MP/8 x2
MP/16 x2
NETServer/8 x2
NETServer/16 x2

Version 2.1(modem code)

Release Notes

The material contained in this manual is for information purposes only and is subject to change without notice.

U.S. Robotics assumes no responsibility for errors or omissions in this manual. Nor does U.S. Robotics make any commitment to update the information contained herein.

Contents

About These Release Notes

The MP8/16 x2 and the NETServer8/16 x2 allow modems (with x2) to connect at speeds up to 56kbps. These release notes contain the following information:

- How x2 works and it's requirements
- How to tell if x2 is enabled in your modem
- x2 features including:
    - New S registers
    - Setting the highest and lowest link speeds
    - New x2 result codes
    - Information and Help Displays

Refer to your MP8/16, NETServer8/16 Command Reference manual for detailed information about using advanced features.

We Welcome Your Questions

We've made every effort to provide you with useful, accurate information. If you have any comments or questions, please let us know.

U.S. Robotics Telephone Support

If you:	**Dial this BBS number**
Want to call Technical Support	(800) 231-8770
Are eligible for a free x2 upgrade*	(800) 231-87770 (select option 5)
Want to inquire about an x2 upgrade for your MP or NETServer**	(800) 231-8770 (select option 5)

**Applies to any product purchased on or after 10/16/96.*

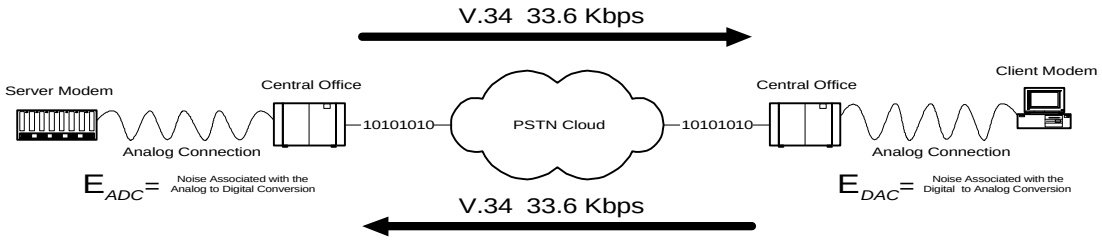
*** x2 is classified as a software/firmware update for MP/NETServer products. If you have an active support agreement on your MP/NETServer, you are entitled to the x2 update.*

U.S. Robotics on the Internet

If you want to:	**Reach us at:**
Reach Technical Support	http://totalservice@usr.com
Visit the x2 website	http://www.usr.com/x2

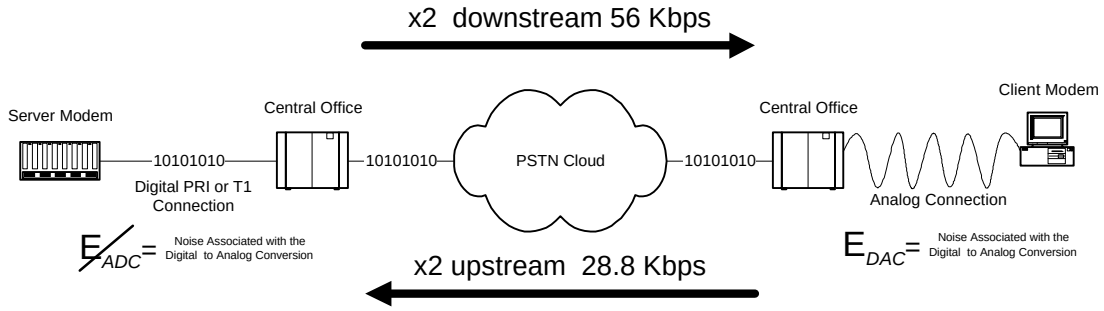
How x2 Works

The V.34 transmission scheme was designed to transmit data between two modems connected to the PSTN over analog lines. During an analog transmission, both ends of the connection suffer impairment due to noise introduced by the analog-to-digital conversion process. In the diagrams below, this impairment is signified by the symbols E_{ADC} and the smaller error due to digital to analog conversion is represented by the symbol E_{DAC}



The x2 transmission scheme transmits data between a client modem connected to the PSTN via analog service and a server modem connected via digital service. For Internet and online service providers with more than 16 phone lines, digital connections are often less expensive than analog and most medium to large-sized providers have them.

Digital connections between the Central Office and the server modem eliminates the noise associated with the digital conversion process -- the error (E_{ADC}) disappears. V.34 limits transmission to 33.6 kbps because it ***expects*** this noise at server side of the connection. x2, on the other hand, leverages the clean signal at the host end and allows the modem to send data downstream at speeds up to 56 kbps.



Only One Analog-to-Digital Conversion

There can be only one analog-to-digital conversion in the phone network between the x2 server modem and the client's DAC. If there is more than one analog-to-digital conversion data transmits at v.34 speeds.

Client and Server Modems

For x2 to operate at speeds up to 56 kbps, a client x2 modem must connect to a server x2 modem.

Client x2 Modems

Client modems can receive data at speeds up to 56 kbps and send data at speeds up to 33.6 kbps. The following modems are examples of client modems:

- U.S. Robotics Courier modem with x2
- U.S. Robotics Sportster with x2
- NETServer8/16 v.34 with x2
- MP8/16 v.34 with x2

Server x2 Modems

The digital x2 modems that you connect to are called x2 server modems. Server modems can send data to x2 client modems at speeds up to 56 kbps. The following modems are other examples of client modems:

- U.S. Robotics Courier I-modem with x2
- Quad modem 5.0/5 with x2
- MP8/16 I-modem with x2
- NETServer8/16 I-modem with x2

What are the requirements for x2?

x2 allows the utilization of the expanded bandwidth inherent in digital lines to send data to analog connections at 56kbps. The vast majority of home users will be able to obtain x2 speeds, provided the requirements described below have been met:

- ***x2 support on both ends***

  x2 must be supported on both ends of the connection, by the remote user's modem and by the remote access server or modem pool at the host end. The host-end device must bean x2 server, and the remote user must have x2 client modem. Typically, the remote user will be using a U.S. Robotics Courier, Sportster, Megahertz modem, MP, or NETServer (x2 client functionality) dialing into an MP I-modem, NETServer I-modem, Courier I-modem, or Total Control Enterprise Network Hub (x2 server functionality).

- ***Digital at one end***

  In typical remote access configurations, many remote users dial in to a concentration point where traffic from multiple remote users is collected. At this concentration point, the connection to the phone network ***must*** be digital, meaning either a channelized T1, ISDN PRI, or ISDN BRI. The line must also be "trunk-side" and not "line-side." ISDN PRI and BRI lines are automatically trunk-side. Channelized T1s are typically trunk-side but may, in some circumstances, be line-side. Note that x2 speeds of 56,000 bits per second occur in the direction from the digital end of the connection to the analog end. Note: NETServer I-modem 8/16 and MP I-modem 8/16 products utilize BRI connections only.

- ***One Analog-to-Digital conversion***

  There can be only one analog-to-digital conversion in the phone network along the path of the call from the remote user to the call termination point (remote access server). You must have a remote access server on the end of a trunk-side digital connection, with the remote user connected to an analog line to ensure this. Note that this means users connecting through a PBX (e.g. at a hotel) may not achieve x2 speeds, because there is typically an extra analog-to-digital conversion for data calls through a PBX.

- ***Quality of Line***

  As with V.34 technology, x2 speeds are somewhat dependent on line quality. However, because x2 takes advantage of the digital nature of the phone network, it is less susceptible to speed degradation than V.34. In fact, the maximum theoretical connect speeds of x2 exceed 60 kbps. U.S. Robotics initial testing has indicated that the vast majority of home users will be able to obtain x2 speeds. In situations where x2 is not obtainable, U.S. Robotics products will fall back to V.34 (with no user intervention required).

How to Tell if x2 is Enabled in Your Modem Pool

If you aren't sure whether x2 is enabled in your Modem Pool, use the **ATI7** command to display product configuration information. If x2 is enabled on your Modem Pool, the following information displays:

```
USRobotics  MP8 V.34 Configuration Profile...

Product type                US/Canada External
Options                     HST,V32bis,Terbo,V.FC,V34+,x2
Fax Options                 Class 1/Class 2.0
Clock Freq                  20.16Mhz
Eprom                       768k
Ram                         256k

Supervisor date             02/05/97
DSP date                    02/02/97

Supervisor rev              2.1.0
DSP rev                     2.1.0

Serial Number               20T0B756W3U0


OK
```

Note: Dates, serial numbers, and revision numbers may vary. The most important line is the "Options" line, which lists support for x2.

How to Tell if x2 is Enabled in Your NETServer

If you aren't sure whether x2 is enabled in your NETServer, use the **ATI7** command to display product configuration information. If x2 is enabled on your NETServer, the following information displays:

```
USRobotics  NETServer8 V.34 Configuration Profile...

Product type                US/Canada External
Options                     HST,V32bis,Terbo,V.FC,V34+,x2
Fax Options                 Class 1/Class 2.0
Clock Freq                  20.16Mhz
Eprom                       768k
Ram                         256k

Supervisor date             02/05/97
DSP date                    02/02/97

Supervisor rev              2.1.0
DSP rev                     2.1.0

Serial Number               20T0B756W3U0


OK
```

Note: Dates, serial numbers, and revision numbers may vary. The most important line is the "Options" line, which lists support for x2.

Backward Compatibility

MP8/16 2.1 and NETServer8/16 2.1 support all the features of version 1.1.6, as summarized in the following table.

Category	Feature
Modulation Types	V.34+ (33.6) V.FC V.32 Terbo ASL V.32/V.32 bis V.29 V.27 ter V.22 V.22 bis V.23 V.25 V.21 V.17 Bell 103 Bell 212A HST
Protocols	V.42 V.42 bis MNP 2-5 Fax Class 1.0 Fax Class 2
Miscellaneous Features	Software Download Synchronous Operation Link Security 10 Stored #s DTMF Tone Detection Leased Line 2W

Appendix A: S-Register

S Register

OAP V.34 Modem Code 2.1 includes new S register functionality to support x2.

Register S58

This register handles whether x2 is enabled or not as well as the two different modes (A-Law vs. U-Law). The following bits can be set.

1 = Disable x2

4 = Toggle A-Law vs. U-Law

Command Mode

The following changes and additions have been made to the command mode user interface to support ×2.

&N Command

The speed indices used with the &N command have been expanded to include all supported ×2 link speeds. The complete list of link speeds and their associated indices are given in the table below.

&U Command

A new command, &U, that works in conjunction with the &N command to further control link speeds, has been implemented.

Controlling Link Speeds

You can use the &N and &U commands to control the link speeds of your MP and NETServer with x2. Use the following table to determine how to use &N and &U commands:

To set the	Use
Highest possible connect speed	&N
Lowest possible connect speed	&U
Range of possible connect speeds	&N and &U

Table 1 - Using Link Speeds

Setting the Highest Possible Connect Speed

The &N command allows you to set the highest possible connect speed. If a remote modem connects to your MP or NETServer with x2 at a speed higher than &N, your MP or NETServer with x2 will not allow it to connect.

Setting the Lowest Possible Connect Speed

The &U command allows you to set the lowest possible connect speed. If a remote modem connects to your MP or NETServer with x2 at a speed lower than &U, your MP or NETServer with x2 will not allow it to connect.

Note: U.S. Robotics recommends that you set your default &N and &U values to 0.

Setting a Range of Possible Connect Speeds

By setting &N and &U values, you can control the range of speeds at which your MP or NETServer with x2 connects. If a remote modem does not connect to your MP or NETServer with x2 at a range between the speeds designated by the &N and &U commands, your MP or NETServer with x2 will not allow it to connect.

Note: The link speed associated with the &U argument cannot be greater than the link speed associated with &N argument.

Use the following table to understand the relationship between &U and &N commands:

If &U	And &N	Then your modem
Equals zero	Equals zero	Connects at the highest possible speed.
	Is greater than zero	Connects at the &N speed only.
Is greater than zero	Is greater than zero and greater than &U	Connects at the highest possible speed in the range from &U to &N.

Table 2 - Constraints on Link Speed

&N and &U Command Values

Use the following table for a complete list of &N and &U link speeds and their associated indexes:

Link Speed	Index	Link Speed	Index	Link Speed	Index
Highest	0	21600	11	49333	22
300	1	24000	12	50666	23
1200	2	26400	13	52000	24
2400	3	28800	14	53333	25
4800	4	31200	15	54666	26
7200	5	33600	16	56000	27
9600	6	32000	17	57333	28
12000	7	36000	18	58666	29
14400	8	40000	19	60000	30
16800	9	44000	20	61333	31
19200	10	48000	21	64000	32

Table 3 - Link Speeds and Indexes

Note: For x2-mode links, &N and &U are used to constrain the speed of the higher speed direction of the link. The speed of the lower speed direction is constrained by values given in S-Registers.

Appendix C: New x2 Result Codes

Numeric	Verbal
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR
5	CONNECT 1200
6	NO DIAL TONE
7	BUSY
8	NO ANSWER
9	[Not used]
10	CONNECT 2400
11	RINGING
12	VOICE
13	CONNECT 9600
14	CONNECT/ARQ
15	CONNECT 1200/ARQ
16	CONNECT2400/ARQ
17	CONNECT 9600/ARQ
18	CONNECT 4800
19	CONNECT 4800/ARQ
20	CONNECT 7200
21	CONNECT 12000
22	CONNECT 12000/ARQ
23	CONNECT 9600/HST
24	CONNECT 7200/ARQ
25	CONNECT 14400
26	CONNECT 14400/ARQ
27	CONNECT 9600/ARQ/HST
28	CONNECT 4800/HST
29	CONNECT 4800/ARQ/HST
30	CONNECT 7200/HST
31	CONNECT 12000/HST
32	CONNECT 12000/ARQ/HST
33	CONNECT 9600/V32
34	CONNECT 7200/ARQ/HST
35	CONNECT 14400/HST
36	CONNECT 14400/ARQ/HST
37	CONNECT 9600/ARQ/V32
38	CONNECT 4800/V32
39	CONNECT 4800/ARQ/V32
40	CONNECT 7200/V32
41	CONNECT 12000/V32
42	CONNECT 12000/ARQ/V32
43	CONNECT 16800
44	CONNECT 7200/ARQ/V32
45	CONNECT 14400/V32
46	CONNECT 14400/ARQ/V32
47	CONNECT 16800/ARQ
48	CONNECT 75/1200
49	CONNECT 1200/75

Numeric	Verbal
50	ABORT
51	INCOMING CALL
52	PHONE OFF HOOK
53	CONNECT 16800/HST
54	OFF HOOK RESTRICTED
55	[Not used]
56	[Not used]
57	CONNECT 16800/ARQ/HST
58	COMMAND DENIED ...
59	NUMBER BLACKLISTED
60	BLACKLIST FULL
61	WAITING
62	DIALING DISABLED
63	DATA
64	FAX
65	+FCO
66	+FVO
67	+FDM
68	+FHS:
69	+FCS:
70	+FIS:
71	+FTS:
72	+FPO
73	+FTI:
74	+FCI:
75	+FPI:
76	+FNF:
77	+FNS:
78	+FNC:
79	+FET:
80	+FPS:
81	+FHT:
85	+FHR
83	CONNECT 16800/V32
84	CONNECT 16800/ARQ/V32
85	CONNECT 19200
86	CONNECT 19200/HST
87	CONNECT 19200/V32
88	CONNECT 19200/ARQ
89	CONNECT 19200/ARQ/HST
90	CONNECT 19200/ARQ/V32
91	CONNECT 21600
92	CONNECT 21600/HST
93	CONNECT 21600/V32
94	CONNECT 21600/ARQ
95	CONNECT 21600/ARQ/HST
96	CONNECT 21600/ARQ/V32
97	CONNECT 21600/VFC
98	CONNECT 21600/ARQ/VFC
99	CONNECT 24000
100	CONNECT 24000/ARQ
101	CONNECT 24000/VFC
102	CONNECT 24000/ARQ/VFC
103	CONNECT 26400

Numeric	Verbal
104	CONNECT 26400/ARQ
105	CONNECT 26400/VFC
106	CONNECT 26400/ARQ/VFC
107	CONNECT 28800
108	CONNECT 28800/ARQ
109	CONNECT 28800/VFC
110	CONNECT 28800/ARQ/VFC
111	CONNECT 21600/V34
112	CONNECT 21600/ARQ/V34
113	CONNECT 24000/V34
114	CONNECT 24000/ARQ/V34
115	CONNECT 26400/V34
116	CONNECT 26400/ARQ/V34
117	CONNECT 28800/V34
118	CONNECT 28800/ARQ/V34
119	CONNECT 2400/VFC
120	CONNECT 2400/V34
121	CONNECT 2400/ARQ/VFC
122	CONNECT 2400/ARQ/V34
123	CONNECT 4800/VFC
124	CONNECT 4800/V34
125	CONNECT 4800/ARQ/VFC
126	CONNECT 4800/ARQ/V34
127	CONNECT 7200/VFC
128	CONNECT 7200/V34
129	CONNECT 7200/ARQ/VFC
130	CONNECT 7200/ARQ/V34
131	CONNECT 9600/VFC
132	CONNECT 9600/V34
133	CONNECT 9600/ARQ/VFC
134	CONNECT 9600/ARQ/V34
135	CONNECT 12000/VFC
136	CONNECT 12000/V34
137	CONNECT 12000/ARQ/VFC
138	CONNECT 12000/ARQ/V34
139	CONNECT 14400/VFC
140	CONNECT 14400/V34
141	CONNECT 14400/ARQ/VFC
142	CONNECT 14400/ARQ/V34
143	CONNECT 16800/VFC
144	CONNECT 16800/V34
145	CONNECT 16800/ARQ/VFC
146	CONNECT 16800/ARQ/V34
147	CONNECT 19200/VFC
148	CONNECT 19200/V34
149	CONNECT 19200/ARQ/VFC
150	CONNECT 19200/ARQ/V34
151	CONNECT 31200
152	CONNECT 31200/ARQ
153	CONNECT 31200/V34
154	CONNECT 31200/ARQ/V34
155	CONNECT 33600
156	CONNECT 33600/ARQ
157	CONNECT 33600/V34

Numeric	Verbal
158	CONNECT 33600/ARQ/V34
159	SECURITY ERROR
160	AT COMMAND DISABLED
161	ONLY QUERY ALLOWED
162	[Used by Quad I-Modem]
163	[Used by Quad I-Modem]
164	[Used by Quad I-Modem]
165	[Used by Quad I-Modem]
166	[Used by Quad I-Modem]
167	[Used by Quad I-Modem]
168	[Used by Quad I-Modem]
169	[Used by Quad I-Modem]
170	[Reserved for future use]
171	[Reserved for future use]
172	[Reserved for future use]
173	[Reserved for future use]
174	[Reserved for future use]
175	[Reserved for future use]
176	[Reserved for future use]
177	[Reserved for future use]
178	[Reserved for future use]
179	[Reserved for future use]
180	CONNECT 32000
181	CONNECT 32000/ARQ
182	CONNECT 32000/x2
183	CONNECT 32000/ARQ/x2
184	CONNECT 36000
185	CONNECT 36000/ARQ
186	CONNECT 36000/x2
187	CONNECT 36000/ARQ/x2
188	CONNECT 40000
189	CONNECT 40000/ARQ
190	CONNECT 40000/x2
191	CONNECT 40000/ARQ/x2
192	CONNECT 44000
193	CONNECT 44000/ARQ
194	CONNECT 44000/x2
195	CONNECT 44000/ARQ/x2
196	CONNECT 48000
197	CONNECT 48000/ARQ
198	CONNECT 48000/x2
199	CONNECT 48000/ARQ/x2
200	CONNECT 49333
201	CONNECT 49333/ARQ
202	CONNECT 49333/x2
203	CONNECT 49333/ARQ/x2
204	CONNECT 50666
205	CONNECT 50666/ARQ
206	CONNECT 50666/x2
207	CONNECT 50666/ARQ/x2
208	CONNECT 52000
209	CONNECT 52000/ARQ
210	CONNECT 52000/x2
211	CONNECT 52000/ARQ/x2

Numeric	Verbal
212	CONNECT 53333
213	CONNECT 53333/ARQ
214	CONNECT 53333/x2
215	CONNECT 53333/ARQ/x2
216	CONNECT 54666
217	CONNECT 54666/ARQ
218	CONNECT 54666/x2
219	CONNECT 54666/ARQ/x2
220	CONNECT 56000
221	CONNECT 56000/ARQ
222	CONNECT 56000/x2
223	CONNECT 56000/ARQ/x2
224	CONNECT 57333
225	CONNECT 57333/ARQ
226	CONNECT 57333/x2
227	CONNECT 57333/ARQ/x2

Appendix D - Information and Help Displays

ATI0 Display

```
5607

OK
```

ATI1 Display

75DD

```
OK
```

ATI2 Display

```
OK

OK
```

ATI3 Display

```
USRobotics Courier V.Everything

OK
```

ATI4 Display

```
USRobotics Courier V.Everything Settings...

       B0  C1  E1  F1  Q0  V1  X7
       BAUD=38400  PARITY=N  WORDLEN=8
       DIAL=PULSE  ON HOOK   TIMER

        &A3  &B1  &C1  &D2  &G0  &H1  &I0  &K1  &L0  &M4  &N0
       &P0  &R2  &S0  &T4  &U0  &X0  &Y1

       S00=001  S01=000  S02=043  S03=013  S04=010  S05=008  S06=002  S07=060
       S08=002  S09=006  S10=007  S11=070  S12=050  S13=000  S14=000  S15=000
       S16=000  S17=000  S18=000  S19=000  S20=000  S21=010  S22=017  S23=019
       S24=150  S25=005  S26=001  S27=000  S28=008  S29=020  S30=000  S31=000
       S32=009  S33=000  S34=032  S35=000  S36=000  S37=000  S38=000  S39=000
       S40=000  S41=000  S42=126  S43=200  S44=015  S45=000  S46=000  S47=000
       S48=000  S49=000  S50=000  S51=000  S52=000  S53=000  S54=064  S55=000
       S56=000  S57=000  S58=000  S59=000  S60=000  S61=000

LAST DIALED #:
```

ATI5 Display

```
USRobotics Courier V.Everything NVRAM Settings...

BAUD=38400   PARITY=N  WORDLEN=8  DIAL=PULSE

       B0   F1   X7   &A3  &B1  &G0  &H1  &I0  &K1
       &L0  &M4  &N0  &P0  &R2  &S0  &T4  &U0  &X0  &Y1

       S00=001  S02=043  S03=013  S04=010  S05=008  S06=002  S07=060  S08=002
       S09=006  S10=007  S11=070  S12=050  S13=000  S15=000  S19=000  S21=010
       S22=017  S23=019  S24=150  S25=005  S26=001  S27=000  S28=008  S29=020
       S31=000  S32=009  S33=000  S34=032  S35=000  S36=000  S37=000  S38=000
       S39=000  S40=000  S41=000  S42=126  S43=200  S44=015  S51=000  S53=000
       S54=064  S55=000  S56=000  S57=000  S58=000  S59=000  S60=000  S61=000

STORED PHONE NUMBERS
       0:                                    1:

       2:                                    3:

       4:                                    5:

       6:                                    7:

       8:                                    9:


       OK
```

ATI6 Display

```
USRobotics Courier V.Everything Link Diagnostics...

       Chars sent                   0      Chars Received               0
       Chars lost                   0
       Octets sent                  0      Octets Received              0
       Blocks sent                  0      Blocks Received              0
       Blocks resent                0

       Retrains Requested           0      Retrains Granted             0
       Line Reversals               0      Blers                        0
       Link Timeouts                0      Link Naks                    0

       Data Compression       NONE
       Equalization           Long
       Fallback               Disabled
       Last Call              00:00:00

       No Connection
       OK
```

ATI7 Display

```
USRobotics Courier V.Everything Configuration Profile...

Product type           US/Canada Rackmount
Options                HST,V32bis,Terbo,VFC,V34+,x2
Fax Options            Class 1,Class 2.0
Clock Freq             20.16Mhz
Eprom                  256k
Ram                    32k

Supervisor date        02/07/97
DSP date               02/05/97

Supervisor rev         2.1.0
DSP rev                2.1.0

Serial Number          20H7B796WK90

OK
```

ATI10 Display

```
USRobotics Courier V.Everything

DIAL SECURITY STATUS

DIAL SECURITY ENABLED:[N]                  LOCAL SECURITY ENABLED:[N]

PROMPTING ENABLED:[N]                      FORCED AUTOPASS:[N]

LOCAL ACCESS PASSWORD:[NO PSW]             AUTOPASS PASSWORD:[NO PSW]

ACCOUNT   PSW       ACCT/E DIAL/B NEW_#  PHONE #
#0     [NO PSW]    [N]    [N]   [N]
#1     [NO PSW]    [N]    [N]   [N]
#2     [NO PSW]    [N]    [N]   [N]
#3     [NO PSW]    [N]    [N]   [N]
#4     [NO PSW]    [N]    [N]   [N]
#5     [NO PSW]    [N]    [N]   [N]
#6     [NO PSW]    [N]    [N]   [N]
#7     [NO PSW]    [N]    [N]   [N]
#8     [NO PSW]    [N]    [N]   [N]
#9     [NO PSW]    [N]    [N]   [N]
OK
```

ATI11 Display

```
USRobotics Courier V.Everything Link Diagnostics...

Modulation               Unknown Speed
Carrier Freq    ( Hz )   0/0
Symbol Rate              0/0
Trellis Code
Nonlinear Encoding
Precoding
Shaping
Preemphasis Index
Recv/Xmit Level (-dBm)   0.0/0.0
SNR             ( dB )
Near Echo Loss  ( dB )
Far Echo Loss   ( dB )
Roundtrip Delay (msec)
Timing Offset   ( ppm)
Carrier Offset  ( ppm)
RX Upshifts              0
RX Downshifts            0
TX Speedshifts           0

OK
```

AT$ Display

```
HELP, Ampersand Commands (CTRL-S to Stop, CTRL-C to Cancel)

       &An     n=0  Disable /ARQ Result Codes   &Pn   n=0  N.American Pulse Dial
               n=1  Enable /ARQ Result Codes           n=1  UK Pulse Dial
               n=2  Enable /Modulation Codes    &Rn   n=0  CTS Follows RTS
               n=3  Enable /Extra Result Codes         n=1  Ignore RTS
       &Bn     n=0  Floating DTE Speed                 n=2  RX to DTE/RTS high
               n=1  Fixed DTE Speed             &Sn   n=0  DSR Always On
               n=2  DTE Speed Fixed When ARQ           n=1  Modem Controls DSR
       &Cn     n=0  CD Always On                       n=2  Pulse DSR, CTS=CD
               n=1  Modem Controls CD                  n=3  Pulse DSR
       &Dn     n=0  Ignore DTR                         n=4  DSR = DCD
               n=1  On-Line Command Mode               n=5  Modem Controls DSR, CTS=CD
               n=2  DTE Controls DTR            &Tn   n=0  End Test
       &Fn     n=0  Load Factory Configuration         n=1  Analog Loopback (ALB)
               n=1  Hardware Flow Control Cnfg.        n=3  Digital Loopback (DLB)
               n=2  Software Flow Control Cnfg.        n=4  Grant Remote DLB
               n=3  HST/Cellular w/ HW FC Cnfg.        n=5  Deny Remote DLB
       &Gn     n=0  No Guard Tone                      n=6  Remote Digital Loopback
               n=1  550 Hz Guard Tone                  n=7  Remote DLB With Self Test
               n=2  1800 Hz Guard Tone                 n=8  ALB With Self Test
       &Hn     n=0  Disable TX Flow Control     &Un   Lowest Link Speed Limit
               n=1  CTS                                n=0  Disabled
               n=2  Xon/Xoff                           n=1  300 bps
               n=3  CTS and Xon/Xoff                   n=2  1200 bps
       &In     n=0  Disable RX Flow Control            n=3  2400 bps
               n=1  Xon/Xoff                           n=4  4800 bps
               n=2  Xon/Xoff Chars Filtered            n=5  7200 bps
               n=3  HP Enq/Ack Host Mode               n=6  9600 bps
```

```
        n=4  HP Enq/Ack Terminal Mode
        n=5  Xon/Xoff for non-ARQ Mode
&Kn     n=0  Disable Data Compression
        n=1  Auto Data Compression
        n=2  Enable Data Compression
        n=3  Selective Data Compression
&Ln     n=0  Disable Leased Line
        n=1  Enable Leased Line
        n=2  Enable Cellular
&Mn     n=0  Normal Mode
        n=1  Reserved
        n=4  ARQ/Normal Mode
        n=5  ARQ Mode
&Nn     n=0  Highest Link Speed
        n=1  300 bps
        n=2  1200 bps
        n=3  2400 bps
        n=4  4800 bps
        n=5  7200 bps
        n=6  9600 bps
        n=7  12000 bps
        n=8  14400 bps
        n=9  16800 bps
        n=10 19200 bps
        n=11 21600 bps
        n=12 24000 bps
        n=13 26400 bps
        n=14 28800 bps
        n=15 31200 bps
        n=16 33600 bps
        n=17 33333 bps
        n=18 37333 bps
        n=19 41333 bps
        n=20 42666 bps
        n=21 44000 bps
        n=22 45333 bps
        n=23 46666 bps
        n=24 48000 bps
        n=25 49333 bps
        n=26 50666 bps
        n=27 52000 bps
        n=28 53333 bps
        n=29 54666 bps
        n=30 56000 bps
        n=31 57333 bps

        n=7  12000 bps
        n=8  14400 bps
        n=9  16800 bps
        n=10 19200 bps
        n=11 21600 bps
        n=12 24000 bps
        n=13 26400 bps
        n=14 28800 bps
        n=15 31200 bps
        n=16 33600 bps
        n=17 33333 bps
        n=18 37333 bps
        n=19 41333 bps
        n=20 42666 bps
        n=21 44000 bps
        n=22 45333 bps
        n=23 46666 bps
        n=24 48000 bps
        n=25 49333 bps
        n=26 50666 bps
        n=27 52000 bps
        n=28 53333 bps
        n=29 54666 bps
        n=30 56000 bps
        n=31 57333 bps
&W      Store Configuration
&Xn     n=0  DCE Synchronous Clock
        n=1  DTE Synchronous Clock
        n=2  RX Clock is Source
&Yn     n=0  Destructive
        n=1  Destructive/Expedited
        n=2  Nondest./Expedited
        n=3  Nondest./Unexpedited
&Zn=s Store Phone Number
&Zn=L Store Last Phone Number
&Zn?  Query Phone Number

OK
```

AT%$ Display

```
HELP, Percent Commands (CTRL-S to Stop, CTRL-C to Cancel)

%An=  Security Account Information %E=n  Erase Account Information
       Command Structure                    n=1  Erase Local Access Psw
%An=PW,ACCT E,DIAL B,NEW#,PH#               n=2  Erase Autopass Psw
       n = (0-9)                            n=3  Erase Accounts Psw
       PW = Password                        n=4  Erase Accounts Phone #
       ACCT E = Account Enable              n=5  Erase Accounts Status
       DIAL B = Dial Back Enable    %Fn   Remote DTE Data Format
       NEW# = New Dial Back #               n=0  8, No parity
       PH# = Dial Back Phone #              n=1  7, Mark parity
%Bn   Remote DTE Data Rate                  n=2  7, Odd parity
       n=0    110  bps                      n=3  7, Even parity
       n=1    300  bps             %L=PWn Security Local Access Psw
       n=2    600  bps                     PWn = (0-9)
       n=3   1200  bps             %Pn=s Store Remote Access Pswd
       n=4   2400  bps                     n=0  Query Access Only
       n=5   4800  bps                     n=1  Full Configuration
       n=6   9600  bps             %Pn?  Query Remote Access Pswd
       n=7  19200  bps                     n=0  Query Access Only
       n=8  38400  bps                     n=1  Full Configuration
       n=9  57600  bps             %S=   Psw To Grant Local Access
       n=10 115200 bps             %T    Touch Tone recognition
%Cn     n=0  Defer Configuration   %V=PWn Security Autopass Psw
       n=1  Revert Configuration    PWn = (0-9)
       n=2  Execute Configuration

OK
```

AT&$ Display

```
HELP, Ampersand Commands (CTRL-S to Stop, CTRL-C to Cancel)
&An     n=0  Disable /ARQ Result Codes      &Pn     n=0  N.American Pulse Dial
        n=1  Enable /ARQ Result Codes               n=1  UK Pulse Dial
        n=2  Enable /Modulation Codes       &Rn     n=0  CTS Follows RTS
        n=3  Enable /Extra Result Codes             n=1  Ignore RTS
&Bn     n=0  Floating DTE Speed                     n=2  RX to DTE/RTS high
        n=1  Fixed DTE Speed                &Sn     n=0  DSR Always On
        n=2  DTE Speed Fixed When ARQ               n=1  Modem Controls DSR
&Cn     n=0  CD Always On                           n=2  Pulse DSR, CTS=CD
        n=1  Modem Controls CD                      n=3  Pulse DSR
&Dn     n=0  Ignore DTR                             n=4  DSR = DCD
        n=1  On-Line Command Mode                   n=5  Modem Controls DSR, CTS=CD
        n=2  DTE Controls DTR               &Tn     n=0  End Test
&Fn     n=0  Load Factory Configuration             n=1  Analog Loopback (ALB)
        n=1  Hardware Flow Control Cnfg.            n=3  Digital Loopback (DLB)
        n=2  Software Flow Control Cnfg.            n=4  Grant Remote DLB
        n=3  HST/Cellular w/ HW FC Cnfg.            n=5  Deny Remote DLB
&Gn     n=0  No Guard Tone                          n=6  Remote Digital Loopback
        n=1  550 Hz Guard Tone                      n=7  Remote DLB With Self Test
        n=2  1800 Hz Guard Tone                     n=8  ALB With Self Test
&Hn     n=0  Disable TX Flow Control        &Un   Lowest Link Speed Limit
        n=1  CTS                                    n=0  Disabled
        n=2  Xon/Xoff                               n=1  300 bps
        n=3  CTS and Xon/Xoff                       n=2  1200 bps
&In     n=0  Disable RX Flow Control                n=3  2400 bps
        n=1  Xon/Xoff                               n=4  4800 bps
        n=2  Xon/Xoff Chars Filtered                n=5  7200 bps
        n=3  HP Enq/Ack Host Mode                   n=6  9600 bps
        n=4  HP Enq/Ack Terminal Mode               n=7  12000 bps
        n=5  Xon/Xoff for non-ARQ Mode              n=8  14400 bps
&Kn     n=0  Disable Data Compression               n=9  16800 bps
        n=1  Auto Data Compression                  n=10 19200 bps
        n=2  Enable Data Compression                n=11 21600 bps
        n=3  Selective Data Compression             n=12 24000 bps
&Ln     n=0  Disable Leased Line                    n=13 26400 bps
        n=1  Enable Leased Line                     n=14 28800 bps
        n=2  Enable Cellular                        n=15 31200 bps
&Mn     n=0  Normal Mode                            n=16 33600 bps
        n=1  Reserved                               n=17 33333 bps
        n=4  ARQ/Normal Mode                        n=18 37333 bps
        n=5  ARQ Mode                               n=19 41333 bps
&Nn     n=0  Highest Link Speed                     n=20 42666 bps
        n=1  300 bps                                n=21 44000 bps
```

```
        n=2  1200 bps                              n=22 45333 bps
        n=3  2400 bps                              n=23 46666 bps
        n=4  4800 bps                              n=24 48000 bps
        n=5  7200 bps                              n=25 49333 bps
        n=6  9600 bps                              n=26 50666 bps
        n=7  12000 bps                             n=27 52000 bps
        n=8  14400 bps                             n=28 53333 bps
        n=9  16800 bps                             n=29 54666 bps
        n=10 19200 bps                             n=30 56000 bps
        n=11 21600 bps                             n=31 57333 bps
        n=12 24000 bps
&W    Store Configuration
        n=13 26400 bps                  &Xn        n=0  DCE Synchronous Clock
        n=14 28800 bps                             n=1  DTE Synchronous Clock
        n=15 31200 bps                             n=2  RX Clock is Source
        n=16 33600 bps                  &Yn        n=0  Destructive
        n=17 33333 bps                             n=1  Destructive/Expedited
        n=18 37333 bps                             n=2  Nondest./Expedited
        n=19 41333 bps                             n=3  Nondest./Unexpedited
        n=20 42666 bps
&Zn=s Store Phone Number
        n=21 44000 bps
&Zn=L Store Last Phone Number
        n=22 45333 bps
&Zn?  Query Phone Number
        n=23 46666 bps
        n=24 48000 bps
        n=25 49333 bps
        n=26 50666 bps
        n=27 52000 bps
        n=28 53333 bps
        n=29 54666 bps
        n=30 56000 bps
        n=31 57333 bps

OK
```

ATD$ Display

```
HELP, Dial Commands (CTRL-S to Stop, CTRL-C to Cancel)

0-9 Digits to Dial
*   Auxiliary Tone Dial Digit
#   Auxiliary Tone Dial Digit
T   Tone Dialing
P   Pulse Dialing
R   Call an Originate Only Modem
,   Pause (Wait for S8 Time)
;   Remain in Command Mode After Dialing
"   Used to Dial Alpha Phone #'s
W   Wait for 2nd Dial Tone (X3-X7)
@   Wait for an Answer (X3-X7)
!   Flash Switch Hook

OK
```

ATS$ Display

```
HELP, S Register Functions (CTRL-S to Stop, CTRL-C to Cancel)

S0  Ring to Answer On                 S35 Reserved
S1  Counts # of Rings                 S36 Reserved
S2  Escape Code Char                  S37 Reserved
S3  Carriage Return Char              S38 Disconnect Wait Time (sec)
S4  Line Feed Char                    S39 Reserved
S5  Backspace Char                    S40 Reserved
S6  Wait Time/Dial Tone (sec)         S41 # of Allowed Login Attempts
S7  Wait Time/Carrier (sec)           S42 Remote Escape Code Char
S8  Comma Time (sec)                  S43 Remote Escape Code Time (1/50sec)
S9  Carrier Detect Time (1/10sec)     S44 Leased Line Delay Timer (sec)
S10 Carrier Loss Time (1/10sec)       S51 Bit Mapped
S11 Dial Tone Spacing (msec)                1 = MNP/V.42 Disabled in V.22
S12 Escape Code Time (1/50sec)              2 = MNP/V.42 Disabled in V.22bis
S13 Bit Mapped                              4 = MNP/V.42 Disabled in V.32
       1 = Reset On DTR Loss                8 = Reserved
       2 = Do Originate in Auto Answer      16 = Reserved
       4 = No Pause Before Result Codes     32 = Reserved
```

```
        8 = Do DS0 On DTR
        16 = Do DS0 On Reset
        32 = Disable HST
        64 = Disable MNP Level 3
        128 = Hardware Reset
S14 Bit Mapped
        1 = Escape Code Hang Up
S15 Bit Mapped
        1 = Disable High-Freq EQ
        2 = Disable Online Fallback
        4 = Disable 450 bps Back Channel
        8 = Reduced Non-ARQ TX Buffer
        16 = Disable MNP Level 4
        32 = Set DEL=Backspace
        64 = Unusual MNP-Incompatibility
        128 = Custom Applications
S16 Test Modes
        1 = Analog Loopback
        2 = Dial Test
        4 = Test Pattern
        8 = Remote Digital Loopback
        16 = Reserved
        32 = Reserved
        64 = Reserved
        128 = Reserved
S17 Reserved
S18 &Tn Test Timeout (sec)
S19 Inactivity Timeout (min)
S20 Reserved
S21 Break Length (1/100sec)
S22 Xon Char
S23 Xoff Char
S24 DSR Pulse Time (1/50sec)
S25 DTR Recognition Time (1/100sec)
S26 RTS/CTS Delay Time (1/100sec)
S27 Bit Mapped
        1 = V21 Mode
        2 = Disable TCM
        4 = Disable V32
        8 = Disable 2100hz
        16 = Disable MNP Handshake
        32 = Disable V.42
        48 = Disable V.42 Detect Phase
        64 = Reserved
        128 = Unusual SW-Incompatibility
S28 V32 Handshake Time (1/10sec)
S29 Reserved
S30 Reserved
S31 Reserved
S32 Reserved
S33 Reserved
S34 Bit Mapped
        1 = Disable V32bis
        2 = Disable Enhanced V32 mode
        4 = Disable Quick V32 retrain
        8 = Enable V23 Fallback
        16 = Change MR to DSR
        32 = Reserved
        64 = Disable RA Busy Msg
        128 = Disable Terbo

OK
```

```
        64 = Disable Selective Reject
        128 = Enable phone exclusion delay
S53 Bit Mapped
        1 = Enable Dial Security
        2 = Enable Autopass Fallback
        4 = Enable Local Access Psw
        8 = Reserved
        16 = Reserved
        32 = Reserved
        64 = Reserved
        128 = Reserved
S54 Bit Mapped
        1 = Disable 2400 symbol rate
        2 = Disable 2743 symbol rate
        4 = Disable 2800 symbol rate
        8 = Disable 3000 symbol rate
        16 = Disable 3200 symbol rate
        32 = Disable 3429 symbol rate
        64 = Disable V.8 Call Indicate
        128 = Disable V.8 Mode
S55 Bit Mapped
        1 = Disable 8S-2D trellis code
        2 = Disable 16S-4D trellis code
        4 = Disable 32S-2D trellis code
        8 = Disable 64S-4D trellis code
        16 = Reserved
        32 = Reserved
        64 = Reserved
        128 = Enable phase roll detection
S56 Bit Mapped
        1 = Disable nonlinear coding
        2 = Disable TX level deviation
        4 = Disable preemphasis
        8 = Disable precoding
        16 = Disable shaping
        32 = Disable V34+
        64 = Disable V34
        128 = Disable VFC
S57 Reserved
S58 Bit Mapped
        1 = Disable x2
        2 = Reserved
        4 = Force x2 A-law mode
        8 = Reserved
        16 = Reserved
        32 = Reserved
        64 = Reserved
        128 = DSR/RI select
S59 Reserved
S60 Reserved
S61 Reserved
```

#1.024.1149