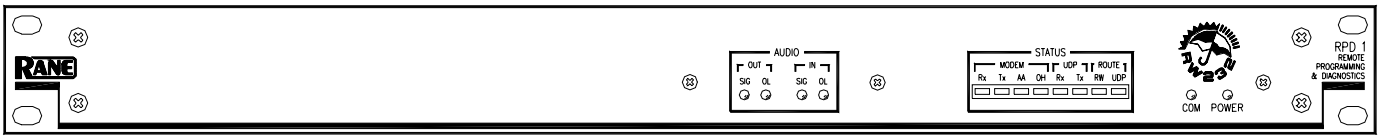


GETTING STARTED

Rane RW 232 products can be controlled from remote locations with the RPD 1 Programmable Diagnostics Unit. During transmission, the modem can send and receive data for remote system diagnostics.

There are 2 operational modes for the RPD 1:

- RW 232 remote diagnostics
- RS-232 remote diagnostics or data transmission using the USER DATA port.

RW 232 RaneWare Diagnostics

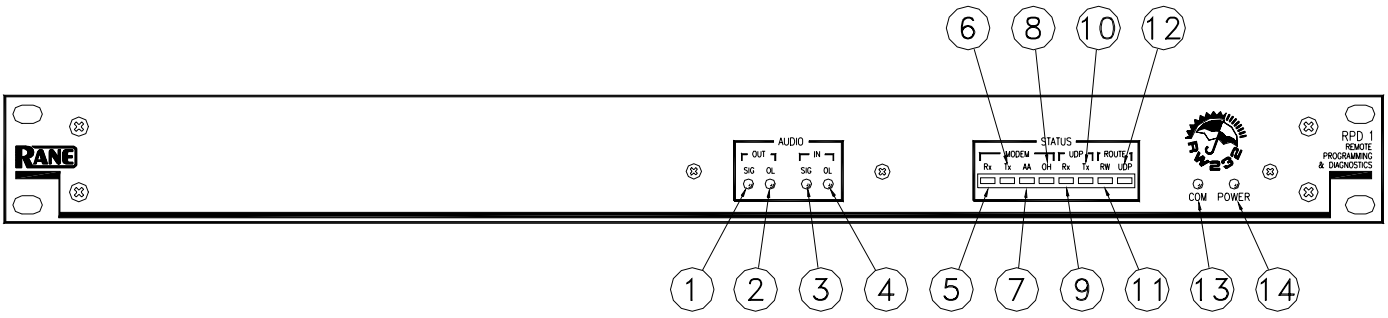
RW 232 remote programming and diagnostics are performed to a remote RPD 1/RW 232 site using a 28.8 kbs or better modem and a PC running RaneWare with Remote to RPD 1 selected on the System Setup page at the host. The remote RPD 1 must be set with Answer Voice *unchecked* and Answer When set to Always. When Remote to RPD 1 is selected at the host, select System > Dial. Enter the phone number and password of the remote RPD 1. The call is placed with the Dial button. If the modems connect and the password is correct, you will be directly connected to the remote RPD 1's RW 232 Output and its RW 232 Input will be disabled from the control system. (See Remote RW 232 Diagnostics on page Manual-8.)

RS-232 Serial Interface Diagnostics

RS-232 remote serial communications are performed to a remote RPD 1 site using any terminal program and a 28.8 kbs or better modem. The remote RS-232 device is connected to the RPD 1's ***User Data Port***. The remote RPD 1 must be set with Answer Voice *unchecked* and Answer When set to Always. Once connected to the remote RPD 1, enter $$$ to place the RPD 1 in terminal mode, which operates the RPD 1 like a computer bulletin board. To go any further a valid User Name and Password must be entered. Once you have been granted entry, set the route to the User Data Port (see Remote RS-232 Diagnostics on page Manual-9).

WEAR PARTS: This product contains no wear parts.

RPD 1 PROGRAMMING & DIAGNOSTICS UNIT - FRONT PANEL



① **AUDIO OUT SIG indicator:** Lights when the Audio Out signal is above -25 dBu. Use to check signal flow.

② **AUDIO OUT OL indicator:** Lights when the Audio Out signal is 2 dB before clipping.

③ **AUDIO IN SIG indicator:** Lights when the Audio In signal is above -25 dBu. Use to check signal flow.

④ **AUDIO IN OL indicator:** Lights when the Audio In signal is 2 dB before clipping.

⑤ **STATUS—MODEM RX indicator:** Lights when receiving data from Modem.

⑥ **STATUS—MODEM TX indicator:** Lights when transmitting data to Modem.

⑦ **STATUS—MODEM AA indicator:** Lights when Modem is sent an Auto Answer command.

⑧ **STATUS—MODEM OH indicator:** Lights when Modem is sent an Off Hook command.

⑨ **STATUS—UDP RX indicator:** Lights when receiving data to the User Data Port.

⑩ **STATUS—UDP TX indicator:** Lights when transmitting data from the User Data Port.

⑪ **STATUS—ROUTE RW indicator:** Lights when the Modem is routed through RW 232.

⑫ **STATUS—ROUTE UDP indicator:** Lights when Modem is routed through the User Data Port.

⑬ **COM indicator:** Flashes randomly when receiving valid data from the control system or PC. *If the DEVICE ADDRESS is not within a valid range (1-250), this LED flashes steadily at ½ second intervals.*

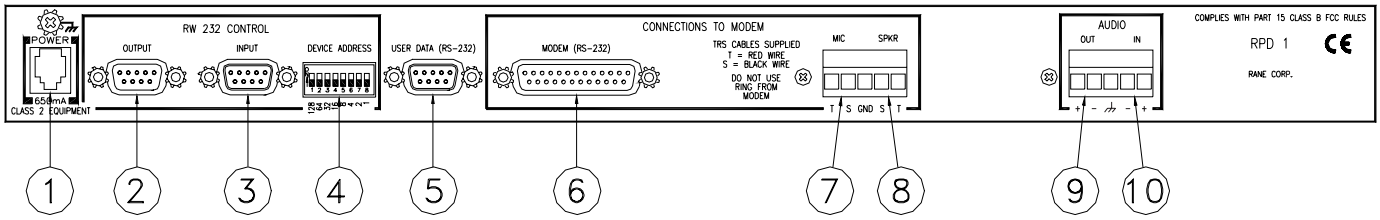
⑭ **POWER indicator:** Lights when the processor is operational.

RPD 1 MODEM COMPATIBILITY

The modem to be used with the RPD 1 must meet these criteria:

1. 28.8 kbps minimum speed.
2. External
3. Hayes compatible.

RPD 1 PROGRAMMING & DIAGNOSTICS UNIT - REAR PANEL



① **POWER input connector:** *Use only a model RS 1 or other power supply approved by Rane.* This unit is supplied with a remote power supply suitable for connection to this input jack. *This is **not** a telephone jack. The RPD 1 is a **modem interface**, **not** a telephone interface.* The power requirements call for an 18 VAC center-tapped transformer only. Using any other type of unapproved supply may damage the unit and void the warranty.

② **RW 232 CONTROL - OUTPUT:** This DB-9 male connects to downstream Rane RW 232 units. Refer to Appendix-Data Connections on page Manual-10.

③ **RW 232 CONTROL - INPUT:** This DB-9 female connects to the RW 232 controller, computer, or other Rane RW 232 unit connected upstream. Refer to Appendix-Data Connections on page Manual-10.

④ **RW 232 CONTROL - DEVICE ADDRESS:** The RPD 1 requires setting of this RW 232 address. See page Manual-5.

⑤ **USER DATA (RS-232):** This DB-9 User Data Port connects the RPD 1 to the Room Controller's program port or the Room's remote data transmission device, such as a PC. Refer to Appendix-Data Connections on page Manual-10.

⑥ **MODEM (RS-232):** This DB-25 male connects RS-232 data of the RPD 1 to the Modem's RS-232 data connector (cable provided).

⑦ **MODEM MIC:** This output section of the Euroblock connects to a 1/8" mini-plug Modem Mic input connector (cable provided). Do not connect the ring on this mini-plug.

⑧ **MODEM SPKR:** This input section of the Euroblock connects to a 1/8" mini-plug Modem Speaker output connector (cable provided). Do not connect the ring wire from the Modem.

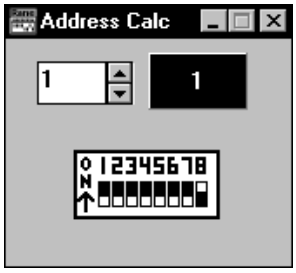
⑨ **AUDIO OUT:** This same Euroblock delivers a balanced line level signal. AUDIO OUT typically connects to Port 6 Input from the ECB 6.

⑩ **AUDIO IN:** This 5-pin Euroblock accepts a balanced line-level signal. AUDIO IN typically connects to the Port 6 Output from the ECB 6.

SETTING THE DEVICE ADDRESS

The Device Address is set using a binary code which may be determined using the following table, our Windows Address Calculator program, or by adding the place values (1-128) silkscreened on the chassis. *Ignore all numbers printed directly on the switch.* For example, turning ON the switches labeled '1' and '2' yields address '3'. In the following table, 0 means switch *down* (OFF), 1 means switch *up* (ON), and the left-most digit corresponds to the switch labeled '128'.

Rane also provides a special calculator to assist in setting the dip switches. After installing the software, in the RaneWare program group, launch the RaneWare 232 Address Calculator. This binary calculator converts decimal numbers into corresponding dipswitch settings.



Device Address Calculator

1	00000001	51	00110011	101	01100101	151	10010111	201	11001001
2	00000010	52	00110100	102	01100110	152	10011000	202	11001010
3	00000011	53	00110101	103	01100111	153	10011001	203	11001011
4	00000100	54	00110110	104	01101000	154	10011010	204	11001100
5	00000101	55	00110111	105	01101001	155	10011011	205	11001101
6	00000110	56	00111000	106	01101010	156	10011100	206	11001110
7	00000111	57	00111001	107	01101011	157	10011101	207	11001111
8	00001000	58	00111010	108	01101100	158	10011110	208	11010000
9	00001001	59	00111011	109	01101101	159	10011111	209	11010001
10	00001010	60	00111100	110	01101110	160	10100000	210	11010010
11	00001011	61	00111101	111	01101111	161	10100001	211	11010011
12	00001100	62	00111110	112	01110000	162	10100010	212	11010100
13	00001101	63	00111111	113	01110001	163	10100011	213	11010101
14	00001110	64	01000000	114	01110010	164	10100100	214	11010110
15	00001111	65	01000001	115	01110011	165	10100101	215	11010111
16	00010000	66	01000010	116	01110100	166	10100110	216	11011000
17	00010001	67	01000011	117	01110101	167	10100111	217	11011001
18	00010010	68	01000100	118	01110110	168	10101000	218	11011010
19	00010011	69	01000101	119	01110111	169	10101001	219	11011011
20	00010100	70	01000110	120	01111000	170	10101010	220	11011100
21	00010101	71	01000111	121	01111001	171	10101011	221	11011101
22	00010110	72	01001000	122	01111010	172	10101100	222	11011110
23	00010111	73	01001001	123	01111011	173	10101101	223	11011111
24	00011000	74	01001010	124	01111100	174	10101110	224	11100000
25	00011001	75	01001011	125	01111101	175	10101111	225	11100001
26	00011010	76	01001100	126	01111110	176	10110000	226	11100010
27	00011011	77	01001101	127	01111111	177	10110001	227	11100011
28	00011100	78	01001110	128	10000000	178	10110010	228	11100100
29	00011101	79	01001111	129	10000001	179	10110011	229	11100101
30	00011110	80	01010000	130	10000010	180	10110100	230	11100110
31	00011111	81	01010001	131	10000011	181	10110101	231	11100111
32	00100000	82	01010010	132	10000100	182	10110110	232	11101000
33	00100001	83	01010011	133	10000101	183	10110111	233	11101001
34	00100010	84	01010100	134	10000110	184	10111000	234	11101010
35	00100011	85	01010101	135	10000111	185	10111001	235	11101011
36	00100100	86	01010110	136	10001000	186	10111010	236	11101100
37	00100101	87	01010111	137	10001001	187	10111011	237	11101101
38	00100110	88	01011000	138	10001010	188	10111100	238	11101110
39	00100111	89	01011001	139	10001011	189	10111101	239	11101111
40	00101000	90	01011010	140	10001100	190	10111110	240	11110000
41	00101001	91	01011011	141	10001101	191	10111111	241	11110001
42	00101010	92	01011100	142	10001110	192	11000000	242	11110010
43	00101011	93	01011101	143	10001111	193	11000001	243	11110011
44	00101100	94	01011110	144	10010000	194	11000010	244	11110100
45	00101101	95	01011111	145	10010001	195	11000011	245	11110101
46	00101110	96	01100000	146	10010010	196	11000100	246	11110110
47	00101111	97	01100001	147	10010011	197	11000101	247	11110111
48	00110000	98	01100010	148	10010100	198	11000110	248	11111000
49	00110001	99	01100011	149	10010101	199	11000111	249	11111001
50	00110010	100	01100100	150	10010110	200	11001000	250	11111010

RANEWARE OPERATION

RaneWare Installation follows a typical Windows software procedure, whether RaneWare is downloaded from the web or from the floppy supplied with your RW 232 unit. For step-by-step installation details, refer to your RPM 26v, RPE 228d, or ECS RaneWare Manual. Software updates can be obtained at Rane's web site, *www.rane.com*.

SYSTEM REQUIREMENTS

- RaneWare works under Microsoft Windows 3.1, NT, 95 or 98, on a PC or laptop with an unused serial port.
  Note: Windows 3.1 will not be supported after 12/31/99.

- The modem to be used with the RPD 1 must meet these criteria:
  1. 28.8 kbps minimum speed.
  2. External
  3. Hayes compatible.

- RW 232 needs a DB-9 cable less than 50' long, connecting from the serial port of a computer to the RW 232 CONTROL INPUT port. This cable is wired straight through, *not null modem*. No interface boxes are required; just a cable and the computer.

- RaneWare can be fully demonstrated and operated without any unit attached (called 'offline').

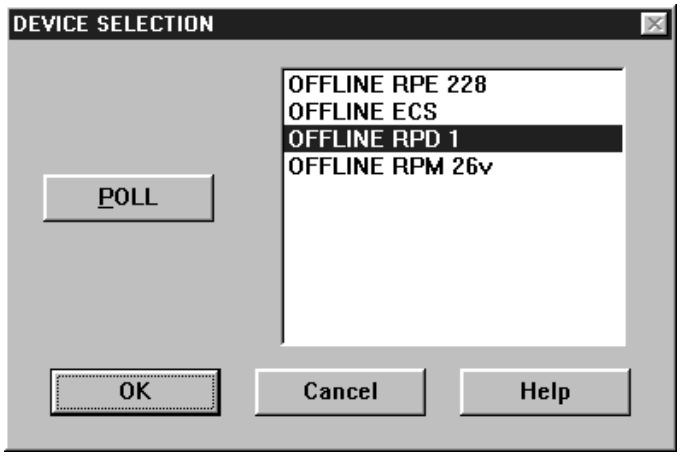
- If any question arises about a particular control on any software screen, position the pointer over the control and press F1 on your keyboard for Help.

DEVICE SELECTION

The quickest way to get to the RW 232 Device Edit screen is to click the Device button on the far right side of the toolbar. When pressed, a list of the first fifteen connected devices appears. Click one of the devices—either an offline device or an actual device—and the Selected device's edit screen appears. The Selected device name is displayed at the top within the title bar.

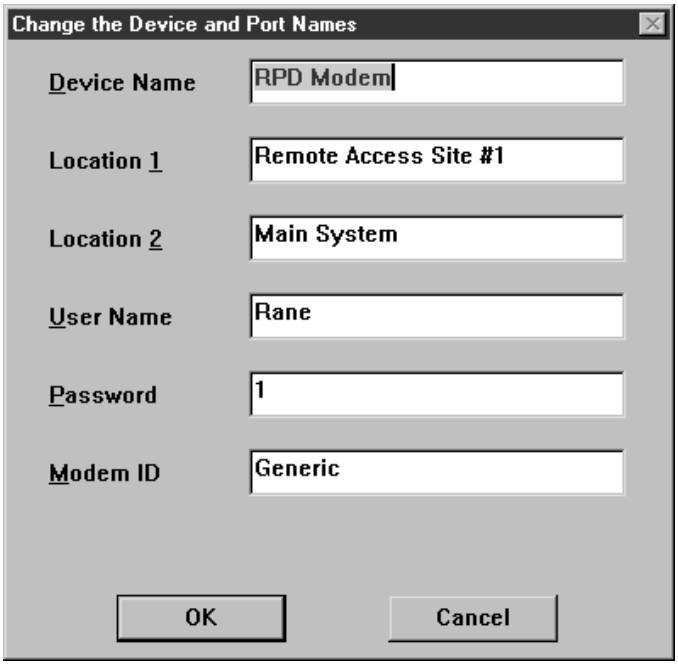
Alternatively, after Polling, the same Device list appears in the Device Selection window. You can also get there via Device > Select. Choose the connected or Offline device from the list and click OK. The connected unit's Device Address will be displayed within brackets [ ] to the left of the device name. Double-clicking on the device name is equivalent to Selecting the device and clicking OK.

If the installation changes by adding more RW 232 units, choose Device > Select, and the Poll button to make the computer recognize currently connected units.



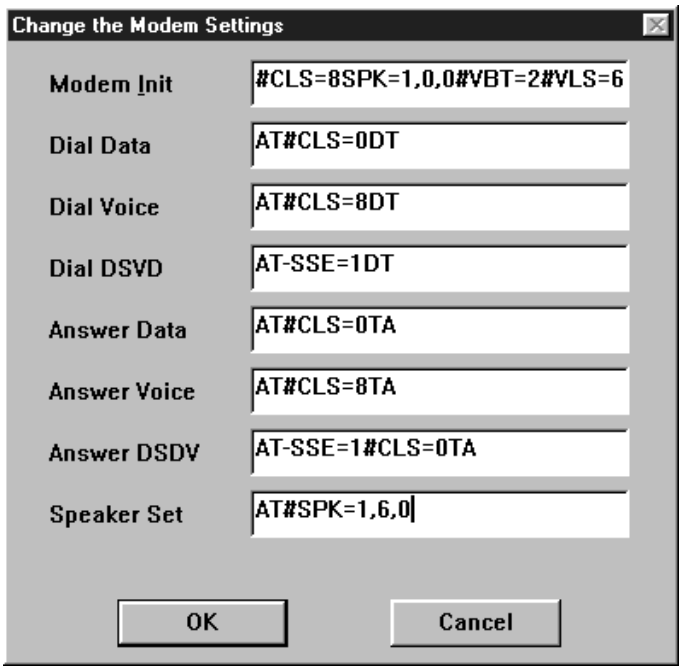
Device Selection Menu

Devices can also be given custom names, tailored to your installation. Simply choose Device > Name Device, and the following screen appears.



Device and Port Names Window

MODEM SETTINGS



Device > Setup RPD Modem window

Modem Init - Example string:
AT&FE0#CID=1#CLS=8#VBT=1#VLS=6L0
&F: Reset
E0: No Echo
#CID=1: Caller ID
#CLS=8: Voice Mode
#VBT=1: Set DTMF tone length 100ms
#VLS=6: Speaker Phone Mode
L0: Set speaker level to minimum

Dial Data - Example: AT#CLS=0DT
#CLS=0: Data Mode DT: Dial Command

Dial Voice - Example: AT#CLS=8#VTS=
#CLS=8: Voice Mode #VTS: Dial Voice Command

Dial DSVD - Example: AT-SSE=1DT
-SEE=1: DSVD Mode DT: Dial Command

Answer Data - Example: AT#CLS=0A
#CLS=0: Data Mode A: Answer

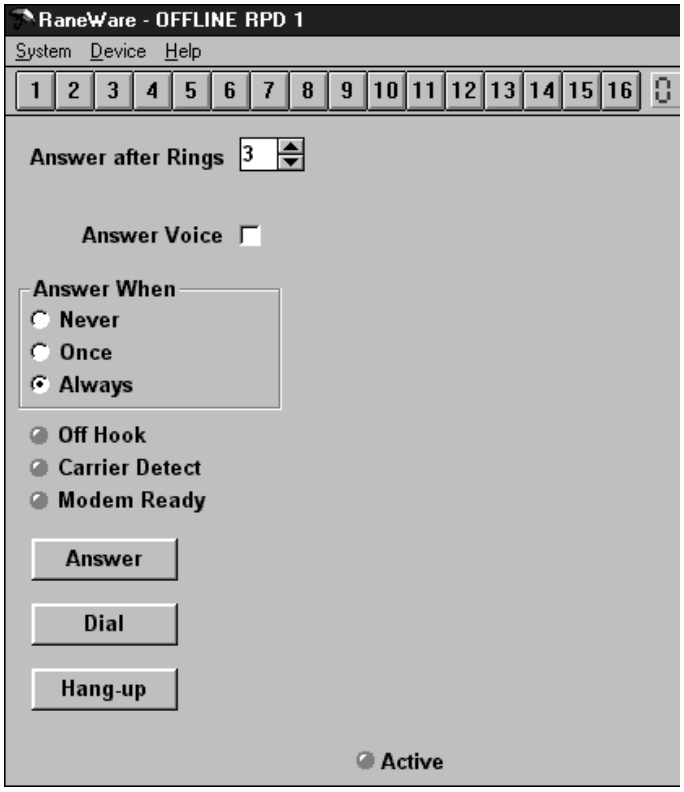
Answer Voice - Example: AT#CLS=8A
#CLS=8: Voice Mode A: Answer

Answer DSVD - Example: AT-SSE=1#CLS=0A
-SEE=1: DSVD Mode
#CLS=0: Data Mode A: Answer

Speaker Set - Example: A#SPK=1,6,0
#SPK=1,6,0: (mic on, speaker attenuation, mic gain)
Mic on=1; Mic Mute=0; Room Monitor=2
Speaker attenuation in 2 dB steps, (0-15) 0=Max; 6=-12 dB
Mic Gain (0-3) 0=0 dB, 1=6 dB, 2=9.5 dB, 3= 12 dB

RPD 1 DEVICE EDIT

Answer after Rings - determines the number of ring signals that will pass before the RPD 1 and modem will answer.
Answer Voice - determines if the RPD 1 and the attached modem will answer in voice or data mode.
Answer When - Sets the auto answer mode.

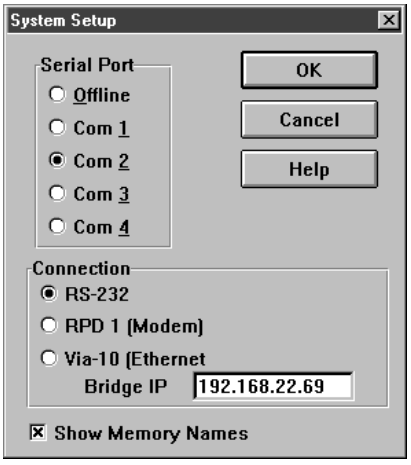


RPD Device Edit window

REMOTE RW 232 DIAGNOSTICS

All that is required to perform remote diagnostics is a PC running Windows® with a 28.8 kb modem or better, with RaneWare® installed. This procedure calls a remote RW 232 site and operates it as if you are there.

1. Launch RaneWare.
2. Click the **Device** button and select any of the Offline RW 232 devices.
3. Select System > System Setup.



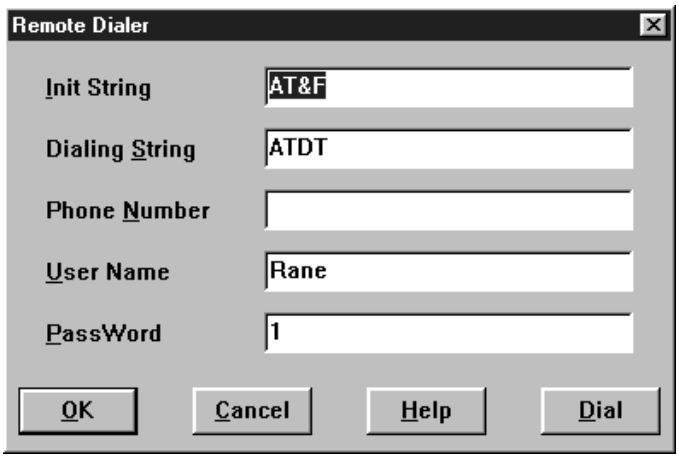
System Steup Window

4. Select the Serial Port that the modem is connected to.

5. Select the RPD 1 (Modem) checkbox. Click OK.

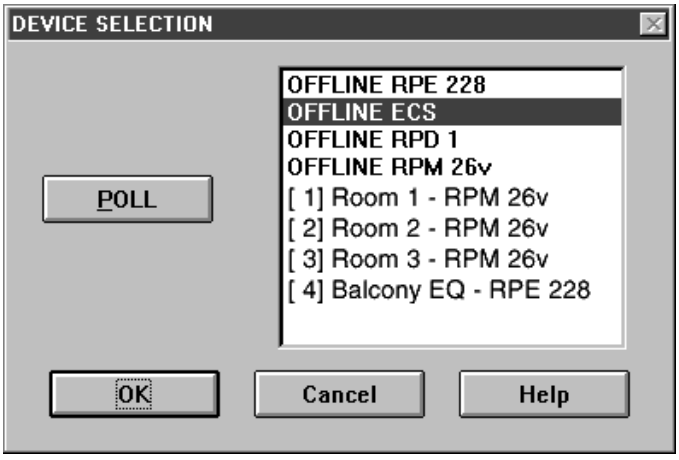
6. Select System > Dial.

7. Enter the remote site's Phone Number, User Name and Password. *User Name and Password are case sensitive, so be aware of what case the initial password was set.*



8. Click the Dial button.

9. Once connected to the remote site, select Device > Select to bring up the Device Selection page.



10. Click POLL to locate the remote devices.

11. The remote devices are under your control. Any local devices will not be affected while Remote to RPD 1 is Selected under System Setup. During the remote session, RPD 1's RW 232 CONTROL INPUT connector is disconnected. *Thus the local controller or PC will not operate the system until the session terminates.*

REMOTE RS-232 DIAGNOSTICS

All that is required to perform remote diagnostics is a PC running Windows® with a 28.8 kb modem or better and any terminal program. This procedure calls a remote RS-232 site and operates it as if you are there. Commands are as follows.

ATZ (reset modem)
OK
ATDT ******* (dial phone number)
CONNECT 19200
$$$ (to place RPD 1 in terminal mode)

Welcome to:
RW 232 Remote
Phone Line 1
RPD Modem

You are connected to a Rane RPD 1 Modem in terminal mode.
Username: Rane (enter User Name of the RPD 1)
Password: 1 (enter Password of the RPD 1[default=1])
Entry Granted.
Command (? for help)>?

-+- Menu Commands -+-
?=Help
X=Display Device State
R=Set Data Router
Q=Quit menu mode
Command (? for help)>
Route Modem port to (I=int, U=User Data Port, R=RW 232 port): U
Connecting User Data port to Modem port…

Command (? for help)> (Once connected to the User Data Port, you are connected to the remote device connected to this port.)

+++ATH (to end this session)
OK

TROUBLESHOOTING

POWER LED is Off:

Check POWER connection on rear panel, and that the remote supply is connected to a live AC source.

No communication between the unit and the computer:

Set the DEVICE ADDRESS to a unique small number, and try polling for units in RaneWare (under Poll in the Device menu). The unit should be found quickly.

Check that the COM port selected in RaneWare (under System Setup in the Setup menu) is the one on your computer that is connected to the unit. Also check that the cable is a standard RS-232 cable (not a null modem type). If an adaptor is used, *it must not be null modem*. The cable must be connected to the RW 232 INPUT jack on the RPD 1 rear.

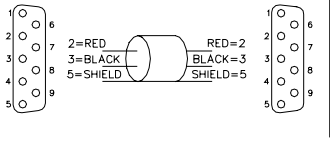
FCC NOTICE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense. Changes or modifications not expressly approved by Rane Corporation could void the user's authority to operate the equipment.

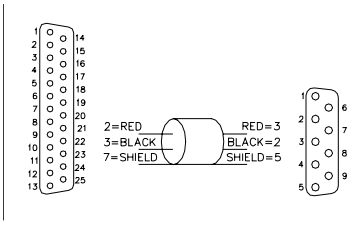
CANADIAN EMC NOTICE

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet Appariel numerique de la classe B respecte toutes les exigences du Reglement sur le material broilleur du Canada.



PC or AMX Port to RPD 1 -
DB-9 female to DB-9 male



PC to RPD 1 -
DB-25 female to DB-9 male

APPENDIX—DATA CONNECTIONS

To control the units from a computer, use nine-pin RS-232 cables 50 feet or shorter. *The cable must **not** be a null-modem type.* A short cable is supplied for connecting adjacent units. Daisy-chain up to 16 units at a time by connecting the COM port on the computer to the INPUT connector on the first unit, and the OUTPUT of each unit to the next unit's INPUT. Since RS-232 can pass through RW 232, additional RS-232 devices may be attached at the end of the RW 232 chain.

I = Input to RPD 1 O = Output from RPD 1

MODEM CONNECTOR PIN-OUT

DB-25 Male

Pin		
1		Shield
2	O	TX
3	I	RX
4	O	RTS
5	I	CTS
6	I	DSR
7		GND
8	I	CD
20	O	DTR
22	I	RI

USER DATA PORT CONNECTOR PIN-OUT

DB-9 Female

Pin		
1	O	CD
2	O	RX
3	I	TX
4	I	DTR
5		GND
6	O	DSR
7	I	RTS
8	O	CD
9	O	RI

CABLES

DB 9 Male (Hayes Modem) to DB 25 Female (RPD 1)

Hayes Modem Pin	RPD 1 Pin	
1	8	
2	3	
3	2	
4	20	
5	7	Shield
6	6	
7	4	
8	5	
9	22	

DB 9 Male (RPD 1) to DB 9 Female (AMX Program Port)

RPD 1 Pin	AMX Pin	
1	NC	
2	2	
3	3	
4	NC	
5	5	Shield

APPENDIX—RPD 1 DEVICE CONTROL LANGUAGE

Data Structures

Abbreviations used:

$:	signifies hexadecimal number
ADDR:	device address
CHNUM:	channel number code
COMSTAT:	communications status code
DCL:	device control language
DT:	Device-type code (predefined)
ID:	Manufacturer's ID code (predefined)
MEMNUM:	memory number code
OPSTAT:	operational status code
SPL:	stored parameter list (product dependent)

Definition:

Two's Complement: The result obtained when all the data bits are inverted and 1 is added to the result. Used to represent negative numbers. The Two's Complement of 3 (i.e. 0000 0011) is equal to 1111 1101 or $FD. This represents '-3'.

RPD 1 Stored Parameter List (SPL)

Index	Name	Encoding Method		
	System Parameters:			
0	Reserved	Set to 0		
1	Auto-Answer Ring Count	0-9	(byte)	0 = answer after 1 ring, 1 = answer after two rings, etc.
2	Answer Mode	0/1/2	(byte)	0 = Data, 1 = Voice, 2 = DSVD
3	Answer When	0/1/2	(byte)	0 = Never, 1 = Once, 2 = Always

Device address (ADDR):

Valid address range is 1 through 250 (0, 251, 252, 253, 254, and 255 are reserved)

Device-type code (DT):

$27 = RPD 1

Manufacturer's identification code (ID):

$08 = Rane Corporation

Channel number codes (CHNUM):

Always set to $00

Memory number codes (MEMNUM):

$00 = *live* or working memory, $01 = preset memory #1, $02 = preset memory #2, ... , $10 = preset memory #16 (RPD 1 has 16 preset memories)

Communications status codes (COMSTAT):

$00 = no error
$01 = invalid data
$02 = invalid command code
$03 = device locked
$04 = device *not* locked
$05 = channel(s) muted
$06 = channel(s) *not* muted
$07 = checksum error
$08 = not connected

Operational status codes (OPSTAT):

$00 = no error

RW 232 Commands

Send data (SPL) to channel (81 hex):
Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $0A (where $00 $0A = number of data bytes to follow including checksum)
Transmit $81 (command code)
Transmit $00 (CHNUM)
Transmit MEMNUM
Transmit 2 bytes; the starting SPL param byte index (See Note 4)
Transmit SPL
Transmit Checksum
Get COMSTAT

Program channel from memory (82 hex): (a.k.a. Program Device)
Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $04 (where $00 $04 = number of data bytes to follow including checksum)
Transmit $82 (command code)
Transmit $00 (CHNUM)
Transmit MEMNUM
Transmit Checksum
Get COMSTAT

Program all channels of all devices from memory (82 hex):
Transmit $FB $00 $FB $00
Transmit $00 $03 (where $00 $03 = number of data bytes to follow including checksum)
Transmit $82 (command code)
Transmit MEMNUM
Transmit Checksum
Get COMSTAT

Lock device (85 hex):
Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $85 (command code)
Transmit $79 (checksum)
Get COMSTAT

Unlock device (86 hex):
Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $86 (command code)
Transmit $78 (checksum)
Get COMSTAT

Mute all channels of all devices (87 hex):
Transmit $FB $00 $FB $00
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $87 (command code)
Transmit $77 (Checksum)

Unmute all devices (88 hex):
Transmit $FB $00 $FB $00
Transmit $00 $02 (where $00 $02 number of data bytes to follow including checksum)
Transmit $88 (command code)
Transmit $76 (Checksum)

Get OPSTAT (00 hex):
Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $00 (command code)
Transmit $FE (Checksum)
Get OPSTAT
Get Checksum
Get COMSTAT

OPSTAT consists of 8 bytes returned in this order:

Byte	Parameter	Value
1	OPSTAT	See OPSTAT return values on Page 4
2	Preset Memory	1-16
3	Working/stored flag	1/0 (See Note 5)
4	Working/dirty flag	1/0 (See Note 6)
5	Ring Count	0-9, 0 = 1 ring, 1 = 2 rings, 2 = 3 rings, etc.
6	Off Hook	0/1, 0 = ON, 1 = OFF
7	Carrier Detect	0/1, 0 = ON, 1 = OFF
8	Modem Ready	0/1, 0 = ON, 1 = OFF

Flash COM LEDs on all units (00 hex):
Transmit $FB $00 $FB $00
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $00 (command code)
Transmit $FE (Checksum)

Get data (SPL) from channel (01 hex):
Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $08 (where $00 $08 = number of data bytes to follow through start param)
Transmit $01 (command code)
Transmit $00 (CHNUM)
Transmit MEMNUM
Transmit 2 bytes; the starting SPL param byte index (See Note 4)
Transmit 2 bytes; the number of SPL parameter bytes (See Note 4)
Transmit Checksum (See Note 3)
Get SPL
Get Checksum (for SPL)
Get COMSTAT

Get device-type and manufacturer's identification codes (02 hex):
Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $02 (command code)
Transmit $FC (Checksum)
Get COMSTAT

Send globals (8C hex):

Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $01 $4F (where $01 $4F = number of data bytes to follow including checksum)
Transmit $8C (command code)
Transmit Global Parameters
Transmit Checksum
Get COMSTAT

RPD 1 Global Parameters (333 bytes):

Type:	Bytes:	Description:
Unit name	16	NULL terminated ASCII string if less than 16 characters long. Otherwise, omit NULL.
Modem ID	8	NULL terminated ASCII string if less than 8 characters long. Otherwise, omit NULL.
User name	8	NULL terminated ASCII string if less than 8 characters long. Otherwise, omit NULL.
Password	8	NULL terminated ASCII string if less than 8 characters long. Otherwise, omit NULL.
Location1	32	NULL terminated ASCII string if less than 32 characters long. Otherwise, omit NULL.
Location2	32	NULL terminated ASCII string if less than 32 characters long. Otherwise, omit NULL.
Modem Init	80	NULL terminated ASCII string if less than 80 characters long. Otherwise, omit NULL.
Modem Dial Data	20	NULL terminated ASCII string if less than 20 characters long. Otherwise, omit NULL.
Modem Dial Voice	20	NULL terminated ASCII string if less than 20 characters long. Otherwise, omit NULL.
Modem Dial DSVD	20	NULL terminated ASCII string if less than 20 characters long. Otherwise, omit NULL.
Modem Answer Data	20	NULL terminated ASCII string if less than 20 characters long. Otherwise, omit NULL.
Modem Answer Voice	20	NULL terminated ASCII string if less than 20 characters long. Otherwise, omit NULL.
Modem Answer DSVD	20	NULL terminated ASCII string if less than 20 characters long. Otherwise, omit NULL.
Modem Voice Speaker & Mic Level	20	NULL terminated ASCII string if less than 20 characters long. Otherwise, omit NULL.
Unit lock flag	1	1 if unit is locked (read-only)
Elapsed time	4	Time of use in seconds (read-only) (Note: This is unsigned long integer. If bit 31 is set, it means that an error occurred, e.g. someone removed the EEPROM while the unit was powered, and that time was restarted from that point.
Reserved	4	Normally set to 0,0,0,0 (factory use only)

Get globals (03 hex):

Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $03 (command code)
Transmit $FB $FB (Checksum, See Note 1)
Get Global Parameters
Get Checksum (for Global Parameters)
Get COMSTAT

Get device serial/identification number (04 hex):

Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $04 (command code)
Transmit $FA (Checksum)
Get 3-byte number, MSB first
Get Checksum (for serial ID)
Get COMSTAT

Get software revision (05 hex):
Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $05 (command code)
Transmit $F9 (Checksum)
Get hardware revision
Get software revision (´ 10)
Get Checksum (for hardware and software revisions)
Get COMSTAT

Reset Unit (91 hex):
Transmit ADDR header ($FB xx FB xx, where xx = ADDR)
Get DT
Get ID
Transmit $00 $02 (where $00 $02 = number of data bytes to follow including checksum)
Transmit $91 (command code)
Transmit RESET ($00 = Reset unit, $01 = Reset unit and set all data to default)
Transmit Checksum
Get COMSTAT

Send Modem Command (92 hex)
Transmit: ADDR header ($FB xx FB xx, where xx = ADDR)
Get: DT
Get: ID
Transmit $00 $xx (where $00 $xx = number of data bytes to follow including checksum)
Transmit $92 (command code)
Transmit Modem command
Transmit Data
Transmit Checksum
Get COMSTAT

Modem Command	Data	Description
0	$00	Initialize Modem
1	'V', 'D', or 'S' + telephone number	NULL terminated ASCII String, Dial modem in Voice, Data, or DSVD mode
2	'V'/'D'/'S'	NULL terminated ASCII String, Answer modem in Voice, Data, or DSVD mode
3	$00	Hang-up Modem
4	'I'/'R'/'U'	Modem Data Port Router where 'I' = Internal, 'R' = RaneWare, 'U' = User Data
5	Raw AT commands	NULL terminated ASCII Strings

Notes

1. When the value $FB occurs anywhere except in an ADDR header, it is repeated.

2. The data size is the number of bytes, prior to the $FB repetition, between the command code and the checksum inclusively.

3. The checksum applies to the "data size" bytes through the byte immediately before the checksum, inclusive. Repeated $FB's are counted only once. The sum is the two's complement negative of the LS Byte of the arithmetic sum. For example, if the sum is $1234, the checksum is $CC.

4. The parameter bytes are indexed using a 2-byte number (MSB first) starting with 0. The number of parameter bytes also uses a 2-byte number with the same format. When sending parameters, the number sent is determined by the data size.

5. The working/stored flag is set if the working memory for either channel doesn't match the stored memory from which it originated.

6. The working/dirty flag is set when the ECS is powered up, or when a memory is recalled. It is cleared when the working parameters are sent or received.

RW 232 Communications Interface

RW 232 is loosely based on PA-422. One key hardware difference is that RW 232 does not utilize hardware handshaking via DTR/DSR. The beginning of a message always takes the form:

$FB xx FB xx (where xx = ADDR)

Note: *When $FB appears in the body of the message, it is always repeated.*

Input port: 9-pin female input port (DB-9F) on device

Output port: 9-pin male output port (DB-9M) on device (for serial linking to the input port on the next device. Up to 16 devices can be linked in this manner.)

Device address means: 8-position DIP switch on device (valid device addresses are 1 through 250)

Baud Rate: 19.2 kilobaud

Character frame bits: 1 start bit, 8 data bits, 1 parity bit (even), and 1 stop bit

Cabling: Use standard RS-232 serial printer or modem cables.

Warning: *NULL modem cables will not work!*

Host or computer interface: Standard PC serial COM port (DB-9M, or DB-25M with adapter)

Note: *Only three lines, Tx, Rx, and Ground, are used.*

References

Rodgers, Robert L., “PA-422 Communications Interface and Device Control Language”, Journal of the Audio Engineering Society, Vol. 38, Number 9, 1990 September, pp. 619-639.

Audio Engineering Society, Inc., “AES Recommended practice for sound-reinforcement systems-Communications interface (PA-422)”, Journal of the Audio Engineering Society, Vol. 39, Number 9, 1991 September, pp. 664-679.

Standards documents: AES15-1991 (Audio Engineering Society)
ANSI S4.49-1991 (American National Standards Institute)

Example Packet Expansion code for RW 232 Messages

```
//   09-10-96       -   Devin Cook (Derived from RW232.CPP code)
// This code only deals with the Body of an RW 232 message (Command/Data)
// The steps needed to fully communicate with an RW 232 device are as follows:
// 1. Send the Address:  [FB xx FB xx]
// 2. Get the returned Device Type and Device ID flags
// 3. Send the FB expanded Body
// 4. Get and check the returned ComStat byte
// Take a simple command and expand it into a full packet.
// Input:
//          Buff      - BYTE array with the unexpanded message and lots of extra room
//          MsgLen - Unexpanded message length
// Steps required are:
// 1. Add Packet size.  This is simply the Command length + 1 for the checksum
// 2. Duplicate 0xFBs
// 3. Calculate Checksum
// 4. Add Checksum to packet (Check for a 0xFB Checksum!)
// 5. Copy Packet back to the buffer
// 6. Return the new Packet Size
// Note: The buffer must be large enough to accept the expanded data.
//       No checking is done to verify it is, so be careful!
// A packet into this routine consists of the one byte Command and any Data
int CmdToPacket(BYTE Buff[ ], int MsgLen)
{
          BYTE L_MSB = ((MsgLen+1) >> 8) & 0xFF;          // Grab MSB of Size
          BYTE L_LSB =  (MsgLen+1) & 0xFF;                // Grab LSB of Size
// FBs is the number of 0xFB bytes in the messages
          int FBs = 0;
// Don't forget to check message length for FBs
          if (L_MSB == 0xFB)
                    FBs ++;
          if (L_LSB == 0xFB)
                    FBs ++;
// Calculate Checksum of Message Length bytes along with bytes in the packet
          int CheckSum = L_MSB + L_LSB;
          for (int x=0;x<L;x++)
          {
                    CheckSum += Buff[x];
                    if (Buff[x] == 0xFB)
                    FBs ++;
          }
          CheckSum = (256-CheckSum) & 0xFF;
// Don't forget to up the FB count for a FB checksum!
          if (CheckSum == 0xFB)
                    FBs ++;
// New Length is:
// 2 (For 2 length bytes) +
// L (Old message Length) +
// Repeated FBs count     +
// 1 (For CheckSum)
          int NewLen = 2 + MsgLen + FBs + 1;
// Create a temporary holding tank for Packet Expansion
          BYTE  Packet[MAX_CMD_BUF];
          BYTE *Ptr = Packet;
// Stick message length in the packet (Watching for FBs of course)
          *(Ptr++) = L_MSB ;
          if (L_MSB == 0xFB)
                    *(Ptr++) = 0xFB;
```

```
        *(Ptr++) = L_LSB ;
        if (L_LSB == 0xFB)
                *(Ptr++) = 0xFB;
// Expand the original packet into the new buffer
        for (x=0;x<L;x++)
        {
                *(Ptr++) = Buff[x];
                if (Buff[x] == 0xFB)
                *(Ptr++) = 0xFB;
        }
// Add the Checksum byte (or Bytes if Checksum == FB)
        *(Ptr++) = CheckSum ;
        if (CheckSum == 0xFB)
                *(Ptr++) = 0xFB;
// Copy the expanded packet back into the original buffer
        memcpy(Buff,Packet,NewLen);
        return NewLen;
}
```