DC WIRING

This article tries to take the mystery out of wiring and control of Model Rail systems. We have taken the assumption that the reader has no Knowledge of Electricity and Electronics. We have tried to set points out in the sequence they will present themselves.

POWER

Model train power falls into three categories. AC (Alternating Current) normally at 16 volts, DC (Direct Current) normally at 12 volts, and low power at 5 volts DC. It is important to remember that the real test of the power supply is the load you'll place on it. This comes primarily from the locomotive(s) but also from lights and other accessories.
The power supply or transformer will be labelled as to the amperage they are meant to handle. Within that range, it is generally recommended to go for the most robust power supply possible. You may never use all the amps...but it's usually cheaper to grow into a power supply than to continually upgrade.
Most power supplies will perform very well for years if used within their limits. It is not uncommon to see forty year old transformers still going strong on a model railroad. You should take care however to replace worn cables and wires. Keep the power supplies in an area where they get plenty of air circulation to prevent overheating.
A built in circuit breaker to prevent a short circuit from causing permanent damage to the power supply or the trains is a must have. These are usually built into the Power Packs, but need to be added to transformer AC wiring. With the ever-increasing amounts of small electronics in today's sophisticated models this protection is more important than ever.

TRANSFORMERS.

Transformers are sold by most leading suppliers. They are available in various voltages and current ratings. All will supply an AC voltage to your system. The most common are listed below.
1 x 12v at 5 Amps,(TX252) 2 x 15v at 1.25 Amps, (TX253)
1 x 18v at 2.5 Amps, (TX258) 1 x 24v at 1.25 Amps. (TX---)
Some suppliers will also supply the above transformers cased and ready to plug into the wall socket, with terminals on the AC output. A circuit breaker to prevent a short circuit from causing permanent damage to the power supply or the trains is a must at this point.

POWER SUPPLIES.

There are many Power sources available on the market which will supply the 12 volts Direct Current you require; only the current rating will vary, depending on how much you require. The larger the system the more current you will require. Starter train systems have normally a 1 Amp power unit. Larger power units are available up to 8 Amps.
Most of the ancillary equipment on your layout such as Points, Signals, Lighting, Timers and Sensors will require a 12DC regulated power supply.

DCC POWER SUPPLIES

DCC systems are computer-like devices, and they require stable DC voltage.
Because not all DCC systems have high quality power sections inside, if you choose a high quality regulated power supply, it will always give a better and more stable result, so your DCC system will perform better.
Whereas the advancement and improvement seen in analogue control is now limited, digital control has the potential to continue growing and improving for many years to come. For those making a start in the hobby, digital offers a much easier introduction than analogue, as the work involved in setting up a reasonable layout is much less, and much simpler, and the potential much greater. Far from being too complicated, digital is in essence ideal for beginners, as it lends itself very well to a smaller layout, but can be easily expanded and upgraded as well

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Protection:

As most of the wiring is under the baseboard it is advisable to wear protective glasses when working under the board because of off cuts of wire and even solder could fall on you causing a damage to your eyes and face. A good light source is also a great help.

Connection Wires.

Wires are designed to carry electric power to the equipment up to a specific current. Wires come in two forms Solid core and Stranded core. The title of the wires usually explains the type of wire it is.
Example:-
1/0.6 Equipment wire, is a single strand wire and the strand has a diameter of 0.6mm.
16/0.2 Equipment wire, has 16 strands of 0.2mm diameter wire to make up the core.
In this situation the more strands the wire has the higher the current rating.

The list below are the most commonly used wires on a layout with their current ratings.

1/0.6	1 strand of 0.6mm diameter wire	Current rating:	1.8 Amps.	Outside Diameter	1.2mm
7/0.2	7 strands of 0.2mm diameter wire	Current rating:	1.4 Amps	Outside Diameter	1.2mm
16/0.2	16 strands of 0.2mm diameter wire	Current rating:	3.0 Amps	Outside Diameter	1.6mm
24/0.2	24 strands of 0.2mm diameter wire	Current rating:	4.5 Amps	Outside Diameter	2.4mm
32/0.2	32 strands of 0.2mm diameter wire	Current rating:	8.5 Amps	Outside Diameter	3.8mm

The 1/0.6 equipment wire is by far the easiest to use because of its solid core, however the drawback is that it is not very flexible, so should not be used if the wire is going to move much.
When the current drawn exceeds the wire current rating it will start to heat up and eventually fail.
You will notice that the majority of wired equipment you purchase has wires around the 1.2mm diameter so probably is 7/0.2mm equipment wire. This is because the equipment does not individually draw more that 1.4 Amps. However when 2 or more pieces are run together then the combined current draw could be more than 1.4 Amps, so a larger wire may be required. This is when you may require a Bus Bar, see the section below.
Running the wires back to the Control Panel is one way of reducing this over current problem, however you will eventually wind up with dozens of wires going back to the panel. If this is the way you want to go there is a range of Multicore cables available from 4 core to 25 core, each core has a unique colour code.

The Wiring Layout.

Most of the points & signals you have installed have 3 wires, a Negative (0v) and two positive wires, & the tracks have 2 wires one Negative and one Positive. We are unable to give you colour codes here as all manufacturers appear to use different colours for certain functions. As you will soon be aware the positive wires are the ones you use to control the equipment via Speed Controller or Switches.
Colour code your wiring from the start of your project, allocate colours to specific tasks. Red for Uncontrolled positive voltage, Blue for controlled positive voltage, Black for Negative voltage, your main feed and return. Points – Green & Orange. Signals – White & Yellow.
Keep the wires tidy with cable ties and sticky pads. If you use the marker tags you can identify the cables as you go. We also have a cable and wire register which can be downloaded and printed.

CB867 CB880 CB869-CB875 CB876 CB890 / CB891 CB420 / CB421

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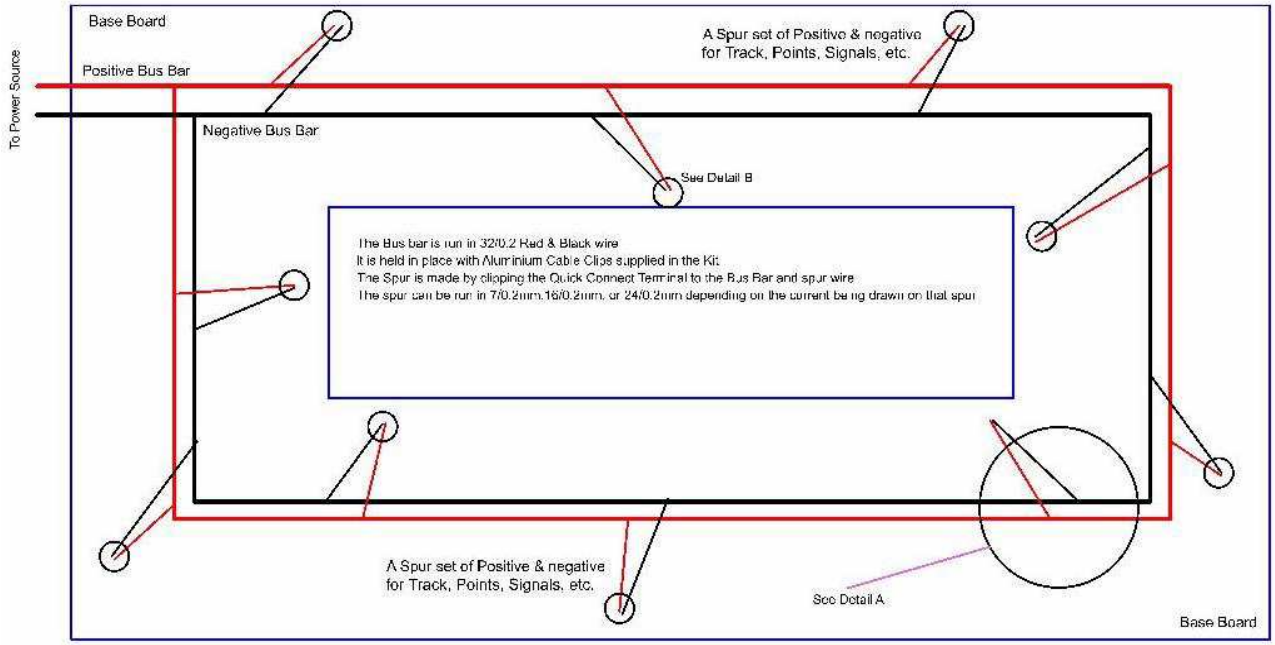
BUS BARS.

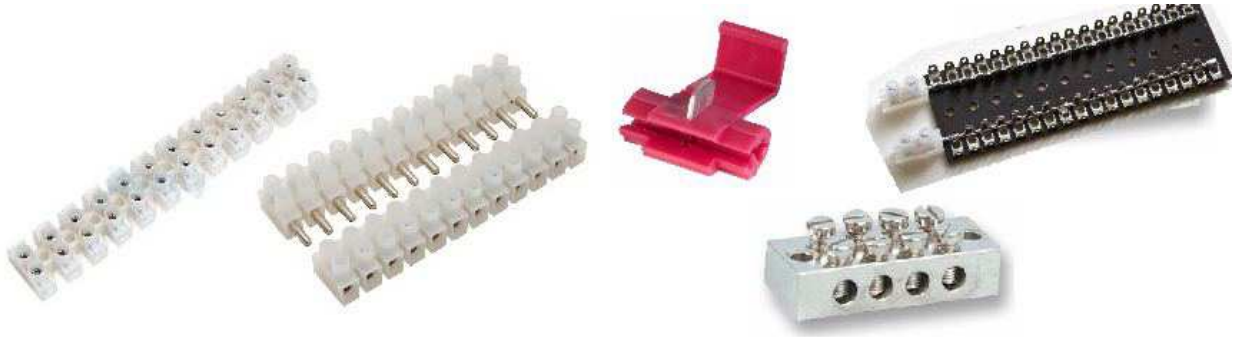
A Bus Bar is a set of wires (one Positive, and one Negative) that run around your layout, at a larger current carrying capability. The most commonly used is 32/0.2 which will carry up to 8.5 Amps. From this Bus Bar spurs are run at appropriate points to terminal blocks to run equipment in that area. Remember control wires will have to be run back to the control panel, and 1/0.6 or 7/0.2 wires can be used.
The drawing below shows how a Bus Bar with spurs is laid out. (See the Separate Datasheet on Bus bars)



Connecting the Equipment:

There are many types of Terminal blocks it comes down to a personal choice, do you want screw type or solder type here we are showing just a few. The basic terminal block (some people call it a chocolate block), these normally come in a length of 12 terminals, and various current ratings (CN171 to CN175), but can be cut to any length required.
The pluggable terminal block, again comes in 12 terminals & various current ratings (CN179-CN180) and are easy to cut into desired lengths. These are ideal for places where you have removable sections of layout, or your whole layout is demountable.
Wire Clips are great for adding a spur to an existing wire without cutting the existing wire. They come in 2 sizes (CT101-CT102)
Common Voltage Junction Box are solid brass and are available in 4 or 8 way (CN185-CN186)
Then there are the solder type terminal strips, which has a Positive side and a negative side (CN164).
(See our Datasheet on terminals for more ideas.)

The equipment you have purchased will normally have short wires (100 to 200mm long) which will need to be terminated in a terminal block under the baseboard. From this terminal block extension wires are run to the control panel, these wires must be selected correctly. If they are just powering the one piece then the extension wire can be run in 7/0.2 or 16/0.2, if they are common wires they may need to be larger 24/0.2 or 32/0.2, or a Bus Bar can be used.



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CN171 - CN175 CN179 - CN180 CT101 - CT102 CN185 - CN186 CN164

The Track.

The first task is to power the track from the controller. It is recommended that you use a minimum of 16/0.2mm Black and Red wire, the larger the layout the bigger the wire, so 24/0.2mm or 32/0.2mm for larger layouts. All proprietary manufactures have their special connectors to supply power to the track

Peco ST-273

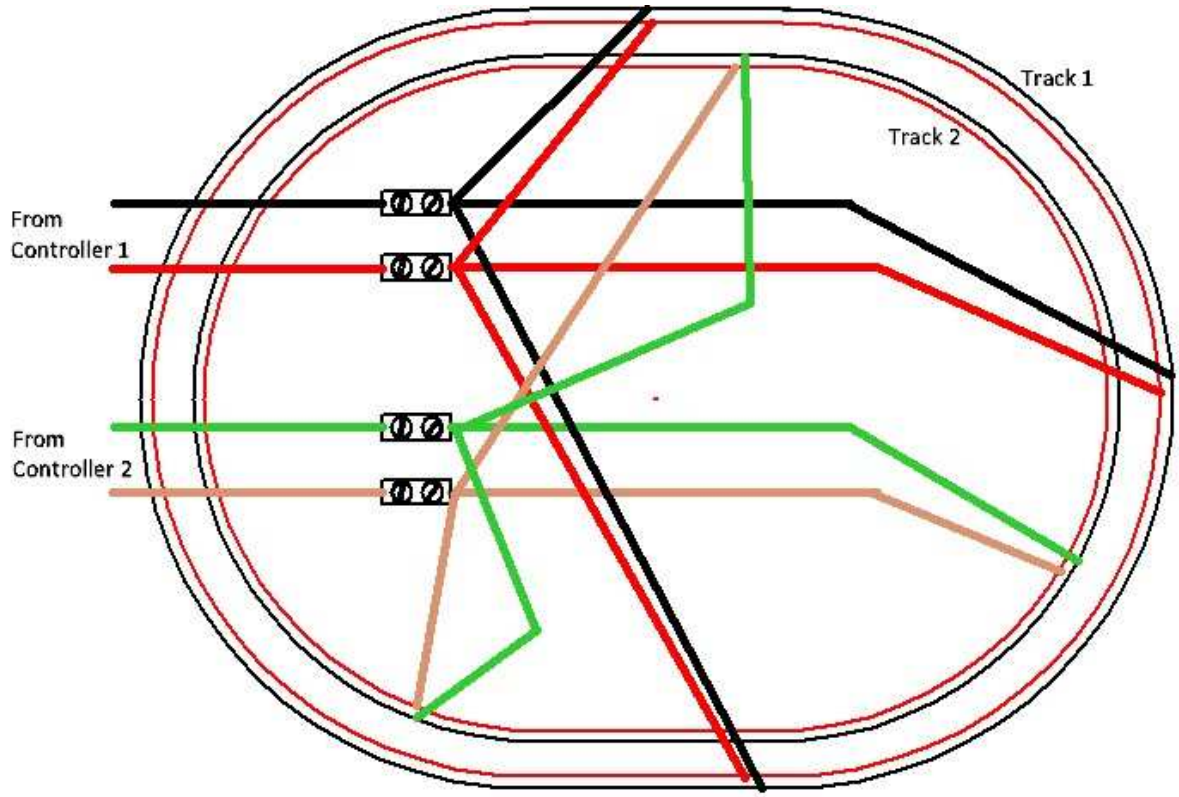
Hornby R8242

Hornby R8241

Bachmann

The following drawing shows the connection between the Power Source / Controller and the Track using one of the above. It is also recommended that you feed the track several times to reduce voltage drop along the rails. In this drawing TRACK 2 wire colours have been changed for clarity of the illustration.

Please Note: When using 2 controllers the polarity from each has to be controlled at points and crossovers. It is advisable to use isolating fishplates to separate the two power sources.



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To summarise:

You will need

A variable voltage - Speed Controller

A fixed voltage of 12v DC and or 15vAC

(Remember check the current rating - the higher the better - build into your Power Source, rather than changing it every 5 minutes.

Create a Bus Bar if your layout is large.

Wire - again don't go for the minimum current rating, go at least one size up. So if the equipment comes with 7/0.2mm wire attached then connect to it with 16/0.2mm.

Keep the wires tidy and maintain a record of colour codes. If you get a fault so much easier tracing a wire if it's not in a birds nest.

Use Multi-core cable to run back to the Control Panel, again less individual wires.

Use the correct connecter where possible

Connect the track to the controller several times to avoid voltage drop.

We have tried to cover the basic principles of wiring a layout. The next phase is specific items within that system such as Points, Signals, Turntables, Lighting and so on.

You will find sheets on most items in the 'More Information & a Little Extra' section.