Echo Valley Railroad Guild Free-Mo Electronics Instructions

Contents

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Quick Reference Items

Turning Layout Power ON/OFF

Since all components of the layout plug into the outlets labelled “battery” on the top of the uninterruptable power supply (UPS), turning off the UPS will turn off the entire layout. Press and hold the on/off switch on the top of the UPS (when on it is lit green). After a second or two the UPS will beep and shut off.

To turn on, press and hold the on/off switch on the top of the UPS. After a second or two it will beep and turn on. The on/off switch will flash green indicating that it is running on battery power. After a second or two the on/off switch will be a steady green indicating that the UPS is running on 110-volt AC power.

If the UPS will not turn on, check to make sure that the extension cord is plugged in to a 110-volt outlet and check to make sure that the rocker switch in the centre of the extension cord spool is turned on (it glows red when on).

Checking and Changing Radio Channel Number or Layout Name

Using a Digtrax DT402 or DT402D throttle:

1. Plug the throttle into a UP5/UP7 jack on the fascia of a module or else directly into an RJ12 jack on the radio itself, with the layout powered up.
2. Press EXIT key.
3. Press the OPTN key then the EDIT key.
4. The display will show the channel number and name currently in use.
5. If you do not wish to change the channel number press the EXIT key.
6. If you do wish to change the channel number, press the “Y +” key to increase the channel number or press the “N –“ key to decrease the channel number.
7. Press the ENTER key to save the new channel number.
8. To change the layout name, press the OPTN key then the EDIT key.
9. Using the left knob select the letter you wish to change and then using the right knob change the letter.
10. Press the ENTER key to save the new name.
11. After changes have been made, all duplex radio throttles will need to be plugged into a UP5/UP7 jack on the fascia of a module to acquire the new channel.

Using a Digtrax DT602 or DT602D throttle:

1. Plug the throttle into a UP5/UP7 jack on the fascia of a module or else directly into an RJ12 jack on the radio itself, with the layout powered up.
2. Select the utility menu button (shows a graphic with multiple horizontal lines).
3. Select item 6, “Duplex Edit”.
4. Follow the scrolling prompts on the screen to see the channel or to change the channel or to change the layout name.
5. If you do not wish to change the channel number press the EXIT key.
6. If the channel is changed, press the “C” key to save the updated channel.
7. After changes have been made, all duplex radio throttles will need to be plugged into a UP5/UP7 jack on the fascia of a module to acquire the new channel.

What if Throttles Display “t-off”?

This is the system’s way of telling you that track power needs to be turned off and then turned on again. Stop all trains, and on a DT402 or DT402D press the “PWR” key at the bottom left of the keyboard followed by the

“N -“ key in the second row from the top of the keyboard. Turn the track power back on by pressing the “Y +“ key in the second row from the top of the keyboard. On a DT602 or DT602D throttle press the on/off rocker switch and select “TRK_OFF” followed by “TRK_ON”.

What if Throttles Display “slot=max”?
Command stations save a maximum number of unique locomotive addresses in their memory at the same time. Slot=max means that this limit has been reached. From time to time the system will automatically purge unused addresses (denoted by 3 beeps coming from the command station). To manually purge all addresses see the narrative at page 38 (Recommended Before Every Operating Session at a Train Show).

Testing either Boosternet or Throttlenet using a Digitrax LT1 tester

A Digitrax LT1 tester is a small device that is wired to a flat-6 cable with an RJ12 connector on the end so it can be plugged into a jack on a command station, booster, a UP5/UP7 or a radio. The layout must be powered up to do testing.

The LT1 has four green LED’s on its top side.

Inside a flat-6 cable there are six wires which are used for the following:
Pins 2 & 5 (black and yellow wires) – are used for ground
Pins 3 & 4 (red and green wires) – are used for LocoNet messages
Pins 1 and 2 (white and blue wires) – are used for signals that are mirror copies of the system DCC or other digital track control packets.

The white wire (pin 1) should always be on the right side of the RJ12 plug when the plug is viewed from above with the clip side up.

If the cable is good, all four LEDs will light (it is normal if not all LEDs are the same brightness).

If a Digitrax throttle (or UR92/UR93) radio is not plugged in, one of the LEDs will not be lit.

Digitrax requires the 6-wire configuration for the following reasons:

In a 6 wire flat configuration, the left 3 wires are effectively a "mirror" image of the right 3 wires.

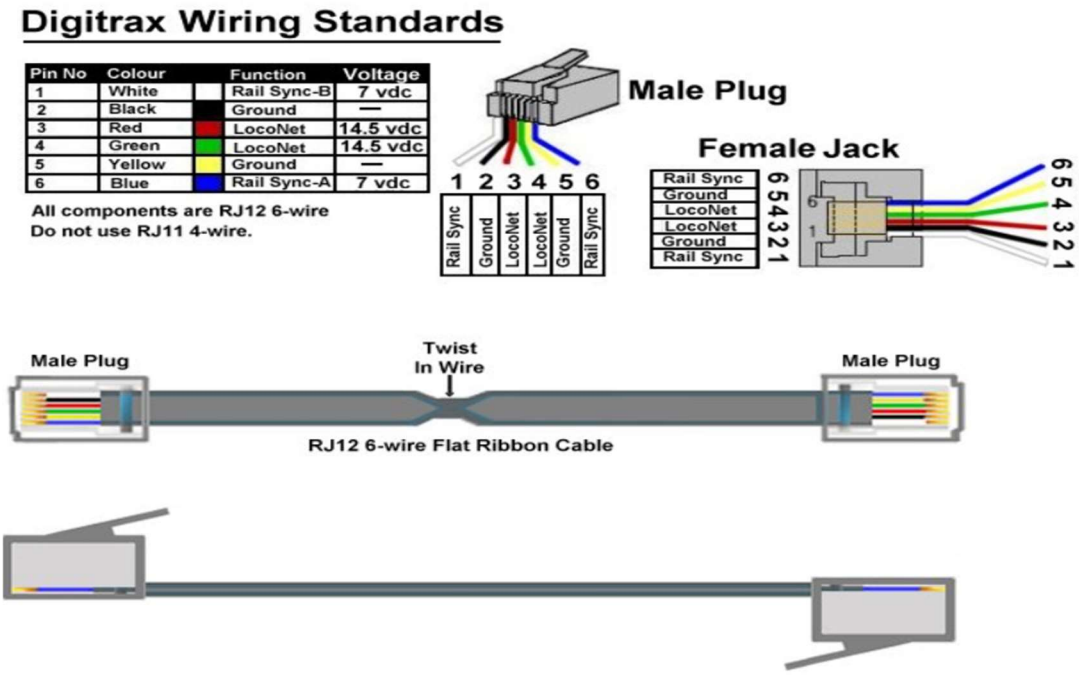
1. There are 2 Ground (pins 2 & 5) and 2 LocoNet data connections (pins 3 & 4), so the effective "loop resistance" is lower because of paralleled wires. This lets LocoNet run over greater distances.
2. If one ground or signal connection is broken or intermittent, the network can maintain a reliable connection.
3. The two outside wires (pins 1 & 6) carry opposite phase copies of the master system rail packets, this is called RailSync. RailSync allows LocoNet boosters and other LocoNet devices to be connected

anywhere along a cable run. This works even with cable runs of thousands of feet and in the presence of noise and interference.

4. The balanced nature of the cable and the way the signal currents propagate in this "RF Quad" configuration generate the lowest possible RFI radiation and EMC susceptibility or inward interference pickup. This is a good thing. This is part of the reason Digitrax LocoNet handily passes the FCC Class B radiation Certification requirements.
5. LocoNet's philosophy and architecture allow "free-form" wiring with no termination or "linear-bus" restrictions. You can star, tee, branch, or expand LocoNet in any configuration. LocoNet can be used in any configuration except for a ring. You should NEVER connect LocoNet back on itself, because pins 1 and 6 should not be connected.

LocoNet Wiring: The Specifics

1. LocoNet supports a total cable length of up to about 2000 feet depending on actual wire type used and its capacitance.
2. No two devices should be connected by more than 1000 feet of cable.
3. LocoNet can be split & branched in any free form style.
4. The only network current pull up termination needed is provided by the Command Station. There should be only one Command Station in the layout.
5. Do not loop LocoNet back on itself. Looping LocoNet back on itself causes RailSync (pins 1 and 6) to be shorted together and to be out of phase. This causes it to look like an overload to the driver circuit.
6. LocoNet works best when the network cables are 22AWG to 28AWG. The recommended 6 wire flat telephone type ribbon cable is 26AWG.
7. Plug and play design using 6 wire telephone type cables and RJ12 jacks makes setting up LocoNet quick and easy.
8. Plug in your LocoNet Cables in the same pin orientation around the layout for best results.



Echo Valley Railroad Guild Free-Mo Electronics Instructions

(some items in this narrative are particular to the Echo Valley Railroad Guild ("EVRG") Free-Mo setup and may not pertain to other Free-Mo set ups; for example, certain cable colours)

Overview

Role of the Command Station

In a typical home model railroad, the Command Station has two functions:
1) it is the "brain" or "traffic cop" of the system; and,
2) its built-in booster supplies power to the rails.

A Free-Mo setup is more susceptible to electrical problems than a home layout because it is larger and because components are repeatedly assembled, disassembled, and transported. Therefore, safeguards need to be built into the design to avoid a total shutdown of the entire layout when a short circuit or other defect arises and to facilitate troubleshooting.

In a Free-Mo setup, the Command Station has only one function, that of the "brain" or "traffic cop" of the system. Its built-in booster is NOT used and therefore does NOT supply power to the rails.

This narrative explains the Digitrax system in a Free-Mo context. Digitrax manuals tend to be written for their primary customer base – owners of home layouts. Therefore, some of the concepts outlined here will not be found in Digitrax manuals.

Loconet vs. ThrottleNet/BoosterNet for Transmitting Digital Signals

A Command Station receives commands from train operators by way of signals that are sent from throttles. For example, pressing function button 2 on a throttle sends a message to the command station that the operator wishes to sound a locomotive horn. The Command Station responds by issuing its own message through the rails to the DCC decoder in a locomotive to cause the loudspeaker in the locomotive to make the sound of a horn.

In a home layout, all digital commands flow through cables that Digitrax calls "***Loconet***" which is ONE network in which all devices are connected to each other.

In a Free-Mo setup Loconet is split into two parts, "BoosterNet" and "ThrottleNet":

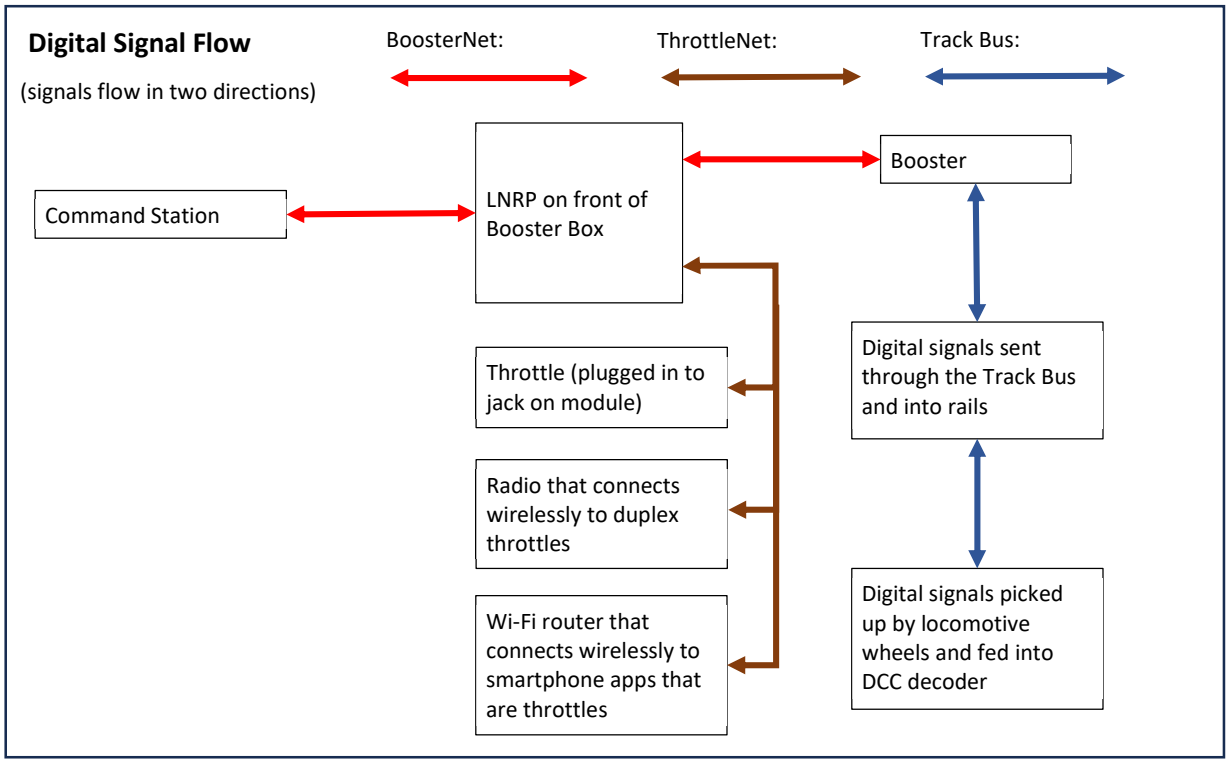
1) ***BoosterNet*** is a network of cables connecting the Command Station to several Boosters. Train operators do NOT directly connect any devices to BoosterNet. Instead, BoosterNet operates untouched by train operators and runs in the background.

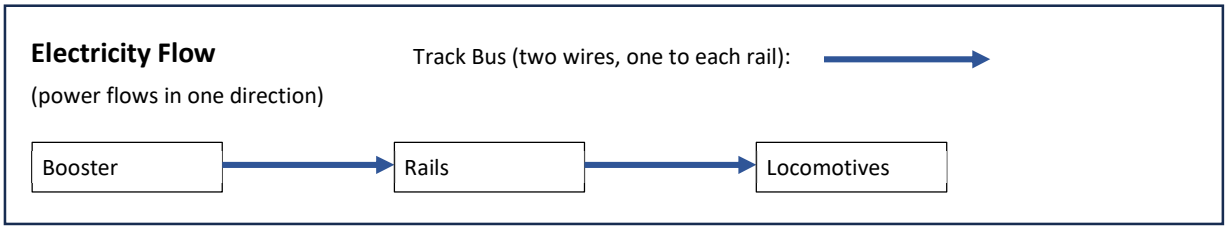
2) ***ThrottleNet*** is a network of cables connecting devices that are used by train operators. These include handheld throttles plugged into jacks on the side of modules and wireless devices using either radio or Wi-Fi. ThrottleNet tends to be a less stable network than BoosterNet because its components include portable items such as throttles that are routinely plugged and unplugged from jacks on the sides of modules and are more susceptible to damage than static components.

BoosterNet and ThrottleNet are connected to each other indirectly by way of devices called Digitrax Loconet Repeater Modules ("LNRP"). These allow digital signals to pass back and forth between BoosterNet and

ThrottleNet while filtering out digital noise that might arise in ThrottleNet. If a wiring or signal problem occurs in ThrottleNet, the LNRP will internally disconnect the faulty segment so that the "protected" BoosterNet can continue operating.

Digital Signals vs. Electricity Flow to Trains





Digital signals are **instructions**: 1) from train operators to the command station; and 2) from the command station to the DCC decoders in locomotives. *Analogy: a TV program is supplied as digital signals sent via a cable or satellite dish.*

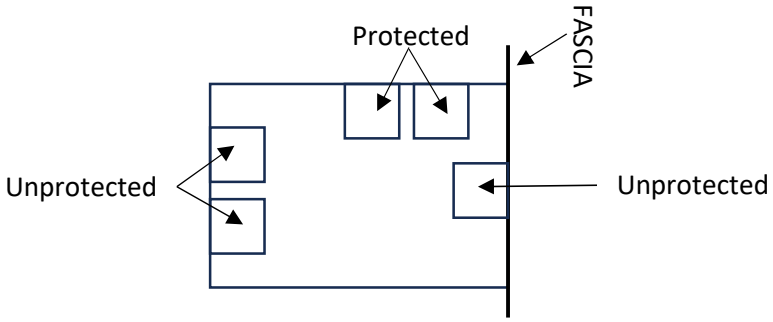
Electricity flow is **power** supplied to the rails and picked up by the wheels of a locomotive to:
1) turn on headlights; 2) run motors; and 3) run speakers. *Analogy: power supplied to a TV from 110-volt wall outlet.*

Both digital signals and electrical power are needed to run trains, just as a TV signal and electrical power are both required to watch a TV program.

Terminology

BoosterNet – begins at the Command Station and ends at Boosters. The Command Station is connected to the "protected" terminals on LNRP devices. In turn, Boosters are connected to the "protected" terminals on LNRP devices. BoosterNet receives digital instructions from ThrottleNet through the LNRP devices. The Command Station interprets these instructions and issues its own digital commands through BoosterNet to Boosters. Boosters, in turn, send the digital signals to decoders in locomotives by way of the track bus wires and the rails. EVRG BoosterNet "flat 6" cable is BLACK-coloured.

Flat-6 RJ12 terminals on an LNRP are as follows:



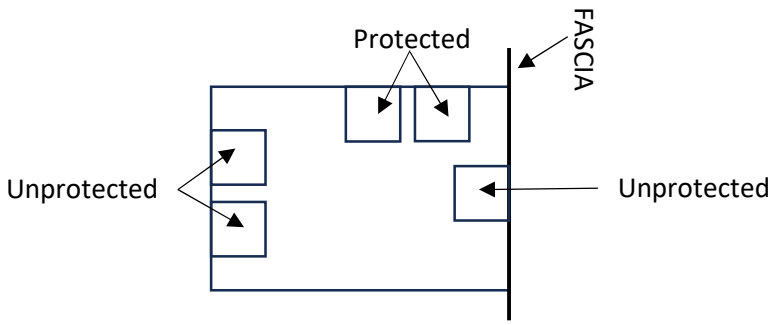
ThrottleNet – begins at the "unprotected" terminals on LNRP devices and ends at devices that interact with train operators. ThrottleNet receives digital instructions from train operators (selecting locomotives, operating horn/bell, adjusting speed/direction), either from throttles plugged into UP5/UP7 devices mounted on the sides of modules, via wireless throttles that send signals to UR92/UR93 radios mounted on masts or via a smartphone app connected to a dedicated Wi-Fi router connected to ThrottleNet. These digital instructions are sent from ThrottleNet to BoosterNet through the LNRP devices. ThrottleNet includes the cables that are fastened to the underside of all modules (with pigtails and connector jacks at module ends), installed per the Free-Mo standard. EVRG ThrottleNet "flat 6" cable is GREY-coloured.

LocoNet – is a term used by Digitrax and collectively includes all components of both BoosterNet and ThrottleNet. To avoid confusion, the term "LocoNet" will not be used in this narrative except when step-by-step programming instructions are provided under the heading "Key Points on Command Stations & Boosters" beginning on page 29, in which case think of BoosterNet and ThrottleNet being combined into LocoNet.

Major components

Uninterrupted Power Supply (UPS)

This receives 110-volt AC power from a wall outlet and produces clean AC power with electrical interference and voltage spikes removed. If there is a utility power outage the UPS will power the model railroad for up to 20 minutes, allowing for an orderly shutdown of the layout if necessary and reducing the chance of damage to electronic components. All power supplies for the Command Station Box, Accessory Booster Box and all Booster Boxes should be plugged into the "battery" sockets on the UPS. To the extent that extension cords are required to power Booster Boxes some distance away froFlat-6 terminals on an LNRP are as follows:



Each of the six boosters supplies power to the track bus running the UPS, these should also be plugged into the "battery" sockets on the UPS.

Digitrax PS2012 Power Supply (Brown Labels)
A high-capacity power supply that runs off AC power and converts it to DC power for running major components. The two components powered by the PS2012 are the Command Station Box (containing the Command Station) and the Accessory Box (containing a Booster which supplies power to the Accessory Bus running underneath the layout). The PS2012 should receive its power from the Uninterrupted Power Supply (UPS).

Digitrax PS2012E (One with Yellow Labels and One with Green Labels)
High-capacity power supplies that converts AC power to DC power for both 8-amp DB210 Boosters inside the Yellow Booster Box (yellow labels) as well as the LNRP mounted in the same box. The same is true for the Green Booster Box (green labels). This should plug into the Uninterrupted Power Supply (UPS) battery either directly or through an extension cord.

Digitrax PS615 (Blue Labels)
Medium-sized power supply that converts AC power to DC power for both 5-amp DB150 Boosters inside the Blue Booster Box (blue labels) as well as the LNRP mounted in the same box. This should plug into an plug into the Uninterrupted Power Supply (UPS) battery either directly or through an extension cord.

Digitrax PS14 Power Supplies (Silver Labels)
Small wallwart-style power supplies that convert AC power to DC power for various low-power devices. Two of these supply power to the two UR92/UR93 radio devices mounted on masts (Silver Labels). The PS14's should receive their power from extension cords that runs underneath the layout, each of which should plug into the Uninterrupted Power Supply (UPS).

Command Station Box (Red Labels)

- The Command Station Box contains 1 Digitrax DCS 200, 8-AMP command station and 1 UP5 jack.

- This is the "brains" and "traffic cop" of the operation which:
    - keeps track of all locomotives.
    - runs BoosterNet via LNRP devices.
    - issues commands to boosters which, in turn, issue commands to decoders in locomotives via the track bus.

- The track power sockets of the command station are NOT used for anything except to connect to the two screw terminals on the back of the UP5 so the UP5 can show if track power is on via the orange LED on the face of the UP5.

Booster Boxes (3) (one with Blue Labels, one with Yellow Labels and one with Green Labels)

- Track power to the rails is provided from Boosters two of which are contained in each Blue, Yellow and Green Booster Box. The Boosters are connected to the track bus six separate power districts. If the layout is smaller, then one of the booster boxes could be left out of the setup. Conversely if the layout becomes very large, additional booster boxes may be required.

- The Blue Booster Box contains two 5-amp DB150's which are configured as a boosters. For a DB150 to operate as a booster and not as a command station there must be a jumper connecting the "CONF A" and "GROUND" terminals on the front of each DB150. If this jumper is missing or becomes disconnected the DB150 runs as a command station. Since a layout cannot have two active command stations, the system will not operate.

- The Yellow and Green Booster Boxes each contain two 8-amp DB210's which are boosters (it is not possible to configure these as command stations). Unlike the DB150's these boosters do not require any jumper wires across any terminals.

- Each Booster Box has an LNRP mounted on the front side. An LNRP has four (4) sockets on its circuit board, two are "protected" and two are "unprotected". In addition, it has one (1) "unprotected" socket on its front panel mounted on the fascia of a module. The "protected" sockets are used by BoosterNet. The "unprotected" sockets are used by ThrottleNet. Each Booster Box receives its digital signals from the Command Station Box via BoosterNet using one of the "protected" sockets.

- Each of the six boosters supplies power to the track bus running under the layout. The layout is divided into six separate power districts. If there is a fault such as a short circuit in one power district, only that power district will be affected, leaving the other five power districts unaffected.

- Mounted on the exterior of both Booster Boxes, beneath the output Anderson Power Poles connected to the track bus of each power district, are double-pole-double-throw rocker switches which are used, if necessary, to reverse the phase of the power sent to the rails (think of this as "reversing polarity"). If locomotives won't run properly when running between power districts, throw the switch beneath the output jacks feeding the power district into which the stalled locomotive is trying to enter.

Accessory Power Box (1) (White Labels)

- Contains a DB210 which is a booster but is not connected to the rails or to ThrottleNet. This is strictly used to provide power to the Accessory Bus to power accessories on modules. This power is supplied from the "Track A" and "Track B" terminals on the front of the booster. This has 8 amps of power.

- Is connected to BoosterNet so a command given to the Command Station to shut down power to devices and the layout will also remove power from the accessory bus.

- The accessory bus uses the equivalent of alternating current (AC). Therefore, the bus has no positive or negative wires.

- All accessories fed from the accessory bus must be able to operate using AC power. If an accessory requires DC power it is a relatively simple matter to convert AC to DC using diodes or, more simply, a bridge rectifier or a pre-packaged “buck converter” which don’t require any electronics knowledge to install. A bridge rectifier must be rated for at least 15 volts with an amperage sufficient to serve the power requirement of the device to be powered (purchasing a bridge rectifier rated for, say, 50 volts and 5 amps would be more than enough for any model railroad accessory).

Networks that must be Setup

Abbreviations:
APP – Anderson Power Poles
UPS – Unterruptable Power Supply battery

There are five (5) networks that need to be setup.

1. Electric power.

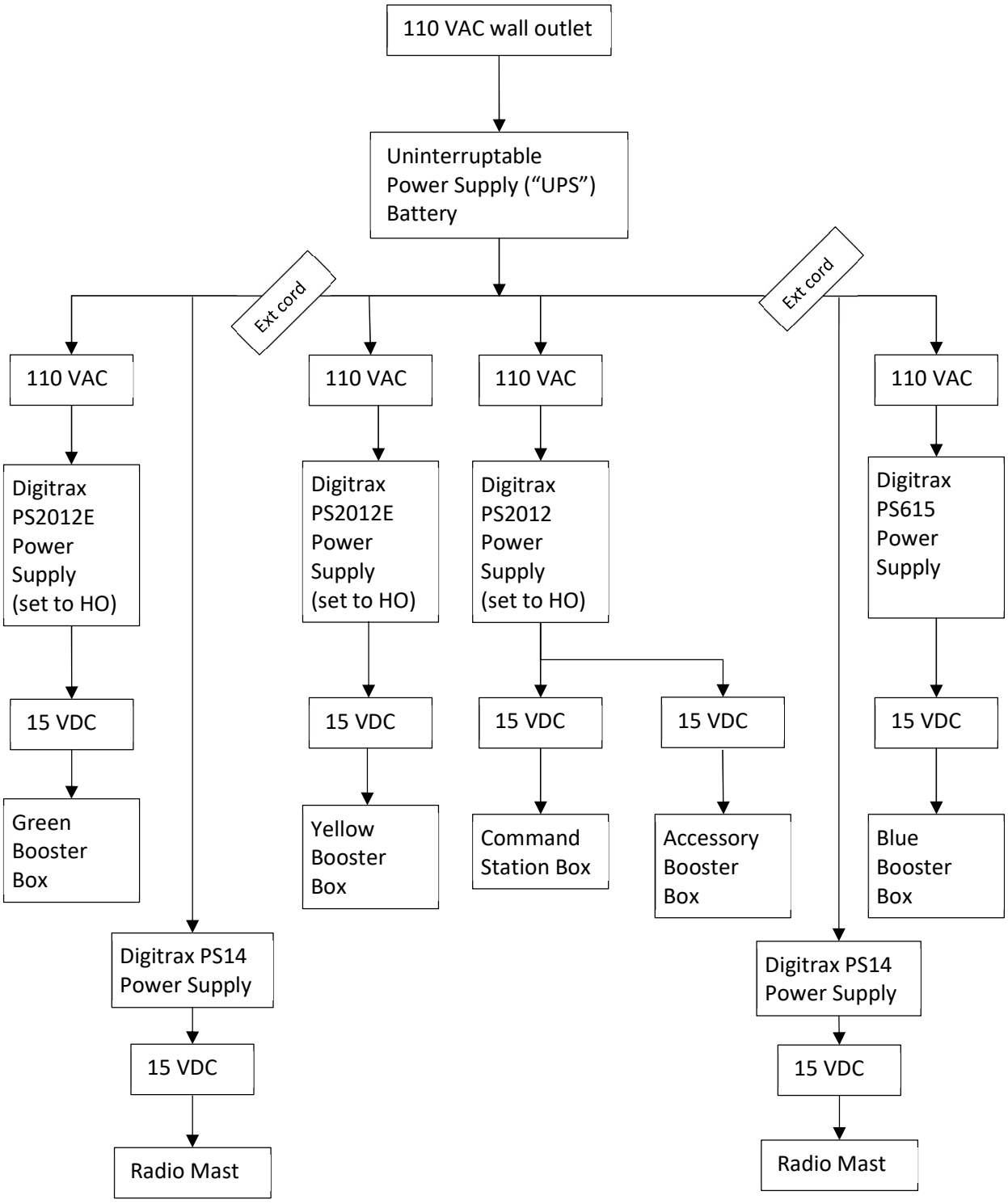
2. BoosterNet, including the common ground.

3. ThrottleNet.

4. Track bus.

5. Accessory bus.

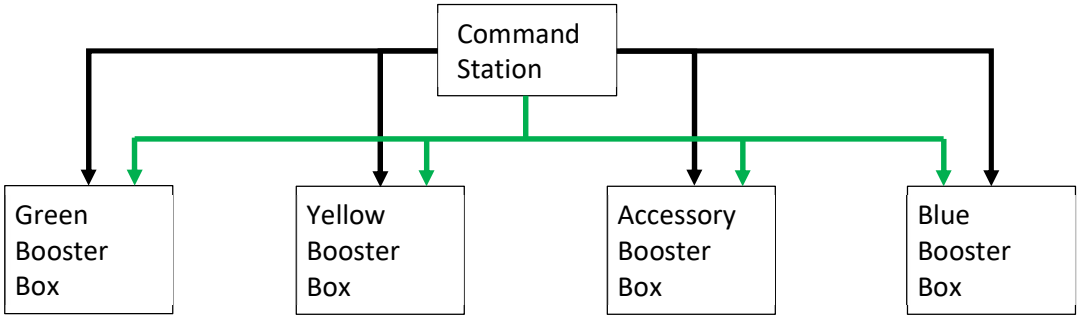
DIAGRAM OF ELECTRIC POWER ALONE



Booster Boxes *are interchangeable – they do not have to be used in a set order.*

The ***Accessory Booster Box*** *is NOT the same as other Booster Boxes and should only be used to power the accessory bus.*

DIAGRAM OF BOOSTERNET ALONE
(FLAT CABLES – BLACK; GREEN CABLES – COMMON GROUND)



These are the ONLY green cables that need be connected for the entire layout; the green Free-Mo standard cables under the modules should NOT be connected to any of these cables.
Connecting these green cables to those under the modules creates a “ground loop” that acts as a large antenna, causing unwanted voltages on the common ground that can cause problems.

DIAGRAM OF THROTTLENET ALONE
(FLAT CABLES – GREY)

Throttle net is separated at each power district.

Multiple UP5/UP7 devices are located on the fascia of modules and are where hand-held throttles may be plugged in

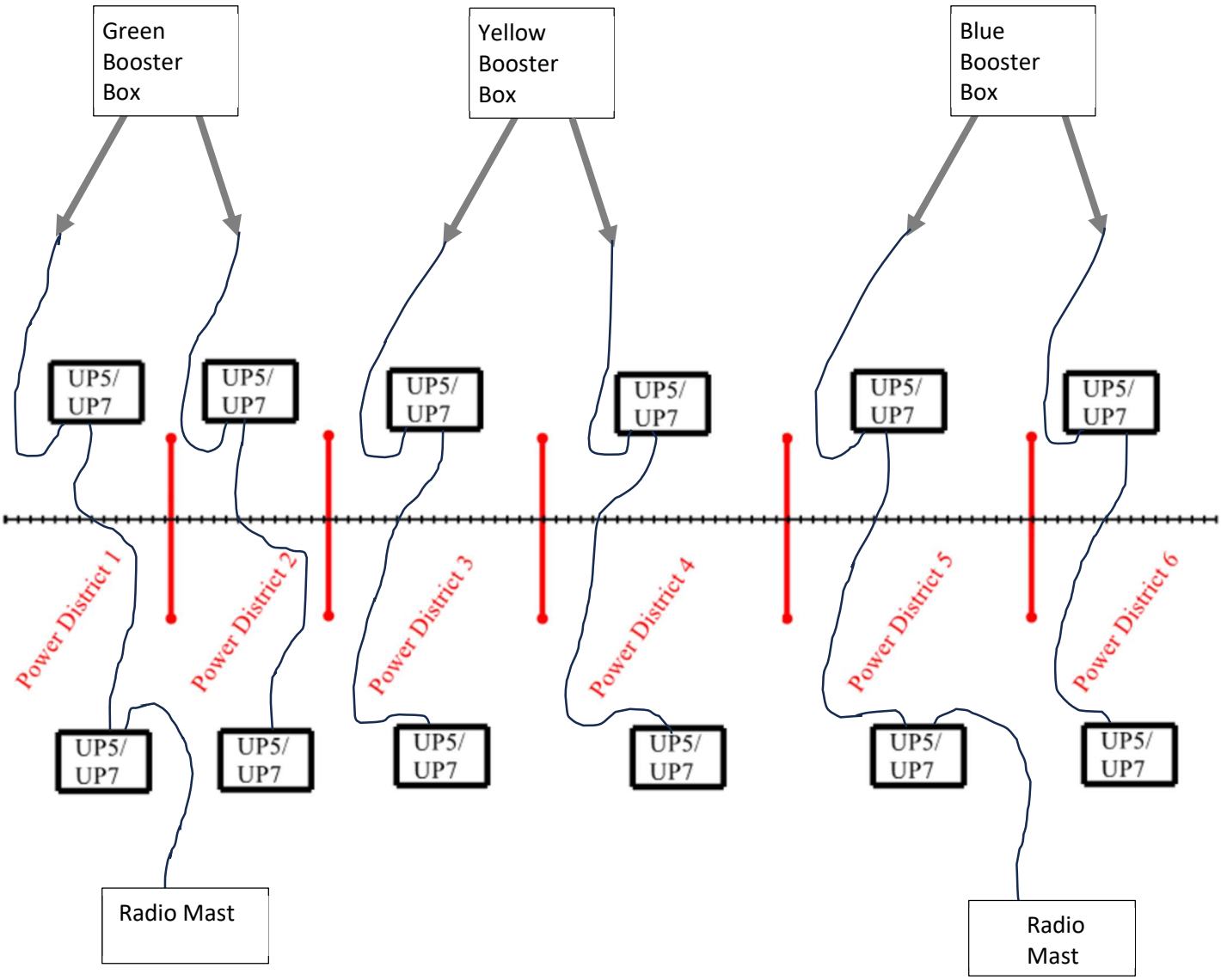
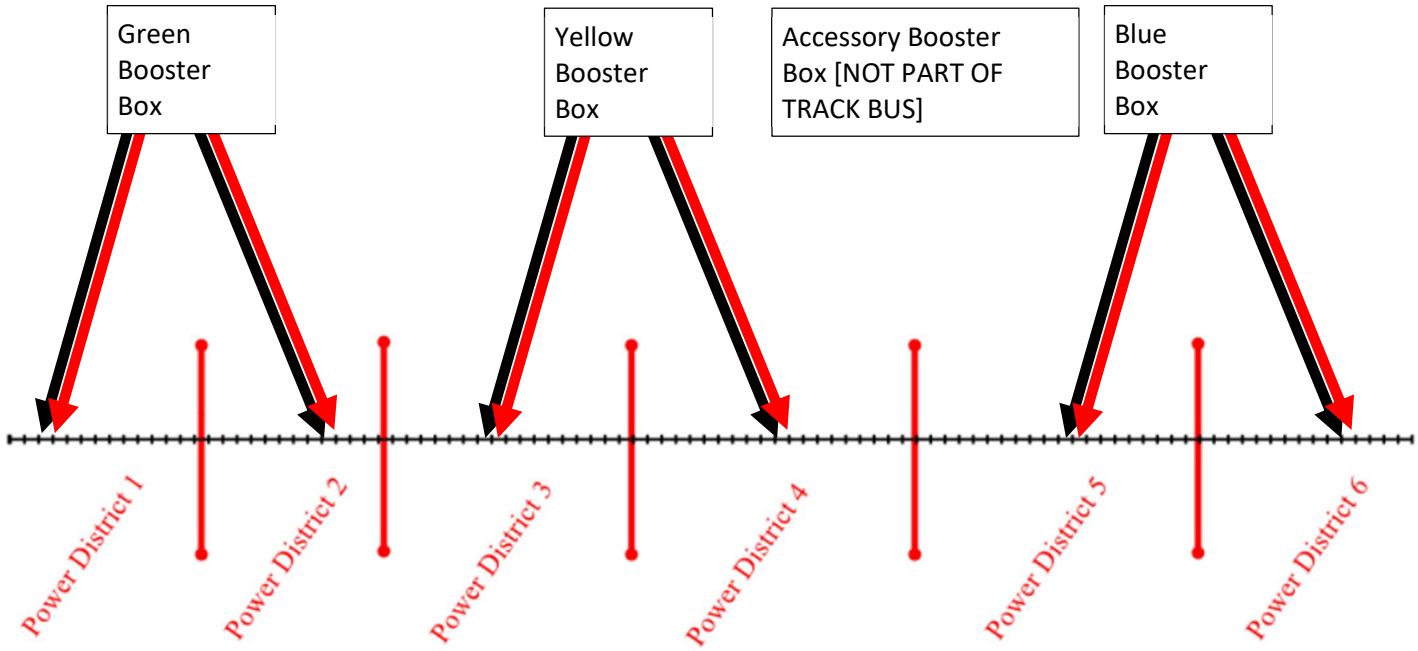


DIAGRAM OF TRACK BUS ALONE
(RED & BLACK CABLES ATTACH TO RED & BLACK CABLES UNDER LAYOUT)

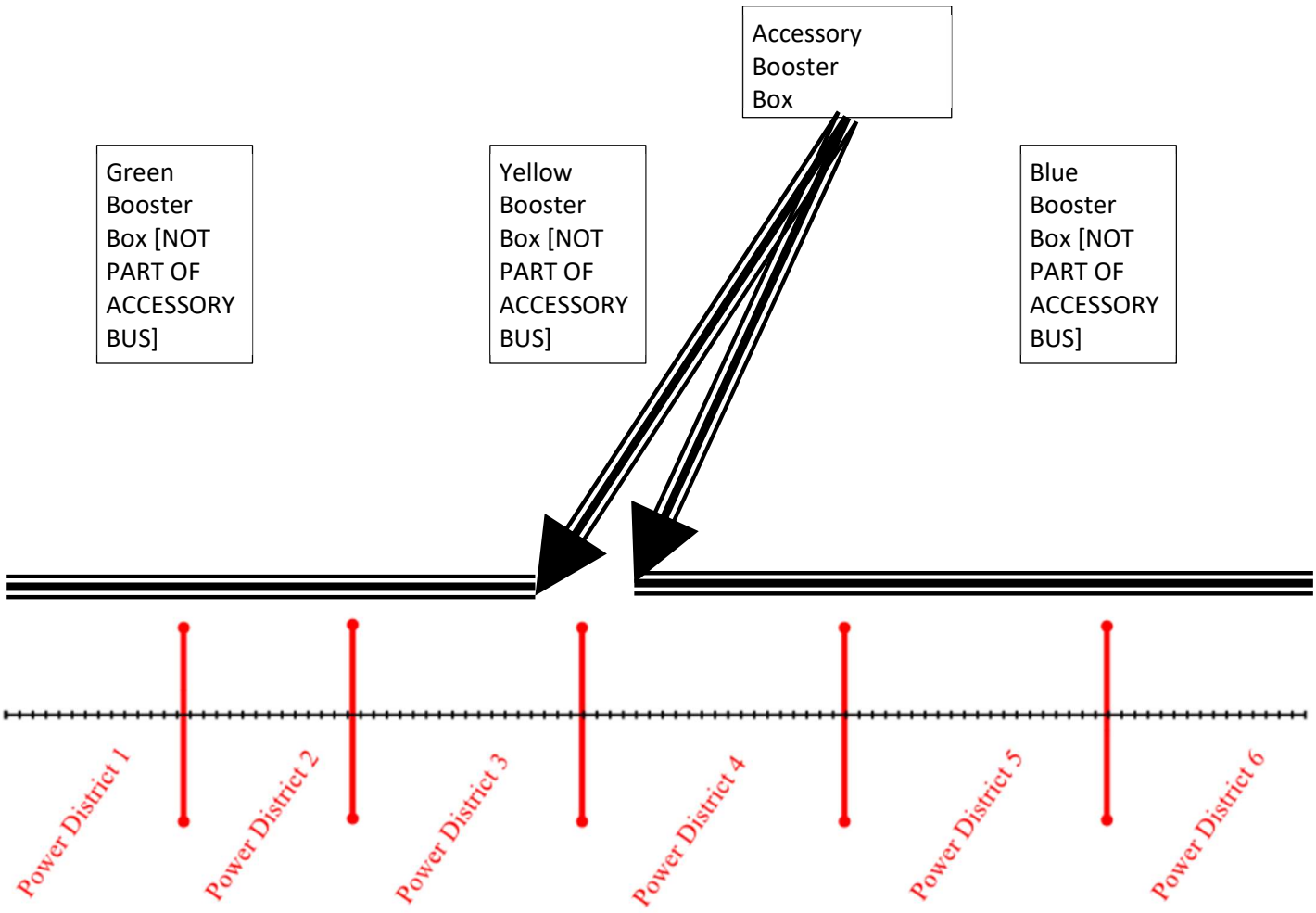
Red & black cables under layout are wired to rails.

Track bus is separated at each power district.



EVERY JUMP RAIL (SOMETIMES CALLED FITTER RAILS) BETWEEN MODULES MUST HAVE AN INSULATED RAIL JOINER AT ONE END (ALL SHOULD BE ON THE SAME END)

DIAGRAM OF ACCESSORY BUS ALONE
(WHITE CABLES ATTACH TO WHITE CABLES UNDER LAYOUT WHICH ARE, IN TURN, WIRED TO ANY ACCESSORIES REQUIRING POWER SUCH AS LIGHTING, POWERED TURNOUTS, ETC.)
NOT DIVIDED INTO POWER DISTRICTS (the outlets on the outside of the Accessory Booster Box provide for two pairs of wire, one that is attached to the Accessory Bus going to the left and the other to the Accessory Bus going to the right – since these wires all come from one Booster they are actually one accessory power district).



Physical Setup (steps to follow at train shows)

The main components of the EVRG Free-mo electrical system are labelled 1 through 9. In some cases the labels might say, for example, “1 of 3”. This means, for that component, there are three items to be connected.

VERY IMPORTANT

The track bus consists of the red/black wires located under the modules which provides power to the rails.

Each Booster Box contains two Digitrax boosters, each of which will provide track power to a power district. Therefore, if all three Booster Boxes are used, there will be six power districts.

The track bus of one power district MUST NOT be connected to the track bus of the adjacent power district. **EACH POWER DISTRICT MUST BE POWERED BY ONE BOOSTER, INDEPENDENT OF ALL OTHER BOOSTERS.**

DO NOT CONNECT ANY OF THE TRACK BUS, ACCESSORY BUS OR THROTTLNET CABLES MOUNTED UNDERNEATH MODULES UNTIL INSTRUCTED BELOW

Placement of devices (without connecting)

[the following narrative assumes that all three Booster Boxes are used, creating six separate power districts]

Place the orange extension cord spool, UPS Battery, Digitrax PS2012 DC Power Supply, Command Station Box, Accessory Power Box and one Booster Box in the same vicinity under the layout at roughly the half-way point.

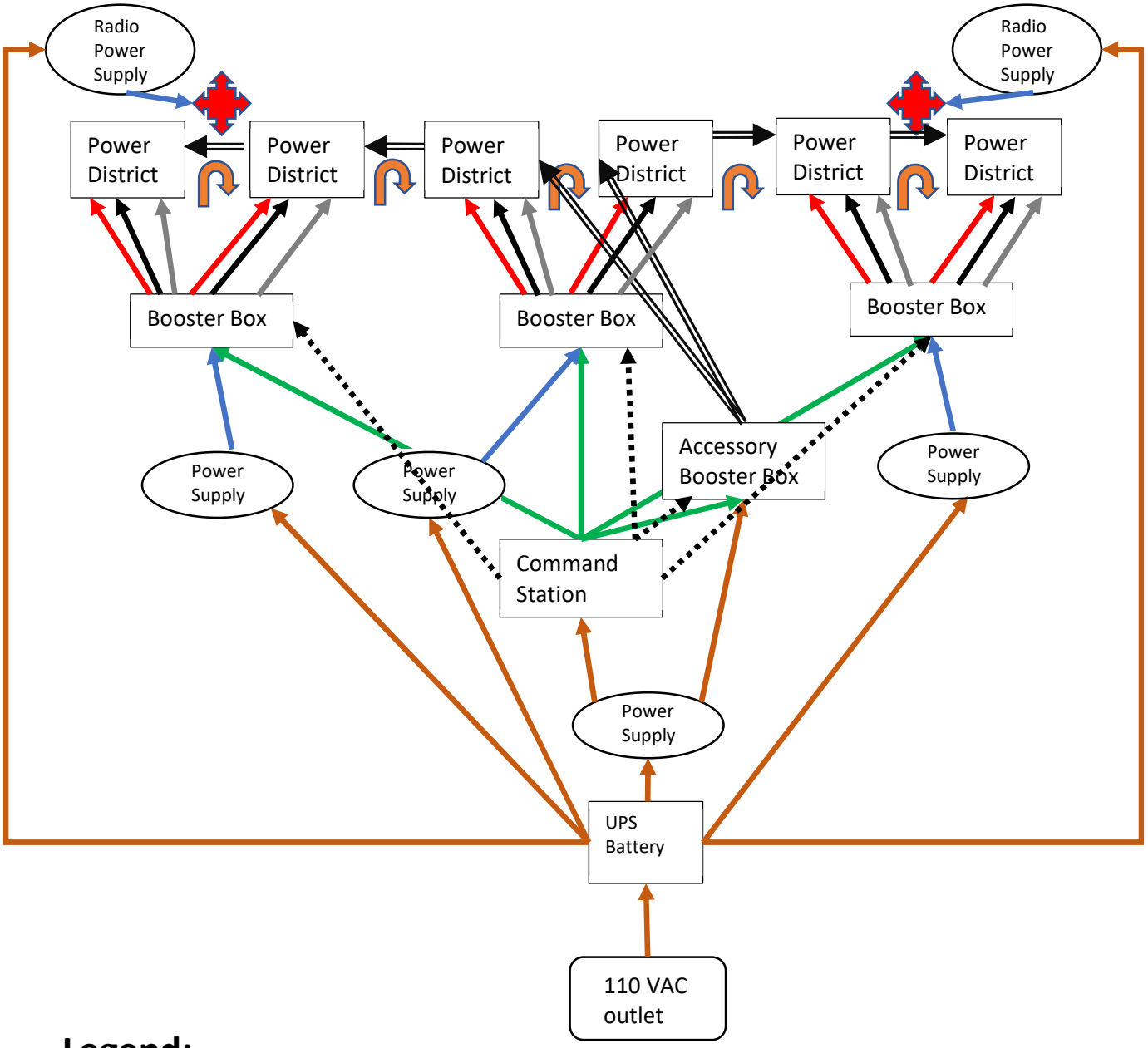
Place two booster boxes and their respective power supplies at remote locations along the layout where there will be a division between power districts. These will be powered by extension cords.

Hang an orange marker labelled “Power District” on the track bus wires at the end of each power district. This is a reminder to NOT connect any under-module wires from one power district to the next EXCEPT for the white Accessory Bus wires that should be connected.

EACH POWER DISTRICT TRACK BUS AND THROTTLENET IS POWERED EXCLUSIVELY FROM ITS OWN BOOSTER, INDEPENDENT OF THE REST OF THE LAYOUT.

Place a radio mast at the same location as the remote booster boxes, along with a UR92 or UR93 radio along with a PS14 power supply for each. As the PS14 power supply will use the same the same AC power source as its neighbouring Booster Box a multi-port “cube tap” or “octopus plug” may be required. The radio masts should be fastened to the legs of modules.

The following diagram depicts the logical positioning of all components under the Free-Mo layout. Note that a power district will comprise multiple modules which will later be electrically connected to each other WITHIN each power district. However, each power district WILL NOT be electrically connected to the adjacent power district. The only exception to this is the Accessory Power Bus which is connected throughout the layout.



Legend:

- 110 VAC power
- 15 VDC power
- Common ground
- Track bus red wire
- Track bus black wire
- Accessory bus white wires
- ThrottleNet grey 6-conductor flat cable
- BoosterNet black 6-conductor flat cable

Orange hanger showing break between power districts (hang under layout at end of power district)

radio

Connecting the Devices

Abbreviations:
APP – Anderson Power Poles
UPS – Unterruptable Power Supply battery

1. Electric Power (110 volts AC) from electrical utility
   a. Using the 100 foot spool of orange extension cord, plug the male end into a wall outlet. There is a toggle switch in the centre of the spool which, if turned ON, glows red showing that there is power. TURN IT ON.
   b. Plug the male end of the cord from the UPS into one of the outlets in the center of the extension cord spool. Use of the UPS is optional. The benefit of using it is to get rid of power spikes or brownouts that might be experienced at the power outlet, thus avoiding potentially catastrophic damage to electronics. Also, the layout will run for several minutes using power from the UPS, allowing for an orderly shut down if power problems persist. The "battery" female outlets on the UPS are the only ones that provide electrical protection.
   c. To turn on, hold down the power button on the top of the UPS for a few seconds until it beeps – the button will flash green for a few seconds and then show a solid green. This provides power to the female outlets on the top of the UPS. TURN IT ON.

2. Electric power (110 volts AC) to Digitrax power supplies under layout (see step 3 for the order in which power supplies should be connected).
   a. Each electronics box has a power supply that plugs into the protected outlets on the UPS, either directly or via an extension cord. These power supplies convert 110 volts AC to 15 volts DC that the Digitrax equipment requires for HO.
   b. The Command Station Box (red labels) and the Accessory Booster Box (white labels) share one Digitrax PS2012 power supply.
   c. The Green and Yellow Booster Boxes (green and yellow labels) each have one Digitrax PS2012E power supply.
   d. The Blue Booster Box (blue labels) has one Digtrax PS615 power supply.

3. Connecting Command Station Box and Booster Box power supplies
   a. Plug the APP connectors from the PS2012 power supply to the power input on the front left of the Command Station Box (red labels) and also on the Accessory Booster Box (white labels).
   b. Plug the APP connectors from each PS2012E power supply to the power input on the front left of the yellow and Green Booster Boxes.
   c. Check that the slide switch on the front of each PS2012/PS2012E is set to HO scale and that the output wires are firmly attached to the posts on the front of the PS2012/PS2012E.
   d. Plug the power cord firmly into the respective power supply (each power cord is colour coded to the respective power supplies) and the other end into a battery outlet on the top of the UPS (either directly or via an extension cord).
   e. TURN ON the toggle switch on the front of the PS2012 or PS2012E, if it isn't already turned on (will glow green when turned on). Note that the PS615 has no toggle switch.
   f. As each of the power supplies is turned on, make sure that the devices inside the Command Station Box and Booster Boxes show that they are powered on by looking at the power light on the front of the boxes.

g. Also look at the Track Status LED on the front of the LNRP devices on the front of each Booster Box as well as the UP5 on the front of the Command Station Box. If turned off, plug a throttle into one of the LNRP devices or the UP5 and turn on track power to light the LEDs

4. Connecting Radio Mast power supplies
   a. Plug the wallwart style PS14 power supplies into an extension cord that is, in turn, plugged into the UPS. Plug the male barrel jack connectors from the PS14 power supplies to the female barrel jack connectors on the base of the radio masts.
   b. Mount a UR92 or a UR93 to the top of each radio mast using the Velcro fastener. Plug the APP and barrel jack connnectors into each device.
   c. Ensure that the power lights are lit on the UR92/UR93.

5. At this stage all of the electronics should be working, with track status LEDs lit on the front of all LNRP/UP5/UP7 devices mounted on the front of the Command Station Box and Booster Boxes.

6. Begin the process of connecting the layout to the electronics by starting at one Booster Box. Connect a pair of track bus cables from side of the Booster Box “track power” outlets to the track bus under one of the modules at end of a power district. Connect a grey ThrottleNet cable to the ThrottleNet cable at the end of the same power district.

7. Place a locomotive on the track on the module that was just attached. Using a throttle on which this locomotive is selected, make sure that the locomotive runs across the module.

8. Connect the track bus and ThrottleNet cables located under the module where the locomotive is located to the next module in the power district. Run the locomotive into this module. If the locomotive stalls when the wheels contact the rails of the next module it is likely that the Anderson Power Pole connectors of one of the modules is the wrong way around. Check the wiring of each module and correct that one that is incorrect (see guidance on wiring track bus APP connectors starting at page 42).

9. Repeat the steps in 8 above until the last module in the power district is connected and the locomotive successfully travels across all modules in the power district.

10. Repeat the steps in 6 to 9 above using the second Booster Box “track power” outlets for the track bus and a second grey ThrottleNet cable and attach both the track bus and ThrottleNet of the adjacent module.

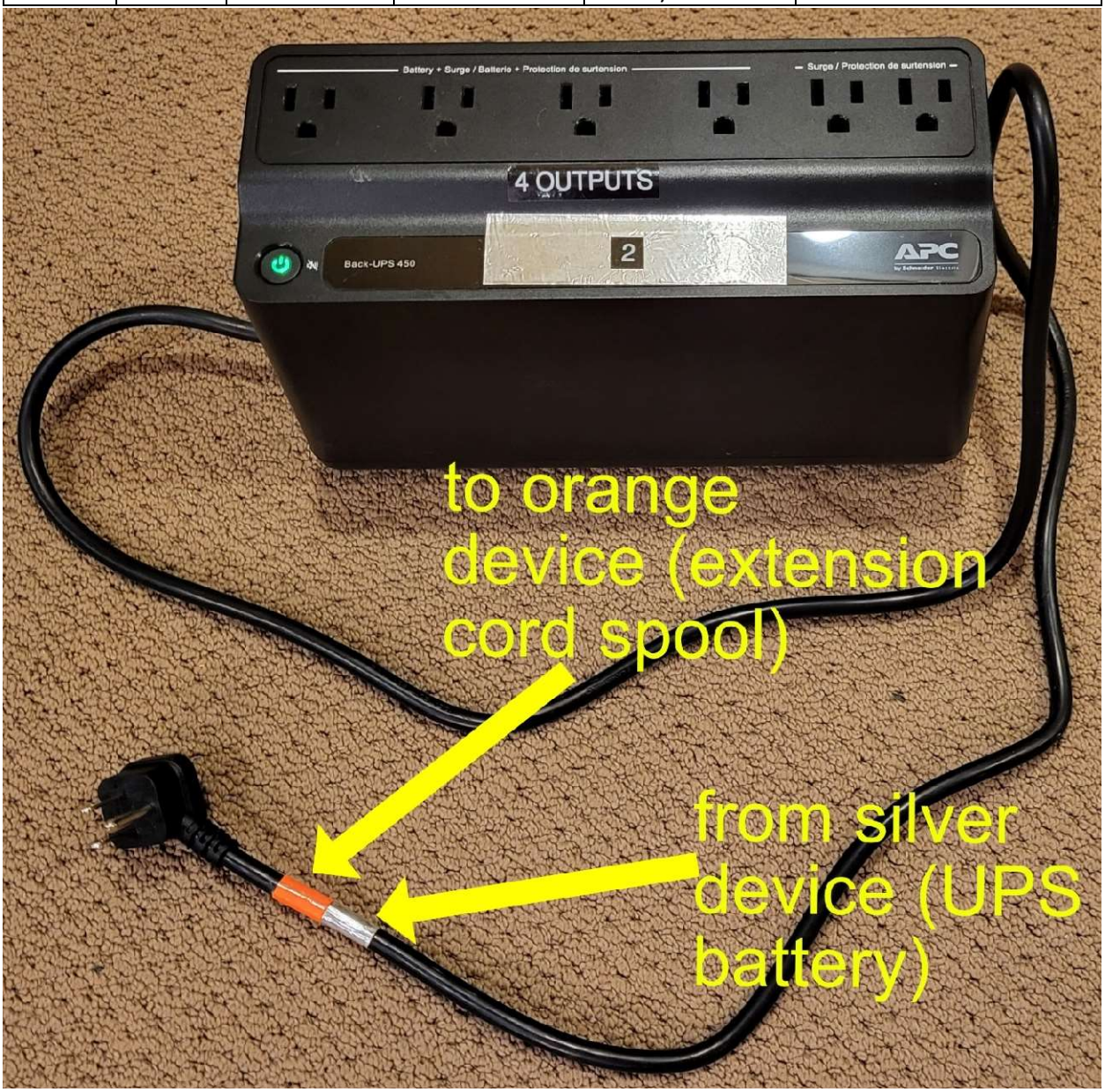
11. Run the locomotive from one **power district** to the next. If the locomotive stalls when its wheels contact the rails on the adjacent module, flip the double-pole-double-throw rocker switch under the “track power” outlets which are feeding the power district that caused the locomotive to stall. This reverses the phase of the track bus (analogous to switching polarity of the rails in a DC layout).

Illustrations of Major Components

Abbreviations:
APP – Anderson Power Pole Connector ("APP *BlueYellow"* means Anderson Power Poles Blue and Yellow)
RJ12 – 6-wire flat cable connector used for throttle jacks, ThrottleNet and BoosterNet

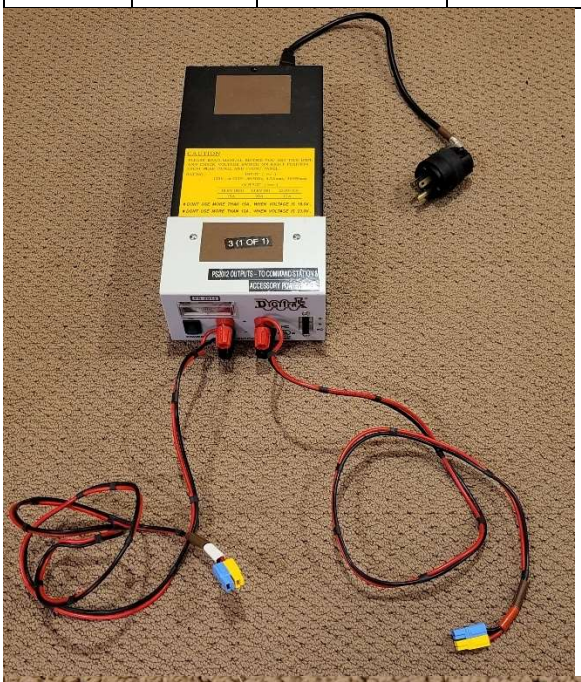
Number	Label Colour	Description	Inputs (1 single)	Outputs (1 single)	Comment
1 1 item	orange	orange extension cord 100-foot spool	plug into 110-volt wall outlet	110-volt socket into which the UPS battery is plugged; only one socket used for layout – other three can be used to power other devices	spool has a red rocker switch which must be on for power to flow (glows red when on)

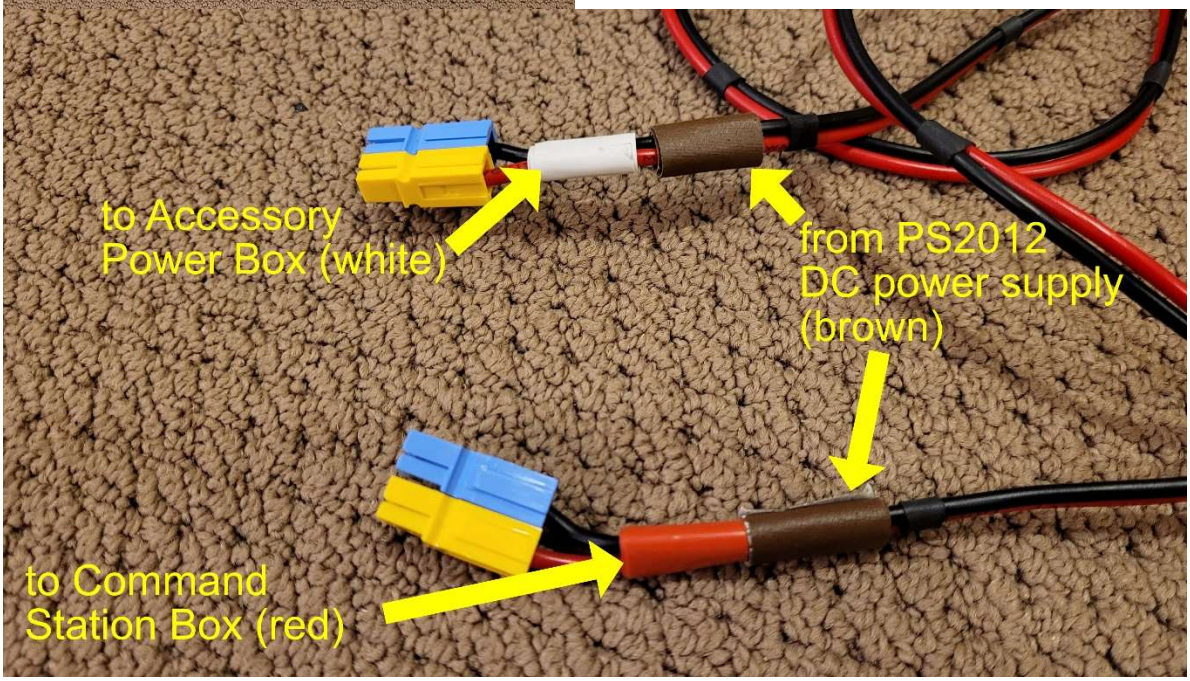
Number	Label Colour	Description	Inputs (1 single)	Outputs (4 single)	Comment
2 1 item	silver	UPS Battery	plug into powered outlet in centre of extension cord spool	110-volt sockets labelled “battery” are used by Digitrax PS2012, PS615 & PS14 power supplies (including via extension cords)	on/off button on top of UPS glows solid green if turned on and connected to live power; flashing green means running on battery; press and hold button to turn on or off



Note colour wire labelling – colour closest to the end of the wire shows which device it plugs into; colour farthest from end of wire shows the device the wire is coming from.

Number	Label Colour	Description	Inputs (1 single)	Outputs (2 pair)	Comment
3 1 item	brown	Digitrax PS2012 DC power supply	110-volt socket on UPS battery labelled "battery"	Command Station Box (red) APP *BlueYellow*; Accessory Power Box (white) APP *BlueYellow*	slider switch **MUST** be set to HO scale (supplies 15 volts, DC); rocker switch on front turns on/off – ***suggest not turning on until all remaining components connected***

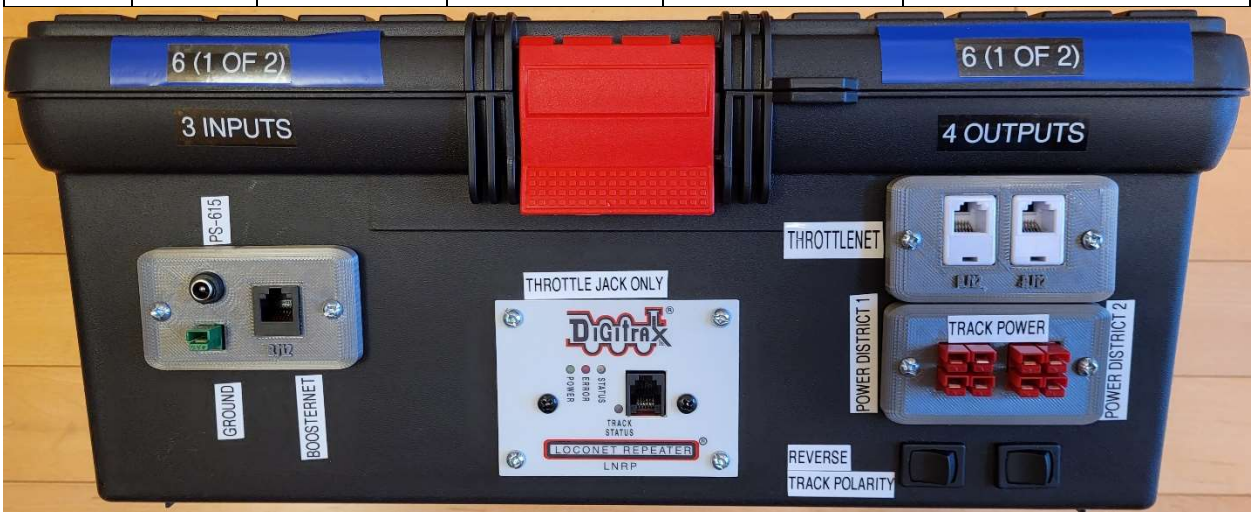




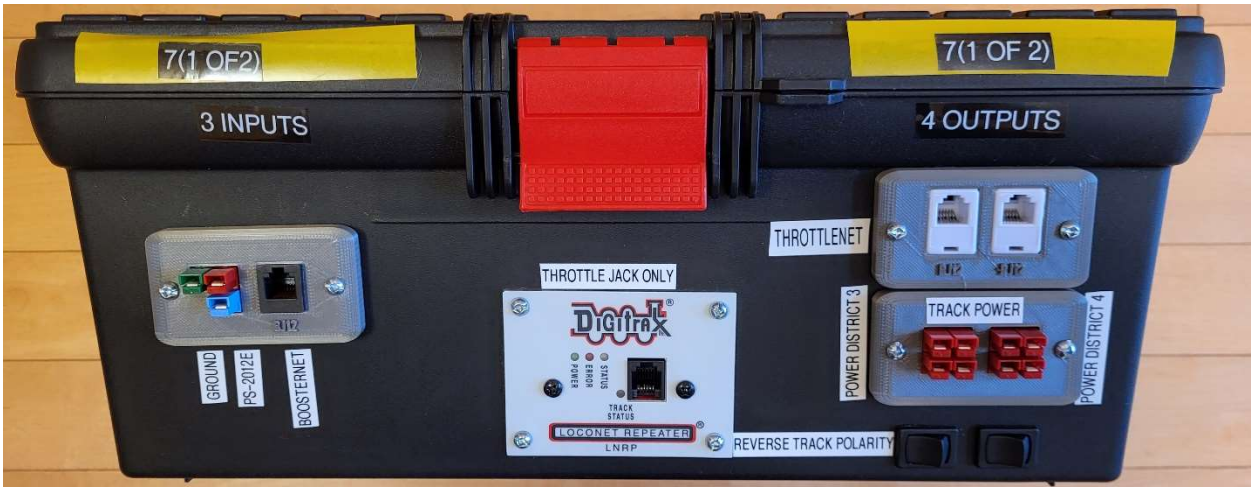
Number	Label Colour	Description	Inputs (1 pair)	Outputs (6 single)	Comment
4 1 item	red	Command Station Box	APP *BlueYellow* From PS2012 DC power supply	3 RJ12 connectors of BoosterNet flat 6-conductor cable (BoosterNet cable is black); 4 APP *Green* on green ground bus wires to Accessory Power Box and each Booster Box.	Place the Command Station box so the lid opens to the side of the Free-mo layout where it will most likely be accessed (will need to be accessed to perform purging of Command Station memory before an operating session – see separate instructions on how to reset Op Switch 39 to closed at page 38)

Number	Label Colour	Description	Inputs (1 pair plus 2 single)	Outputs (2 pair)	Comment
5 1 item	white	Accessory Power Box	APP *BlueYellow* From PS2012 DC power supply; APP *Green* from Command Station Box (green ground bus wire); one RJ12 connector of BoosterNet (black cable) from Command Station Box	2 pair of APP *White*, one pair feeds the white accessory bus under ½ of the layout and the other pair feeds the white accessory bus under the other ½ of the layout	Place under layout near PS2012 DC power supply

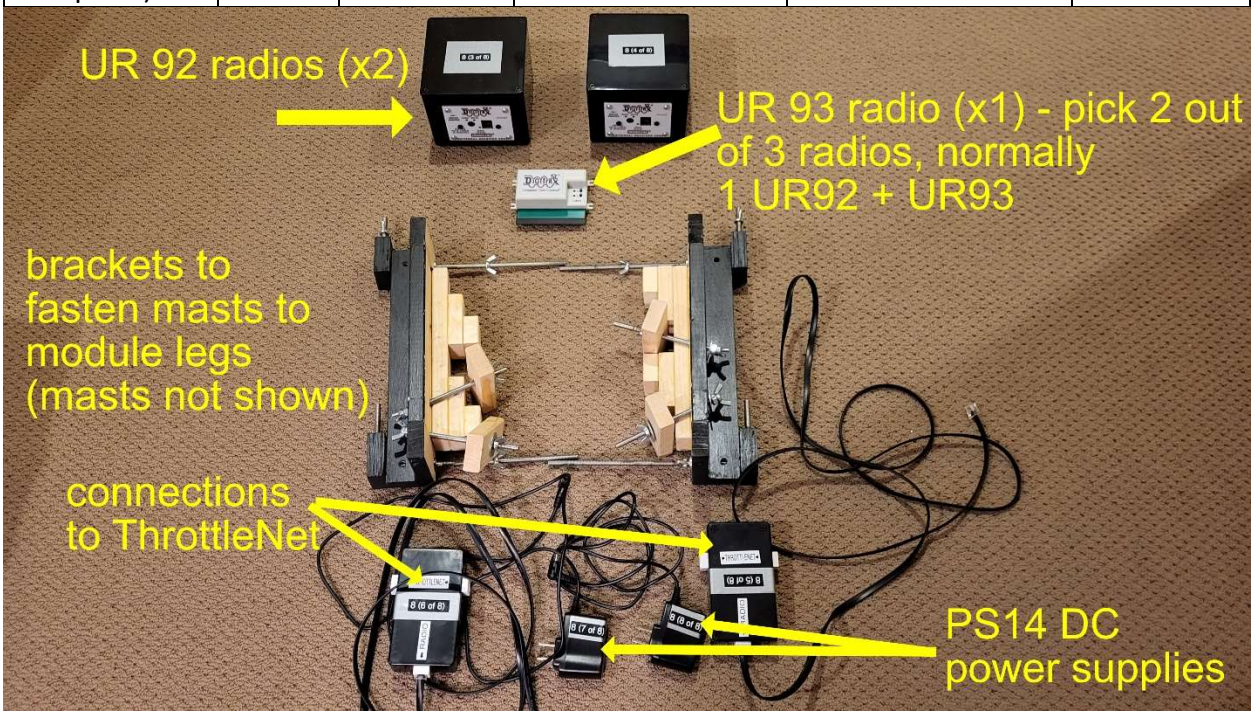
Number	Label Colour	Description	Inputs (3 single to box; 1 single to PS615)	Outputs (2 single plus 2 pair)	Comment
6 2 items, box plus PS615 DC power supply	blue	Blue Booster Box	Barrel Jack from Digitrax PS615 DC power supply (the PS615 is powered by one 120-volt extension cord running under the layout); APP *Green* from Command Station Box (green ground bus wire); one RJ12 connector of BoosterNet (black cable) from Command Station Box	2 RJ12, one each on 6-conductor flat grey cable to ThrottleNet under each power district; 2 pair of APP *Red*, one pair of which feed the track power bus for one power district and the other pair which feed the track power bus for another power district (note that two pair of the APP *Red* outputs are not used)	Place under layout near PS615 DC power supply



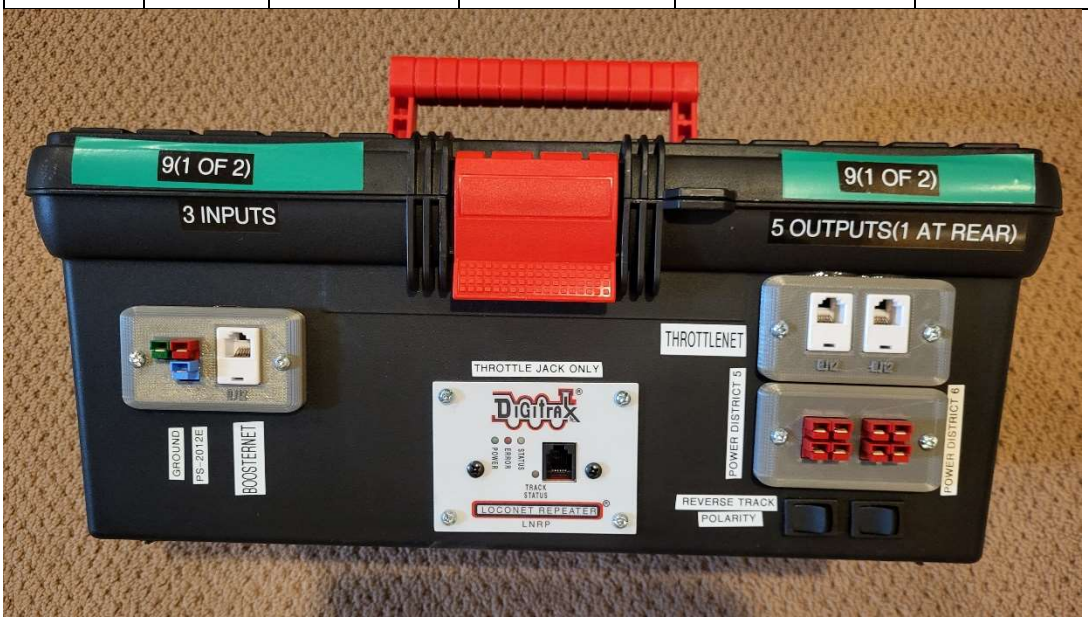
Number	Label Colour	Description	Inputs (3 single to box; 1 single to PS615)	Outputs (2 single plus 2 pair)	Comment
7 2 items, box plus PS2012E DC power supply	yellow	Yellow Booster Box	APP *RedBlue* from Digitrax PS2012E DC power supply (the PS2012E is powered by one 120-volt extension cord running under the layout); APP *Green* from Command Station Box (green ground bus wire); one RJ12 connector of BoosterNet (black cable) from Command Station Box	2 RJ12, one each on 6-conductor flat grey cable to ThrottleNet under each power district; 2 pair of APP *Red*, one pair of which feed the track power bus for one power district and the other pair which feed the track power bus for another power district (note that two pair of the APP *Red* outputs are not used)	Place under layout near PS2012E DC power supply



Number	Label Colour	Description	Inputs (2 at mast bottom, 2 at mast top, 2 ThrottleNet)	Outputs (2 single, 1 from each ThrottleNet box)	Comment
8 8 items (2 masts & brackets, 2 boxes for Throttlenet connections, 2 PS14 DC power supplies, 2 UR 92 radios) (a UR93 radio was added in 2022 and should be substituted for one UR92 for better radio reception)	silver	Radio equipment	Barrel jacks from PS14 bottom of each mast; PS14 plugged into end of extension cords using “cube tap” or “octopus plug”; RJ12 input from ThrottleNet into a black box; RJ12 output from black box which inputs to RJ12 at bottom of each mast; APP *RedYellow* and RJ12 at top of each mast into UR92 or UR93 radios	2 RJ12, one each on 6-conductor flat grey cable to ThrottleNet under each power district	Fasten each mast to a module leg nearby each Booster Box



Number	Label Colour	Description	Inputs (3 single to box; 1 single to PS615)	Outputs (2 single plus 2 pair)	Comment
9 2 items, box plus PS2012E DC power supply	green	Green Booster Box	APP *RedBlue* from Digitrax PS2012E DC power supply (the PS2012E is powered by one 120-volt extension cord running under the layout); APP *Green* from Command Station Box (green ground bus wire); one RJ12 connector of BoosterNet (black cable) from Command Station Box	2 RJ12, one each on 6-conductor flat grey cable to ThrottleNet under each power district; 2 pair of APP *Red*, one pair of which feed the track power bus for one power district and the other pair which feed the track power bus for another power district (note that two pair of the APP *Red* outputs are not used)	Place under layout near PS2012E DC power supply



Note that each of the Blue, Yellow and Green Booster Boxes have a BoosterNet jack and a common ground APP jack on the rear to facilitate “daisy chaining” BoosterNet from one Booster Box to another Booster Box. This reduces the amount of cables required from the Command Station to Booster Boxes. Following is a photo showing what the rear of each box looks like:

Key Points on Command Stations & Boosters

Digitrax DCS 200

Note: the term "LocoNet" is used at some places in this section because it is Digitrax terminology – LocoNet consists of ThrottleNet AND BoosterNet as if they were set up as one network.

The "POWER ON" green LED at the bottom left of the front panel glows solid if power is on.

The TRACK STATUS indicator:

- Is orange when the track is getting control signals
- Is not lit if there is no voltage on the track (if turn on using DT402 or DT402D throttle – press "PWR" followed by "Y+")(if turn on using DT602 or DT602D throttle – press the Power Rocker button on one side of the rocker and then select "TRK ON")

The HO toggle setting sets the maximum track voltage to 15 volts.

The green CONFIG indicator shows the primary operating mode. A steady green with a brief blink every 4 seconds means that OpSw 5 is set correctly. If there are 8 blinks every 4 seconds then change OpSw 5 to "closed" (see further instructions later in this narrative). The device will operate correctly in either case.

If the CONFIG indicator is mainly off, change OpSw 1 to "thrown".

The NET indicator is a red LED that displays what the DCS 200 sees on LocoNet. Following are other indicators:

NET LED Indication	**Meaning**
Solid Red	LocoNet OK
On, blink off	A valid LocoNet message is detected
Off	A short circuit on LocoNet
Off, blink every ½ second	In Option Setup MODE

Audible sounds:

Number of Beeps	Meaning
1	Powered on successfully or a programming command has been sent
3	A loco address has been purged due to non-use
4	Short circuit shutdown
6	Powered up as a command station in a system that already has an active command station (solution: eliminate second command station; cause could be a loose jumper wire on a DB150 booster between the CONF A and GROUND terminals)
7	CMOS battery is in low condition; replace battery asap (must remove the top of the DCS200 using four Philips screws; the battery is a button battery which lasts up to seven years).
8	Local CMOS memory has been corrupted and was reset automatically. A technical diagnostic.
9	Transmit failure – there is a device blocking proper message action on LocoNet
16	Software timeout failure. No action required; normal operation will resume

Continuous soft clicks	Low input power supply voltage. If voltage falls below about 9.5VDC or 8VAC the soft clicks will continue until the low voltage situation is corrected.

Option Switch setup (OpSw):

- Factory default settings for DCS200 switches is “t” or thrown. It is recommended that OpSw 5 be set to “c” or closed. This does not affect operations but makes diagnostics easier.

- Changing Option Switches:
    - Ensure power to DCS200 is ON.
    - Disconnect DCS200 from BoosterNet (LocoNet in Digitrax terminology) by unplugging all RJ12 jacks from the front of the command station (or by unplugging the BoosterNet output RJ12 jack located on the front of the Command Station Box).
    - Connect a throttle directly to RJ12 jack A or B on the front of the DCS200 or, if using the BoosterNet output on the front of the Command Station Box, plug the throttle directly to the BoosterNet jack on the front of the Command Station Box.
    - Move the MODE toggle switch on the front of the DCS200 to the “OP” position.
    - Connect a throttle directly to jack A or B.
    - Press the “SWCH” key on the throttle (on a DT402, DT402D, DT502 or DT502D is on the top-right of the keyboard, next to the “LOCO” button.
    - The screen will show something like “Sw 001 == c”.
    - Using the key pad, key in the number of the OpSw to be changed (e.g., 2).
    - Use the CLOC/c key to set the OpSw to c (closed) or the OPTN/t key to set to t (thrown)
    - Exit Option Switch Mode by moving the MODE toggle to “RUN”. Remember to reconnect BoosterNet.
    - Track power will be off; use the throttle to turn it on.

- Special Instructions for Op Switches 36, 38 and 39 [RECOMMENDED BEFORE EVERY OPERATING SESSION – FOLLOW THE INSTRUCTIONS BELOW FOR OP SWITCH 39 TO CLEAR ALL INTERNAL MEMORY STATES, INCLUDING LOCOMOTIVE ROSTER]:
    - Ensure power to command station is ON.
    - Disconnect the command station from BoosterNet (LocoNet in Digitrax terminology) by unplugging all RJ12 jacks from the front of the command station (or by unplugging the BoosterNet output RJ12 jack located on the front of the Command Station Box).
    - Connect a throttle directly to RJ12 jack A or B on the front of the DCS200 or, if using the BoosterNet output on the front of the Command Station Box, plug the throttle directly to the BoosterNet jack on the front of the Command Station Box.
    - Move the MODE toggle switch on the front of the DSC200 to the “OP” position in which the toggle is pointing straight out from the DCS200 perpendicular to the front edge (it will normally be in the “RUN” position before doing so in which the toggle in its up position).
    - Press the “SWCH” key on the throttle (on a DT402, DT402D, DT502, DT502D or similar is on the top-right of the keyboard, next to the “LOCO” button).
    - The screen will show something like “Sw 001 == c”.
    - Using the key pad, key in the number of the OpSw to be changed (recommended to key in 39 to clear all internal memory states). After doing so, the screen will show “Sw 039 == t” or else “Sw 039 == c”.

- Press the “CLOC” key on the throttle throttle (on a DT402, DT402D, DT502, DT502D or similar is on the bottom of the keyboard, between the “OPTN” and “EMRG STOP” buttons). Pressing the CLOC key will result in the screen showing “Sw 039 == c”. This closes switch 39.
- Move the MODE toggle switch on the front of the DSC200 to the “SLEEP” position in which the toggle is pointing down; wait for a second.
- Move the MODE toggle switch on the front to “RUN” position in which the toggle is pointing up.
- Remember to reconnect BoosterNet (LocoNet in Digitrax terminology). Track power will be off; use the throttle to turn it on by pressing the “PWR” button at the bottom left of the keyboard and the the “Y +” key in the second row from the top of the keyboard.

- Selected items from the OpSw table (see DCS200 Digitrax manual for a complete list)

OpSw Number	Effect when OpSw set to “c”	Factory Default
5	Command station master mode (recommend changing to “c”)	t
18	Extend the booster short circuit shutdown time from 1/8th to ½ second [THIS HAS BEEN SET TO “c”]	t
33	Allow track power to restore to prior state at power on	t
34	Allow track to power up to run state, if set to run prior to power on	t
36	Clears all mobile decoder info & consists	t (see special instructions on how to switch to “c”)
38	Clears the loco roster	t (see special instructions on how to switch to “c”)
39	Clear all internal memory states	t (see special instructions on how to switch to “c”)
42	Disable 3 beeps on purging a loco	t

Digitrax DB 150

The "POWER ON" green LED at the bottom left of the front panel glows solid if power is on and being used as a command station. If being used as a booster the LED will blink continuously.

Power to the DB 150 (or any other Digitrax booster or command station) should never be rapidly cycled on-off-on. When power is switched off, wait 30 seconds before turning the power on.

The TRACK STATUS indicator:

- Is orange when the track is getting control signals
- Is not lit if there is no voltage on the track (if turn on using DT402 or DT402D throttle – press "PWR" followed by "Y+")(if turn on using DT602 or DT602D throttle – press the Power Rocker button on one side of the rocker and then select "TRK ON")

The HO toggle setting sets the maximum track voltage to 15 volts.

Audible sounds:

Number of Beeps	Meaning
1	Powered on successfully or a programming command has been sent
3	A loco address has been purged due to non-use
5	Booster short circuit shutdown
6	Powered up as a command station in a system that already has an active command station
9	Transmit failure – there is a device blocking proper message action on LocoNet
16	Software timeout failure. No action required; normal operation will resume
Variable clicks	OpSw 41 is closed. Diagnostic clicks will sound when a valid LocoNet command is received

Option Switch setup (OpSw):

- Factory default settings for DB 150 switches is "t" or thrown, except for 5, 17, 25, 33 and 34 which are "c" or closed.
- Changing DB 150 Option Switches:
    - Move the MODE toggle switch on the front of the DB 150 to "OP" position; LocoNet will go inactive and all other boosters plugged in to LocoNet will shut down.
    - Disconnet LocoNet from the DB 150.
    - Connect a throttle directly to jack A or B.
    - Press the SWCH key on the throttle to enter Sw (Switch) mode.
    - Key in the number of the OpSw to be changed (e.g., 2).
    - Use the CLOC/c key to set the OpSw to c (closed) or the OPTN/t key to set to t (thrown)
    - Exit DB 150 Option Switch Mode by moving the MODE toggle to "SLEEP", then "RUN". Remember to reconnect LocoNet. Track power will be off; use the throttle to turn it on.
- Special Instructions for DB 150 Op Switches 36, 38 and 39:
    - Set the OpSw to c.
    - Set the MODE toggle to "SLEEP".
    - Set the MODE toggle to "RUN".
    - Set the MODE toggle to "OP".
    - Select the desired switch, 36, 38 or 39.

- Exit DB 150 Option Switch Mode by moving the MODE toggle to “SLEEP”, then “RUN”. Remember to reconnect LocoNet. Track power will be off; use the throttle to turn it on.

- Selected items from the Op Switch table:

OpSw Number	Effect when OpSw set to “c”	Factory Default
02	Booster only override	t
18	Extend the booster short circuit shutdown time from 1/8th to ½ second [THIS HAS BEEN SET TO “c”]	t
39	Clear all internal memory states	t
42	Disable 3 beeps on purging a loco	t
50	Longer booster short circuit recovery time	t

Key Points on Throttles

DT 402 & DT 402R Throttles

1. The loco icon at on left and right blinks if the loco address is ready for selection; a steady loco icon means that the loco is currently selected or in use by another throttle; the blinking smoke icon above the locomotive indicates which one is currently active. If the display shows “SEL” no address is selected.
2. The small dot at the top right of the screen will be on steady if track power is on. If not shown, then track power is off. If blinking system is idle.
3. The mode indicator located at the bottom centre of screen shows the current mode of operation of the throttle. For example, in Fn mode any entry on the numeric keypad will affect functions. In Sw mode, keypad entries will change turnouts and in Lo mode, entries will enter loco address numbers, etc.
4. Emergency Stop key – factory default is set for “Local” stop meaning that only the active loco selected at the time Emergency Stop is selected will stop; by going in into the Option settings this can be changed (ES->idle) to Global Stop (go to OpSw, select ES->idle and then press “On”. This is NOT NORMALLY DESIRABLE. This will cause Emergency Stop to shut down the entire layout and set the track power to IDLE. Track power will then need to be turned back on to operate trains.
5. Radio Operation
    a. Join a Duplex Group by first making sure that there is a good battery installed; plug into LocoNet (the Duplex Group name and channel number should appear, #11 through 26).
    b. Configuring Duplex Group name – Plug throttle into LocoNet; press EXIT; press OPTN and then EDIT; turn the L throttle knob to position the cursor and then the R knob to choose the character and press ENTER to accept the character; repeat until desire name is obtained; press ENTER to change the Duplex Group name (all throttles will need to rejoin on the new Group name).
    c. Configuring the Duplex Group channel – plug throttle into LocoNet; press EXIT; press OPTN then EDIT; press Y/+ to increase the channel number or N/- to decrease; press ENTER to change the channel number (all throttles will need to rejoin).
6. Consisting
    a. Select the loco address of the TOP loco on the R throttle knob.
    b. Select the address of the loco you want to consist on the L knob.
    c. Before consisting make sure that both locos are set to operate in the desired direction.
    d. Press the MU key; press the Y/+ key to add the loco address on the left knob or N/- to remove it.
    e. The R throttle controls the consist.
7. Option setting:
    a. Press OPT/t key to access the Options menu.
    b. Use the R throttle to scroll through the options.
    c. Use the Y/+ or N/- key to toggle the option values.
    d. When satisfied with all changes, press ENTER.
    e. Press EXIT at any time before pressing ENTER to cancel all changes.

Option Setting	**Description**	**Options (Default in BOLD)**	**My Setting**
RF1 mode	On enables Simplex radio	**Off** On	Off

Clicks	On enables clicking when making any keypad or knob changes	**On** Off	Off
NoBlstic	On enables ballistic tracking by providing rate-sensitive knob steps so faster turning gives bigger step changes.	**Off** On	Off
STimeout	On shortens the amount of time before the throttle kicks into Power Save when no changes have taken place.	**On** Off	Off
F3Static	On makes F3 key On/Off action	**On** Off	On
F2 Mom	On makes F2 key momentary action, used for payable whistle where applicable	**On** Off	On
SLFollow	On enables slot following mode for locomotives selected in multiple throttles	**On** Off	Off
ES->Idle	On stops entire layout when Emergency Stop key pressed. Off stops only locomotive selected in throttle.	**Off** On	Off

Option Setting	Description	Options (Default in BOLD)	My Setting
PWRSaver	On enables Radio/IR mode power save on throttle inactivity	**On** Off	On
DplxBad	On enables white flashlight LED to blink when repeated Duplex radio messages fail.	**On** Off	On
DxRxLPwr	On enables maximum Duplex power saving, disables continuous update of slot following.	**On** Off	On
NewTypes	On allows throttle to override command station new-type loco speed step settings.	**On** Off	On
Nu Type=	128 speed step setting 14 speed step setting 28 speed step setting Advanced 128 speed step setting Advanced 28 speed step setting	**128** 14 28 128A 28A	128
Recall#	Recall stack set at last 4 entries Last 8 entries Last 16 entries	 **RC04** RC08 RC16	RC04
BackLite	Maximum brightness Maximum brightness but lowest power usage	**MAX 2** MIN 1	MAX 2
FactoryD	Select ON and press ENTER key to force all options settings to factory defaults	On **Off**	Off

DT602 & DT 602D Throttles

Turn ON/OFF:
The button marked with the on/off symbol is a rocker switch – press the on/off side of the rocker and then select either “Trk_ON”, “Trk_OFF”
or “Power Off”.

Function Keys
Selecting “Info+” at the button right of the screen (button C) is a useful way of displaying all Function (FN+00) keys that are active for the selected locomotive.

How to MU locomotives:
- Using the RIGHT-HAND throttle, select the locomotive that you wish to be the “Top” locomotive – i.e., the one that will have control of the consist (normally is the lead engine).
- Press the LOCO button then select “MORE” at the bottom right of the screen (button C); select “MORE” again (button C) then select “MU” from the bottom left of the screen (button A).
- The large locomotive number will start to flash and the locomotive with the Top address will appear in a much smaller font after the words “consist to”.
- Select “MU+”.
- Using the keypad, enter the locomotive address that you wish to be in the consist.
- Select “MU+” (on some occasions “MU+” is not displayed, but button A still works as if “MU+” is displayed).
- Select “Exit”.

How to Remove MU locomotives:
- Stop train in a safe place away from traffic.
- Ensure that the MU top locomotive is selected on the RIGHT-HAND throttle.
- Press the LOCO button then select “MORE” at the bottom right of the screen (button C); select “MORE” again (button C) then select “MU” (button A).
- Using the keypad, enter the locomotive address that you wish to remove from the consist.
- Select “MU-“ (button B).

RECOMMENDED BEFORE EVERY OPERATING SESSION AT A TRAIN SHOW
(or if certain locomotives behave unexpectedly)

THIS PROCEDURE WILL SET COMMAND STATION OP SWITCH 39 TO "CLOSED" TO CLEAR ALL INTERNAL MEMORY STATES, INCLUDING LOCOMOTIVE ROSTER.

Using a Digtrax DT402/DT402D/DT502/DT502D Throttle:

1. Command station powered ON.
2. Disconnect all BoosterNet connections to other boxes.
3. Plug throttle into jack on front of Command Station box using a flat-6 cable (either into the UP5 on the front of the Command Station tool box or into a jack on the Command Station itself).
4. Command Station MODE toggle switch to "OP" (centre position).
5. Press "SWCH" key (top-right of keyboard).
6. The screen will show a switch number and whether it is closed or open ("switch" does not mean a turnout in this context; it is a switch internal to the system). It may show "Sw0001=c", "Sw0003=t" or whatever.
7. **Enter 39 on the keypad**. Screen will show "Sw0039=t" or "Sw0039=c".
8. Even if "Sw0039=c", press "CLOC" key at bottom of keyboard. You will hear a beep. Screen now shows "Sw0039=c".
9. Press the "Exit" key.
10. Move Command Station MODE toggle switch to "SLEEP" (down position). Wait 5 seconds.
11. Move Command Station MODE toggle switch to "RUN" (up position).
12. Reconnect all BoosterNet connections to other boxes.
13. Track power will be off; use throttle to turn on track power by pressing "PWR" button and then "Y+" key.
14. Tell train operators that they will have to reacquire their locomotives. In some instances, they might also have to re-establish contact with the radio by plugging their throttle into a UP5/UP7 jack on the side of the layout.

Using a Digtrax DT602/DT602D Throttle:

1. Command station powered ON.
2. Disconnect all BoosterNet connections to other boxes.
3. Plug throttle into jack on front of Command Station box using a flat-6 cable (either into the UP5 on the front of the Command Station tool box or into a jack on the Command Station itself).
4. Command Station MODE toggle switch to "OP" (centre position).
5. Press the "S" key (second row of keyboard in centre).
6. The screen will show a switch number and whether it is closed or open ("switch" does not mean a turnout in this context; it is a switch internal to the system). It may show "Sw0001=Closed", "Sw0003=Thrown" or whatever.
7. **Enter 39 on the keypad**. Screen will show "Sw039=Thrown" or "Sw039=Closed".
8. Even if "Sw0039=Closed", press "Closed" command on the menu at bottom of screen (button "B"). You will hear a beep. Screen now shows "Sw0039=Closed".
9. Press the "X" key (it is the left side of its rocker switch).
10. Move Command Station MODE toggle switch to "SLEEP" (down position). Wait 5 seconds.
11. Move Command Station MODE toggle switch to "RUN" (up position).

12. Reconnect all BoosterNet connections to other boxes.
13. Track power may be off; use throttle to turn on track power by pressing the on/off side of the power button at bottom left of keyboard (it is a rocker switch) button and then select “Trk_ON” from on the menu at bottom of screen (button “A”).
14. Tell train operators that they will have to reacquire their locomotives. In some instances, they might also have to re-establish contact with the radio by plugging their throttle into a UP5/UP7 jack on the side of the layout.

Using a DB150 as a Booster (our normal configuration)

When using a DB150 as a booster, there MUST be a jumper connecting the “CONF A” and “GROUND” terminals on the front of each DB150 (if this jumper is missing or becomes disconnected the DB150 runs as a command station and, since a layout cannot have two active command stations in operation at the same time, the system will not operate). If the command station or the DB150 emits 6 beeps in a row when powered on it means that the DB150 has been powered up as a command station in a system that already has an active command station. Check the terminals on the front of the DB150 to see if the jumper wire is in place – it might have come loose. The solution is to ensure that the jumper is in place and then turn off power to the DB150 and then turn it back on (if this doesn’t solve the problem, turn off both the command station and the DB150 for a few seconds after checking the jumper and then turn both back on).

Troubleshooting

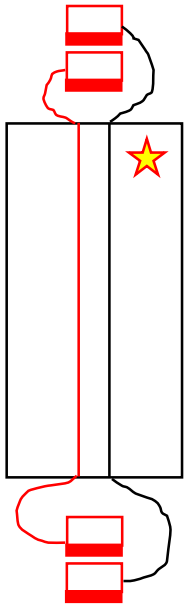
No power to anything	Check that orange extension cord on the spool is plugged into a wall outlet. Check the the toggle switch in the centre of the extension cord spool is turned ON (will glow red when turned on). Check that the UPS is plugged into one of the outlets in the centre of the extension cord spool. Check that the power button on the top of the UPS is glowing solid green (if flashing, is turned on but running on battery which means that there is no connection to a wall outlet or there is no power at the wall outlet). To turn on or off press and hold the button until it beeps.
No power to the Command Station Box, a Booster Box or a radio mast but there is power at other devices	Check that the Digitrax power supply (PS2012, PS2012E, PS615 or PS14) for the respective electronic box is plugged in to one of the battery terminals on top of the UPS or into an extension cord that is, in turn, plugged into the UPS. Check that the power cord is firmly seated in the receptactle on the Digitrax power supply. Check that the power supply is set to HO scale. Check that the toggle switch on the front of a PS2012 or PS2012E power supply is turned on (it will glow green when on). Note that the PS615 and PS14 power supplies do not have a power switch.
Command Station and Booster Boxes are all turned on but there is no track power anywhere.	Check that track power is turned on – using any throttle press the power button and then press TRK_ON (there is an orange light on the UP5/UP7 and LNRP panels which will light if there is track power).
No track power in one power district but all other power districts are working.	Check to see if there is a short circuit on the track, typically caused by derailments. Check that the track bus for the power district is plugged into the APP jacks on the front of the Booster Box.
The layout doesn't operate when one or both of the DB150 boosters in the Blue Booster Box are attached to the layout.	DB150 devices may be operated as a command station and a booster. When in a Free-mo layout which is already equipped with a command station it is imperative that neither DB150 is configured as a command station. These MUST BE configured as boosters only. The presence of more than one command station in a layout will render the layout inoperable. To configure a

	DB150 as a booster only, there must be a jumper wire that connects two of the terminals on the front of a DB150. These are the “CONF A” and “GROUND” terminals. If the layout stops working as soon as one of the DB150 devices is introduced to the layout, check to ensure that these terminals are connected to each other and that the small terminal screws on the terminal block on the front of the DB150’s have not come loose.
A locomotive runs across the modules of one power district but stalls as it crosses the boundary to the next power district.	There are three possible situations that will cause this: 1. The track bus feeding the second power district is “out of phase” with that of the the power district from which the locomotive is leaving. Throw the double-pole-double-throw rocker switch located under the track bus Anderson Power pole jacks on the front of the booster box which are connected to the second power district. 2. A pair of track bus Anderson Power Poles under one module is connected the wrong way around. Inspect to determine which of the modules are incorrect and reverse the order of the Anderson Power Poles. 3. The track bus of the second power district is not receiving any track power. Try sliding the locomotive by hand into the second power district. If it doesn’t run, check to make sure that the track bus is connected to the booster powering that power district.
System exhibits strange behaviours which can’t be easily diagnosed.	Check the toggle switches located at the lower right-hand corner of each Digitrax box (Command Station and each Booster located in Booster Box). Ensure that the left toggle is set to “HO scale” and that the right toggle is set to “run”. Turn off power to entire layout by pressing the power button on the top of the UPS and holding it until the power is switched off. Wait at least 15 seconds before turning it back on. If this does not solve the problem, take the following steps to methodically try to isolate where in the layout the problem is located: 1. Disconnect all BoosterNet cables from the Command Station (including the Accessory Booster). 2. Connect the BoosterNet cable that goes to ONE of the he Booster boxes (blue, yellow or green box). Check to see if both power districts supplied by that Booster Box are working by placing a locomotive on the track. If so, the problem is not in in that Booster Box or in the power districts powered by that Booster Box. Proceed to the next step. 3. If neither of the power districts will work, disconnect the track bus wires from the Booster Box to both of its power districts. Check that the Boosters in the Booster Box are

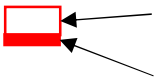
	operating by looking at the power light on both booster boxes and the track power light on both. 4. Connect the track bus wires for ONE of the power districts to the Booster Box. If that power district is now working, repeat for the second power district. 5. Repeat the process for the next Booster Box, starting at step 2 above. If steps 1 to 5 above fail to solve the problem, it is likely that the problem is a fault in ThrottleNet and not in the track bus or on the tracks. Take the following steps to isolate the problem: 6. Disconnect all BoosterNet cables from the Command Station (including the Accessory Booster). 7. Starting with one of the Booster Boxes, disconnect both ThrottleNet cables running from the Booster Box to both power districts. 8. Connect the BoosterNet cable from the Command Station to the Booster that you are focussed on. Check both boosters inside the Booster Box and make sure that they are both operating. 9. Connect one ThrottleNet cable from one Booster to one power district. Check that ThrottleNet is working in that power district and that a locomotive will run in that power district. 10. If step 9 doesn't work, disconnect the ThrottleNet cable attached in step 9 and connect the ThrottleNet cable from the other Booster to the other power district and that a locomotive will run in that power district. 11. If you are able to narrow down the problem to one power district (either in ThrottleNet or in the track bus), disconnect all wires to one module at a time from the adjacent module until the power district works. This will help identify which module is creating the problem. Examine all wires under the module, including ThrottleNet wires. It helps to disconnect each wire one at a time. If the system starts running after a wire is disconnected you know the problem lies in the area connected to that wire. Pay particular attention to UP5/UP7 devices mounted to the fascia of modules. These can fail from the repeated plugging in and unplugging of throttles (sometimes one of the fine contacts inside the jack will come out of position and contact the adjacent contact).

Illustration of Logic Behind Anderson Power Pole Wiring on Free-mo modules

Standard: top Anderson Power Pole always connects to the left rail <u>when facing the end of the module</u>, with the “hood” side up



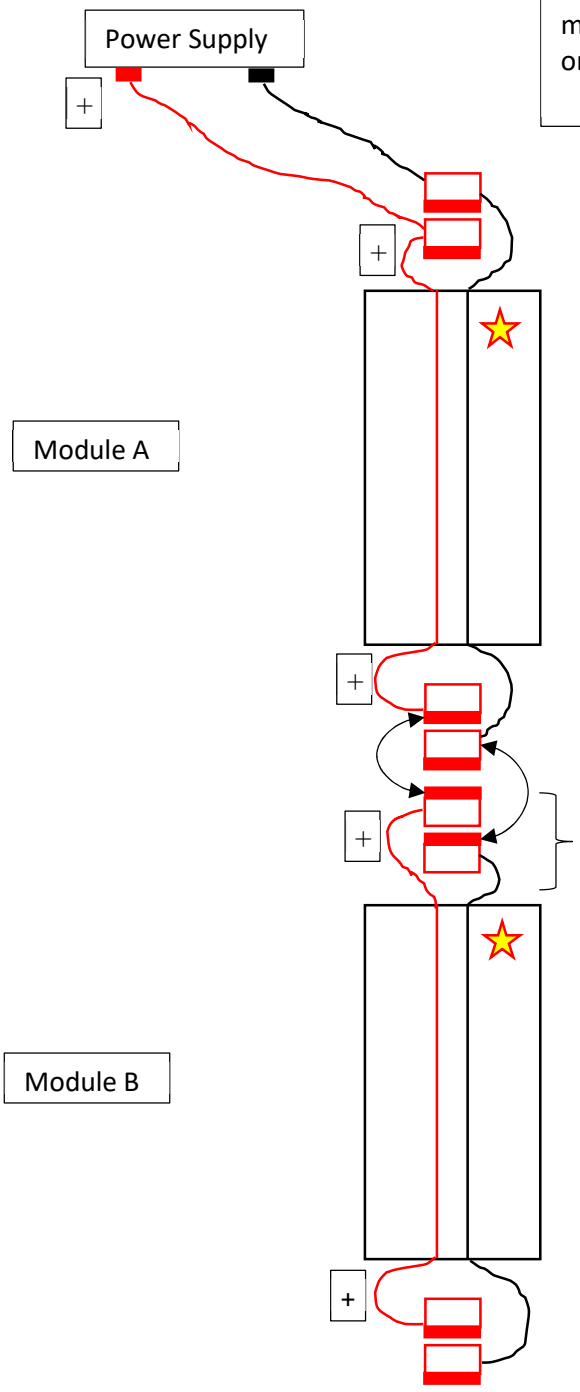
View this end from this perspective



Hood

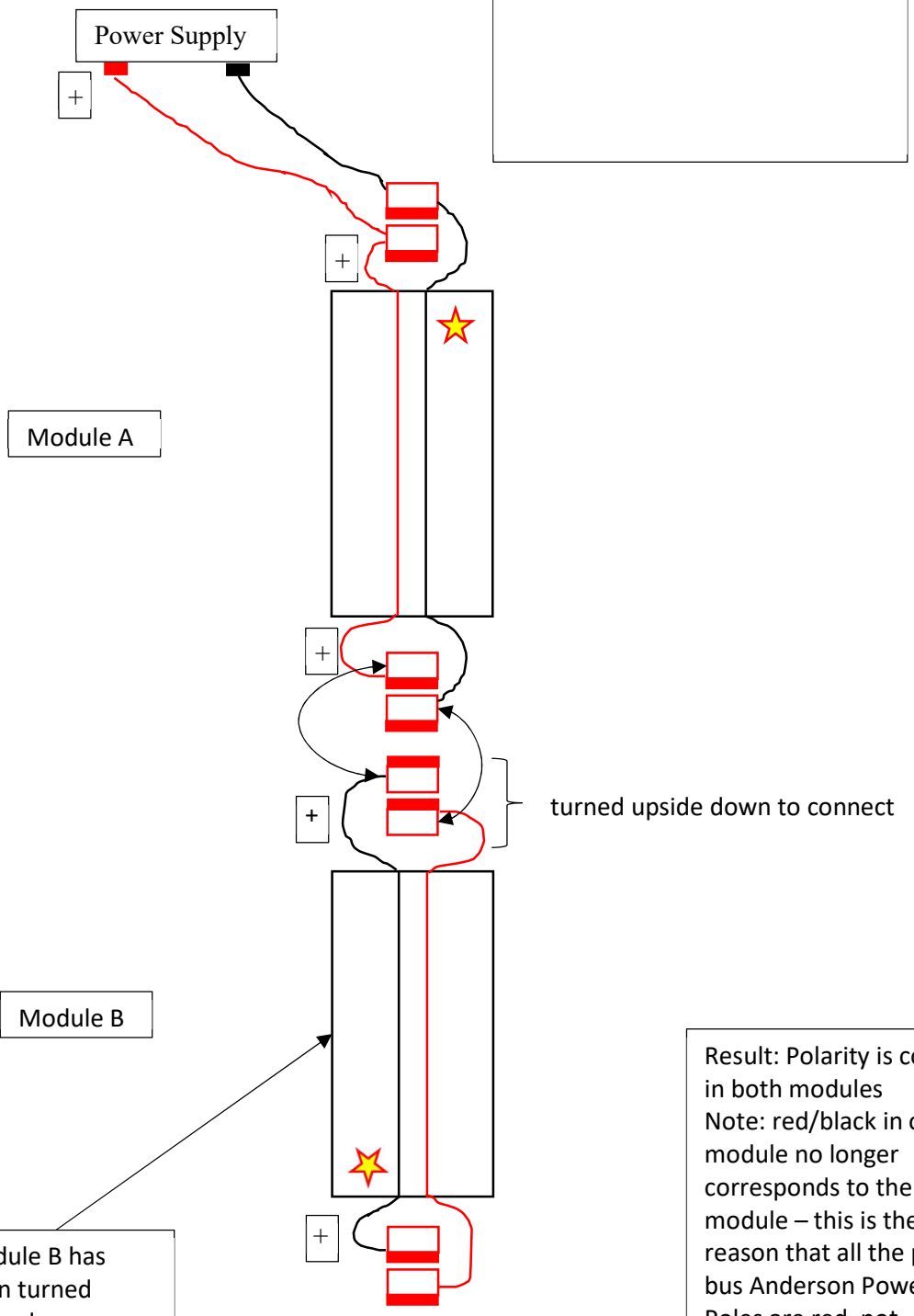
Tongue

To connect modules, one pair of connectors must be turned upside down in order for the hoods to mate with the “tongues” on the on the end of the other module

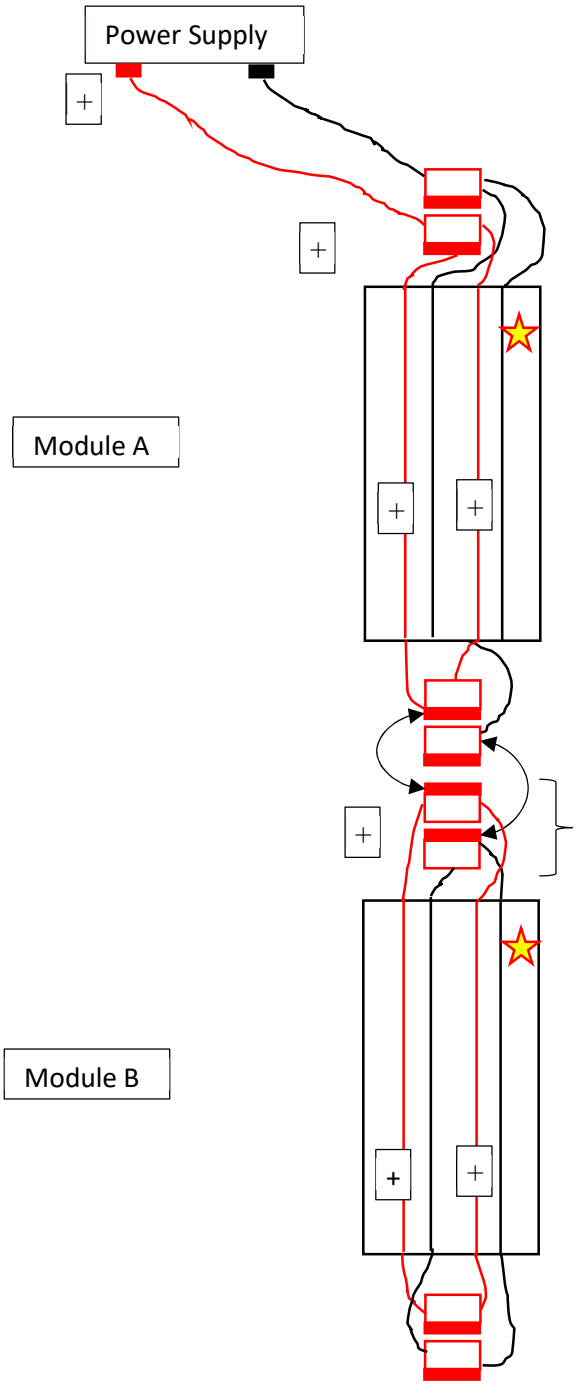


Result: Polarity is correct in both modules

Module B connected to Module A the other way around



Result: Polarity is correct in both modules
Note: red/black in one module no longer corresponds to the next module – this is the reason that all the power bus Anderson Power Poles are red, not red/black



VERY IMPORTANT: Double track modules are wired the same way as single track modules. Both right-hand rails are attached to the same bus wire and both left-hand rails are attached to the other bus wire. This is true even if there will be a turn-back loop at the end of the modules whereby a train heads north, goes around the loop, and returns south. See next page for explanation of how a turn-back loop works.

Result: Polarity is correct in both modules