

An introduction to DCC & Overview of Model Railway Control

If you are reading this then there is a fair chance that DCC control is new to you and that you're wondering about taking your first steps into DCC control... However, before you read on it is important to understand that DCC isn't really new at all, in fact, it has been available now for more than 30 years, and it has matured into a highly reliable and globally standardized system with fantastic features!

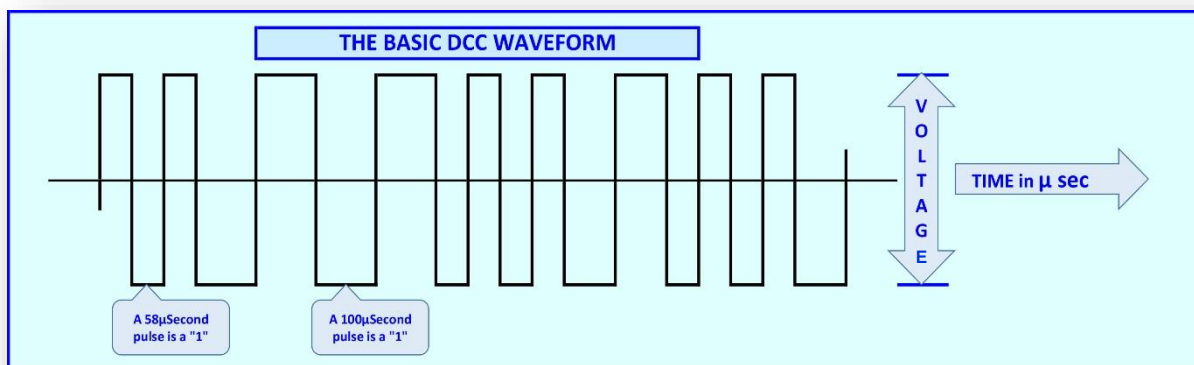
DCC continues to evolve, so we know that no matter how hard we try to explain some issues, there will always be more to say... or even a need to clarify some points for individuals, so your questions are welcome at any time.

Please don't hesitate to ask - if we know, we'll send you an answer as soon as we can - if we don't know, we will research and find an answer for you. Our contact details are available on our website.

What is DCC?

DCC controllers generate a high frequency PWM signal to the track at a fixed voltage.

A short "techno-shot" about DCC – we will not make the rest of this tech-talk though!



<<PWM means "pulse-width modulation" and it is in effect a high frequency alternating-type voltage with a square wave-form. DCC controllers communicate with the decoder in the locomotive by changing the timing of the waveform pulses.

So... The basis for DCC is an AC wave-form in a way, but not AC as you know it.

Motors react the same way to the PWM power that they do for DC, however rather than varying the voltage, the PWM voltage always stays the same and the controller changes the pulse lengths (width) and timing (frequency) to communicate binary data and to be seen as "voltage time more-or-less on and off" in order to change motor speed or things like light intensity.>>

That's enough techno-talk: next page... it's back to plain speaking!

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PWM voltage at higher frequencies as is used by modern DCC systems from all respected brands of DCC is totally safe for all DC motors used in model railways, including coreless motors.

DCC is quickly replacing the traditional AC/DC control methods used by modellers for over 75 years. No matter which brand makes it, DCC is generally made to a pre-set standard in all core areas of model railway operation and is therefore whilst there ARE differences, the basic building blocks of a DCC controlled system are interchangeable no matter who makes them.

As I write this, the only significant deviations from the global NMRA-DCC standard are made by "train-set brands", so as our first significant "advice point" in these information pages, we strongly recommend that you be very careful of digital control systems made by manufacturers whose primary business is locomotives, rolling stock and train sets!

By the way... we are sometimes asked about this position: in fact we are not anti these brands at all...

In fact, we think that successful leading brands are at the core of keeping the hobby healthy and growing. However, their reason for creating controller product is simply to allow them to sell sets with multiple loco's or to expand the exposure of their brand, and compatibility with standards therefore has little meaning to them - Additionally, even when they do comply with NMRA DCC standards, they often also save cost by reducing functionality of the controllers or their decoders, so their product may give you less control, programming or other flexibility and benefit...

So - no matter how good they look, or how low their cost, if the intended purchase is made by any "train-set brand" - check carefully first.

If in doubt ask us, as a simple question may save later frustration... and lots of money!

What is the real DIFFERENCE between DCC and conventional DC control?

This is a complex subject, but DCC is able to be as basic or as complex as you wish, so a simple definition is helpful. We will avoid technology discussion here as the real issue is "what is the benefit" of DCC, not how does it work!

We also do not want to buy into the "DC vs DCC" argument. It's a hobby after all, and this just one more of many simple choice that will let you enjoy the hobby!

Think of it this way.

With DCC, you can tune, operate and control each locomotive as an individual item, and choose to make it operate on its own or in concert with other locomotives.

With conventional DC control, even at its most sophisticated, you really only control "blocks of track" and any locomotive on that track must always respond the same way. At its simplest, DCC offers better loco performance and does more with less wires & wiring complexity than any brand of DC system. Once complex layouts are built, differences actually grow, although DCC also starts to need lots of wire - so forget those silly people that try to tell you that "DCC needs only 2 wires".

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There are big differences though – and easy expandability is a benefit that DCC modellers really appreciate: Every DCC system, big or small, allows evolution or growth to give you almost unlimited potential to add things that many DC users only dream of - changing routes using the buttons on your control unit, switchable smoke units and lighting in loco's, simple creation of signal and turnout/point interlocking via direct or PC control, and now very commonly, sound that is in each loco - and not just a simple "chuff" or diesel noise, but flange and brake squeal, coupler clank, steam injectors, correct loco-by loco steam "beat" or "loco specific" diesel sounds.

It's not a surprise therefore that DCC has really become the new standard method of controlling a model railway layout. The technology is simple and reliable too - whilst the modeller still turns a knob or presses switches to control the locomotives much like before, the actual control signal is broken into small "information packets" and goes via the rails to each individual specific locomotive, and only that locomotive responds to each command.

Because each controller can remember and control each individual locomotive via a pre-set number and can also control a quantity of locomotives at the same time (as well as managing accessories and their control) DCC literally places the control of the layout "in the owners hands" for the first time ever!

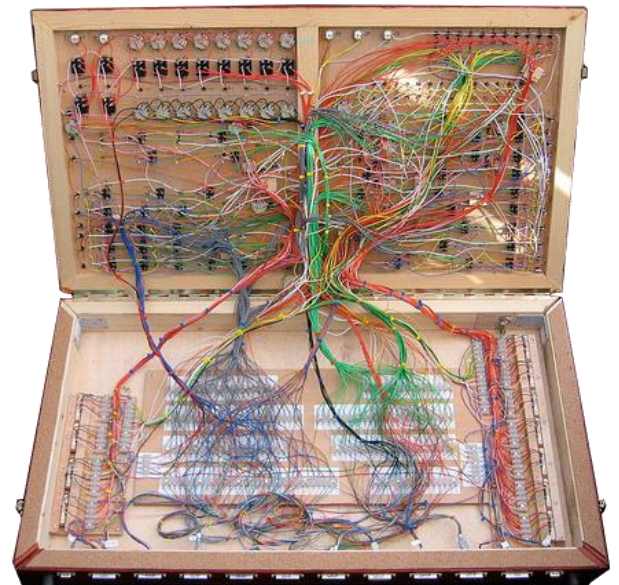
A short history of model railway control

The inception of the "electric train set" evolved in the decade before world war two and was a true milestone, allowing the age of model railways as a hobby for the whole world to begin. (Did you know that, at its peak, a model railway was the second most popular hobby worldwide, after stamp collecting).

Initially most common "electric powered" models were produced in 1/4" or 7mm scale, known collectively as "0 scale", however as manufacturing techniques and materials became more sophisticated, first S Scale, followed by 00, then H0, TT and finally N and Z scale developed. The consistent thing about all these scales and sizes is that although they grew in usability and acceptance because of ever-greater detail and performance, and this in turn enabled larger and larger layouts because of smaller and smaller model size, power and control remained conceptually the same... A voltage was applied to the track, and by adjusting the level of that voltage, the model was made to go faster or slower. By reversing power, the locomotive was reversed.

Of course, for a small "set" or simple oval, this control method is adequate. However, as layouts become larger, a more complex track layout evolves, and more locomotives need to share the track.

To maintain independent control, it therefore becomes necessary to add additional control units, each separated by switching or "isolated" sections of track. Eventually, wiring becomes a hugely complex project, complicated control panels must be created and even basic operation relies very much on a complicated set of control activities, because although the owner really wants to control his locomotives, he must in fact control the track and its electrical configuration first.



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DCC - a new control system is born

After modellers interest had been stirred by "command control" experiments by several brave individuals, some commercial pioneering systems such as the GE "Astrac" and the Hornby "Zero One" system were brought to market for a brief time. These failed for various reasons and development stalled for a short time...

However, with the advent of very stable chips in the form of low cost micro sized PIC processors it became possible to provide a sophisticated control system at a reasonable price at last, and Digital Command Control (DCC) was born. In a unique effort never seen before in our Hobby, the US based NMRA became involved and created a set of "standards" for DCC development with the support of pioneering manufacturers and laid a solid base for the evolution of DCC.

Some larger European manufacturers initially went their own way, however market forces and consumer desire for standardised digital control has slowly worn away at this and led by MOROP (a European volunteer standards body within the hobby) manufacturers have DCC standards have steadily grown towards total domination of model railway control world-wide.

What's wrong with your old DC controller?

Nothing at all if you are happy with it - but are you SURE you are happy with it - most are not! DC control is now in steep decline because it just does not really answer many of the "wants" of the more sophisticated modeller. DCC is growing quickly because it allows far more flexible operation of the trains, returns fine loco control to the modeller and removes much of the need for complex wiring.

Why is DCC so much better? because with conventional DC control, no matter how complex you make your wiring, it will still remain harder than it needs to be controlling even one loco perfectly or tuning performance between locos properly - and you will continue to find it almost impossible to control two loco's independently on the same track.

No matter how hard you try with DC control, you will never have the opportunity for realistic operation of multi-unit trains, double-heading, banking and running two loco's in opposite directions close to each other on the same track.

Of course you can wire it all up to come close – but real freedom to move trains for totally realistic running remains close to impossible... no matter how complex the wiring becomes. And... without digital, forget sound, easy control, of turnouts and accessories, lighting control, silky smooth loco performance and many other options available off the shelf for DCC right now!


The NCE "PowerCab" - a popular DCC "starter controller".

It may look complex, but it really is easy and comfortable to use whether you are 7 or 70!

PowerCab has an excellent feature set And it can Be expanded From its initial 1.5 To 5 amps and more easily. This makes it one of The best start Set choices

These buttons are Used to drive and control & they are directly under your thumb, whether you're right or left handed!

The other buttons are used to select locos, address, tune or to adjust them as well as to set up / operate DCC Accessories etc.



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Why should I change to DCC?

DCC simply wins because the technology is made to a pre-set group of standards by all brands. Sure, it is a sophisticated product, but the "interface", which is the bit you get involved with, is simple, easy to use and easy to apply to your layout. In fact, wiring for DCC is much simpler than creating the complex wiring, switching and control panels needed for a normal DC layout.

Consistent standards guarantee every competent manufacturer a solid market platform, and because of these same standards, one manufacturer's items will work with most others too, so a viable commercial product has quickly evolved to be a very flexible, simple to apply and extremely stable control method.

It is important to understand that DCC has, at its core, the ability to deliver many sets of instructions to many locos, accessories or various "machines" via a single wiring circuit, and that it can maintain control or remember many simultaneous tasks... That means less wiring, easier operation and more flexibility. Simply, it's easy to understand, easy to set up, and easy to use.

DCC is evolving very fast... Modellers are clever and adventurous, so whilst it was not all that long ago that pioneering individuals picked up on the possibilities, now more and more average modellers are benefiting from the improvement in control that DCC makes possible!

To quote a well-known UK magazine, DCC is definitely "The way ahead for railway modellers who like to run trains!"

So if DCC is the coming thing - What is in it for ME?

First of all: if you are a DC user who does not want to change... you can still take advantage of some things. Digital control can help you with accessory operation even if you still want to stay a "DC driver" so don't throw out the baby with the bathwater...

For a good example of how digital devices can work beautifully for DC modellers, take a look here:

[AD-S8sx Solenoid motor controller](#)

The DCCconcepts 8-way solenoid point motor works beautifully if connected to a 15~18v DC or AC power supply and your Peco, Seep, Hornby, H&M, Atlas or similar turnout motors will work better than ever –you will even be able to switch the turnouts frog polarity and have panel lights without buying or adding any other switching, saving you time, money and effort!

However, if you desire more controllability, better slow running, smoother running locos, operations that can mirror the prototypes methods, the potential for "at hand" accessory control, double heading, banking heavy trains, the potential for computer control, switchable loco/coach lighting or sound - you really do need to make the change to DCC.

DCC was made possible by the lower cost of new technology, but it was born from the need to make it better, the desire for lower wiring complexity, to add to realistic railway modelling possibilities and to improve usability...

So in a nutshell: a proper approach to the adoption of DCC will let it do more for you, with less complication.

Continued...

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DCC continues to evolve to do more and more for the modeller, as you will find out, but for its ability to simplify the basic wiring process alone, it deserves your attention.

In fact it delivers so much more for every user that it is the fastest growing "new technology" ever seen in the hobby. And it's clearly here to stay!

Cost - I can't afford to change overnight!

Fair enough...while the cost difference compared to a standard DC operating system is not necessarily big, it's not a small investment either. However there is no need to simply dump one system and adopt another immediately!

We believe that once you experience DCC you will want to change as soon as you can, but gradual change is possible and many modellers do it that way.

You see, DCC standards allow "chipped" locos to work perfectly on a DC powered layout!

So... the transition can be gradual. Chip a loco and it will still be able to run on your normal layout under DC control – and even after you make the switch to DCC, you can still "visit" or run your locos on your club or friend's DC-only layouts.

Of course, you cannot mix your DC and DCC controllers, but you can arrange power to the track via a simple switch so that you can run DC one day, DCC the next as you make the transition.

Finally - It's easy to "chip" most locomotives, and even the complex ones aren't that hard given a little information. every loco can be converted (I've never found one that can't be done anyway).

Yes, some are harder than others of course, but help is at hand right here if you need advice, and if you don't want to do it yourself, we can direct you to high quality installers who will do the more complex tasks for you.

OK - what's my next step?

Well, we don't expect you to simply drop everything, run out and purchase the very first DCC unit you see, so we strongly recommend that you do a little research before you commit to your new DCC system. Please take the time to read some of the other information pages in this section, make a few notes and think carefully before you make a final decision! These links may help you in your research: We guarantee all products will do what's needed!

[DCCconcepts DCC control and wiring pages](#)

[DCCconcepts Zen Decoders – decoders that really will fit your locos](#)

[DCCconcepts Accessory Decoders – the best and most versatile available](#)

Do you still have questions? No problem – just email us and ask, we'll be happy to help!