Technical Reference

for the

POWER PRO DCC™

Digital Command Control

DCC Packet Analyzer

Version 0.9s

Convenient , easy connection to track or control bus

Features:

- View DCC packets being sent by command station in hex or plain english
- Selectively filter out idle, reset, speed, function and or speed packets
- Opto-isolated to prevent ground loops from DCC system to computer (requires external 9-12 volt DC supply)
- Can be powered from track or Cab Bus jack
- ICC packet analyzer compatible mode (hex only display)
- Verbose mode makes easy to decipher packets
- Additional Bonus: display NCE Cab Bus activity

Additional Requirements:

- PC or Mac running a terminal program capable of 38.4Kbps, 7 data bits
- 9 pin serial cable

Optional Accessories

- Optional 9-12 volt DC supply with 3.5mm power connector

Every attempt has been made to ensure this product complies with all applicable NMRA Standards and Recommended Practices.

Analyzer connections:

The following connections are needed to use the DCC Packet Analyzer.

- The RS232 connector provides data to your PC via a standard (pin 1 to pin 1) serial cable.
- Pins 2 and 3 of the Control Bus "RJ" jack connect to the track.
- Power for the analyzer is normally supplied from an external 9-12 volt DC power supply through the 3.5mm phone jack (tip positive) or the Cab Bus RJ-12 connector (pin 2 -ground, pin 5 -positive).
- Using an external "wall wart" supply enables use of the opto-isolator feature of the analyzer. If you are sure there is no ground sneak path (such as when a laptop computer is used) the DCC Analyzer can be powered from the track or control bus by installing jumpers JP1 and JP2.
- Dip switch 4 must be OFF to use the packet analyzer (Switch 4 on = cab bus analyzer)
- Dip switches 1-3 are currently ignored

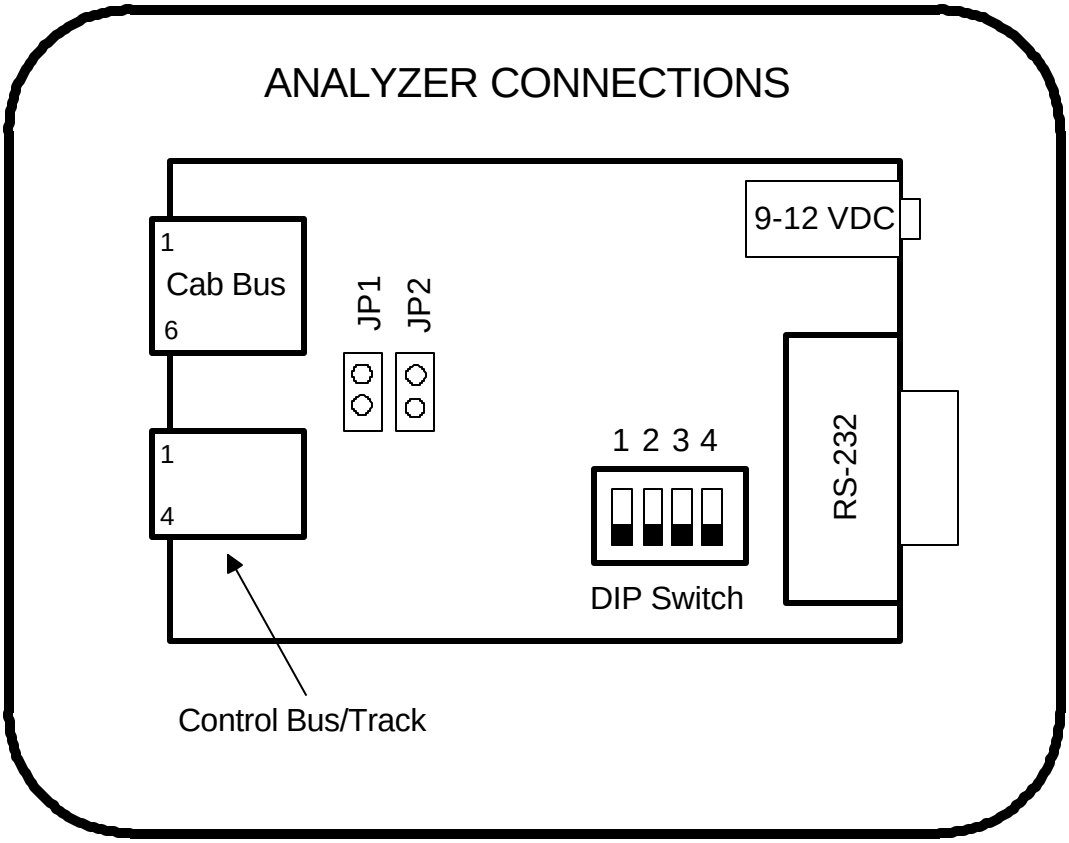

Figure 1 Analyzer connection locations

Data Communications

We've had good luck using Hyperterminal supplied with Win95 and Win98. The communications settings are 38.4kbps, 7 data bits, 1 stop bit. Use the 'No Flow Control' option. The analyzer does not echo characters so you may also want to turn echo on. Also turn on 'Append line feeds to incoming line ends' under the Properties->Settings->ASCII Setup menu.

Before connecting the analyzer to the track or command station verify communications by pressing '?" to get a menu of commands and the analyzer software version.

Operations

The analyzer powers up in ICC compatibility mode (H0 mode).
Press '?' followed by <enter> to get the following abbreviated list of commands supported.

```
A[+/-] Accessory packets on/off
A[P/S] display as paired or individual outputs
H[0-7] Hex mode 0-7 0=ICC mode
I[+/-] idle packets on/off
L[+/-] Locomotive pkts on/off
R[+/-] Resets on/off
S[+/-] Signal packets on/off
V Verbose mode

<press any key>
```

Figure 2 - Help Display

Expanded Command List

- All commands to analyzer must be followed by <enter>
- All packet data from analyzer terminated by a carriage return (0x0d)

Hex mode commands

V - changes display to verbose mode

H0 - displays packet in hex with an ASCII symbol indicating number of preamble bits

Example of packet with 12 (“) preamble bits to locomotive #3 (03h) and a speed of zero (60h) followed by the checksum (63h): **“036063**

Table of ASCII characters representing preamble size

ASCII Char.	# of bits in preamble	ASCII Char.	# of bits in preamble	ASCII Char.	# of bits in preamble
(space)	10	_	23	:	36
!	11	.	24	;	37
“	12	/	25	<	38
#	13	0	26	=	39
$	14	1	27	>	40
%	15	2	28	?	41
&	16	3	29	@	42
‘	17	4	30	A	43
(	18	5	31	B	44
)	19	6	32	C	45
*	20	7	33	D	46
+	21	8	34	E	47
,	22	9	35	F	48

Hex Mode Commands (continued)

H1 - displays packet in hex as in H0 but with spaces between data bytes

Example of packet with 12 (“) preamble bits to locomotive #3 (03h) and a speed of zero (60h) followed by the checksum (63h): **“ 03 60 63**

H2 - displays packet in hex with out preamble size

Example of packet to locomotive #3 (03h) and a speed of zero (60h) followed by the checksum (63h): **036063**

H3 - displays packet in hex with out preamble size and spaces between data bytes

Example of packet to locomotive #3 (03h) and a speed of zero (60h) followed by the checksum (63h): **03 60 63**

H4 - displays packet in hex with preceded by ‘P’ and the number of preamble bits in hex

Example of packet with 12 (P0C) preamble bits to locomotive #3 (03h) and a speed of zero (60h) followed by the checksum (63h): **P0C036063**

H5 - displays packet in hex with preceded by ‘P’ and the number of preamble bits in hex and spaces between data bytes

Example of packet with 12 (P0C) preamble bits to locomotive #3 (03h) and a speed of zero (60h) followed by the checksum (63h): **P0C 03 60 63**

H6 - same as H2
H7 - same as H3

Verbose mode commands (note: verbose commands that enable/disable display of packets also work in hex display mode)

H changes display to hex mode

A+ enables display of accessory packets
A- disables display of accessory packets
AP displays accessory packets as paired outputs
Example: `A0052R` - accessory 52 reverse (off) position
AS displays accessory packets as (single) non-paired outputs
Example: `B0001b4OFF` - Board number 1, bit 4 off (board number = CV513/CV521)

I+ enables display of idle packets
Example: `IDLE`
I- disables display of idle packets

L+ enables display of locomotive speed packets
Example: `L003 S00R` - short loco address 3, 14/28 speed zero in reverse
Example: `L1234 S123F` - long loco address 1234, 128 speed 123 in forward
Example: `L003 ESTOP` - short loco address 3, emergency stop
L- disables display of locomotive speed packets

R+ enables display of reset packets
Example: **RESET**
R- disables display of reset packets

S+ enables display of signal packets
Example: `S1234 C4` - Signal 1234 data byte = C4 in hex
S- disables display of signal packets

Other packet display examples (these packets can not be disabled... yet)

Function Group 1 packets

```
L123  FL----    - Loco (short address) 123 function group 1  (F0 on; F1,2,3,4 off)
L1234 FL4-2-    - Loco (long address) 1234 function group 1 (F0,2,4 on; F1,F3 off)
```

Function Group 2 packets

```
L123  F87-5     - Loco (short address) 123 function group 2  (F8,7,5 on; F6 off)
L1234 F8-65     - Loco (long address) 1234 function group 2 (F8,6,5 on; F7 off)
```

Function Group 3 packets

```
L123  FCBA9     - Loco (short address) 123 function group 3  (F12,11,10,9 on)
L1234 F-B-9     - Loco (long address) 1234 function group 3 (F11,9 on; F12,10 off)
```

Consist control packets

```
L011  CON=123R  - Set loco short address 011 to consist address 123
L1234 CON=123R - Set loco long address 1234 to consist address 123
```

OPS programming packets byte program (long form)

```
L123  CV0152=075  - Set loco short address 123 CV#152 to 75 decimal
L1234 CV0004=106  - Set loco long address 1234 CV#4 to 106 decimal
```

OPS programming packets bit program (long form)

```
L123  CV0152 b5=1   - Set loco short address 123 CV#152 bit 5 to 1
L1234 CV0004 b1=0 - Set loco long address 1234 CV#4 bit1 to 0
```

OPS programming packets bit verify (long form)

```
L123  OPS VFY   - Loco short address 123 bit/byte verify operation
L1234 OPS VFY   - Loco long address 1234 bit/byte verify operation
```

OPS programming packets byte program (short form)

```
L123  CV23=060  - Set loco short address 123 CV#23 to 60 decimal
L1234 CV24=106  - Set loco long address 1234 CV#24 to 106 decimal
```

NOTES:

If the long locomotive address is out of 4 digit range (10000-10231) it will be displayed in hex. This is because there is not enough time to transmit 5 digits over the RS232 port before the next packet must be displayed

If a packet is not understood it will be displayed in hex

Long addresses are always displayed a 4 digits, short address are always 3 digits

14/28 speed packets always have 2 digits for speed, 128 packets always have 3 speed digits

Short form OPS programming of bits is currently displayed as L123 OPS? This is because the decoding of this command is not finished yet.

The meaning of signal packet data is not known yet so we display it in hex until the RP for this packet are finalized.