On30 Modules
Mid Atlantic Division
Standard

Version 1.1.00
Revised September 6, 2005

Introduction

The Mid Atlantic On30 module standard is based in part on the simple Free-Mo Standard posted at www.Free-mo.org . In addition, various parts of this standard evolved over time through the various conversations (and heated arguments) on the On30 Modules Yahoo group.

The primary purpose is to provide a set of guidelines that would allow members to independently construct modules that could be joined together at shows and give the appearance of having been built as a sectional layout. The NBR&N (modular) and the Yosemite Short Line (sectional) are two groups that have provided a great deal on inspiration for this work.

The modular assembly has been conceived of as a point to point railroad for greater operational possibilities. Continuous running, as such, is not integral to the design of any module. Return loops, Wyes and Turntables will be employed to turn trains.

Free Mo does not specify the actual methods of module construction. This is left up to the individual builder. Only the module ends, track placement, track connection, module height, electrical requirements and basic scenery suggestions for uniformity are specified.

This standard borrows from many sources from the web, and I acknowledge this document could not have been created without using (plagiarizing) their information. Their website locations are included under the website listings. In addition the majority of the DCC Electrical Standards were developed by Geren W. Mortensen Jr., (the Universal DCC Bus especially!) and Chris Abbott. Without their work this document would not be possible.

The **Basic Standard** establishes the rules that apply to all modules. The **Advanced Standard** can be used to increase creativity and covers mainline grades and free form design. Recommended Practices should be employed for greater continuity, but are not mandatory.

Module builders are free to build rectangular modules, 2' wide by whatever length is desired. Under the advanced standard, module dimensions and shape are left to the imagination and artistic license of the module builder. There is no front or back designation for either module type and as a result they can be orientated in any manner with other modules. ***For interoperability, the Basic (mandatory) standards must be followed.***

1.0 Module Construction

1.1 Basic (Mandatory) Standards

Interface Plates are to be 6 inches high by 24 inches wide by ¾" thick plywood (birch plywood works well). To allow room for C-clamps, keep the inner surface of endplate clear of obstructions (electrical terminal blocks, Loconet connectors, etc.). Recommended clearance area is 2" high by 4" wide, centered at bottom edge of endplate inner surface.

Module Length is left up to the discretion of the builder.

Module Frame and Surface should be constructed of dimensionally stable materials to ensure proper alignment with other modules under all possible environmental conditions. Avoid dimensional pine lumber. It has a tendency to warp and 'cup' throwing off track alignment. In its place, consider using materials such as plywood ripped into strips the equivalent size of dimensional lumber, other types of laminates, extruded foam sheets, etc See website listings for module construction suggestions.

Default Height to the Railhead from the floor is 50 inches. Each leg must include vertical adjustment of +/- 1 inch minimum to compensate for uneven floors. This should provide an adjustable rail top height from the floor between 49" and 51". See website listings for leg suggestions.

50" is the standard height for the NBR&N. 48" is the standard for many other groups - members may wish to consider making legs adjustable from 47-51" This can easily be done with 4" cabinet levelers from Lee Valley tools.

Subroadbed shall be 1/2 inch plywood or equivalent (foam tops and plywood/homasote combinations are acceptable), braced to prevent sag or flexing.

Each module shall be equipped with sufficient legs to be **Freestanding** and a module must stand secure and level, independent of other modules, through the use of proper cross and angle bracing. Modules may (most likely) be used with spectators viewing from either side.

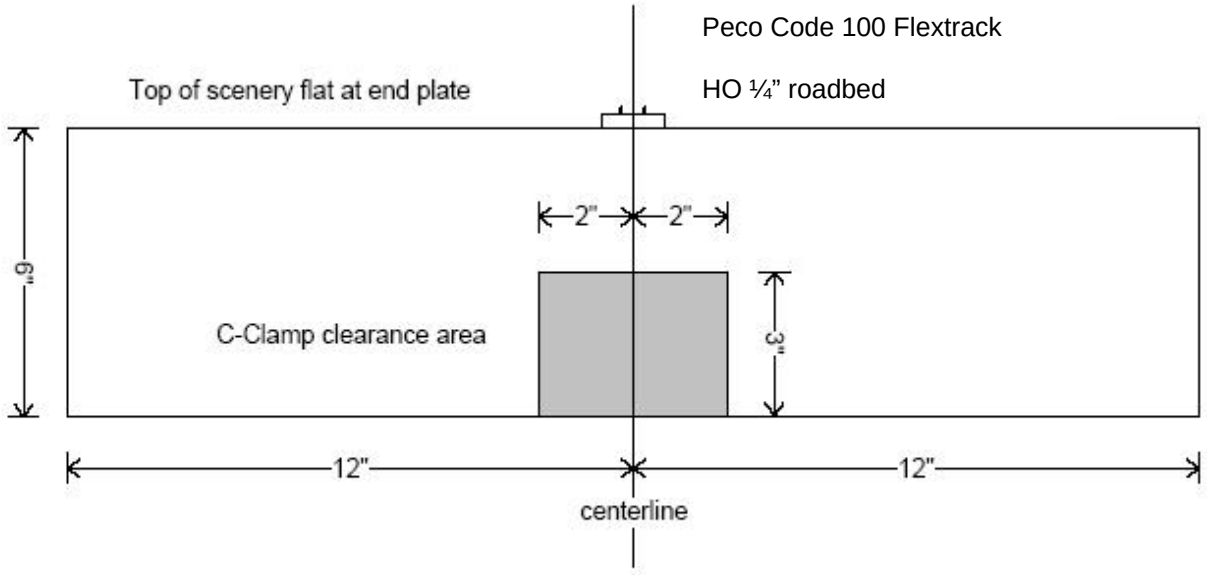

Figure 1: Module End Plate

1.2 Advanced Standards

Module width between end plates is left to the discretion of the modeler. Consider 12 inches as the minimum width to allow sufficient scenery between the track and module edge to protect equipment during a derailment. Module end plates between permanently mated modules (module sets or sections) can be of a different width. *Only the end plates designed to be interchangeable with other modules must meet the 24" standard.*

Mainline Grades: Mainline grades are allowed on modules
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- ✓ **Module grades** must not exceed 4% (1" every 24") on mainline trackage
- ✓ **Track** must be level for the 6" prior to each interface.
- ✓ **Suitable Easements** are required between grade and level track. A recommended minimum would be an 8" transition from level ground to a 4% grade. This imposes a practical limit of a <2" rise over a 4' module, and a <3" rise over a six foot module (6" level on each end, 8" transition to grade (2 1/4 ft) + 1" rise per each additional foot of module length.
- ✓ **Opposing Interfaces** may be of different heights.

Module Legs must be adjustable from 40-60". There are several plans for different types of legs in use. See website listings for leg suggestions.

1.3 Recommended Practices

Module Skirts can be used. Both sides of a module can be skirted. The ends of the skirts will extend two inches past the module end plate to allow overlap from the skirting on an adjacent module. The bottom edge of the skirt shall be 1" off floor when the leg adjustments are set to the modules minimum height.

2.0 Track

2.1 Basic (Mandatory) Standards

Mainline Track shall be code 100 nickel-silver flex track or hand laid at each interface.

Mainline Minimum Radius is 26 inches (32 inches is preferred) with at least 12 inches of straight track between reverse curves on mainline modules.

Track Shall Be Centered at the module ends (see fig 1).

Track Must Be Perpendicular to the end, also **Straight** and **Level** for 6 inches from each end of the module (see Fig 2.1). By ensuring 6" of straight track from each module, the 12" between reverse curves can be maintained. *Note this track placement makes the ends of the module interchangeable.*

Rail shall be cut off 1 inch away from module end; ties and ballast shall be continued to the module end for good appearance and matching with the adjacent module.

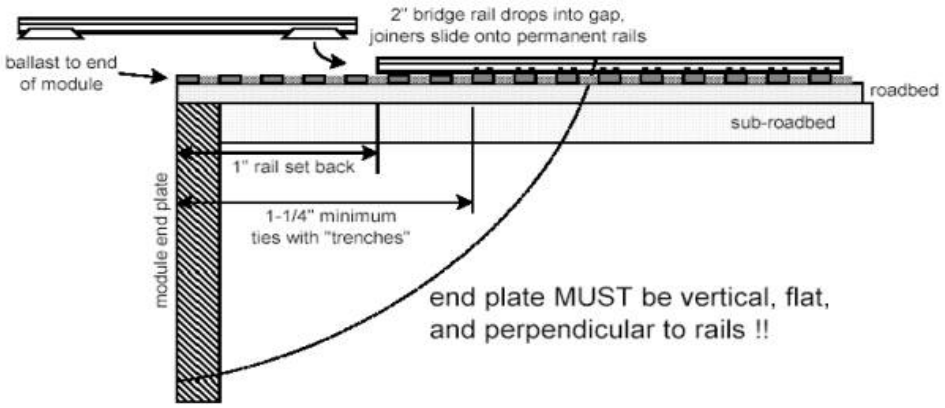


Figure 2.1 – Fitter rail

Ties will be commercially available low profile ties or home made equivalent. Track with ties in the dirt (no roadbed profile), will be used at the interfaces. See Fig 1.

Mainline Turnouts shall be #6 or equivalent. Frogs will be powered. A mainline turnout is be defined as one where the main track travels through the curved portion of the turnout. If the diverging track could be used as the mainline (as in passing sidings), it does not have to meet mainline requirements as long as that information is posted.

Mainline Track will be placed no closer than 6" from the track center-line to the side edge of a module. Yard or industrial spur tracks will be placed no closer than 4" from the track center-line to the side edge of a module.

Easements will be used when transitioning between straight, level track and curves or grades.

NMRA On3 Clearances should be used for all track.

2.2 Advanced Standards

Mainline Track can be code 83 within the module, but must transition to code 100 at the interface. Code 55 may be used on sidings if desired.

3. Control and Wiring

DCC has been chosen as the standard for the Mid Atlantic Module group. The nearly limitless possibilities for multiple cabs combined with the option of onboard sound made this an overwhelming favorite. The universal DCC throttle bus designed by Geren W. Mortensen Jr. will work with any DCC system except for Easy DCC.

See **DCC Universal Bus Construction and Components.**

3.1 Basic (Mandatory) Standards

10 Amp Barrier Style Terminal Blocks shall be installed at each interface and shall accept #12 AWG wire with soldered spade tongue lugs

A #12 Stranded Two Conductor Wire Bus shall extend full module length under mainline.

#18 AWG Feeders will connect individual rail lengths to the rail bus

Inter-module Connector Wires shall be #12 AWG, 10" long with soldered spade lugs

Spur Tracks shall be completely isolated from mainline.

Accessories, except DCC controlled turnouts, shall not derive power from track power

A DCC Data Bus Cable, Male-Male, the length of each module plus 18” will accompany each module. At the minimum, one F-F Coupler shall be carried for interconnection with other modules. DCC cables shall be constructed in accordance with datasheet “DCC Universal Bus Constructions and Components”

4.0 Scenery

4.1 Basic (Mandatory) Standards

A Flat Scenic Profile should be used at the module standard end(s). A module should not only have universal ends in a physical and electrical sense, but also in a scenic sense as well. Having a scenic element that abruptly ends at one module end, like a mountain, river, or road, detract from the ‘one layout’ scenic ideal. Remember, this applies to the universal module end; on an internal interface between two sections of one ‘module’, these requirements do not apply. The flat scenery profile should continue for 6 inches into the module.

Module fascia color shall be a Tan, semi gloss enamel. Glidden "Evermore" "Stony Creek" Latex should be used

4.3 Recommended Practices

Hand Throws are encouraged where practical to actuate turnouts.

Standard Ballast Techniques are encouraged. A mix of (2) parts grey number 75 to one part cinder number 76 is preferred. These are Woodland Scenics products and the fine grade should be used.

Ground Foam Grass and Soil in the ballast is recommended as an occasional scenic event - especially on less used trackage.

Rails may be painted rail brown with occasional rust streaks.

Definitions

These definitions are provided to establish a common basis of understanding of the following standards.

Accessory Power Bus: The continuous two wire bus powering electrical accessories such as turnout motors, structure lighting, animation, etc.

DC: Direct Control through convention throttle/power pack.

DCC: Digital command control

DCC Control Bus

DCC Control Panel

Endplate: The specified end surface of a module that joins with an adjacent module.

Fitter rails: The 2" long removable rails and joiners used to bridge the joints between adjacent modules or sections.

LocoNet Bus: The continuous six-wire bus carrying DCC information among the DigiTrax brand DCC system components such as throttles, boosters, radio receivers, etc.

Mainline Track: On every module there is at least one route that connects the middle of the first interface with the middle of the second interface. One of these routes should be designated as the mainline route and must obey mainline track restrictions- all the other trackage does not.

Module: A section of a portable layout that has a common endplate, track connections and electrical connections to mate to other units and features a single track mainline. Portable layout is constructed to provide a point-to-point, point to loop or loop-to-loop meandering main line. A module may consist of multiple subsections.

Module (Basic): Unit of a portable layout that is level and of a fixed dimension, typically 2X4, 6 or 8,

Module (Advanced): Unit of a portable layout that may feature grades. Dimensions are not fixed and allow for a unit of any interior width, length or geometric shape.

Pigtail: Connector/wire assemblies used to connect any of the electrical busses together between modules.

Passing Siding: Parallel track that allows one train to overtake and pass a second train. Length is sufficient to hold entire train. Located along single-track main lines to facilitate passing.

Run-around Siding: Parallel track that allows motive power to run-around a cut of cars to switch a facing point spur. Length is not sufficient to hold an entire train. Located in industrial areas to facilitate switching operations.

Single Track: Single track that allows continuous operation of trains in one direction. Combined with multiple passing sidings, intermittent operation of trains in opposing directions is possible.

Section: A part of a larger Module. Used in conjunction with other sections and assembled in the same configuration to create that module. Conforms to end profile, track and electrical connections only on the ends that mate with other independent modules. Typical examples include a long yard, passing siding or turn back loop constructed of multiple sections that only mate together in one configuration.

Standard end: A location where a module will connect to other modules; also contains an external interface that must meet all mandatory standards.

Track (Power) Bus: two wire bus feeding power to the track,

Websites

Free-Mo resources

Free- Mo Yahoo group
Free-Mo resource site by Chris Palomarez

Guidelines to different groups Free-Mo standards

Slaughter guide

Northern Cal guidelines

Calgary Free-mo module specs

Module designs

Free-Mo site

- Free-Mo 1Design/Construction
- More Module Plans 45 degrees
- Module Set-up Benefits 45 degrees
- Free-Mo Bench work
- Track termination plate
- Mini-mo & double sided
- Easement Design on Shandin loop

N California

San Luis Obispo

Central Arizona

Bob Schrempp's loop

jig tool to build modules with angles (45 & 22.5 degrees)

Leg construction

Troughton Not another module article folding ABS legs (scroll down for legs)

Free-Mo site article on folding legs 1x2 using LeeValley leg brackets by the Arizona RR Society

Free-Mo site article on ABS legs by Robert Moore

Northern Cal leg design 2x2 using Lee Valley leg brackets

Calgary Free-Mo using 2x2 leg pockets (Scroll down)

Track work

creating easements for curves

mounting of recessed switches

easy flush mounted switches

Revision History

DCC Universal Bus Construction and Components

The Components in Figure 2 are used to construct a Cab, XpressNet or Loconet throttle network for standard modules. If followed, these wiring diagrams will allow creation of a DCC throttle network that is completely compatible with the most popular DCC systems - Digitrax, Lenz, NCE, SystemOne, and Zimo. This bus should also work with other command control systems using flat telephone-style cabling. It will not work with EasyDCC, which uses coaxial video cable for its throttle network.

This specification calls for readily available, inexpensive parts. While callouts are indicated for Tony's Train Exchange part numbers, an equivalent part from another source may be substituted, as long as it meets the same specifications as the listed part.

Each Module shall carry at the minimum a single Pass-thru cable equal to the length of the module plus 18" (to allow for interconnection) and one F-F coupler. These can be obtained through the group.

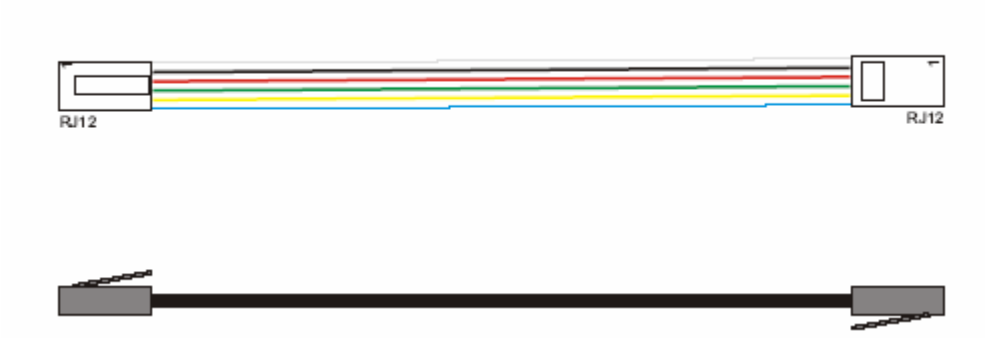
It should be noted that the wiring for each cable is identical - a relationship of Pin1-to-Pin1 is maintained throughout the bus. This allows any cable to be substituted for any other cable as needed. This same cable is also used for the throttle cables on NCE/SystemOne Cab Bus- and Lenz ExpressNet-based systems.

Digitrax throttles use this connector as a default.

The following wiring diagram, Figure 1, illustrates the basic cable used in all instances. It is a simple 6-wire data cable using 6P6C RJ11 connectors and 6-conductor flat telco/network cable. These cables can be ordered custom made to any length, or may be made by the modeler with relative ease.

The cable is inexpensive, at approximately 12 cents per foot, and the connectors can be obtained for approximately 30 cents each (or less, in quantities).

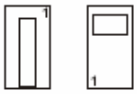
This cable, along with a Female-to-Female coupler fulfills the minimum DCC "pass-thru" requirement for a module.



Throttle Bus Components

6-Conductor Flat Phone Cable -
Tony's Train Exchange P/N M6C or equivalent

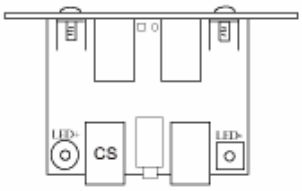
RJ11/12 6-Position Plugs -
Tony's Train Exchange P/N M PG or equivalent



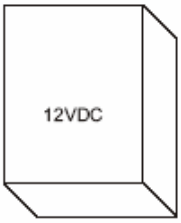
Female-to-Female Coupler -
Tony's Train Exchange P/N M FF

Two-way Splitter -
Tony's Train Exchange P/N M SP2
(1-RJ11 Plug-to-2 RJ11 Jack)

Universal Throttle Connector Panel -
Tony's Train Exchange P/N UTP/TTX or equivalent



12V DC 1Amp filtered power supply -
Tony's Train Exchange P/N TTX-XNCE or equivalent.

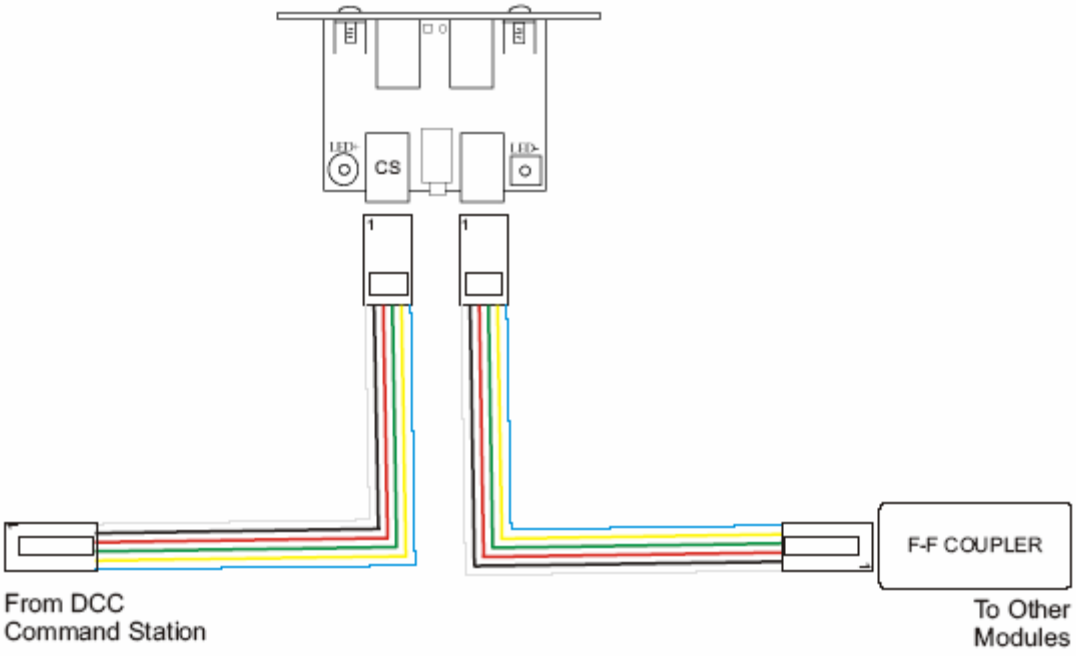


The next diagram illustrates the connection of a throttle connection point onto the DCC bus. The connection point, referred to as a Universal Throttle Panel (UTP) can be inserted anywhere on the layout it is needed. It is simply connected between two Pass-thru Throttle Bus cables. Some modelers may wish to include a UTP permanently on their module, especially if their module provides a point where operators may wish to stop to operate trains (e.g. A switching module or yard).

Alternately, these may be placed between modules as needed in place of a Female-to-Female coupler to provide additional plug-in capability.

The UTP is truly universal, and is compatible with throttles from the previously mentioned manufacturers.

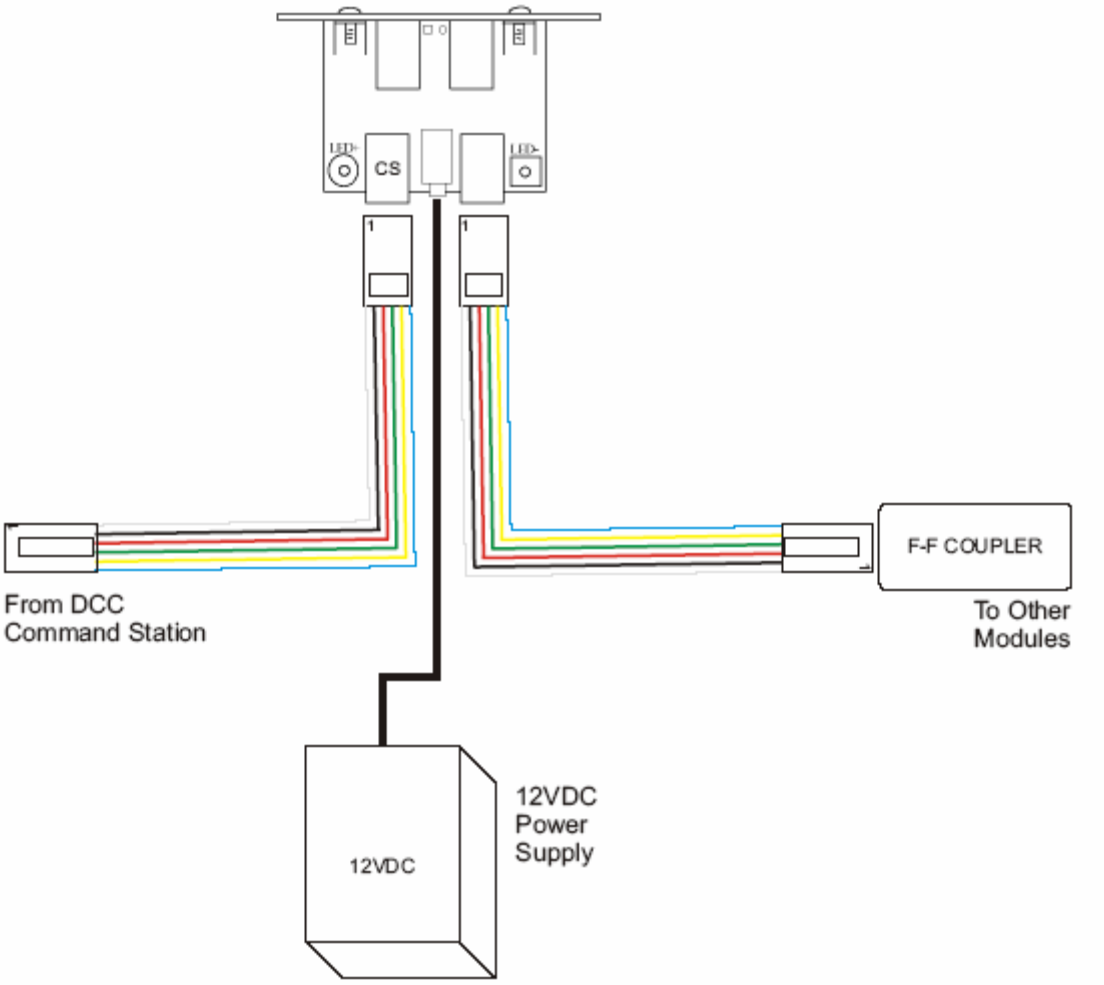
In some cases, the manufacturer's cable has been replaced with a Pass-thru-type cable.



On large layouts using NCE or SystemOne DCC systems, it is necessary to “inject” power to operate the throttles at intervals around the layout. This is due in part to the power supply voltage drop over long runs of small-gauge wire typically found in telephone network cable. For NCE and SystemOne DCC systems, this distance is between 30 and 40 feet. The specified power supply is of the “wall wart” variety, and simply plugs into the small jack on the rear of the UTP.

It is important to observe the “direction” of data flow when inserting the power supply to avoid feeding the 12VDC back into the command station. The UTP circuit board is marked to indicate which connector should be fed from the command station. When properly installed, the UTP, the UTP will open the appropriate circuit to prevent 12V from feeding back to the command station.

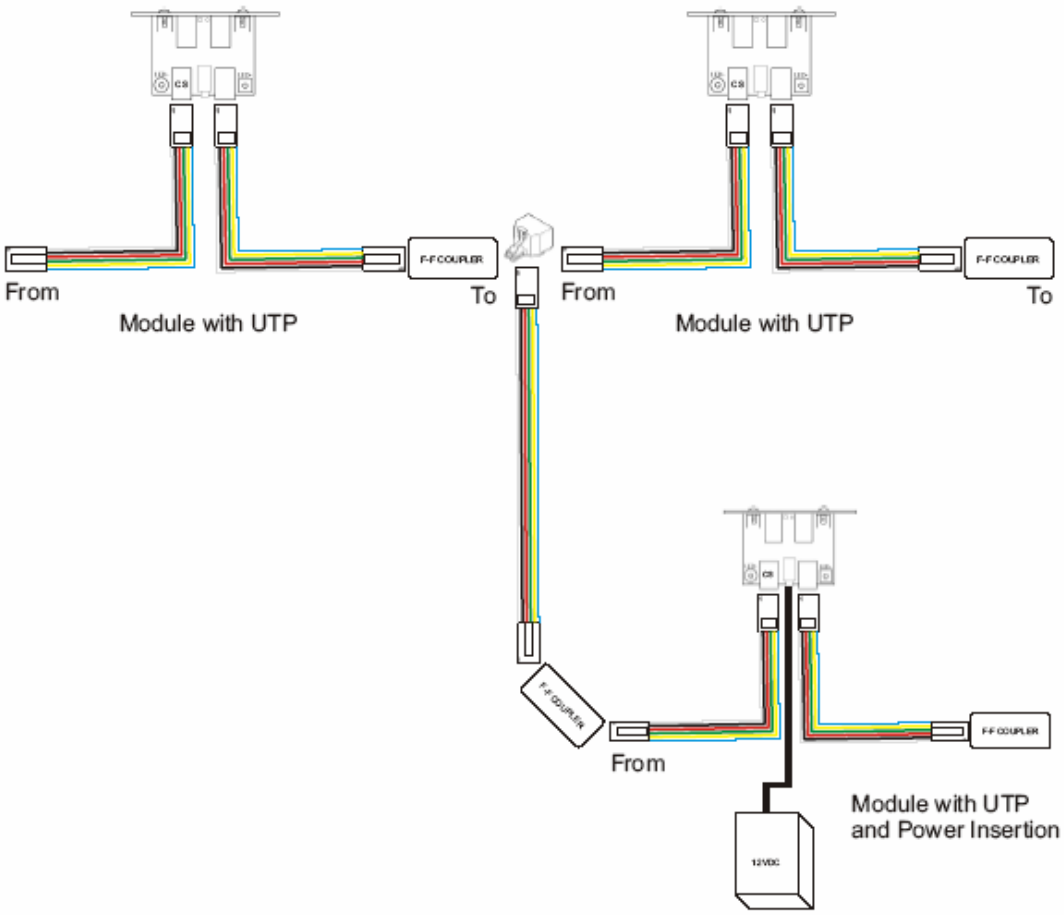
This additional power supply is not necessary when using a Digitrax or Lenz DCC system.



In situations where there are branching modules, the DCC bus should branch as well. This illustrates how a two-way splitter plug can be used to accomplish this branching. Notice that power insertion is indicated on the branch. This may or may not be necessary, depending on system type and the lengthof the branch.

It is theoretically possible to branch as often as desired, up to the cumulative limits of the total system bus length. The maximum bus length for Digitrax Loconet and NCE/SystemOne Cab Bus is approximately 1,000 feet. Systems using eXpressNet may reach up to 3000 feet.

In all cases, the DCC Throttle Bus must NEVER form a closed loop. While there is little chance of component damage, operational problems may occur if a loop is formed.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