

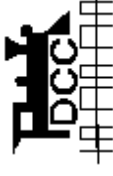
NMRA Digital Command Control Standard

**Matt Katzer
Jim Hamby**

Portland, Or

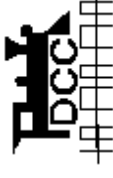
Agenda

- DCC design requirements
- Module functionality
- Installation and use
- Controller capabilities
 - Menu boxes to show capabilities
- Demo
 - Digitrax
 - LENZ (Digital Plus)
 - Decoder Install



Why are you here

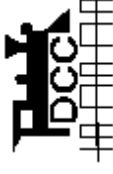
- **Clinic will focus on the question “what is DCC”**
 - command control standard
 - examine different implementations
 - example features
- **What are your expectations?**
- **We will use computer graphics to show functionality**
 - computers are not required
 - computers are the presenters tools



Why the DCC standard

- **The Industry was fragmented**
 - many different control implementations
 - CTC, Dynatrol, Keller, Marklin-AC all incompatible
 - manufactures do not have the R&D capability to do a good engineering design
 - Innovation was stalled
- **DCC is a world-wide solution**
 - supports all scales (Z to G)
 - committee membership is international (21 countries)
 - Industry supports it (Marklin, Stewart, Bachman, Kato, Roco, Fleschman, Arnold, Atlas and others)

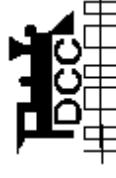
The DCC standard was designed to add innovation to the hobby and stop the industry fragmentation.



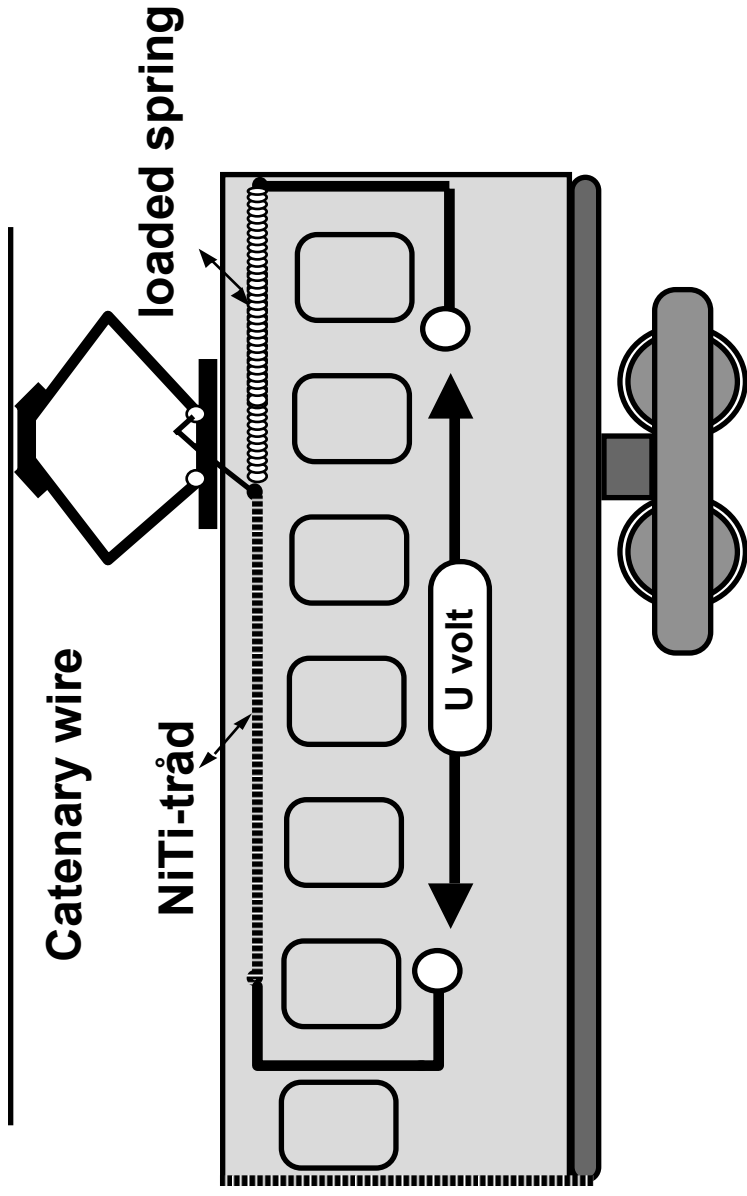
DCC Functionality

- **DCC design Issues**
 - Safety
 - Reliability
 - Simplicity of Installation/Use
- **What are the capabilities of DCC Standard**
 - Smooth Speed Control
 - Multi Unit Operation
 - Control of Auxiliary Functions
 - Large Number of Engines (or addresses)
 - S9 Compliance

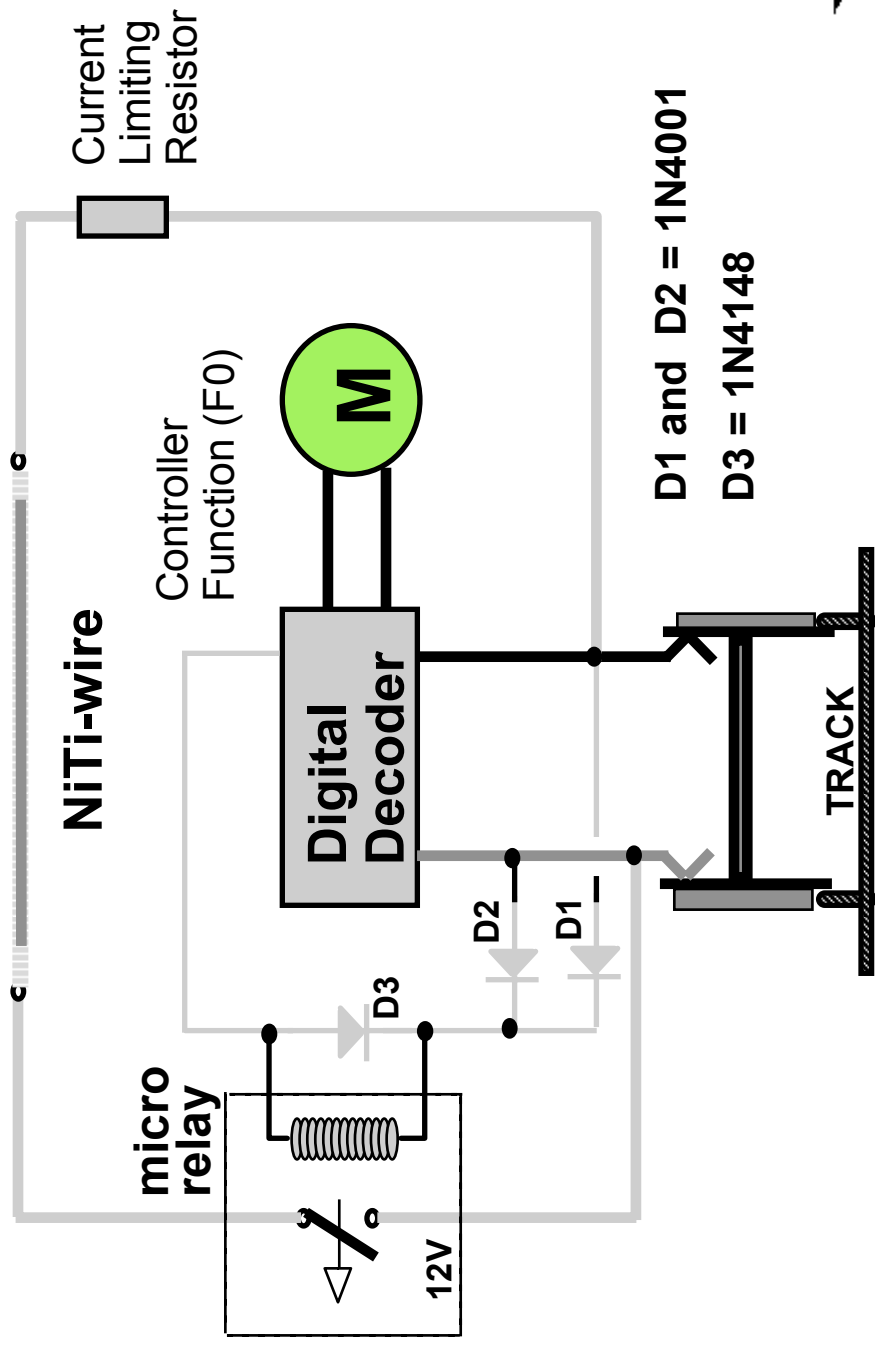
Lets look at a DCC Example



How to build a memory metal servo



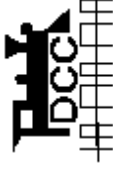
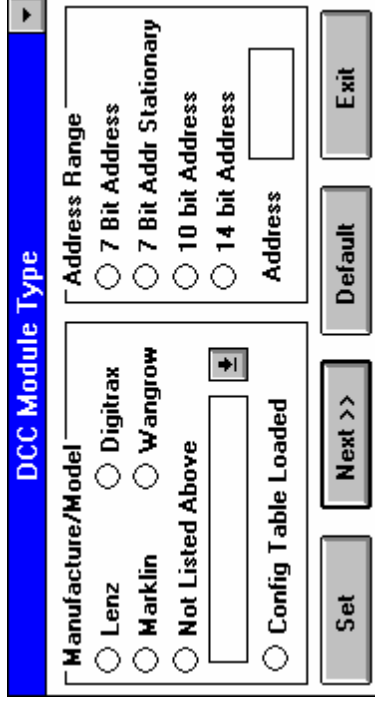
How to control memory metal (NiTi-wire) in a digital system



NMRA Design Model

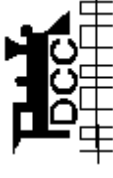
- **Maximum user flexibility**
 - allows direct speed control
 - Acceleration curves
 - Consist
 - Accessories

- **Compatibility**
 - Marklin/Lenz/Digitrax/Wangrow
 - flexible growth
 - 32,000 address



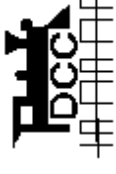
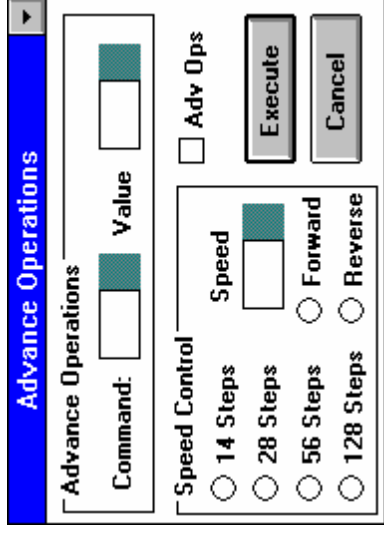
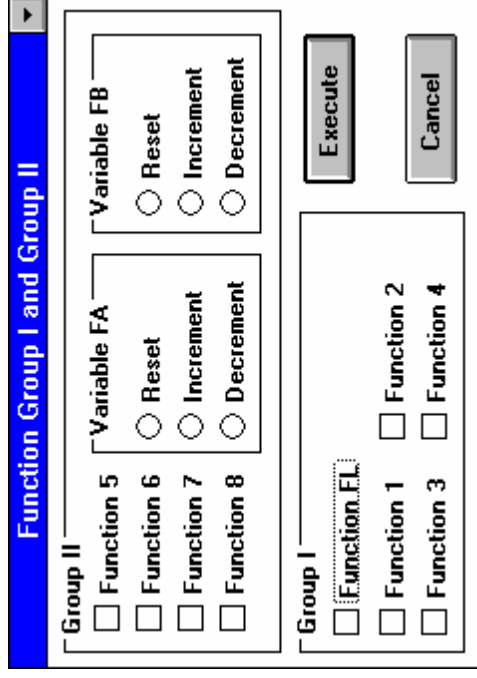
DCC supports all scales

- **Modules fit into all scales**
 - Z scale to G support (LGB just announced new version)
- **Electrical values tailored to scale**
 - Z scale support small 1/2 amp
 - N are typically 1 - 1.5 amps
 - Ho and G are between 2 - 6 amps
- **DCC is an open system**
 - commercially viable (Multiple mfg's)
 - No proprietary or copyrighted material
 - multiple source for controllers (NMRA long term goal is sub \$10).



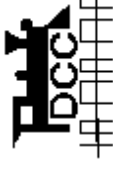
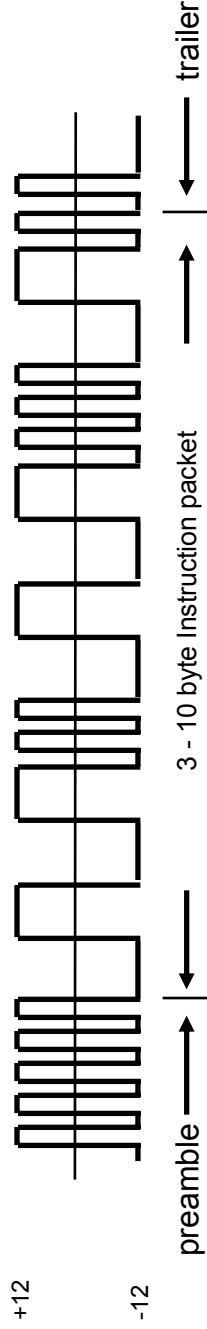
NMRA DCC Capabilities

- The DCC standard allows flexible and growth!
 - Functions pre-defined
 - Multiple vendors (Wangrow, LENZ, Digitrax, VTC)
 - up to 128 speed steps
- Computer Interface (for those that want them)
 - Lenz, Digitrax or Wangrow



How does DCC work?

- **Instructions are sent over rails**
 - uses a packet format
 - pulses in packet range from -5 - 12 volts
 - pulse are 56/120 usec in duration (150 - 200Hz)
- **Pulse mode has side benefits**
 - easy to duplicate (cheap to manufacture)
 - frequency helps keep layout clean
- **DCC is a DC command control standard**
 - uses a DC signal base
 - analog engines run fine on a DCC layout without modification (using stretch 0's/1's to control engine)



DCC Accessory Controls

- **Expansion for user Accessories**
 - discrete functions
 - variable functions
 - automatic speed curves
 - broadcast modes

Accessory Decoders

Type I

Function 1

Function 2

Function 3

Function 4

Function 5

Function 6

Function 7

Function 8

Type II

Variable 1

Reset

Increment

Decrement

No change

Variable 2

Reset

Increment

Decrement

No change

Direct Address

Address

Command Type

Broadcast Type I

Direct Type I

Broadcast Type II

Direct Type II

Execute

Cancel

Service Mode

Configuration Variable Primary Address/Consist Control Value

Programming Modes

Read

Page Mode Access

Write

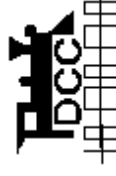
Direct Mode Access

Read All

Speed Table >>

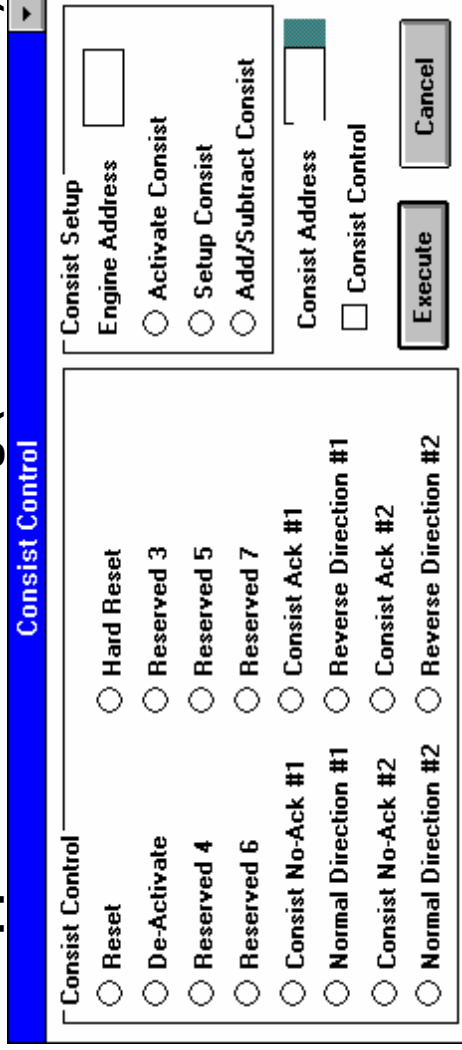
Execute

Cancel

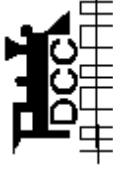


NMRA DCC Consist Controls

- **Excellent support for multiunit consist!**
 - upto 32,000 consist
 - you control direction, base speed and special functions
 - consist support varies from mfg (command station)



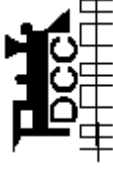
- **User selected loco address**
 - base specification has 99
 - 32,000 extended addresses
 - Spec requires EEPROM addresses (user programmable)



Where Can I get the Spec?

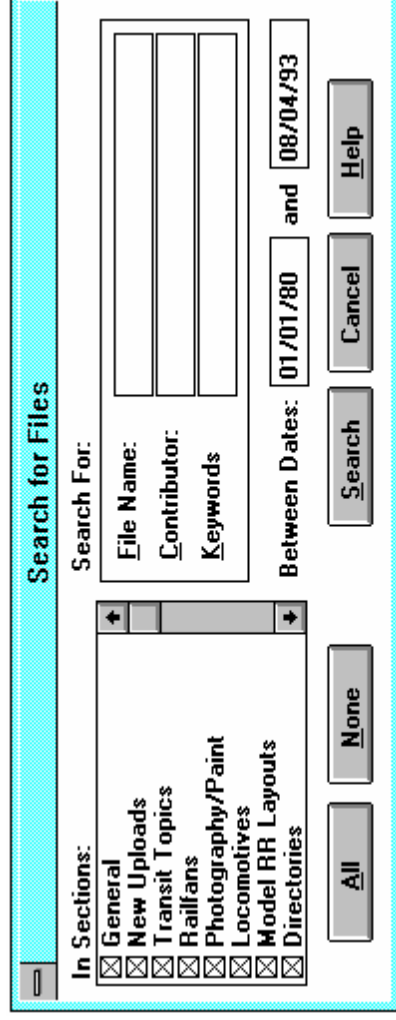
- **Spec has been published**
 - You can request copies from NMRA headquarters (see NMRA Bulletin for address, Contact Kalmbach Library)
 - **DCC committee has 1994 version (\$23.00)**
(contact Matt Katzer; 645-7951)
- **Electronic information?**
 - internet: sra@bistromath.mitre.org
 - www: [//www.mcs.net/~dsdawdy](http://www.mcs.net/~dsdawdy)
 - Compuserve: Train-net forum
 - BBS: **The Conductor (503-690-8176/4892)**

DCC is the defacto Standard!

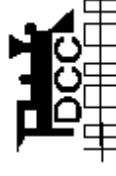


CompuServe

- **Monthly usage fee \$8.95**
- **Train-net forum is where the action is**
- **On-line conferences, library, message logs**
(subscribe call 800-848-8199 or 614-457-0802)



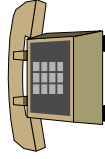
TrainNet+ Forum



The Conductor BBS

- **Easy to access the BBS**
 - must support ANSI graphics PC users try pro-comm plus or pro-comm for Windows
 - Follow instructions on logon
 - make sure you register on the BBS

- **Two lines for access**



- 503-690-8176 (2400 baud)
- 503-690-4892 (14.4K baud)

- **Lots of demo programs**

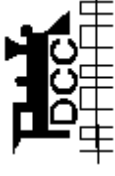
- two CDROMS of shareware
- 1.6 Gbyte on line database
- No charge BBS

File Library Area	
[1]	Command & Control Files
[2]	Misc Tools
[3]	Train Photos
[4]	Marklin Library
[5]	Railfan Library
[6]	Train-Basic(TM) Samples
[7]	User File Upload Area
[8]	CICA Windows CD-ROM
[9]	PCSIG CD-ROM ver. 12
[0]	Railroad Simulation Files

Is DCC for You?

- **The DCC supports all scales**
- **Easy to use for the Novice as well as the technologist**
- **Standard allows future growth!**

Yes!



Questions ?

Now, lets run Trains!

Matt Katzer 503-645-7951
Jim Hamby 206-699-7100
Ken West 503-642-9597

DCC Demo equipment:

- LENZ (LZ100, LV100 and LH100)
- Digitrax Challenger. Bigboy

