Evolution
Changing a Wiring Standard

The Process

by

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NTRAK Module Wiring Standard

Original standard in place from 1976 to 2012

Adoption of DCC

First very large layout with DCC in Chantilly VA in 2004

NTRAK Wiring Committee formed in 2004 to recommend a standard that would accommodate DCC and large layouts.

Committee recommendation became Recommended Practice in 2006, rapidly adopted by NTRAK clubs.

Became the standard in 2012. Older standard on modules grandfathered

The Original Standard

Track bus — 18-gauge zip wire with TRW Cinch-Jones 302 connectors

Power Bus — 16-gauge zip wire with TRW Cinch-Jones 302 connectors

Cinch-ones 302 connectors:

- Readily available (Radio Shack) for $3.00 each, price today is $15.00+.
- Must be soldered to the zip wire, then shell fastened in place and clamped to wire. Differing soldering capabilities of modelers.
- Difficult to keep clean, especially slots in female connector, increasing contact resistance.
- Plating on contacts wears off increasing contact resistance.
- Contact resistance 0.016 ohms when new.
- Rated current: 10 amps

The Problem

Design objective: <1 volt drop at end of electrical district.

Large NTRAK layout at Chantilly VA in 2004, all modules wired to old standard.

Could not use ampere capacity of DCC Booster.

Trains simultaneously operated on layout required 30 amps max current.

Meeting voltage drop objectives required almost 100 amps of DCC power.

100 – 30 = 70 amps of excess Booster power

About $3,000 in excess, not needed electronics.

The Wiring Committee

After problem identified Jim FitzGerald of NTRAK, Inc assembled a group of 5 individuals, all EEs with extensive NTRAK and DCC experience, plus Jim himself to look at and produce an NTRAK electrical Recommended Practice.

The module wiring committee:

Joe Ellis	Dayton NTRAK
Jim FitzGerald	NTRAK, Inc.
Martin Myers	Baltimore NTRAK
Allan Schappel	Philadelphia NTRAK
Doug Stuard	Northern Virginia NTRAK
John Wallis	North Raleigh Model Railroad Club

Investigation

With 18-gauge wire and Cinch-Jones connectors, determined that the Cinch-Jones connector accounted for 1/3 the voltage drop through the module, *when the connector was new, increasing with age and use.*

Calculations showed the best match between current needs and distance to meet the <1 volt drop requirement is 12-gauge wire.

Committee member Doug Stuard was a ham radio operator and suggested we consider the Anderson Powerpole connector, used in ham and many other applications.

Anderson Power Products
Sterling MA

Founded in 1877 in Boston to make products for the electric light and power industry

In 1890 invented the trolley pole, adopted as standard by many systems.

Manufactured “Transit Cycles” in 1896

In 1920 manufactured automatic time switches

In 1953 invented the SB (storage battery) connector used in forklifts, golf carts and wheelchairs.

In 1964 invented the Powerpole® connector for Bay Area Rapid Transit (BART), today also used in modular office furniture, wheelchairs, floor sweepers, power supplies UPS systems, wireless telecom equipment, amateur radio and medical applications.

The Anderson Powerpole® Connector

Anderson PP30 30A connector is match for 12-gauge zip wire

- Designed for BART, about 1 billion produced, 5A to 1,500A
- Self-Cleaning contacts, rated for 10,000 connect/disconnect cycles
- Genderless, can be configured through molded on dovetails
- Contact resistance is 0.0006 ohms, 25 times less than Cinch-Jones
- PP30 connector rating is 30 amps 600 volts
- Can be crimped and/or soldered
- Silver/tin plated copper (Cinch-Jones cadmium plated brass/bronze)

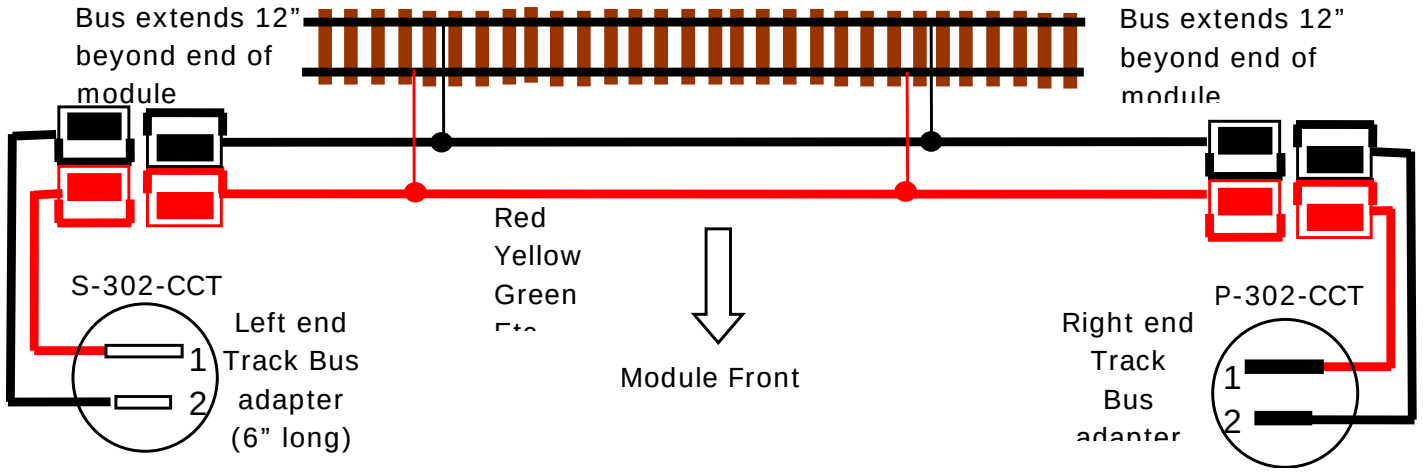
Cutaway View

Mated

Engineering Studies, Calculations, Tests

Module Configuration

Bus	Module End	Stacking	Configuratiion
Track Bus	Right Left	Vertical Vertical	Red over Black Black over red
DC Power (white)	Both	Horizontal	Red on left; Black on right
AC Power (brown)	Both	Horizontal	Red on left; Black on right



Results

PP30 + 12-gauge wire became **Recommended Practice** in 2006

- Highly recommended for all newly constructed modules.
- Recommended for any existing modules being rewired or major alterations
- Modules using PP30+12 required to provide PP30 to Cinch-Jones adapters

Rapid adoption by module builders and owners — in 2008 largest NTRAK layout about 1/3 the 700 modules were PP30+12.

PP30 + 12-gauge wire became **Standard** in 2012

- Modules using Cinch-Jones connectors now required to provide the PP30 to Cinch Jones adapters.

Benefits

Longer electrical districts mean less expensive electronics — with Booster located at geographical/electrical center.

- With PP30+12 can be 100+ feet
- With Cinch Jones 30 feet maximum
- Significantly less Boosters required, less $$

Electrical district design flexibility — yards, industries, etc.

Cost reduction — with Cinch Jones cost increases and availability decreases a module wired with PP30+12 is less than 1/3 the cost of the same module with Cinch-Jones + 18-gauge.

Where to Buy

Online suppliers:

www.Powerwerx.com

www.qsradio.com

NRail Store: www.Nrail.org/store

Also carried by major industrial distributors

Most prices quantity based

No local supplier in this area.

Cost

Item	Quantity	Unit Price
Contact	1-99	$0.25
	199-499	0.20
	10000+	0.14
Housing	1-49	0.55
	50-99	0.52
	100-249	0.48
	10000+	0.32
12-Gauge Zip Wire	25’	1.00/foot
	50’	0.89
	100’	0.83
	500’	0.73

Summary

The process was successful — Objectives met & the standard was changed

Quick adoption even while RP — club mass conversions

Allows flexible configurations

Major benefit of lower costs

Many other low voltage uses.

Adapted to T-TRAK modules and layouts with virtually no change except feeder wires.

Useable in all scales.