



# Implementing DCC at the Sacramento Model RR Historical Society

*DCC or How I Learned to Stop Worrying and Love the Age of Computers and Electronics*

(Apologies to Stanley Kubrick)  
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## "I quit"

- Old layout was a nightmare to troubleshoot and had old technology that had deteriorated.
- 2000/2001 – voted 34-4 to rebuild layout including new Digital Command Control (DCC) electronics.
  - 4 quit



## Today

- 2005 – active membership of 41
  - DCC is alive and well on the standard gauge.
    - All standard gauge members support DCC.
  - 3 ft. Narrow Gauge layout staying analog



## How'd you do that?

- Prove it...
  - Demo on old analog layout w/member's DCC command station
  - Built a test/demo module
    - Sound equipped locomotives
    - Running multiple trains in one block
    - Helper units cut in and out of train
    - Proved mixed analog/DCC



## Help The Members...

- But I have a gazillion engines that need decoders.
  - Clinics, hands-on help
    - Held monthly
    - Every member has at least one engine w/DCC
    - Continuous training
    - Computer-assisted programming



## Decoder Install Tools



## Help The Members...

- Run DCC in an operating session, you're hooked.



## Too Cool

- DCC control fun features
  - Slow running
    - Even a junker locomotive can run at scale speed in the yard.
  - Special lighting effects
  - Sound
  - Helper units
  - MU lash-ups



## Which System...?

- Full disclosure
  - SMRHS has no financial relationship with Digitrax.
- Digitrax
  - Big player, staying power
  - Club references
  - Geek committee preferred it
    - LocoNet architecture
      - Judged most efficient communications scheme between command station, boosters and throttles.
      - Very similar to Ethernet concept
    - Drawback-original throttles not 'user friendly'
      - DT400 throttle came out just in time.



## What about analog ...?

- Dual mode option, separate blocks
  - Best done w/ progressive cab-control (PCC)
    - PCC automatically detects occupancy and direction of travel and assigns analog throttle to block occupied and next block.
      - Default is to connect DCC to the block
    - Block occupancy detection boards modified to work with the DCC signal present on the rails.
    - Prototype tested on demo module
    - Cannot use common-rail track power w/Digitrax and multiple boosters
    - Challenge at reversing loops – how to support DCC & analog
  - EDA (Kermit Paul design) PCC
  - Also compatible to Chubb CMRI system -- \$\$\$\$\$



## Blocks-Why?

- Multiple booster power districts
  - 5 amps/booster
    - Layout capacity for many trains and lighted passenger cars (.25-.50 amp/loco, ~.5-1.0 amp/car)
  - Short circuit protection
    - PM42 circuits "sub-power districts"
    - One derail or short doesn't stop the railroad
  - Signaling (Operating section detection)
    - Shows which section of track is occupied



## design/build construction project

- Reality of time and budget changed the schedule
  - But I wanna run trains!
  - Interleave construction periods w/running periods (open house)
  - Keeps us motivated to 'get 'er done' during construction
  - Having a master plan cuts down on bickering.
  - Be flexible and change as needed; change controlled by board of directors



## DCC – Plug ‘n Play

- Initial installation allowed members to ‘play’
  - Members advised DCC would come up first, with analog capability to come later
  - Hold-out members were ‘pulled’ in by seeing others with their newly DCC-equipped engine on the mainline

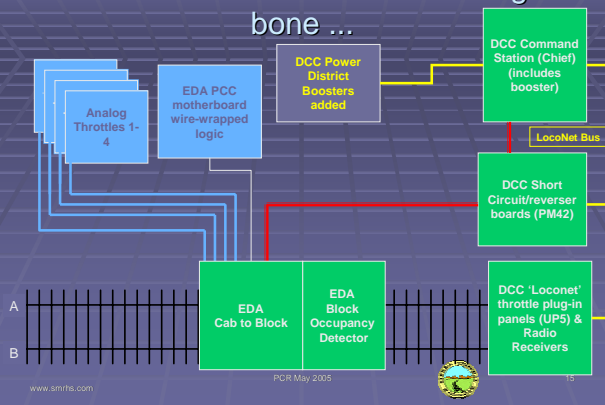


## 2 years after dynamite...

- Golden Spike ceremony at “Bieber”
  - Completion of the mainline, loop to loop



## Knee bone’s connected to the thigh bone ...



## Layout Programming Station

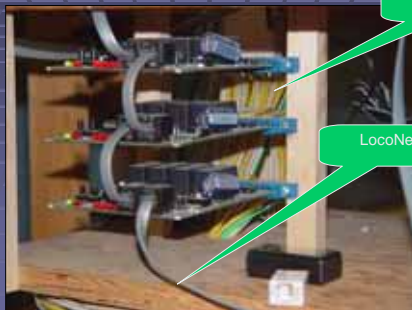
Laptop for programming/monitoring

Radio Receiver

Command Station



## PM42 Short Circuit Protectors/Reversers



## LocoBuffer-I

RS-232 x LocoNet



## Cab-to-Block EDA boards



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## Cab-to-Block EDA boards



Detector - 3 circuits/card

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## On-Layout programming track switch



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## Turntable



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## Best Practices

- #12 ga. wire track bus wires, #16 track drops
  - No jumpers at rail joints
  - No loss of rail power
  - Track drops are soldered to bottom of rail
    - Time intensive
  - Wrap splice joints first, test
  - Then solder
  - The "Quarter" test



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## Best Practices

- Divide LocoNet bus – one branch for throttle and radio receivers, the other branch for boosters and PM42's
  - Makes trouble-shooting easier
    - Divide and isolate when searching for problems
  - Watch the LocoNet voltage – parasitic loads depress voltage and can impair communications
    - Provide 'wall wart' power supplies for UP5 throttle plug in panels

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## Best Practices

- DCC compliant hand-built switches
  - Point rails same polarity as stock rails up to the frog
    - If a derail occurs the point rails act as guard rails.
    - Will not short out Rail-A to Rail-B



## Best Practices

- Loco-Buffer and Decoder-Pro shareware for programming/monitoring
  - User friendly method of programming decoders vs. throttle-based CV-programming
    - Speed tables – matching locos in a consist
    - Lighting effects
  - Additional abilities to monitor LocoNet traffic, send messages to throttles



## Programming

### Requirements

- Computer running Decoder-Pro
  - <http://mfi.sourceforge.net/>
  - Don't need latest hottest machine – 486 will do
- LocoBuffer-II interface
  - <http://www.locobuffer.com/>
  - Retail built-up avail from RR Circuits
    - <http://www.rr-circuits.com/LocoBuffer-II/locobufferII.html>
- Command Station



## DecoderPro



## Best Practices

- Common ground path for all boosters and command station
  - manufacturer's recommendations
- We ran new, grounded 117VAC circuits to the main panel
  - Command station on one circuit
    - Turn on first
    - Master "Panic" kill switch
  - Booster stations on another circuit
    - Turn on second
  - Switch machine/auxiliary power on a third circuit



## Best Practices

- Post active loco addresses before operating
  - We don't have a static roster of engines; many members have same road/number
  - Forces members to watch for duplicate id's
  - "Who's got my train!?"
  - Avoid running trains with address "3"



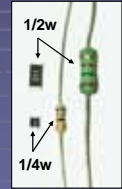
## Best Practices

- Stop 'twiddling' the knob when in radio mode
  - Each speed change sends message to radio receiver
  - Collision of messages on the air can overload the receiver.
  - Radio receiver times out
    - Plug throttle back in to regain wireless control
- Tethered throttles in yards
  - Cuts down on radio traffic



## Best Practices

- Decoder installations
  - Test the decoder prior to installation
    - Club provides tester
  - SIP headers (0.10" spaced pins)
    - Allows shell to be removed and lighting leads unplugged
  - Chip (SMC) resistors for lighting
  - Solder decoder connections
  - Get the right tools (soldering station, magnification, etc.)



## Lessons Learned

- DCC allows you to 'run your train instead of your track'.
  - Corollary: only one train can safely occupy the same section of track at the same time, so pay attention when operating.
- Operator training is essential.
- Get every member equipped with at least one loco w/DCC (set the hook).
- Unresolved – high current inrush due to QSI-decoders (large on-board capacitors) causing short-circuit symptom
- Custom lighting (e.g., passenger trains) can overload current capacity - plan for plenty of booster capacity



## Lessons Learned

- It's usually something simple, but we tend to look for the complicated when trouble-shooting problems
- Work with your chosen DCC manufacturer – they all are super helpful – just tell the truth if you let the smoke out.
- Consisting – you need to learn to create speed tables (Decoder-Pro) to match loco's
- When all else fails, check to see if the power is on
- Have spares on hand – public shows bring out the gremlins.



## SMRHS DCC

- Today
  - Mainline completed, full DCC operation with 5 boosters
  - 2 x 900 MHz radio receivers
  - 11 x UP5 throttle connection panels
  - 15+ DT400r throttles owned by members + 1 by SMRHS
  - 2 UT2 'dummy' throttles by SMRHS
  - 2 programming stations, one laptop/Loco-Buffer on-lay-out, 2<sup>nd</sup> using Zephyr and desktop.
- Next steps
  - Add more UP5 panels as needed
  - Integrate EDA detection for CTC and signaling
  - Integrate analog throttles



## Questions/Discussion

- Contact us...
  - Via web site, [www.smrhs.com](http://www.smrhs.com)

