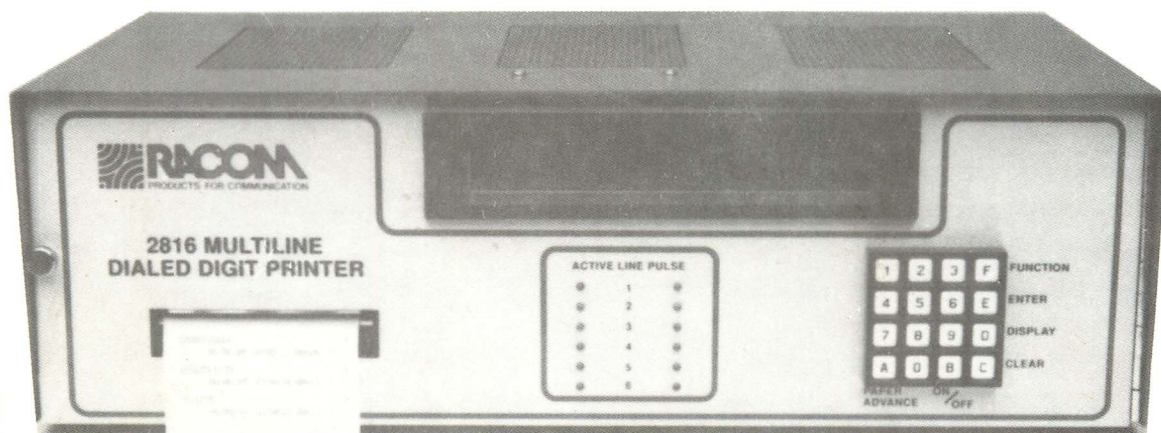


# **RACOM 2816** **Dialed Digit Printer**

Model 2816P



## **Instruction Manual**

1/27/95

## DUAL LOCK CODES or PASSWORDS (SP3)

For RACOM Models

2816P - Dialed Number Recorder and

2816 - Multiline Dialed Digit Printer

This option adds two levels of locks or password protection to RACOM's Dialed Number Recorders (DNRs). Lock Code One gives full access to all the functions of the DNR, including audio monitoring and recording. Lock Code Two allows the DNR to print telephone numbers but not monitor or record audio. Both lock codes are field programmable.

### Locking The Unit:

To locked the unit hit the "F" key and then the "B" key on the keyboard.

### Unlock The Unit:

To unlock the unit, enter the 5 digit unlock code and then hit the "C" key on the keyboard.

### Default Lock Codes:

When the unit is shipped from RACOM, Lock Code One is "12345". This code gives full access to all features of the unit. The second lock code is "45678". This code enables telephone number printing but not audio monitoring or recording.

### LOCK and UNLOCK SUMMARY:

LOCK by hitting the "F" and "B" keys.

UNLOCK by entering the 5 digit code and hitting the "C" key.

UNLOCK CODE "12345" gives full access.

UNLOCK CODE "45678" enables number printing only.

### CHANGING THE LOCK CODES:

The lock codes may be changed by hitting the "4" key while in the setup menu. This will give a special lock code change display that will allow new lock codes to be entered. The five digit locks codes should be entered with the numeric keys on the keyboard. The "A" and "B" keys may be used to move the cursor left and right. After the codes are entered, hit the "E" key to accept them or the "C" key to cancel them. Be sure to hit the "7" key on the setup display so that the new lock codes are permanently saved in the unit. The unit must have been enabled with Lock Code One to have access to this feature.

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.

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## SECTION ONE

### FUNCTIONAL DESCRIPTION

The RACOM 2816P Dialed Number Recorder evolved from the Racom 2800 and 2805 Dialed Digit Printers. The RACOM 2816P is a one line portable version of the RACOM 2816 Multi-line Dialed Digit Printer. The 2816P contains the latest state-of-the-art microprocessor circuitry with plug-in circuit boards.

The RACOM 2816P Dialed Number Recorder can easily be connected to most telephone lines by its modular connector to provide a printed record of the following:

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

The 2816P has connections for two cassette recorders and a headphone. It can be connected directly across the telephone line or it may be used with a remote loop extender, such as the Racom Model LP2816.

The information can also be displayed on the RACOM 2816Ps LCD display.

The 2816P has an optional RS232 data output 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 2816P 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: Portable briefcase  
Size: 18" Wide x 5" High x 14" Deep  
Weight: 16 lbs.  
Power: 120 VAC 60 Hz 90 Watts  
230 VAC 50 Hz 90 Watts (Option 5)  
Number of Lines: 1  
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

DC Input (isolated  
from ground) bridging  
line loading - 10M Ohm  
idle line voltage - 24 VDC or greater

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  
input 100K Ohms bridging, DC blocked and  
isolated from ground

Recorder Coupler Outputs: Audio and relay contacts for two recorders

Audio monitor: Miniature connector for headphone

Remote receiver: Dual tone - 852Hz and 1633 Hz

\* 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. 

3511755

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

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

Telephone number dialed.

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

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

This call lasted for 8 minutes and 1 second.
2. 

13511755

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

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

Toll telephone number dialed.

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

"0" indicates that the audio recorder was off.

This call lasted for 20 minutes and 9 seconds on Line 1.
3. 

00:34 08/10/89 14:04:57 07:03 1 R

This call was answered at 14:04:57.

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

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

From: 2163511755

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

This call was from 2163511755 (CND option).

This call was not answered.

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

The telephone rang for 55 seconds.

- 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

-----

The RACOM 2816P has a number of flaps that give access to various parts of the unit. Flaps underneath the printing mechanism store the power cord, RS232 cable and hold the paper roll.

Once the unit is in place, the electrical connections can be made. For convenience, a telephone instrument connected to the same line as the 2816 should be located nearby. The following connecting arrangement will satisfy the majority of installations.

### Connections:

1. Turn the power switch off.
2. Place the mode switch in the desired position.
3. Connect the telephone line to the modular connector.
4. Plug the 2816 into a standard 120 VAC grounded outlet.
5. Turn the power switch to the "on" position.
6. Depress On/Off Button to make the printer go on-line.
7. Refer to instructions describing how to set the electronic clock if the time or date is wrong.
8. Lift the handset from a telephone which is connected to the same telephone line as the printer. The "line active" LED should light.
9. Replace the telephone handset and the printer should print the length of time the telephone was off the hook, the day of the month and the time of day. This information will be printed on all calls.
10. 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.
11. The printer unit is now ready to be placed in service.

## FRONT PANEL SWITCHES AND INDICATORS

-----

### LCD DISPLAY

-----

The RACOM 2816 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 1 key. This will display detailed information about the telephone line. It can display the information as the RACOM 2816 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

-----

#### 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 2816 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"

The LCD will display detailed information about the telephone line when the 1 key is pressed. It will display information as the RACOM 2816 is receiving it and before it is printed out. It will also indicate the present status of the line. The recorder may be toggled on and off while the 2816 is displaying line information.

### Numbered Key "9"

The 9 key is used to control if the 2816 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 2816 on and off line. The display and printout will indicate when this happens. When the RACOM 2816 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 2816s 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 2816s 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 2816 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 backward and forward 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 2816P has connectors for two cassette recorders and a audio monitor jack. Audio is on the miniature connectors (1/8 inch diameter). The subminiature connectors (Marked motor) connect to the remote jack on the recorders and they enable the recorder's motor to run under control of the 2816P. The 2816'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 in the line display mode by pressing the "1" key. 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.

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.

## LOOP EXTENDER RECEIVER

-----

The Racom 2816P has a receiver for a remote loop extender. This allows the 2816P 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. The receiver is enabled when the mode switch is in the REMOTE position.

The 2816 may be ordered with other tone frequencies or for signal tone operation.

An optional 48 Volt power supply (Option F) can be used to power the remote loop extender. The power supply and the remote receiver is enabled when the mode switch is in the REMOTE/48V position.

### CALLER NUMBER DELIVERY (CND) Optional

-----

The 2816P will print out the calling number when the telephone company provides the 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.

### INKED RIBBON REPLACEMENT

-----

The inked ribbon cartridge, located under the top panel 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. Swing open the panel over the printing mechanism.
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.

### PAPER TAPE REPLACEMENT

-----

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

1. Flip open the panel which is underneath the printing mechanism.
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. Cut the end of the paper straight and free of folds with a pair of scissors.
5. Slide new paper roll over the spindle and push it on to the spindle clips.
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.

## 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 small flap underneath the case.

Most switches have two positions - A or B. The switch is open in Position B and closed in Position A. A switch is in Position B when the rocker is flush with the front edge of the switch. Switches with toggle levers are in Position B when the toggle lever is toward the front.

Position A is when the flat or toggle lever is toward the rear of the switch.

#### 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 2816s 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.

## THRESHOLD ADJUSTMENT (R463)

-----

The RACOM 2816 has a D. C. line voltage detector circuit in it. This circuit detects if the phone 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 dial pulse rate switch may be used to make the printer reject these pulses.

#### 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

-----

For each line in a RACOM 2816, there is a switch that inverts the signal from the 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.

#### D. C. INPUT CONFIGURATION

-----

Usually, the Racom Model RACOM 2816 Multiline Dialed Digit Printer is operating in a bridging mode. This means that the RACOM 2816s high impedance inputs are connected across the telephone line.

The RACOM 2816 has separate A.C. and D.C. bridging inputs for each line. Normally, for each line, these A.C. and D.C. inputs will be connected across the phone line for that line.

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

SW401	Section 4	Position B
Mode switch		Bridging position

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	Print first/last rotary dialed digit if it was not finished.
	B	Normal
SW103-3		Keep in Position B
SW103-4		Keep in Position B
SW103-5		Keep in Position B
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.
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	B	Keep in Position B
SW401-2	A	Bridging mode. Line is controlled by the DC voltage between tip and ring
	B	Remote loop extender mode. Line is controlled by tones.
	Note: On 2816Ps the panel mounted MODE SWITCH parallels this switch. Keep this switch in position B.	
SW401-3	A	Touch tone and audio AGC is disabled
	B	Touch tone and audio AGC is in operation
SW401-5		Keep in Position B
SW401-6		Keep in Position B
SW401-4	A	DC input inverted
	B	DC input normal
SW401-7		Keep in Position B
SW401-8		Keep in Position B

CONTROLS -----	FUNCTION -----
R406	AGC and amplifier drive Fully clockwise for maximum drive
R436	Auxiliary audio output level adjustment. Fully clockwise for maximum level.
R463	On-hook/off-hook threshold voltage.
R461	Ring detector sensitivity.



## 2816 MULTILINE DIALED DIGIT PRINTER

### Option 4 - Data Output

#### With 64K Buffer

#### 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.

The 64K buffer may hold data until the computer is available. The status of the data buffer is shown on the 2816's LCD display. Holding and sending of data may be accomplished with the 9 key on the 2816's keypad, with X on - X off control codes on the RS232 link or with the DSR (Data Set Ready) pin on the back of the 2816.

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.

#### DATA BUFFER STATUS

The following words appear on the 2816's LCD display and give the status of the Data Buffer as shown below.

WAIT	The 2816 has been placed in the wait and hold data state. Place it in this state with the 9 key on the 2816's keypad or by sending an X off (Ctrl-S) to the 2816 over the RS232 link. The buffer is presently empty. The word "HOLD" will appear as soon as there is data in the buffer.
HOLD	The buffer is holding data. Data flow can be started by hitting the 9 key on the 2816's keypad or by sending an X on (Ctrl-Q) to the 2816. During hold, the DSR lead is high, indicating that the 2816 has data to send.
SEND	The 2816 is sending data or may be trying to send data if the DTR (Data Terminal Ready) lead is not high.

IDLE        The 2816's buffer is empty. Data will not be held in the 2816.

OFF         The RS232 data option is turned off.

### 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	
		*The 2816 should be reset after this switch is changed.	
SW301	Section	Keep in position "B"	

## CONNECTIONS

Connections for this data output option are provided on TB7 on the rear panel of the 2816. Shown below are the definitions for these terminals. Also, the pin they would connect to on a PC's 25 pin RS232 connector is shown.

### TB7 Terminal 1 Ground (Signal Ground)

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

This connects to Pin 7 on the PC.

### TB7 Terminal 2 RXD (Receive Data)

This is the terminal that data is received on. Use of this terminal is optional because the 2816 only processes the X on and X off control characters.

Connect this to Pin 2 of the PC. The PC can send an X off (Ctrl-S) when it wants the 2816 to hold data and an X on (Ctrl-Q) when the 2816 is sending data.

### TB7 Terminal 3 TXD (Transmit Data)

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

On a PC, it would connect to Pin 3.

### TB7 Terminal 4 RTS (Request to Send)

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

Both Pins 5 and 6 from the PC should be connected here.

### 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 send data if this terminal is not held high.

With a PC interface, this terminal should connect to Pin 20 of the PC. This is the DTR lead of the PC. The PC can place this lead low to make the 2816 hold data.

### 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.

On a PC, this would connect to Pin 8. Pin 8 is the PC's CD (carrier detect) lead. The PC's program could monitor this lead to see when the 2816 has data to send.

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

## 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.

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