED marks the start and finish of each time call. The instant the "line active" LED is illuminated, the time indicated in the clock is stored in the time register. The elapsed time counter and dial input register are then enabled. When the LED extinguishes, the information in both registers is printed. The relay is energized when this LED is illuminated.

KEYBOARD

The RACOM 2816A has a sixteen button keyboard located on the faceplate. This keyboard is used to control and set up the unit. When a key is pressed, the two LEDs will initiate a flash as each key is recognized. During normal operation, the keyboard primarily controls the LCD display and the keys function as follows:

Numbered Key "0"

Pressing the 0 key will cause the LCD to go to the system display and the system commands may be entered.

Numbered Key "1 to 6"

The digits 1 to 6 are used to select the telephone line that the LCD will display detailed information about. The LCD display will display information as the RACOM 2816A is receiving it and before it is printed out. It will also indicate the present status of the line. The recorders may be toggled on and off while the 2816A is displaying line information.

Numbered Key "9"

The 9 key is used to control if the 2816A is holding or sending RS232 data (Option 4). See the Option 4 (Data Output) section.

Paper Advance Key "A"

Pressing the "A" key will cause the paper to advance.

On/Off Line Key "B"

When the LCD is in the system display mode the "B" key is used to take the RACOM 2816A on and off line. The display and printout will indicate when this happens. When the RACOM 2816A is off line, information will not be accumulated and all data in the unit will be cleared.

When the LCD is displaying line information the "B" key will toggle the recorder and audio monitor on and off. The printer will print the status of the recorder and the LCD display will show the status. See the section on audio recording.

Clear Key "C"

Pressing the "C" key will clear an incomplete command key sequence.

Display Key "D"

Pressing the "D" key will cause the printer to print out the contents of the LCD display.

Enter Key "E"

Pressing the E key will make the printer print out column headings.

Function Key "F"

This key is used to select any of the special keyboard operations that are listed below. To activate the operation, press the function key "F" and then the key "D" or "E" for the desired operation.

Clock Set - Function Key "F" and Key "E" - By pressing first key "F" and then key "E", the RACOM 2816As clock set routing is accessed. Please see the section on setting the electronic clock for more information.

Set-Up - Function Key "F" and Key "D" - This combination is used to enter the RACOM 2816As set-up program. Please see the section on set-up for more information.

SETTING THE ELECTRONIC CLOCK

The electronic clock is a calendar clock which will automatically compensate for the months having 28, 30 or 31 days. The clock has a battery backup so it will continue to hold the correct time when the RACOM 2816A is without power.

1. To enter the clock set mode, hit the F key and then the E key on the keyboard.
2. The LCD display will now display the message "Date and 24hr time". The date and time will be displayed on the second LCD display line.
3. Please note that the date is displayed as month/day/year and the time is in 24 hour format.
4. On the display, there is a flashing cursor. This can be moved left and right with the A and B keys. It is automatically moved to the right as each digit is entered.
5. Enter the date and time by typing the new date and time on the keyboard.
6. You may cancel this clock setting routine by hitting the C key.
7. Hit the E key to have the internal clock set to the date and time shown on the display.

RECORDING AND AUDIO MONITORING

The Racom 2816A has a 1/8th inch audio monitor jack on the front panel and connections for cassette recorders on the back panel. The 2816A's printout indicates what calls (or parts of calls) are recorded. The recorder and audio circuits are toggled on and off automatically with telephone usage or they may be controlled manually from the keyboard.

To turn the audio and recorder on and off, put the LCD display in the line display mode by pressing the digit (1 to 6) for the desired line. The recorder and the audio monitor may now be toggled with the "B" key. When it is toggled, an "R" or an "O" will appear on the LCD. "R" indicates that the unit will record and "O" indicates that the recorder is off. The audio monitor jack is also switched between lines with the 1 to 6 keys on the key board.

When the line being monitored is in use (active), toggling the recorder will cause a printout to occur. The right side of the paper shows two letters (R or O), the first letter (to the left) shows recorder status before the change and the second letter (closest to the edge) shows the new status.

When the telephone is hung up, only one letter is printed. This shows the record's status at the end of the call.

When the telephone is on-hook, the recorder is always off. However, what the recorder does when the telephone goes off-hook may be changed with the "B" key and is controlled by a variable called "Rec". See the software set section for more information on this.

On the back of the 2816A, each line has its own connections for cassette recorders. Cassette recorders may be connected to a line as follows:

1. Select the line the recorder is to be connected to and determine which terminal strip is for that line. Then make the following connection to that terminal strip.
2. Each line has two normal open relay contacts, marked Relay 1 and Relay 2 as shown on the Rear Terminal page.
3. Each relay contact may have the jack marked "REMOTE" of two identical cassette recorders connected across it. Connect the leads from the recorder's remote stop/start plug between terminals 8 and 9 or between terminals 10 and 11.
4. Terminal 6 is the audio and connects to the center pin of the aux. or mic. connectors of all the cassette recorders on a line.
5. Terminal 7 is the audio ground for these cassette recorders and connects to the shield of the aux. or mic. connectors.

The audio level going to the recorder is adjusted by R436 on each line. If the output level is not satisfactory, determine which line card is being used and adjust R436 on that card.

CALLER NUMBER DELIVERY (CND) Optional

With this option, the 2816A will print out the telephone number of the calling party, for incoming calls, when the telephone company provides CND service. The 2816P will print out the word "From" and then the phone number to indicate the telephone number that is calling. The words "Privacy" and "Out of area" are also printed out as the telephone company sends them.

OPENING THE FRONT PANEL

If it becomes necessary to gain access to the inside of the unit, it can be done by swinging open the front panel as described below. (The front panel has a thumb screw on the left end and a hinge on the right end.)

1. Remove the thumb screw at the left end of the front panel.
2. Then carefully swing the front panel to the right.
3. Notice how wires are dressed so that they may be the same when the panel is closed.

CLOSING THE FRONT PANEL

1. Be sure the ribbon cables are dressed neatly and flatly behind the front panel. Make sure they are not hanging out.
2. Be sure the switches and displays on the front will clear the wiring and circuit boards.
3. Carefully close the panel.
4. Lift the left end of the front panel so that the screw hole is aligned and install the thumb screw.

Caution: There are a number of wires and switches on the front panel. Do not force the front panel or damage may result. The panel should swing freely.

INKED RIBBON REPLACEMENT

The inked ribbon cartridge located on the front of the printing unit should be replaced approximately every four (4) rolls of paper, every six (6) months or whenever the printed numbers become difficult to read.

1. See section on opening the front panel.
2. Before removing the old ribbon, study the way it is installed in the printer.
3. Remove the old ribbon cartridge by pulling out on the tab marked "Lift".
4. Push the new ribbon straight back into the printer mechanism until it snaps into place. Be sure the ribbon is above the paper. Use the knob to remove any slack from the ribbon.
5. See section on closing the front panel.

PAPER TAPE REPLACEMENT

The RACOM 2816A uses 3 inch wide adding machine tape which is available in most office supply stores.

1. See section on opening the front panel.
2. Remove the expended roll of paper; grasp the empty roll firmly, but carefully, and pull out.
3. Remove the old tube from the paper spindle and discard.
4. Slide new paper roll over the spindle. Thread the new roll into the rear of the printer and under the printer circuit board. Be certain the paper rolls from the bottom of the roll through to the front of the printer unit.
5. After the paper has been passed through the unit, replace paper roll and spindle into the spindle clips.
6. Cut the end of the paper straight and free of folds with a pair of scissors.
7. While depressing the paper advance button (the A key), push the paper into the slot at the bottom of the printer mechanism. The paper will be automatically threaded through the unit and out the front. Be certain the paper is threaded under the ribbon.
8. See section on closing the front panel.

TELEPHONE LINE LOOP TYPE

In the 2816A each line operates independently and may be configured to operate with loop start or ground start telephone lines. Each line, in the 2816A, has its own terminal strip and telephone line connections on the rear panel.

Most residential and small business telephone lines are loop start lines. The 2816A is configured for this type of line when it is shipped. To connect to a loop start telephone line please connect the 2816A as follows:

1. Connect one side of the telephone line (Usually the green wire or tip) to terminal 2. Polarity does not matter with this hook up.
2. Connect the other side of the telephone line (Usually the red wire or ring) to terminal 4.
3. Place a jumper between terminals 1 and 2.
4. Place another jumper between terminals 3 and 4.
5. Located in the 2816A on the circuit board, for the line that connections are to be made to, are two bare wire jumpers that connect terminal 1 to terminal 2 and terminal 3 to terminal 4. These jumpers are just above the relay (K401). If these jumpers have not been cut, then steps 3 and 4 may be skipped.
6. See the section on Off Hook Threshold Adjustment.

The ground start telephone line is another type of line. Many PBX and pay phone lines are of this type. For this type of line, please follow these steps:

1. Connect the Tip side of the telephone line (Green wire) to terminal 1.
2. Connect the Ring side of the telephone line (Red wire) to terminal 3.
3. Place a jumper between terminals 3 and 4.
4. Place another between terminal 2 to ground (Terminal 5).
5. Located in the 2816A, on the circuit board for the line to which connections are to be made, are two bare wire jumpers that connect terminal 1 to terminal 2 and terminal 3 to terminal 4. These jumpers are just above the relay (K401). These jumpers must be cut.
6. See the section on Off Hook Threshold Adjustment.

OFF HOOK THRESHOLD ADJUSTMENT (R463)

Each line of the RACOM 2816 has a D. C. line voltage detector circuit. This circuit detects if the telephone is on or off the hook and decodes rotary dial pulses. The telephone line voltage which causes the RACOM 2816 to recognize an off or on hook condition is called the threshold voltage.

The threshold voltage is set by Pot R463 and monitored by the "Pulse" LED. There is one R463 per line as there is one "Pulse" LED per line. Once the R463 and the "Pulse" LED for a particular line have been located, they may be adjusted as follows:

With normal bridging mode operation, this LED is illuminated when the line voltage is low and off when the line voltage is high.

R463 should be adjusted so that this LED is illuminated when the phone is off the hook and off when the phone is on the hook.

When the phone generates rotary dial pulse, this indicator should flash in sequence with the dial pulses. If it does not, then touch up the adjustment of R463.

Note: Some exchanges may generate pulses on the line before or after rotary dial sequences. These will usually make this indicator LED flash. If this happens, R463 and the dial pulse rate switch may be used to make the 2816A reject these pulses.

LOOP EXTENDER RECEIVER OPTIONAL

The Racom 2816A has a receiver for a remote loop extender. This allows the 2816A to receive signals from a remote dual tone loop extender or slave, such as the RACOM Model LP2816. The tone frequencies are 852 Hz and 1633 Hz. To enable the receiver on a particular line, place sections 1 and 2 of switch SW401 on that line's circuit board in position A (Closed). The line from the slave should be connected to the 2816A as a loop start line.

To return the 2816's line to the line voltage controlled bridging mode, put section 2 of switch SW401 in position B (Off or open).

SECTION TWO

This section deals with the RACOM 2816 from a more technical viewpoint than section one. Internal adjustments or modifications should be made only by technically qualified personnel.

CONFIGURATION

Before the RACOM 2816 is shipped, we carefully check out all functions. We configure the unit so it will work on most phone lines without reconfiguration. The RACOM 2816 is very versatile and it has many uses. This section deals with the configuration and setup of the RACOM 2816 to make it do particular things. The RACOM 2816 is configured in two ways. The first being with internal switches and the second being with the setup of software parameters.

INTERNAL SWITCHES AND CONTROLS

ACCESS TO INTERNAL SWITCHES AND CONTROLS

The internal switches and controls discussed in this section are located behind the front panel. Access to these internal switches and controls can be gained by opening the front panel.

Most switches have two positions - A or B. The Position B is when the switch is open or off and Position A is when the switch is closed or on.

DOUBLE OR SINGLE SPACE

The RACOM 2816 can either double space or single space between call transactions. Double spacing provides a clear separation between calls for transcribing.

Section 7 of switch SW103 controls this feature.

SW103	Section 7	Pos. A - Single space
		Pos. B - Double space

TOUCH TONE AND DIAL PULSE EXCLUSION

All units are equipped with a feature that will shut down either the touch tone or rotary dial pulse decoders after the first digit of a number is decoded. If the digit is a touch tone digit, the rotary dial pulse decoder will be shut down. If the digit is pulsed, then the touch tone decoder will be shut down. This feature helps reduce falsing. SW103, Section 6 controls this feature.

SW103 Section 6 Pos. A - No exclusion

Pos. B - Exclusion feature is enabled as described above.

PRINT LAST ROTARY DIALED DIGIT

Normally, a rotary dialed digit is entered into the RACOM 2816s memory after a valid amount of inter-digit time has elapsed. In some specialized applications, line current is reversed or removed before the inter-digit time has elapsed. So that the last digit is not lost in these applications, place SW103, Section 2 in Position A. Doing this will also result in the RACOM 2816 registering touch tone or rotary dialed digits that are received before line active time has been exceeded.

SW103 Section 2 Pos. A - Print first/last rotary dialed digit if it was not finished.

Pos. B - Normal

TOUCH TONE ACCEPTANCE OR DROPOUT TIME

Touch tone acceptance is the time in which touch tone digits are accepted by the printer. The acceptance time begins when the line active LED lights and resets each time a touch tone digit is entered. After the acceptance time is exceeded, no more touch tone digits will be accepted until after the system has been restored to an "on-hook" condition. This feature is designed to prevent "falsing" caused by frequencies contained in speech.

The length of time is set by setting the variable "T Tone" to the desired time. Set "T Tone" to 255 for infinite touch tone acceptance time.

ROTARY DIAL PULSES TIMEOUT

Thirty seconds after a call has been started, the rotary dial pulse decoder for a line will be shut down. This is called rotary dial pulse timeout and it is controlled by the variable "Pulse". To illuminate rotary dial pulse timeout, set the variable "Pulse" to 255.

DIAL PULSE RATE SWITCH

For each line in a RACOM 2816, there is a Dial Pulse Rate Switch. This switch selects the maximum dial pulse rate to be decoded by the RACOM 2816. This is Section 1 of Switch 401 on the line board. With the switch in position A, the maximum dial rate is 13 P.P.S. With the switch in position B, the maximum dial rate is 21 P.P.S.

INPUT INVERT SWITCH

Each line in a RACOM 2816 has a switch that inverts the signal from the D.C. line threshold detector. For normal operation, the switch for a particular line should be in position B. Put the switch in position A to invert the input. This switch is Section 4 of Switch 401 on the line board.

VOLTAGE CONTROLLED OPERATION

Usually, the 2816 will be operating so that the voltage across the telephone line controls if the line is considered off hook by the 2816. This means that the RACOM 2816's high impedance inputs are connected across the telephone line and measure the D.C. voltage across the line. With this hook up, the 2816 is said to be bridging the telephone line.

The 2816 has separate A.C. and D.C. inputs for each line. Normally, for each loop start line, these A.C. and D.C. inputs will both be connected across the telephone line for that line.

For voltage controlled operation, these internal switches should be set as follows on the appropriate line boards:

SW401	Section 4	Position B
SW401	Section 2	Position B

R463 should be set as described in the "Threshold Adjustment Section". The setting of other switches will also affect operation and are outlined in other parts of this manual.

SOFTWARE SETUP

Many of the operating parameters for the RACOM 2816 are contained in the software. These parameters, or variables, are factory preset and stored in a memory chip called an EPROM. However, some parameters may be changed to suit user requirements. These parameters are user programmable and are stored in a non-volatile memory chip called a NOVRAM. The working memory of the RACOM 2816 is in the CPU chip. Upon power up or reset, and approximately every two hours, the CPU selects the operational parameters from either the EPROM or the NOVRAM, depending on Switch 103 Section One (See Microprocessor Board section).

To make the parameter changes, the user must enter the software setup mode. The software setup mode is entered by hitting the F key and then the D key on the keyboard. Now the display will give a choice of several options. Please enter the digit shown for the option you want. These options are as follows:

KEY	OPTION	FUNCTION
---	-----	-----
1	Timers	Programs a number of timers that are in seconds.
2	Counters	Digit counter for each line.
3	Timing	Pulse timing that controls the pulse counting section of the RACOM 2816.
5	EPROM	This command is not shown on the display. Pushing it will result in all variables being reset to their initial values from the EPROM.
6	Recall	All variables will be reloaded from the NOVRAM.
E	Enter	This button must be pressed to enter data into the working memory of the CPU. This may be done as soon as the user completes the changes.
7	Save	All variables will be saved in the NOVRAM. This will flash if they need to be saved.
8	Reset	Push this to do a reset of the CPU in the RACOM 2816.
0	Exit	Push to exit the setup mode.

TIMERS

Enter a 1 to access the timers. These timers are all in seconds.

VARIABLE	DESCRIPTION
Ring	This is a maximum period that the RACOM 2816 will wait for the next ring burst.
TTone	The elapsed time at which the touch tone decoder will be disabled. It is reset with each touch tone digit. Set this to 255 if constant operation is desired.
Pulse	The elapsed time at which the dial pulse decoder will be disabled. It is reset with each pulse. Set this to 255 so it will never be disabled.
TBase	The period used for time base operation.
Unit	This is the unit identifying character that the 2816 transmits, in position 4, of its RS232 output. It is converted to an ASCII character.
Rec	Controls what the Audio monitor and recorder does when a telephone line goes off hook. Codes are as follows:
Value	Relay and audio
0	Always off.
1	As set from the "B" key on the keyboard.
2	Defaults to off, may be changed with "B" key.
3	Defaults to on, may be changed with "B" key.

COUNTERS

Enter a 2 to access the various counters.

VARIABLE	DESCRIPTION
D1	This is the minimum number of digits that must be received before line one will print call information. Setting this variable to zero will result in all calls being printed. If you want long distance calls printed, set it to 8.
D2	Same as above except for line 2.
D3 - D6	Same as above except for lines 3 to 6.

TIMING

Enter a 3 to access the pulse timing variables. These timers are all in seconds.

VARIABLE	DESCRIPTION
Active	This is the period from when the Pulse LED comes on to when the line active LED goes on and the call is recognized. This timer increments at a 3.33 millisecond rate.
Idle	This is the period from when the Pulse LED goes out to when the line active LED goes out and the call is considered complete. This timer increments at a 10 millisecond rate.
In Dig	This is the inter-digit interval between dial pulse digits. This increments at a 10 millisecond rate.
MK/BK	This stands for Make/Break and is used to filter spikes and contact bounce out of the pulse decoder. Racom recommends that this be set between 20 and 70. Lower settings should be used with faster dial rates.

INTERNAL CONTROLS SUMMARY

Microprocessor Board

Located inside the RACOM 2816 are two switches and a control on the microprocessor board which selects the various operating characteristics of the RACOM 2816. One of these switches is a sixteen position rotary switch (Ref: SW102) and the other is an eight section DIP switch (Ref: SW103). Switches are in the "open or off" condition when placed in Position B. They are in the "closed or on" condition when placed in Position A.

SWITCH	POSITION	FUNCTION
SW102	0 - F	16 Position Rotary Switch This switch must be set to the number of line cards in the unit (1 to 6).
SW103-1	A	Recalls the 32 bytes of setup from the NOVRAM each update period (user programmable)
	B	Recalls the 32 bytes of setup from the EPROM each update period (factory programmed)
SW103-2	A	Prints first/last rotary dialed digit if it was not finished.
	B	Normal
SW103-3		Keep in Position B
SW103-4	A	RS232 data output is enabled.
	B	RS232 data output is off. Keep in position B if the this option is not present.
SW103-5	A	Internal printer is off
	B	Printer is enabled
SW103-6	A	No exclusion.
	B	Touch tone and rotary dial pulse will exclude each other.
SW103-7	A	Single spaced.
	B	Double spaced.
SW103-8		Keep in Position B.
SW105-1	A	These control the interrupt clock rate of the CPU. They should always be closed.
SW105-2	A	
R129		This potentiometer controls the contrast of the LCD display.

LINE BOARDS

On each line board, there is an eight section switch and several controls. These determine the characteristics of the line.

SWITCH	POSITION	FUNCTION
SW401-1	A B	Slow pulse decoding only Fast and slow pulse decoding
Note: Keep in position B if SW401-2 is in position B.		
SW401-2	A B	Remote loop extender mode The line is controlled by tones. Bridging mode - The line is controlled by the DC voltage between tip and ring.
Note: On 2816Ps, the panel mounted MODE SWITCH parallels this switch. Keep this switch in position B.		
SW401-3	A B	Touch tone and audio AGC is disabled AGC is enabled
SW401-4	A B	DC input inverted DC input normal
SW401-5		Keep in Position B
SW401-6		Keep in Position B
SW401-7		Keep in Position B
SW401-8		Keep in Position B

CONTROLS	FUNCTION
R436	Auxiliary audio output level adjustment. Fully clockwise for maximum level.
R463	On-hook/off-hook threshold voltage.
R461	Ring detector sensitivity.

JUMPER	FUNCTION
JP401	Upper position for circuit boards in board positions 1, 3 or 5. Lower position when the circuit board is in board position 2, 4 or 6.

REAR TERMINAL CONNECTIONS for the 2816A
(Back panel terminals as viewed looking at the rear of the unit)

Line 6 connections	Line 5 connections	Line 4 connections	Line 3 connections	Line 2 connections	Line 1 connections
TB 6	TB 5	TB 4	TB 3	TB 2	TB 1
11 \ Relay 2 N.O.	11 \ Relay 2 N.O.	11 \ Relay 2 N.O.	11 \ Relay 2 N.O.	11 \ Relay 2 N.O.	11 \ Relay 2 N.O.
10 /	10 /	10 /	10 /	10 /	10 /
9 \ Relay 1 N.O.	9 \ Relay 1 N.O.	9 \ Relay 1 N.O.	9 \ Relay 1 N.O.	9 \ Relay 1 N.O.	9 \ Relay 1 N.O.
8 /	8 /	8 /	8 /	8 /	8 /
7 Audio ground	7 Audio ground	7 Audio ground	7 Audio ground	7 Audio ground	7 Audio ground
6 Audio output	6 Audio output	6 Audio output	6 Audio output	6 Audio output	6 Audio output
5 Ground	5 Ground	5 Ground	5 Ground	5 Ground	5 Ground
4 Ring (DC input)	4 Ring (DC input)	4 Ring (DC input)	4 Ring (DC input)	4 Ring (DC input)	4 Ring (DC input)
3 Ring (AC input)	3 Ring (AC input)	3 Ring (AC input)	3 Ring (AC input)	3 Ring (AC input)	3 Ring (AC input)
2 Tip (DC input)	2 Tip (DC input)	2 Tip (DC input)	2 Tip (DC input)	2 Tip (DC input)	2 Tip (DC input)
1 Tip (AC input)	1 Tip (AC input)	1 Tip (AC input)	1 Tip (AC input)	1 Tip (AC input)	1 Tip (AC input)

Each line has its own terminal strip and connections for its telephone line and recorders as shown above.

To connect to a loop start telephone line (Residential or small business line) do the following:

- Connect the green wire (Tip) to terminals* 1 and 2.
- Connect the red wire (Ring) to terminals* 3 and 4.

A ground start telephone line (PBX line) connects as follows:

- Connect the green wire (Tip) to terminal 1.
- Connect the red wire (Ring) to terminals 3 and 4.
- Connect terminal 2 to ground.
- Cut the jumpers on the line board that connect terminal 1 to 2 and terminal 3 to 4.

Cassette recorders may be connected as follows:

Each line has two normal open relay contacts, marked Relay 1 and Relay 2 above.

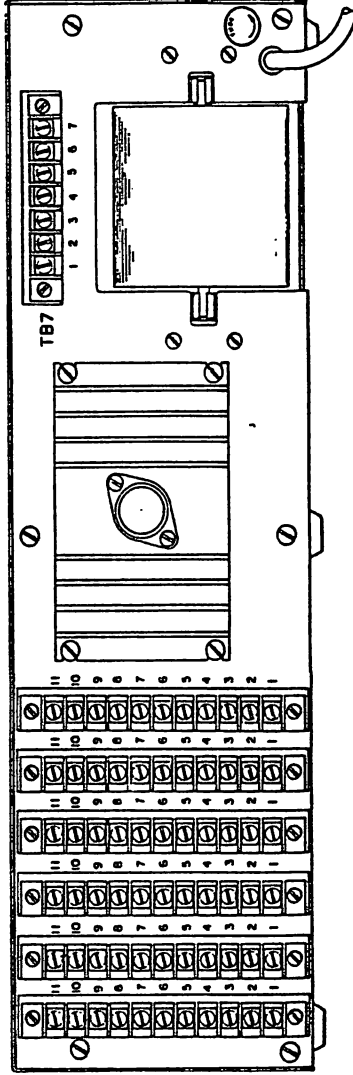
Each relay contact may have the jack marked "REMOTE" of two identical cassette recorders connected across it.

Terminal 6 is the audio for the aux. or mic. input of all the cassette recorders for a line. Terminal 7 is the audio ground for these cassette recorders.

* NOTE: There may be jumpers on the line boards connecting terminal 1 to 2 and terminal 3 to 4.

TABLE TWO

TB6 TB5 TB4 TB3 TB2 TB1



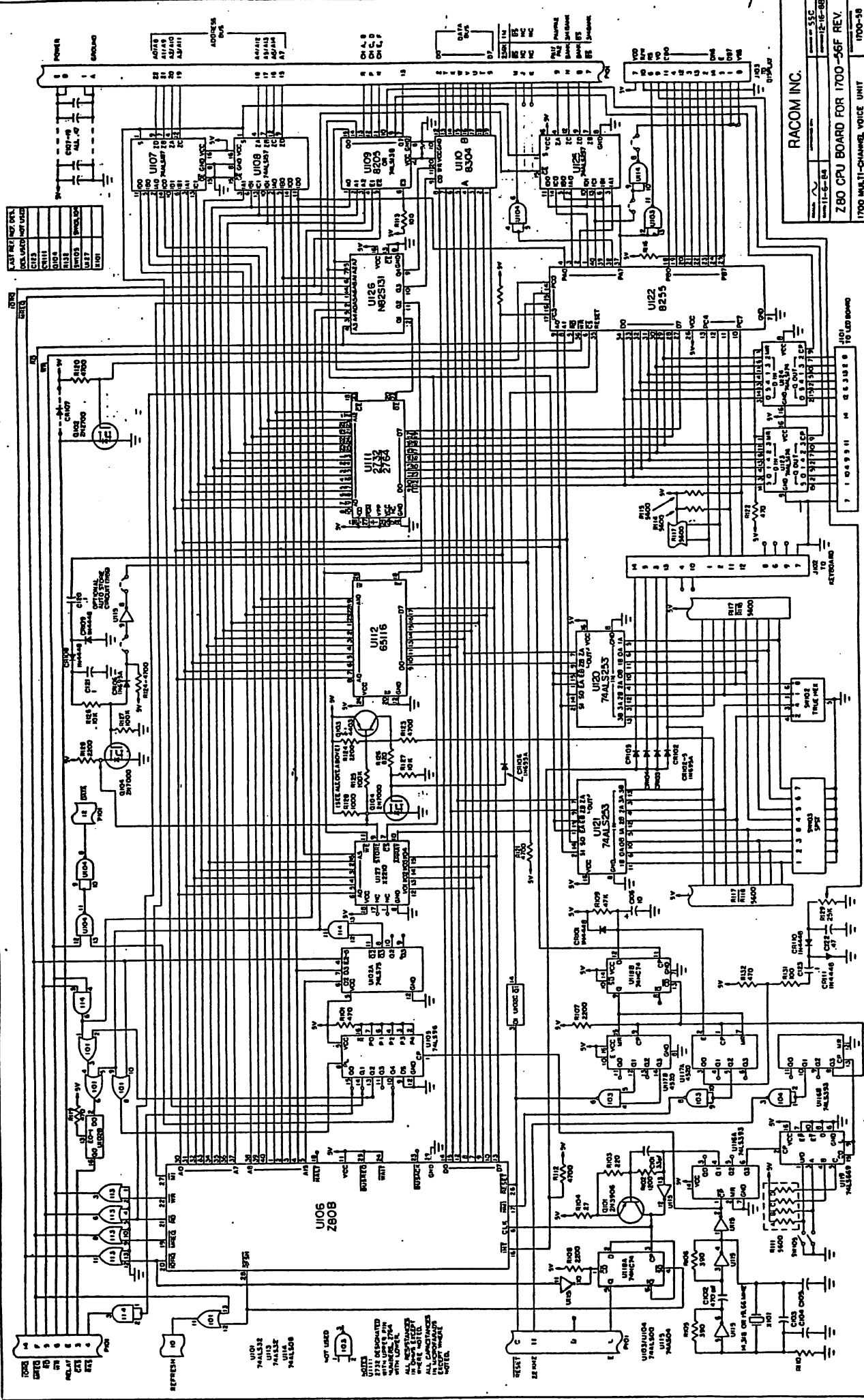
RACOM INC.

Model 2812-13

REAR VIEW

2812 DIALED DIGIT PRINTER

2812-13



RACOM INC.
1700 MULTI-CHANNEL VOICE UNIT
1700-19

Z80 CPU BOARD FOR 1700-56F REV.
12-16-88

1700-56F

1700-56F

1700-56F

1700-56F

1700-56F

1700-56F

1700-56F

1700-56F

1700-56F

1700-56F

1700-56F

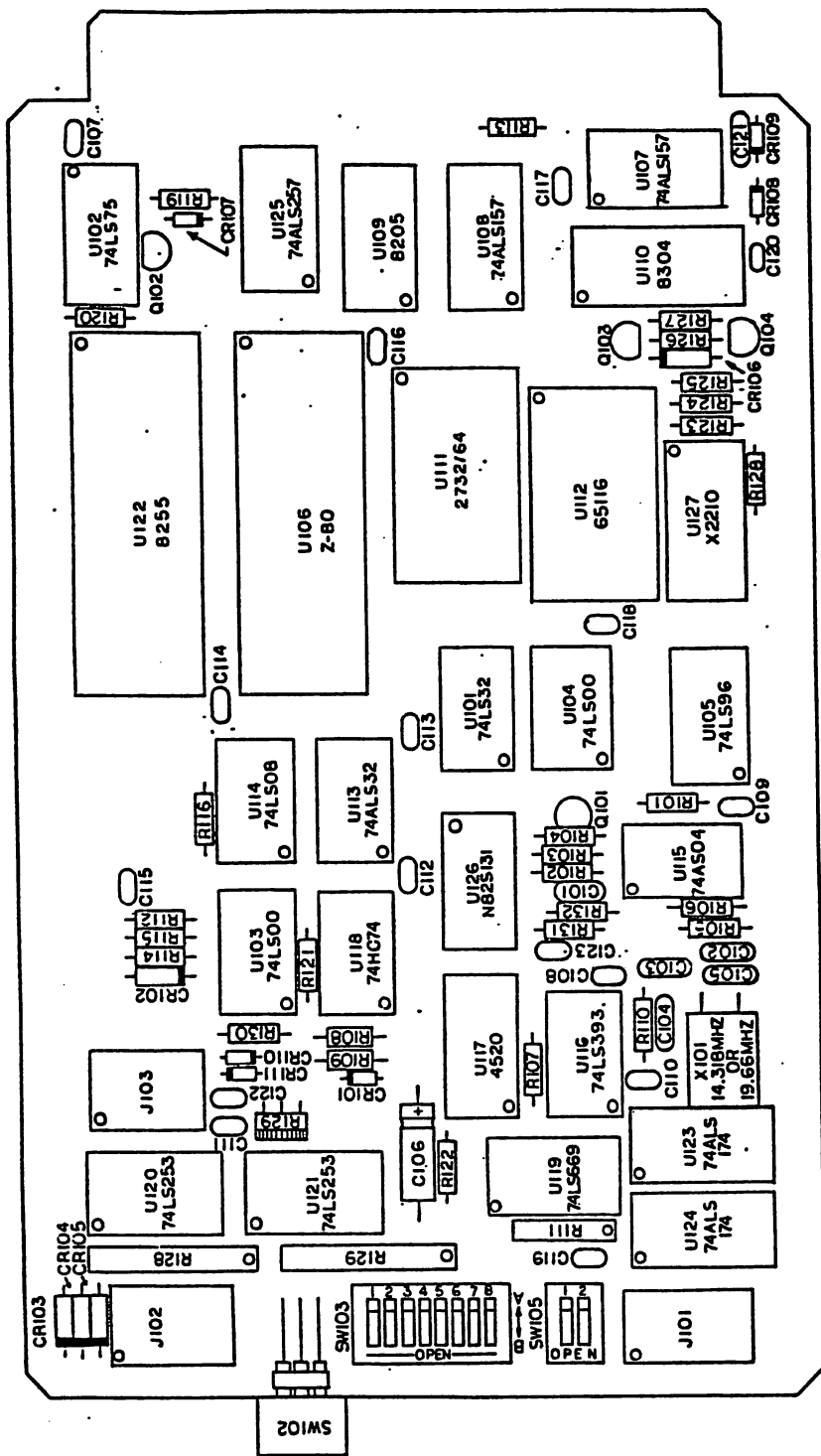
1700-56F

1700-56F

1700-56F

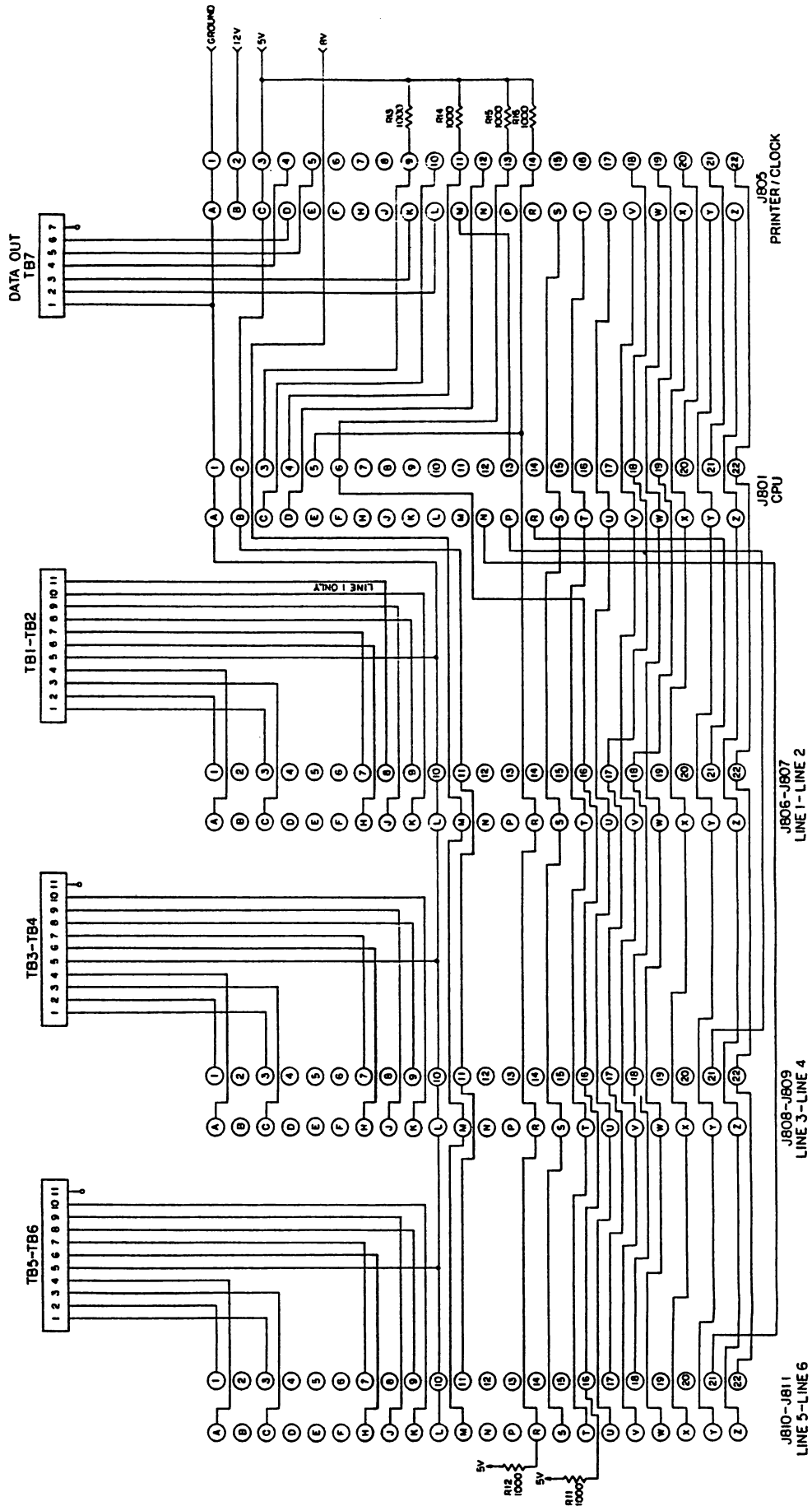
1700-56F

1700-56F

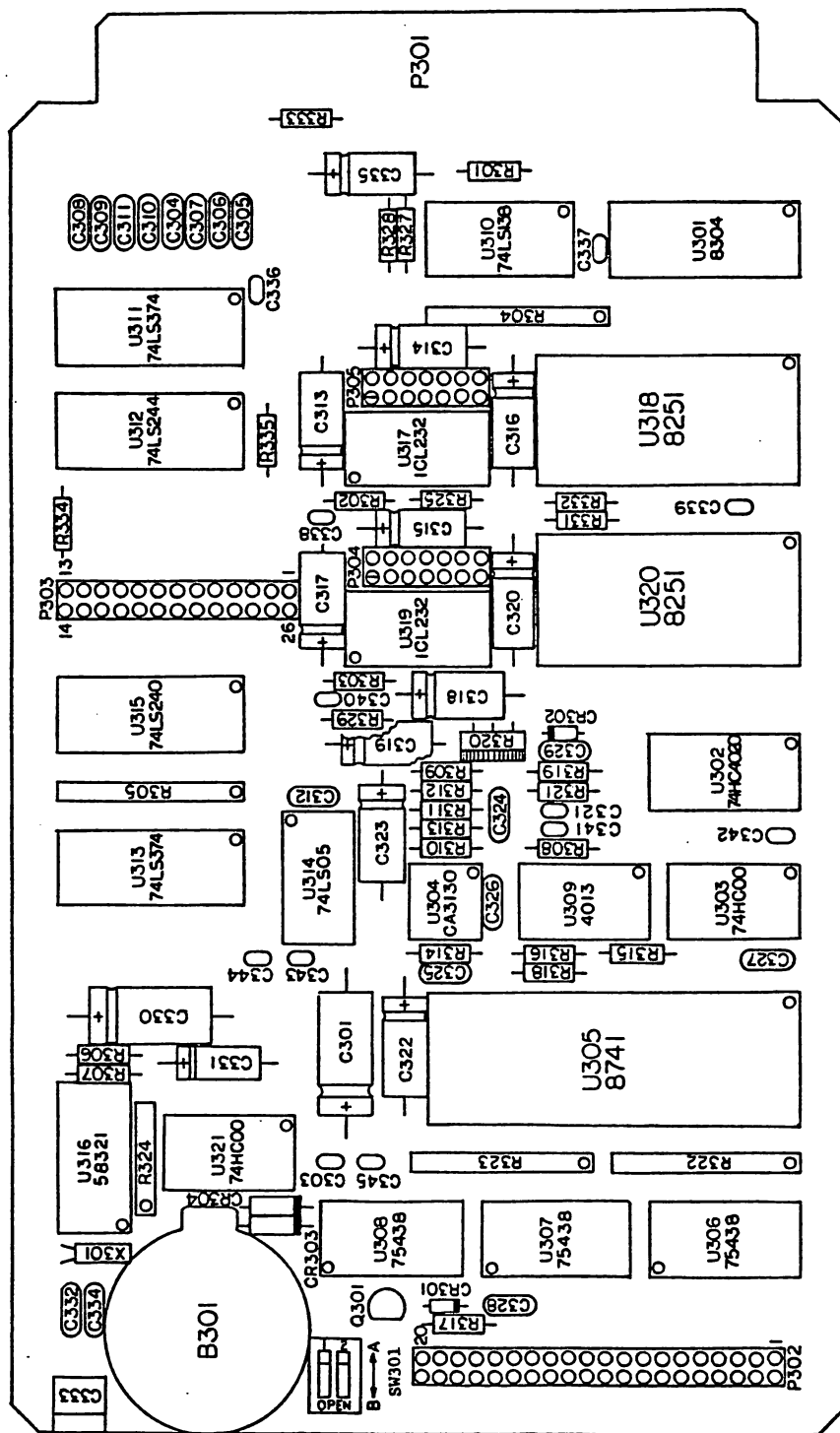


RACOM INC.

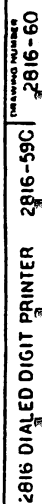
SCALE: 2:1	DESIGNED BY JDS
DATE: 10-8-81	REVISED 12-16-88
CPU COMPONENT LAYOUT FOR 1700-56F	
1700 MULTI CHANNEL VOICE UNIT	
1700-55	

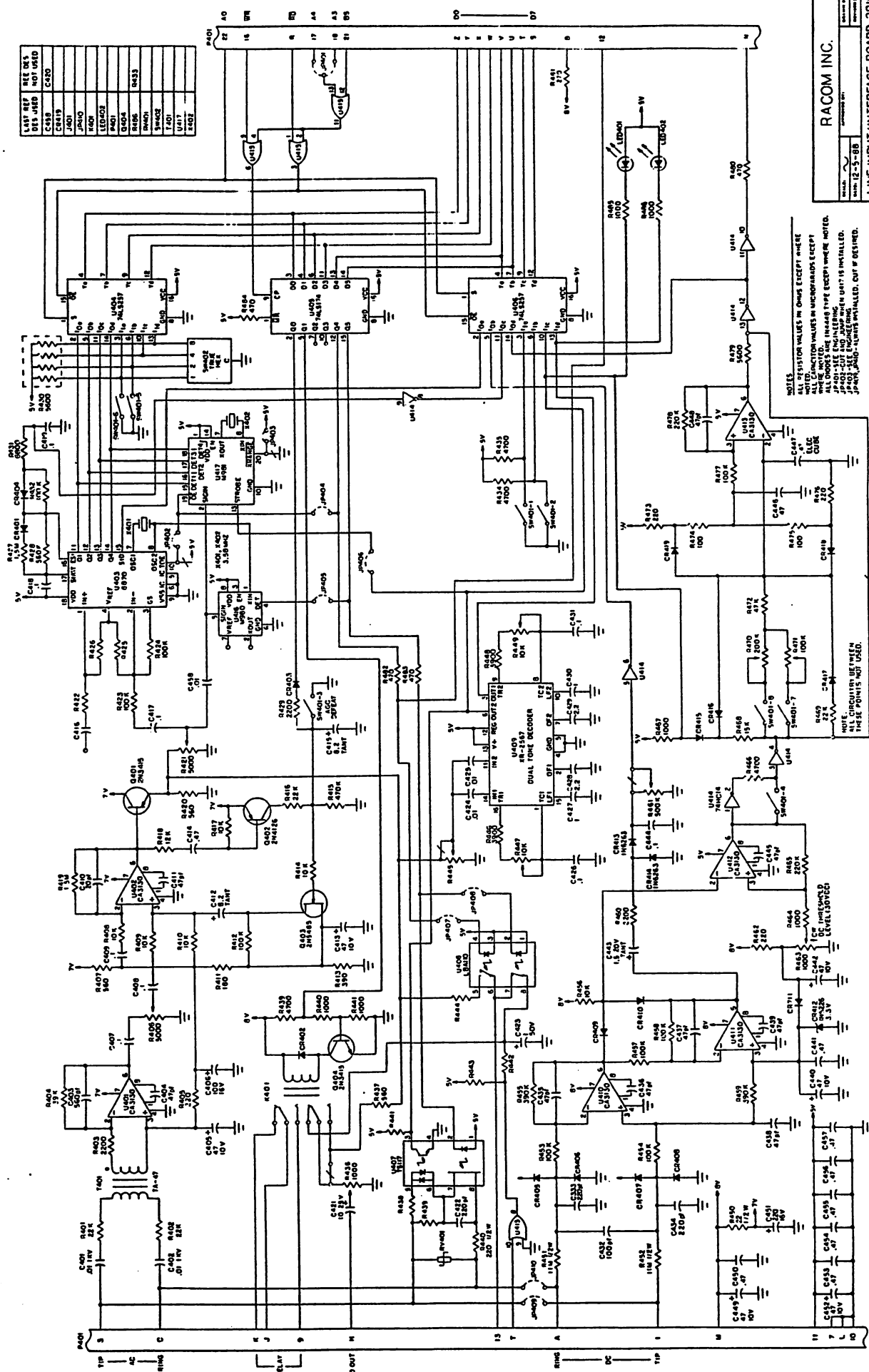


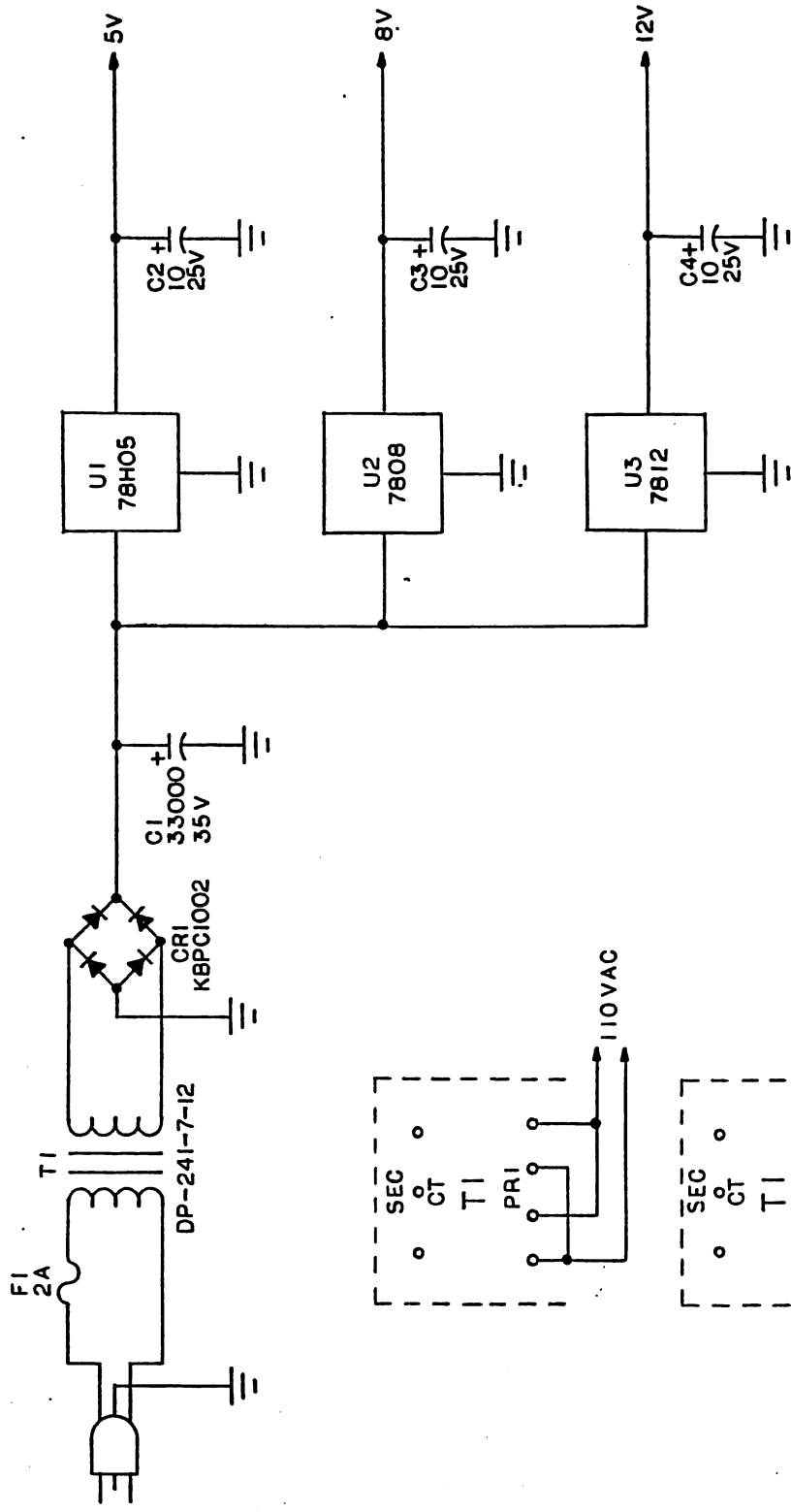
RACOM INC.	
Model 2816	Serial 55C
Rev. 7-23-90	
WIRING DIAGRAM FOR THE SERIES 2816	
2816 DIALED DIGIT PRINTER	2816-69



RACOM INC.	
SCALE: 2:1	APPROVED BY: SSC
DATE: 11-16-89	REVISED: 2-11-89
PRINTER/DISPLAY COMPONENT LAYOUT	
2816 DIALED DIGIT PRINTER 2816-53C	
DRAWING NUMBER 2816-51	

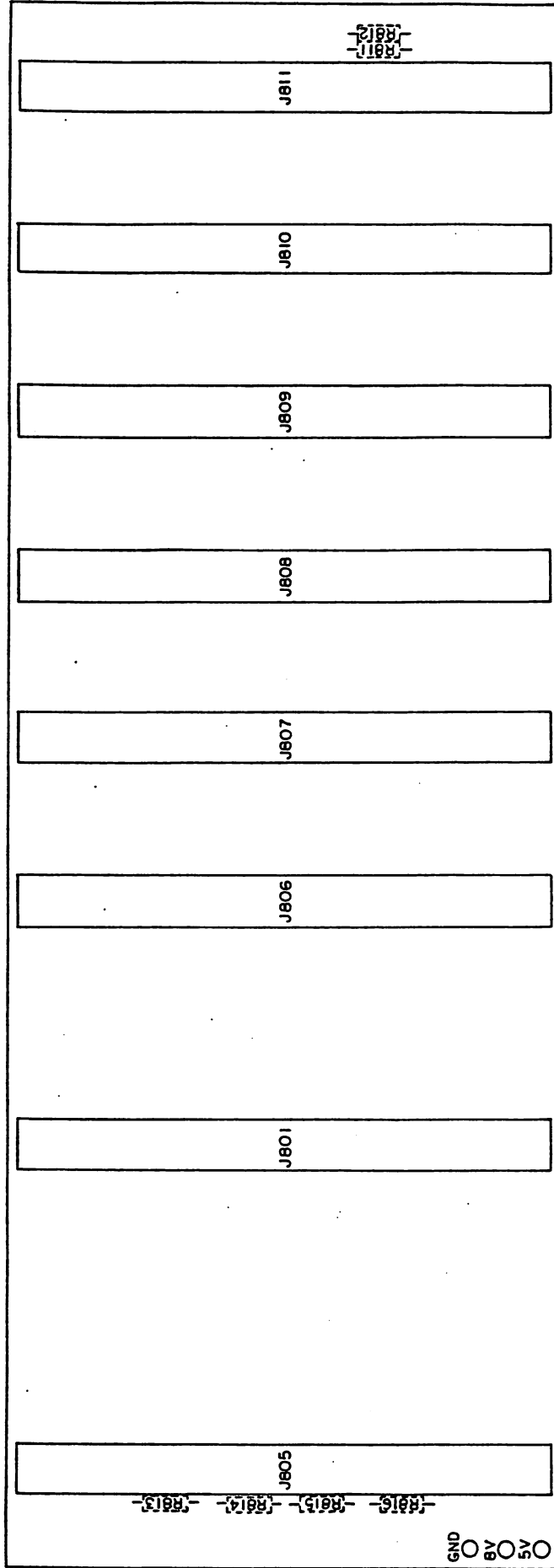






RACOM INC.

SCALE: ~	APPROVED BY:	DRAWN BY SSC
DATE: 7-25-90		REVISED
2816 POWER SUPPLY		
2816 DIALED DIGIT PRINTER		DRAWING NUMBER 2816-93



RACOM INC.

SCALE: 2 : 1	APPROVED BY:	DRAWN BY: SSC
DATE: 7-25-90	REVISED	
MOTHER BOARD 1700-91 PARTS LAYOUT		
2816 DIALED DIGIT PRINTER		DRAWING NUMBER 2816-70

2816 MULTILINE DIALED DIGIT PRINTER

OPTION 4 - DATA OUTPUT

DESCRIPTION

This data output option is used to put data from the 2816 into a computer for further processing and analysis. The voltage levels are compatible with RS232 circuits.

This data output is intended to be connected to a computer so that the data from it may be formatted and then processed. For testing purposes, it may be connected to a terminal.

Data is transmitted at 300 or 1200 baud, asynchronous, 7 bits, even parity and 1 stop bits.

The data from a call is transmitted when a call has been completed. After this data transmission, the 2816 will then print the data.

The data for each call is transmitted separately in an 87 byte ASCII coded sequence. The first byte is a dollar sign (\$). It is followed by 84 bytes of data that contain all the information about the call. The 86th byte is a line feed. The 87th byte is a carriage return and indicates the end of the transmission.

SWITCHES

Two switches are used for this data output option. See Figure One for switch locations.

SW103 Section 4 Data Output

Position A - "On"	Only turn on if data output is hooked up.
Position B - "Off"	Keep units without data output option off or they will not function correctly.

SW103 Section 5 Internal Printer

Position A - "Off"	Printer is off
Position B - "On"	Printer is on

SW301 Section 1 Baud Rate

Position A - 300 Baud
Position B - 1200 Baud

SW301 Section 2 Keep in position "B"

CONNECTIONS

Connections for this data output option are provided on TB7 on the rear panel of the 2816.

TB7 Terminal 1 Ground

This is the ground and common connection. It must be connected to the receiving equipment.

TB7 Terminal 2 RXD

This is the terminal that data is received on. Use of this terminal is optional because the 2816 does not process data it has received.

TB7 Terminal 3 TXD

This is the terminal that the 2816 transmits data on. It must be connected to the receiving equipment.

TB7 Terminal 4 RTS (Request To Send)

In the 2816, this terminal is tied through at 2200 ohm resistors to the +12 volt supply.

TB7 Terminal 5 DSR (Data Set Ready)

Use of this terminal is optional. This terminal is used by the receiving equipment to tell the 2816 not to send data. When a ground or negative voltage is on this terminal, the 2816 will hold any data it has until this terminal is returned to +4 volts or greater. If this terminal is not used, it should be jumpered to TB7, terminal 4 to insure that it will be held at a positive voltage. This terminal should be used with care. The 2816 will not print if this terminal is not held high. If data is held too long, then some calls may be lost.

TB7 Terminal 6 DTR (Data Terminal Ready)

Use of this terminal is optional. When the 2816 has data to send, the voltage on this terminal will be greater than 5 volts, signaling the receiving equipment that the 2816 has data to send. After the data is sent and when there is no data to send, the voltage will be less than -5 volts.

9 PIN "D" CONNECTOR PINOUT (DB-9)

AND

2816 TO PC INTERCONNECTION

Shown below is the pinout of the optional 9 pin "D" connector (DB-9) on the back of the 2816. Also shown is how the 2816 would connect to a PC's pin RS232 "D" connector (DB-25).

The 2816s 9 pin "D" connector (DB-9) is configured so that the pins will be compatible with 9 pin RS232 "D" connectors on PCs. A DB-9 to DB-9 cable can plug the 2816 into a PC. A gender change may be needed, but pin swapping is not needed.

<u>TB7</u>	<u>LABEL</u>	<u>DB-9 PIN</u>	<u>DB-25 ON A PC</u>
1	Gnd	5	7
2	Rx	3	2
3	Tx	2	3
4	RTS	6 & 8	5 & 6
5	DSR	4	20
6	DTR	1	8

TYPICAL 2816 DATA OUTPUT

Power-up designator		Program version							
			MULTILINE DIAL DIGIT PRINTER					/STD	
\$9aa	RACOM 2816	F28V01/STD	00:26	02/18/89	15:10:11	2	RS232		
\$20P									
\$27P3511755		Pulse	02/19/89	05:14:00	02:20	2	Print		
\$18P19311212		TTone	02/19/89	15:14:17	02:04	1	Print		
\$38P13511755		Pulse	02/19/89	17:18:37	13:24	3	Print		
\$21P0		TTone	02/20/89	09:10:26	00:15	2	RS232		
\$30P			00:02	02/20/89	10:10:27	00:14	3	RS232	
\$1:P2163511755		TTone	02/20/89	12:11:18	00:40	1	Print		
\$20P			02/20/89	15:01:05	00:54	2	RS232		
\$30P			00:08	02/20/89	15:11:05	00:54	3	RS232	
\$30P			02/20/89	15:12:59	00:07	3	RS232		
\$1QP123456789*0#123456789*0#123456789+TTone			02/20/89	15:13:27	00:19	1	Print		
\$2;P12163511755		Pulse	02/20/89	15:13:08	00:48	2	Print		
\$3FP1213425364789506123787		Mixed	02/20/89	15:32:34	00:07	3	Print		
\$17P3623443		Pulse	02/20/89	15:33:29	00:22	1	Print		
\$30P			01:13	02/20/89	15:34:06	3	RS232		
\$26P112233		Mixed	02/20/89	15:34:22	00:11	2	Print		
\$30P			02/20/89	15:34:42	01:11	3	RS232		
\$40P			02/20/89	15:35:53	00:03	4	RS232		
\$57P3511755		TTone	02/20/89	15:35:57	0123m	5	RS232		
\$60P			02/20/89	15:36:04	00:02	6	RS232		
\$29P123456789		TTone	02/20/89	15:36:10	00:27	2	Print		
\$1QP123456789012345678901234567890123+Pulse			02/20/89	15:38:15	00:19	1	Print		
\$1@P4111112121111111		Pulse	02/20/89	15:38:36	00:15	1	Print		
\$26P654321		Pulse	02/20/89	15:39:09	00:13	2	Print		
<div> <div>Number dialed</div> <div>Unit Identifying Character</div> <div>Number of digits in number (Coded as one ASCII byte)</div> <div>Overflow</div> <div>Dial type</div> <div>Elapsed ringing time</div> <div>Date</div> <div>Time</div> <div>Ignore</div> <div>Phone line used</div> <div>Elapsed time of phone usage</div> </div>									
Phone line used									

PLEASE NOTE: columns 78 to 85 should be ignored.

W A R R A N T Y

Racom, Inc. warrants the equipment purchased hereunder to be free from defect in material and workmanship under normal use and service, when used for the purpose for which the same is designed, for a period of one year from the date of delivery, provided that notice of such defect is given to Racom within thirty (30) days after discovery thereof and provided that inspection by Racom indicates the parts are defective to Racom's reasonable satisfaction. Racom's obligations under this warranty are limited to the repair or replacement of defective parts and the return of such repaired or replaced parts to the purchaser F.O.B. factory. At Racom's option, any defective part shall be returned to Racom's factory for inspection, properly packed and all expenses prepaid. No parts shall be returned unless the purchaser first obtains a return authorization number, which will be furnished on request. Equipment furnished by Racom, but manufactured by another, bears only the warranty given by such other manufacturer, which will be furnished on request. No warranties other than those set forth in this section are given or are to be implied with respect to the equipment furnished hereunder and Racom shall, in no event, be liable for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause.

This warranty is considered void when in the opinion of Racom, Inc. that unit has been altered or tampered with other than factory authorized adjustments as prescribed within this manual. Repairs made on any unauthorized altered units will be charged for according to Racom's standard rates.

CORRESPONDENCE AND PARTS ORDERING

Whenever writing about this unit or ordering parts, always refer to the model and serial number and the approximate date of purchase. Parts should be ordered by the Racom part number.

RETURN OF EQUIPMENT

No equipment or part thereof shall be returned to Racom unless the purchaser first obtains a return merchandise authorization from Racom. This number is to be marked on the shipping container and all shipping documents.

NOTE: Contents of this manual are considered proprietary in nature and may not be reproduced in any form or matter without the expressed written consent of Racom, Inc. management. Specifications are subject to change without notice.