Downloder II, Error Processing

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1 Operation with forced errors

The Downloader II has error recovery and error toleration features. To test these features deliberate errors were forced in the communications system by placing excessive capacitance on the output of the Laptop's RS-232 data lines.

The RS-232-C specification says that RS-232 circuits will operate up to a load of 2,500 pf[6] (pico farads) and do need to operate with a larger capacitive load.

Several different combinations of capacitors were used to generate a large capacitive load. The original theory was that if the limit is 2,500 pf, then 5,000 pf should cause problems. This was not the case. Reasonable operation was observed at loads of up t0 20,000+ pf.

The RJ-45 port only operates at 115,200 baud and it worked nicely with lodes in excess of 20,000 pf. When this was happening, the error retry per message increased, indicating that errors were occurring and were being automatically corrected.

The RS-422 port operates at several speeds from 2,400 baud to 115,200 baud. During a download sequence utilizing the RS-422 port, **B**aud **R**ate **N**egotiantion (**BRN**) is done to determine what is the highest baud

[1] `$Header: d:/Downloader2/RCS/Errors.tex,v 1.1 2010-09-20 12:59:27-07 Hamilton Exp Hamilton $`
[4] `tocdepth = 4`
[5] `$Header: d:/Downloader2/RCS/Errors.inc,v 1.1 2010-09-20 12:59:24-07 Hamilton Exp Hamilton $`
[6] 50 feet of wire is given as an example of something that might have 2,500 pf of capacitance, but the limit is 2,500 pf, not 50 feet.

rate that reliable communications may be made at. The BRN sequence starts at 2,400 baud and continues up to 115,200 in several steps[7]

During the BRN an effort is made at each baud rate to send and receive as echo data a standard test pattern. If the echoed data is correct, i.e. identical, then the next baud rate is attempted. This logic is repeated until the highest baud rate is found. If an error is detected in the echoed data, then four more attempts (for a total of five attempts) are made. If all five attempts are a failure, then the BRN process drops back to the preceding baud rate and uses it for the download operation.

It should be noted that "ordinary" ceramic capacitors were used for this testing. They have a stated accuracy of ±10%. The capacitors were placed in a "proto-board" to make adding and deleting parts of the configuration as easy as possible.

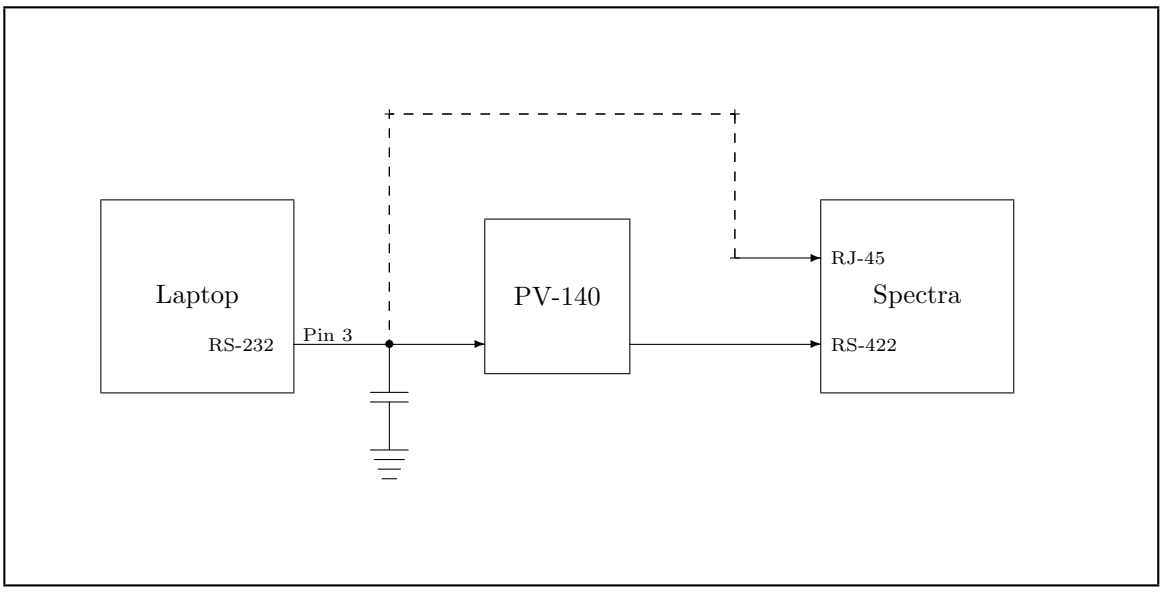
Load, Speed Mode, Baud Rate, Spectra Port	Max Retrys	Msg/Sec	KBytes/sec	Duration	Errors	TOs	Error Rate %
24,800 pf "Fast" 115200 RJ-45	6	78	5.5	4:48	3,875	0	17±
24,800 pf "Fast" 115200 RJ-45	6	75	5.2	5:09	4,479	0	19.3
24,800 pf "Med" 115200 RJ-45	5	49	3.5	7:38	3,965	0	15.5
33,800 pf "Fast" 38400 RS-422	1	51	3.6	6:07	18	12	0.16
120,000 pf "Fast" 19200 RS-422	0	26	1.8	12:06	0	1	0.00
220,000 pf "Fast" 9600 RS-422	1	13	.9	24:07	4	1	0.03

Table 1: Performance of the Downloader II with error inducing loads placed on the RS-232 connections (pin 3-5) on the Laptop RS-232 port.

Note

1. Testing on during 2010 on Aug 31 and Sep 2.
2. The RS-232 specification states that RS-232 circuits should not have more than 2,500pf of capacitance.
3. These are the results attempting to cause errors and verify that the Downloader II will work correctly with them.

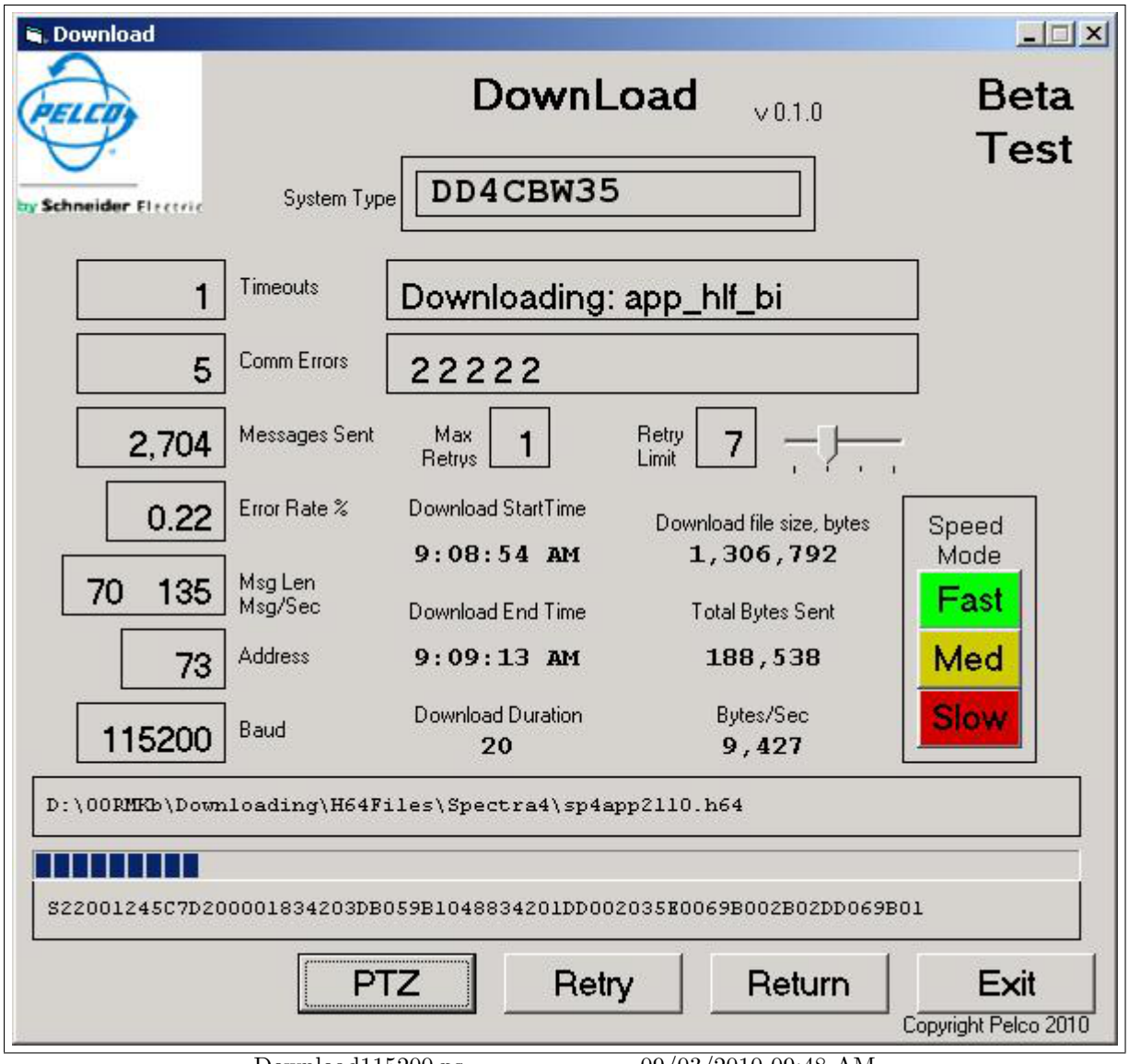
[7]The baud rates utilized are 2,400, 4,800, 9,600, 19,200, 38,400 and 115,200.



$RCSfile: Errors.inc,v $

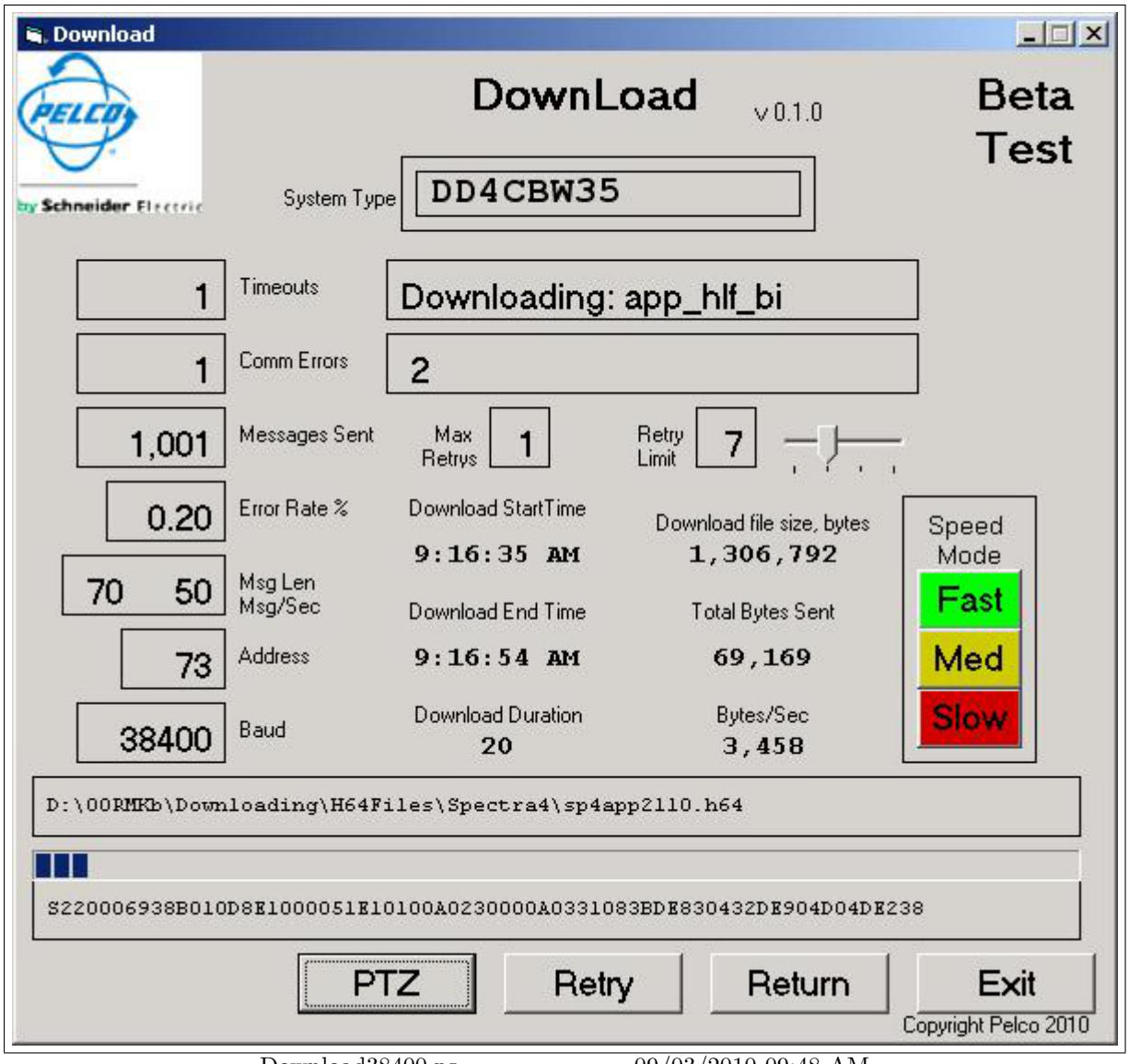
Figure 1: Placement of the capacitive load

4. The downloaded file consisted of, nominaly, 18,703 70 byte records. The first and last records were shorter.
5. The full file length was 1,306,792 bytes.



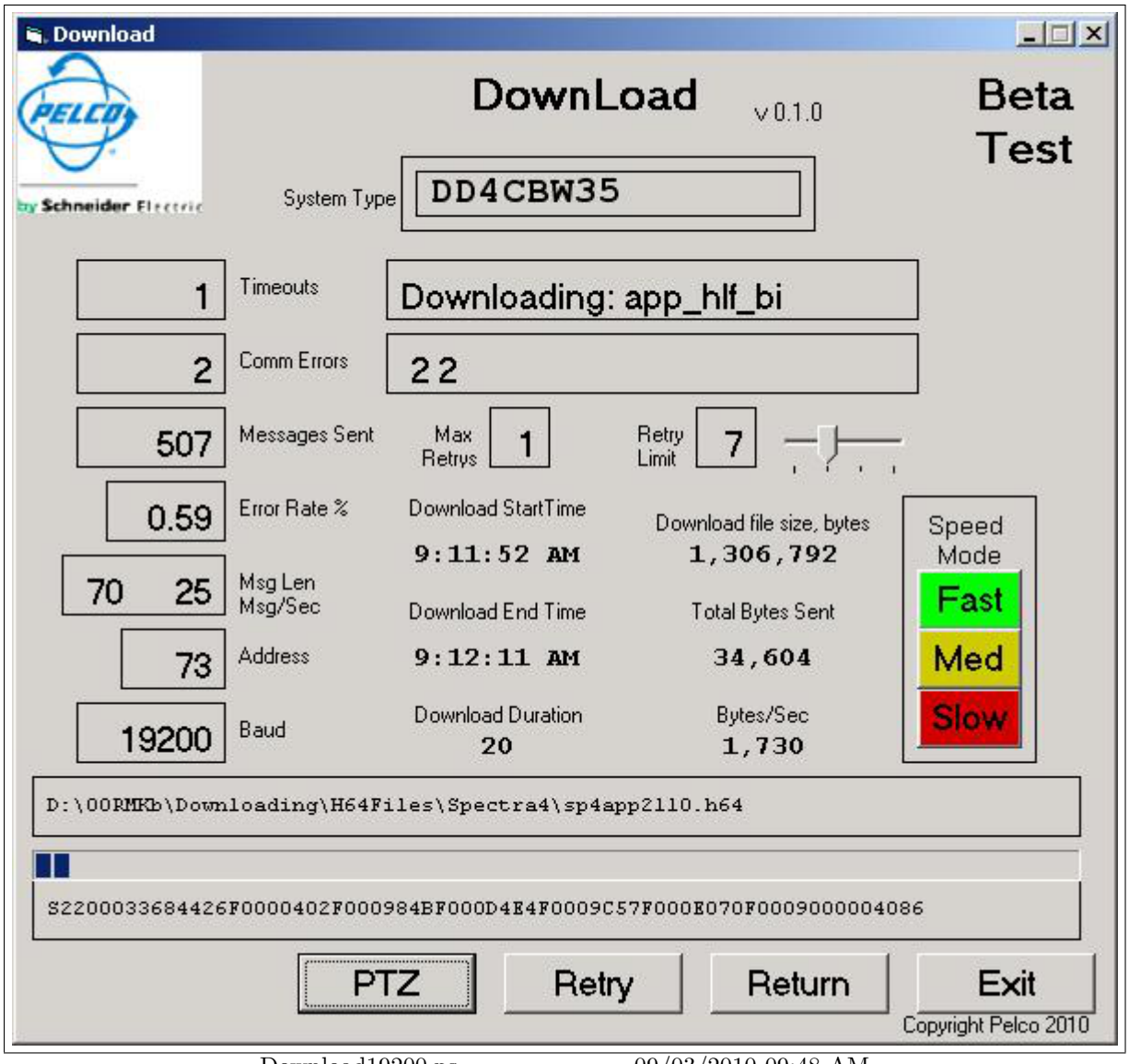
Download115200.ps 09/03/2010 09:48 AM

Figure 2: Downloading with No loading through the RS-422 port, Partial download



Download38400.ps 09/03/2010 09:48 AM

Figure 3: Downloading with 40,000 pf load through the RS-422 port, Partial download



Download19200.ps 09/03/2010 09:48 AM

Figure 4: Downloading with 100,000 pf load through the RS-422 port, Partial download

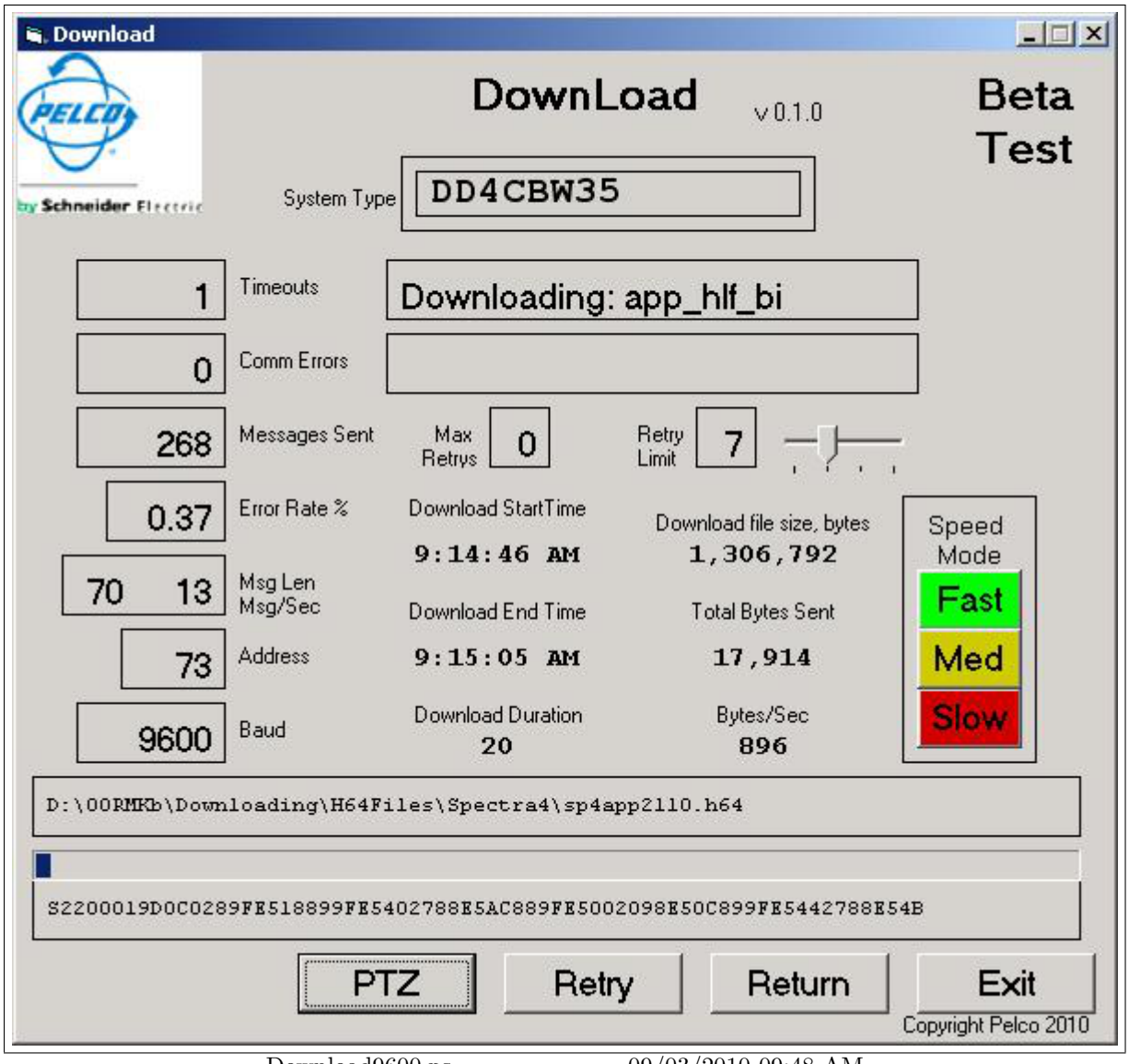


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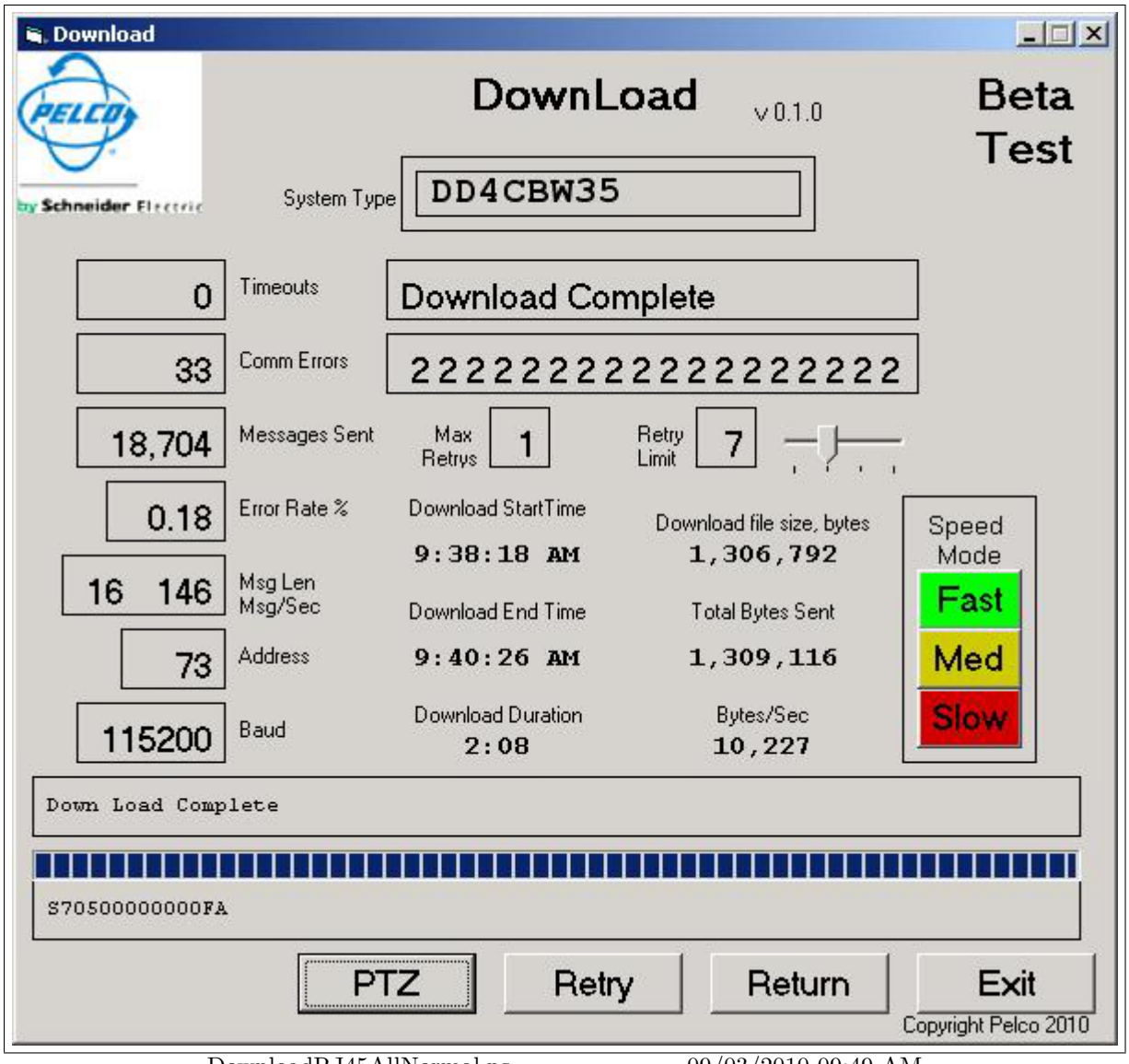
Figure 5: Downloading with 200,000 pf load through the RS-422 port, Partial download



DownloadRJ45AllNormal.ps 09/03/2010 09:49 AM

Figure 6: Downloading with no load load through the RJ-45 port, Full download

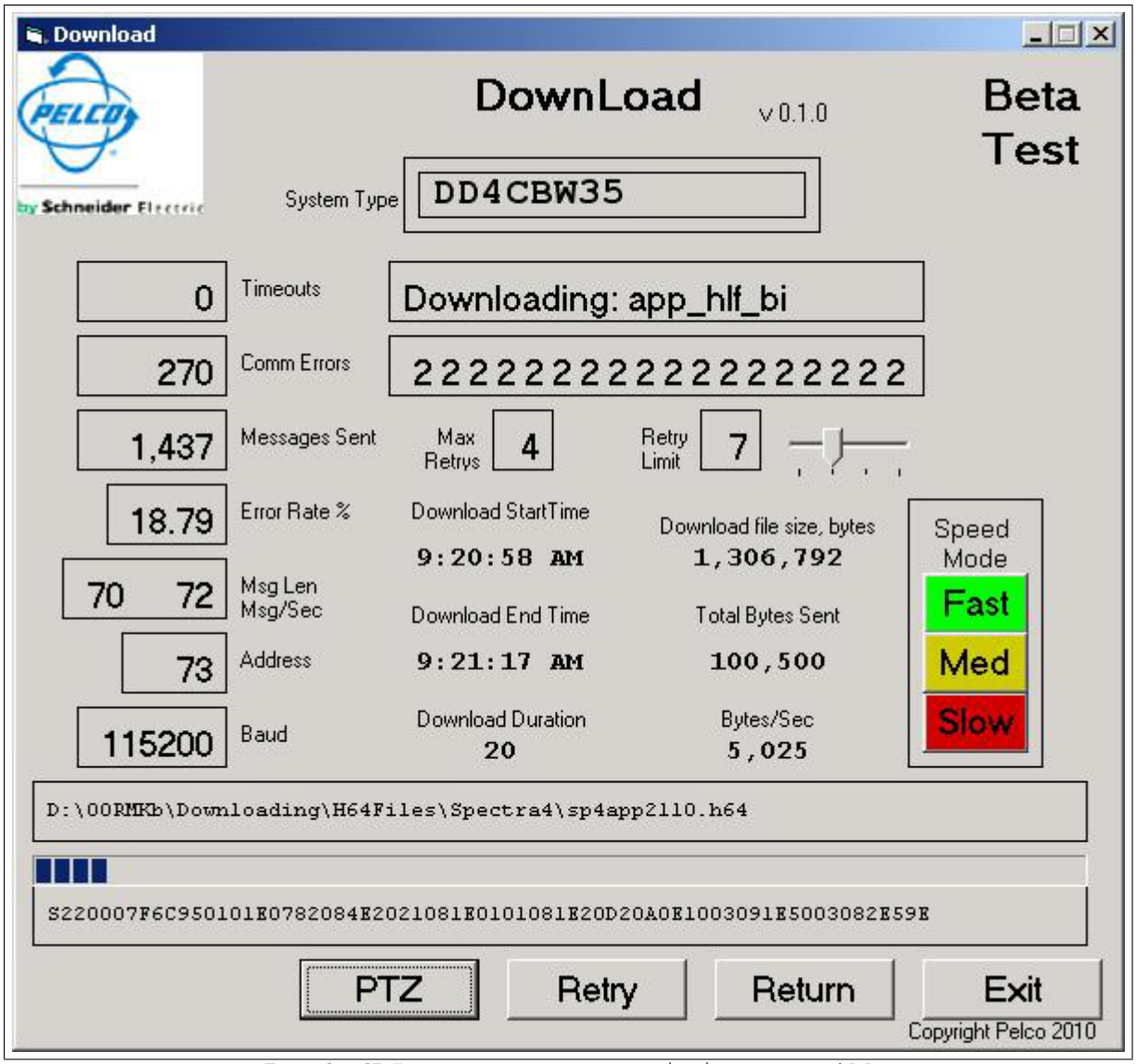


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Figure 7: Downloading with 30,000 pf load through the RJ-45 port, Partial download

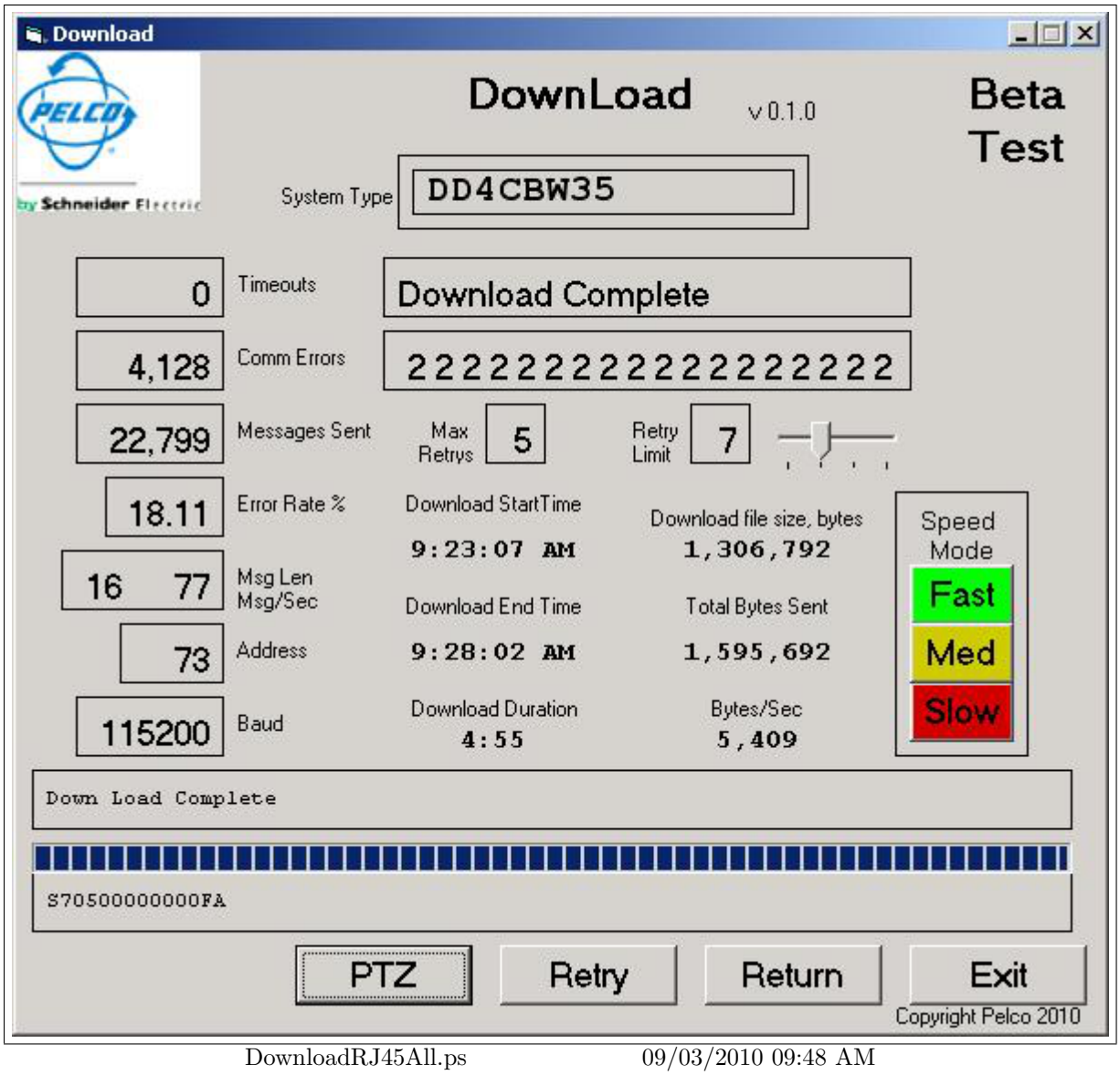

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Figure 8: Downloading with 30,000 pf load through the RJ-45 port, Full download

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