



# DCCconcepts DCC Decoder

# Instructions

*This manual covers the following models. Models marked with an asterisk may not all be available at time of the initial publication of this manual. All our decoders are pre-wired for Stay-Alive & available with or without the Stay-Alive device.*

**D2SA and D4SA standard size decoders with 8 pin JST harness**

**M2SA and M4SA Medium sized decoders with 8 pin harness**

**S2SA and S4SA Mini Decoders with 8 pin JST harness**

**TS2SA and TS4SA thin Mini Decoders with 8 pin hard wired harness**

**\* DP4SA 4 function direct plug and play decoders**

**\* CLSA CV readable “function only” decoders**

Thank you for purchasing a DCCconcepts decoder... We are modellers too and you've bought the very same decoder range we developed to use in our own loco's, so we are sure that you'll enjoy both their features & reliable performance.

We are also sure that out of the packet, they will do everything you need and deliver smooth, reliable results with a minimum of fuss because from the very beginning we set out to create a versatile, easy to install, and simple to adjust range of products that offer great value and top quality performance when used with any NMRA compatible control system.

Similarly we have done our best to make this manual direct and easy to understand so you will be encouraged to learn a little about how simple it is to do more than just set addresses, and be able to enjoy the process and benefits of getting the best possible performance from your locomotives.

In its initial form, this manual will cover all of the basics, however there are so many special features available from our decoders that we felt it best to limit this document to things that MOST modellers can do or will want to do when they are comfortable with their control system...

So... as time progresses we will also build a comprehensive “feature by feature” FAQ for the more specialised and unique things that can be achieved, so please check back often... or email us for more information if you have something special you need to do with a decoder – we will always be happy to hear from you and do our best to help.

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**If you cant find what  
you want at a  
glance...  
Use the PDF reader  
“Key Word”  
Search Function:**

If you need to find a specific subject then place a key word related to it in the search box of your PDF reader - it will search and take you directly to all instances of that word in the document - This is often faster and easier than scanning many pages for one specific bit of information



## Decoder Instructions page 2

### General Specifications for DCCconcepts decoders:

#### Size:

D2SA and D4SA decoders:	25.25mm x 16.6mm x 5.3mm	(0.95" x 0.65" x 0.2")
M2SA and M4SA decoders:	18.5mm x 10.5mm x 4.8mm	(0.73" x 0.42" x 0.18")
S2SA and S4SA decoders:	18.5mm x 10.5mm x 4.8mm	(0.73" x 0.42" x 0.18")
TS2SA and TS4SA decoders:	18.5mm x 10.5mm x 3.3mm	(0.73" x 0.42" x 0.13")

#### Power Handling:

All of our decoders have more than adequate power for any N, TT, HO, OO, On30 or similar modelling scale.

The D and M series are also suitable for many S or smaller O scale models when they are powered with modern low current draw can or coreless motors.

We set our decoder specifications at NMRA standard track voltages. Please be aware that while most US made systems meet this specification all of the time, many EU made controllers have track voltages well in excess of the DCC standards recommendations.

While our decoders will still perform reliably and well irrespective of your systems actual output voltage and we have built in significant tolerance to cope with these higher than usual voltages and errant waveforms, we suggest that if your system output IS higher than the standards then please do not drive the decoder past its stated limits.

In general, providing your locomotive draws less than 1 amp consistently with an average train, then, irrespective of track voltage, you should use them with confidence.

If your locomotive is old with an inefficient motor that draws more than  $\frac{3}{4}$  of our rated decoder power consistently, then we do suggest that when slipping or under excess load it may exceed normal reasonable power use, so for locomotives like this we suggest that you mount the decoder with good access to external ventilation, testing initially with the body off for a while to ensure that the decoder does not become overly hot.

### *Decoder General Specifications.*

*The power ratings below show the limits, not average running current draw:*

<b>D Series</b>	1.3 amp max motor drive (Decoder total maximum 2 amps peak). 2 or 4 light / switchable functions, each 150mA, 200mA max
<b>M Series</b>	1.1 amp max motor drive (Decoder total maximum 1.6 amps peak). 2 or 4 light / switchable functions, each 150mA, 200mA max
<b>S Series</b>	1.1 amp max motor drive (Decoder total maximum 1.6 amps peak). 2 or 4 light / switchable functions, each 150mA, 200mA max
<b>TS Series</b>	1.1 amp max motor drive (Decoder total maximum 1.6 amps peak). 2 or 4 light / switchable functions, each 150mA, 200mA max
<b>DP Series</b>	1.1 amp max motor drive (Decoder total maximum 1.6 amps peak). 2 or 4 light / switchable functions, each 150mA, 200mA max
<b>CL Series</b>	4 light / switchable functions, each 150mA, 200mA max



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- Addressing:** DCCconcepts decoders are supplied to you with address 3 preset into the decoder. All models will accept any address between 1 and 9999.
- If at any time you are unsure of the address that has been set in your DCCconcepts decoder, then don't worry - just enter programming track mode with your controller and either "read" the address or reset the decoder to its default address of three by entering 2 into CV8.*
- Harnesses:** Our 8 pin NMRA plug is very high quality using turned pins of our own design. These are gold plated to give the best possible contact & very reliable wire attachment. Plug PCB's are Mil-Spec fibreglass.
- D Series** 90mm overall harness length. Decoder end has a removable 9 pin 1.5mm pitch JST plug. The locomotive end has an 8 pin NEM652 plug with wires dressed to the UK standard (N-S or lengthwise) orientation as this approach gives the tidiest looming irrespective of plug orientation.
- The harness for the 2FN version has all wires connected to the 8-pin loco plug. The 4 Fn version has an added "free" purple wire for Fn 4/Aux 2.
- M Series** 90mm overall harness length. The decoder end has a very neat micro sized removable 9 pin fine 1mm pitch JST plug. Other details as per D Series.
- S Series** 90mm overall harness length. The decoder end has a removable 7 pin micro JST. Other details as per M and D series, except that as the decoder end offers only 7 pins, the 4 Fn S series decoders will also have Fn 3/Aux 1 and Fn 4/Aux 2 as free or unattached green and purple wires.
- TS Series** 90mm overall harness length. The decoder end has all wires soldered to the decoder PCB to keep the TS decoder as thin as possible for tight spaces. The harness for the 2FN version has all wires connected to the 8-pin loco plug. The 4 Fn version has an added "free" purple wire for Fn 4/Aux 2.
- DP Series** No full harness or heat-shrink as this decoder will plug directly into the locomotives 8 pin NEM652 socket. The 4 Fn DP4SA has an added "free" purple wire for Fn 4/Aux 2, plus stay alive wires of course.
- CL Series** The CL Series has a harness structure similar to the TS4SA decoders - We have taken this approach as the grey and orange motor wires are no longer needed in a function only decoder, leaving the pin positions that they occupy free for the purple wire needed for Fn 4/Aux 2

### General feature listing for DCCconcepts decoders:

These are the primary features of DCCconcepts decoders however this is not intended as a comprehensive listing – e.g. we detail here how many light functions there are, but we list individual abilities of each light & auxiliary functions in a later section of the manual.

- Standards** DCCconcepts decoders are designed to comply with NMRA and MOROP standards and recommendations, and will work well and reliably with all standards compliant control systems
- Addressing:** You may choose any loco number between 1 and 9999. Of course if your controller supports "aliasing" you can of course also allocate a name to your locomotive. If you choose to use a short address enter only the number itself – there is NO need to add any zeros before a short number.
- Please note: Because we know that many of our decoders will be used by new or inexperienced modelers using less than clear instructions for entry level controllers, and this can easily lead to addressing errors, we have limited "short address" changes to the programming track only, as entry level controllers are not always easy to understand & use, often lacking reliable "Program on the main" abilities.
- Adjustment:** All programming with the exception of short addresses can be set either on the main or on the programming track. Many adjustments to decoder settings can even be done while the locomotive is running on your layout.



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- Motor** DCCconcepts decoders support adjustment of all motor control parameters that may be required, including Start volts, Vmid, Vmax, momentum and related parameters. Our decoders also feature a full speed table ability and allow additional advanced fine tuning of related acceleration and deceleration parameters as well as speed step transitions via several higher level CVs. (These will be detailed in a separate document soon).
- DC Running:** When fitted with a DCCconcepts decoder your locomotives will run smoothly and well on a DC powered layout. Due to the need to “wake” the decoder, you will need to turn the knob a little further than with a DC loco to start the loco moving initially. Locomotives fitted with our decoders retain back EMF support & constant lighting when they run on DC.
- While we have made sure that DC running is extremely smooth with the average locomotive (running can be smoother than an unchipped loco on DC) please understand that there can be exceptions... Your chipped loco's may NOT run well on DC if you use a DC Controller with feedback, SCR, half-wave or coarse PWM speed control.
- All DCCconcepts decoders are preset at the factory to allow running on both DCC and DC equipped layouts with no need for you to make any set-up or programming changes at all. DC running can be disabled if required by reducing the number in CV29 by 4. (recommended if you will never use DC running)*
- Back EMF:** DCCconcepts decoders have an advanced preset Back EMF ability that is very versatile and will usually give perfect low speed control without any adjustment other than CV2. Our testing shows that all RTR locomotive brands, coreless motors and aftermarket can motors used in kit building run well at default settings with no need for adjustment.
- For those who use multi-locomotive consisting and want to turn back EMF off to maintain even effort between locomotives, you have the choice of setting back EMF to turn off at a particular speed step or you can even chose to use a function button for direct on-off control.*
- Silent Drive:** All DCCconcepts decoders have high frequency silent drive for quiet, silky smooth running.
- Brake on DC:** All DCCconcepts decoders support “Brake on DC”. To make it possible to use brake on DC you will need to turn off DC running. This is done by reducing the value already set in CV 29 by 4 (for example, if it is set to 6, make it 2, if it is set to 38, make it 34)
- Functions:** DCCconcepts decoders have either 2 or 4 functions which can be switched on and off via the function control buttons of your handset. To keep identification simple, 2 function decoders are Red and 4 function decoders are blue. (DP4 has NO heatshrink) Functions on our decoders can be remapped easily.
- Note 1:** *Functions 1 (white) and 2 (yellow) are preset at the factory for directional front and rear lights and will automatically turn on and off depending on locomotive direction – they can also be turned on and off with the “headlight” or light function which is also function 0.*
- Note 2:** Where fitted, function 3 (also known as Aux 1 in Europe) which uses the Green wire is controlled by default with function button 1. Function 4 (also known as Aux 2) which uses the Purple wire is controlled by default with function button 2.
- Light control:** All functions can be re-allocated to different buttons and of course all of the active/light functions can be set to be directional or constant, dim or bright - or if you wish, to deliver a very complete range of more than a dozen different lighting effects to add prototypical accuracy to your models. Details of this procedure are included later in this manual.
- All functions can also be used for active accessories such as smoke units, providing that the accessory you have chosen operates within the power rating of the function.
- If you need to use an accessory that requires more power than a single function can supply, you should parallel two function wires and re-map their control buttons so they turn on and off at the same time.
- Locking:** Each decoder can be “locked” once it has been programmed, therefore removing any chance of later accidental re-programming – this is particularly useful when you wish to use two or more decoders in a single locomotive or DMU/EMU set, as decoders can then be set up to respond to different function buttons while sharing a common address, making operation much easier



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- Consisting:** DCCconcepts decoders support all forms of consisting (double-heading)
- Reset:** Should you want to reset your DCCconcepts decoder after experimentation or if you have forgotten the decoder address you can restore all settings to “ex factory” by using program track mode and setting CV8 to 2. Once this is done, the decoder address will revert to number 3.
- Warranty:** **DCCconcepts have a generous warranty and we encourage you to utilise it if needed.**
- There is very little to go wrong with a decoder. We use the most modern surface mount machinery available, high quality parts and every decoder is automatically tested even before it is taken from the PCB sheet it was created on. After their completion, many are tested again, this time using both a computer system and popular DCC systems. We then test samples AGAIN when they are delivered to us.
- Our warranty is therefore simple and direct:**
- Free replacement:** If within one year of purchase a decoder with no visible physical or heat damage and a properly wired harness will not work and it will still not respond and run on address 3 after 3 attempts at a reset then we will replace it free of charge.
- Part cost replacement:** If there is any form of heat or other damage to the decoder heat-shrink, if the heat-shrink is removed or there has been any soldering or modification to the PCB then it will NOT be treated as a full warranty replacement,
- However we DO want you to be confident and DO understand accidents happen, so if damage is heat or physical in any way we will still help you by replacing it for a “part cost” of 50% of our current web price (for a single equivalent) plus return post costs
- Conditions:**
- (a) Decoders should be returned with notes covering what you think happened. (b) We will need a date of purchase & a valid receipt before supplying replacement decoders. (c) We will normally replace ONLY the decoder. Please do not return harnesses as these will not be replaced or renewed (obviously the TS series will include its fixed harness). (d) We will record part replacements and we will not accept more than 3 such claims for damaged decoders from any one user within a 12 month period*

## Addressing and first steps to setting up your decoder

Before installing a decoder check that your loco is running well, check that pickups are well adjusted & wheels are clean. Ideally, run it in for a few minutes before decoder installation. Once your decoder is installed and you've tested and made sure that there are no problems by placing it on the programming track and reading it, it is time to have some fun! Select number 3 and give it a run... If you ran it in, did the pre-checks on DC and it ran well, now it's going to run very well indeed... but we can make it even better once the address is set, so let's do that now:

### Setting your chosen address: (This should be done on the programming track)

Following your DCC systems instructions, please enter “programming track mode”.

If your DCC system can read CVs, it will first read the manufacturers registered number (DCCconcepts is #36) and then it will read the software revision number...

This is usually followed by an invitation to set the long and short address. Your decoder can be set to any number between 1 and 9999 so you have lots to choose from - however MOST modellers use the locomotive cab-side number so they do not have to remember a list of numbers! **Which number you choose is up to you of course however there are TWO types of address available to you so read on a little further before you do anything please!**

**Finally, please note that Digitrax systems and some other brands cannot set or accept numbers above 9983**

### The short Address:

This is not really a “2-Digit” number as many think! It is in fact a 1 BYTE address in binary terms and so it can, depending on your DCC system brand, be either from 1 to 99 or from 1 to 127!



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*(In line with the Standards, DCCconcepts decoders will accept any number from 1 to 127 as a short address)*

This is important information as that means that any number between 100 and 127 can be interpreted as long or short depending on the DCC system brand. However... because of the disparity between brands in this area, we recommend that you avoid numbers 100~127 unless you will only use the loco at home!

### **A simple approach to short addresses:**

Regard a short address as 1~99 and ignore the 100~127 option unless you have a loco with that cab-side number.

If you want to set your decoder to a short address, follow your DCC system instructions but even though it may offer you a 4 digit display, do not add or enter any 0's before the number... simply enter it as it will be used.

**For example, just enter 66 as 66, and not 0066**

Long address is the most common choice for DCC modellers as cab-side numbers are easy to remember! We recommend if you're going to use a long address the short address should be left at 3.

## **Wiring and description of functions and related wire colour codes.**

All of the active (light/smoke etc) functions of DCCconcepts Decoders can be remapped to any function button or to deliver a wide range of lighting types – directional or constant light, constant dim or rule 17 dimmable when stopped, flickering fire box, strobe, alternating ditch lights, pulsing dual mars lights, flashing beacons and more. Specific details of what to change and how to change it are detailed a little further on.

### **Note please:**

*ALL "function" wires exit DCCconcepts decoders via the harness or at the harness end of the decoder.*

*The black and blue wires which exit the decoder at the end opposite the harness are for "Stay alive" and should not be used for any other purpose.*

**Blue Common Wire:** This is the "Common positive" wire for all functions (all other function wires are negative – important to remember if you are installing LEDs).

Each function uses the Blue wire as the second part of its circuit.

**Expert Tip:** *If space is at a premium or if you want only half power to any light or accessory you can connect it to a white or yellow or green or purple wire, without the blue - using one side of the loco pickups as its return path to complete the circuit – either side is equally OK for this. This form of connection is most common in N scale locomotives.*

**Function 1 / White wire:** This function is usually used for front lights. The default is for directional lighting and for it to be operated with the F0 or "Light" button on your controller. (This can be changed to operate in other ways or with other buttons if you prefer).

### **Settings for the White Wire:**

CV49 controls what the white wire will do

CV34 controls which function button can be used to activate the white wire

CV64 will allow you to dim lights attached to this function

**Function 2/Yellow wire:** This function is usually used for rear lights. The default is for directional lighting and for it to be operated with the F0 or "Light" button on your controller. (This can be changed to operate in other ways or with other buttons if you prefer).

### **Settings for the Yellow Wire:**

CV50 controls what the yellow wire will do

CV35 controls which function button can be used to activate the yellow wire

CV64 will allow you to dim lights attached to this function



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**Function 3/Green wire:** (also known as Aux1) usually used for cab or added lighting (diesel) or flickering firebox (steam). Default is a steady light, non directional. Operate with function 1 (Can be changed to operate in other ways or with other buttons if you prefer)

### Settings for the Green Wire:

CV51 controls what the green wire will do

CV36 controls which function button can be used to activate the green wire

CV64 will allow you to dim lights attached to this function

**Function 4/Purple wire:** (also known as Aux2) usually used for added lighting or DMU interior lights etc. Default is for steady light, non directional. Operate with function 2 (Can be changed to operate in other ways or with other buttons if you prefer)

### Settings for the Purple Wire:

CV52 controls what the purple wire will do

CV37 controls which function button can be used to activate the purple wire

CV64 will allow you to dim lights attached to this function

## Changing the way that a function acts Activating special light functions

Rather than give you charts to read which often confuse those who are new to DCC, we have chosen to list the actual settings for you function-by-function.

### The action of each function wire is controlled by a CV# specific to that wire

**White wire: CV49**

**Yellow wire: CV50**

**Green wire: CV51**

**Purple wire: CV52**

These “Action” CV’s always stay the same, even when you use “function mapping” to change or re-allocate them to alter which function button actually makes the function turn on and off. To change the way that any function acts or reacts, simply alter the number in the appropriate CV in accordance with the listing below.

Please, do have a go – if you make a mistake it will not matter as you can always change it back, or simply reset the decoder by entering 2 into CV8 and the lighting will revert to the factory default which is constant bright light.

Light Effects:	Effect	Forward	Reverse	Both
	Constant light	0	16	32
***	Flickering firebox	1	17	33
	Mars light	2	18	34
	Flashing light	3	19	35
	Single pulse strobe	4	20	36
	Double Pulse Strobe	5	21	37
	Rotary Beacon	6	22	38
	Gyra Light	7	23	39
***	Rule 17 (dim when stop)	8	24	40
***	Ditch light L or R phase 1	10	25	42
***	Ditch light L or R phase 2	11	26	43
	Constant dim light	12	27	44
***	Auto Mars light	13	28	45

*An asterisk alongside a lighting effect indicates that there may also be additional choices in the way that it can be set so there are possibly additional specific detailed instructions and explanations available for that particular lighting effect*



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**Setting the long Address:** As we already discussed, this is really a 2-byte number which means it can be anywhere between 124 and 9999.

Following your DCC system instructions, work through to long address and enter the number you want. After entering, confirm and then go back to running track mode, select the loco number that you just entered and enjoy giving the locomotive another trial run...

### Basic wiring and a description of related wire colour codes

Whilst locomotive manufacturers may not always follow correct colour codes they do generally comply with the standards covering the use of "DCC ready" decoder sockets within locomotives, all DCCconcepts decoder harnesses and connectors do meet standards, so you can approach their installation with confidence.

This illustration shows the correct connections for an NMRA compatible / NEM652 8pin plug when it is viewed from the top (wire side) & therefore also represents a socket viewed from the top.



To make it easier for you to correctly insert the plug first time, manufacturers will usually mark the #1 or Orange pin with an asterisk, a star or the number 1.

Look carefully... its not always obvious! Don't stress too much about it though: If you can't find the mark, inserting the plug wrong way round will not harm the locomotive or your decoder, however the loco will run backwards when the control system indicates forwards and the lighting will not work correctly.

If this happens simply remove carefully, rotate it 180 degrees and re-insert.

***In the notes about wiring colours below, where we mention left or right side of the loco, it is relative to the view from the loco drivers cab.***

- Pin 1 - **Orange:** Motor wire, usually the top or right brush.
- Pin 2 - **Yellow:** Rear light function (also known as function 2). Default setting, operate by default with "light" button. *Can be re-mapped if you wish.*
- Pin 3 - **Green:** Function 3 (also known as Aux 1). Default setting, operate by default with Function button 1. *Can be re-mapped if you wish.*
- Pin 4 - **Black:** To track or Loco pickups. By convention usually the left side of the loco
- Pin 5 - **Gray:** Motor wire, usually the lower or left brush
- Pin 6 - **White:** Front light function (also known as function 1). Default setting, operate with "light" button. *Can be re-mapped if you wish.*
- Pin 7 - **Blue:** Common positive wire for all active functions.
- Pin 8 - **Red:** To track/Loco pickups. By convention usually the right side of the loco

**Note:** 4 Function decoders also have a 9th purple function wire that is not attached to the 8 pin plug. This is used for activating a 4<sup>th</sup> active function and should also be paired with the blue wire to complete a circuit. Default settings have this function operated with Function 2 button. If you do not use this wire, cut it short & insulate it at the end.



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Wiring and related wire colour codes continued...

**If your locomotive does not have a socket, do not worry.**

Just cut off the 8 pin plug, then simply follow the wiring guide on Page 8 and hard-wire your decoder to your locomotive. Make sure that any joins in the wire are protected with fine heat shrink that will prevent short circuits that will damage decoders. When hard-wiring your decoder it is best to trim all wires to the correct lengths, work tidily and take your time!

**Note: It always seems a good idea to new DCC users... But:**

DCCconcepts do not recommend adding sockets to locomotives that do not have them as it is unnecessary and only adds to the potential for problems unless soldering skills are good AND there is a secure way to mount the socket, which takes a surprisingly large amount of room.

Besides, many of our decoders already have a plug on the harness and matching socket at the decoder end making the addition of a second socket totally redundant.

So - its not needed, and anyway... common sense says that hard wiring a non DCC-ready locomotive takes less space and when you think about it, why double up on the need for connections. it is simply far easier to directly hard wire a decoder!

### **Suppression capacitors:**

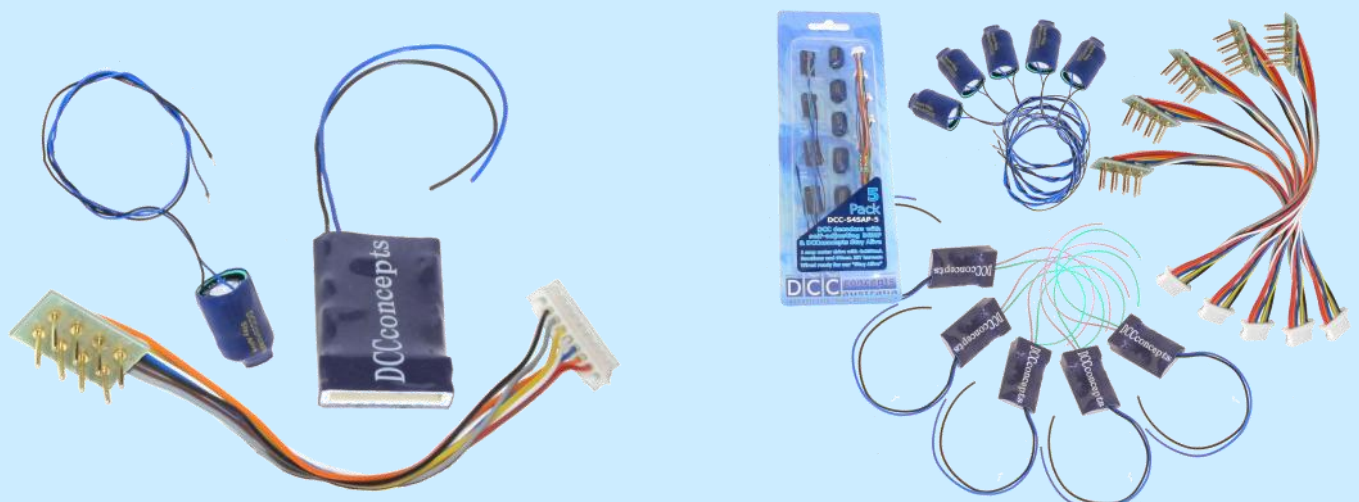
*DCCconcepts recommends removal of all capacitors and suppression parts from all locomotives prior to installing your decoder. We make this recommendation without hesitation as we have NEVER seen any loco run better with them left in and we have seen MANY perform badly as a result of their presence*

*Removing the capacitors will ensure the best quality running without exception, as the capacitors used in locomotive DC suppression circuits interfere with the very important communication between decoder Back EMF and the motor, preventing things working as well as they can.*

*If you are fortunate this can result in only slight negative effects, but in some cases, the interference is so strong that locomotives are impossible to control well at slow speeds.*

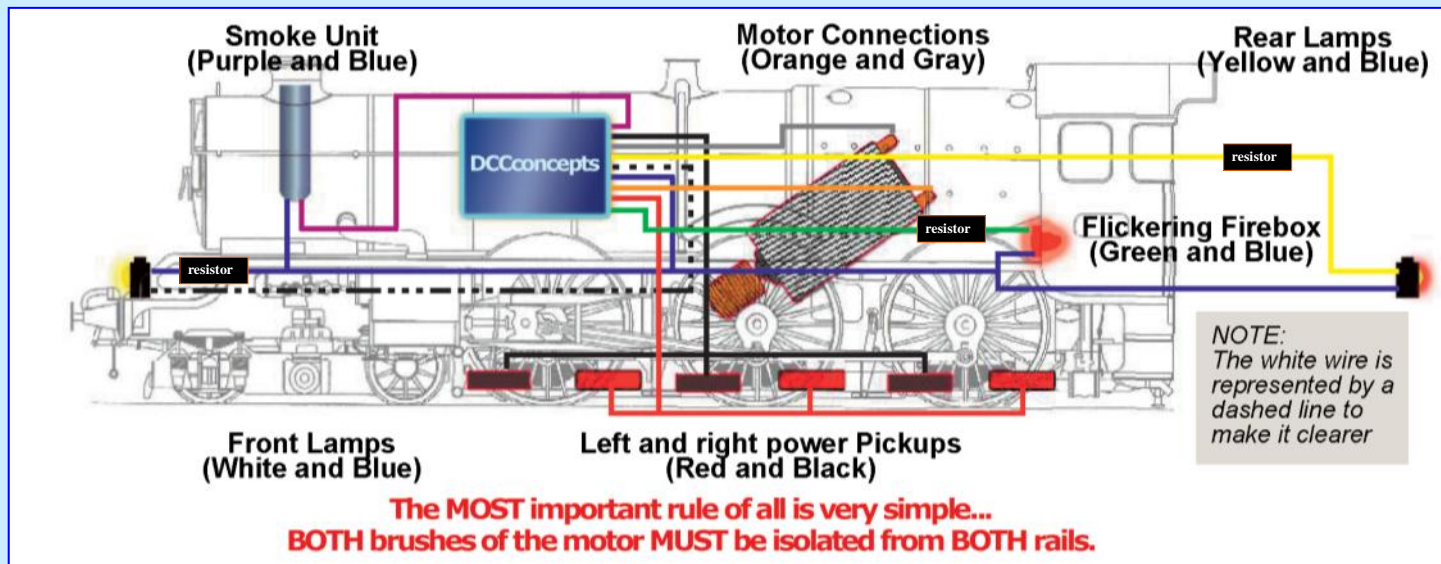
*There is NO downside to removal of capacitors and related suppression parts, especially in regard to interference generation from the locomotive, as the decoder already has a far greater suppression effect than the original DC suppression parts.*

*Therefore removing them will not increase the radiation of radio interference under any circumstances.*



## Decoder Instructions page 10

These illustrations may help you visualise the wiring structure in various locomotive types



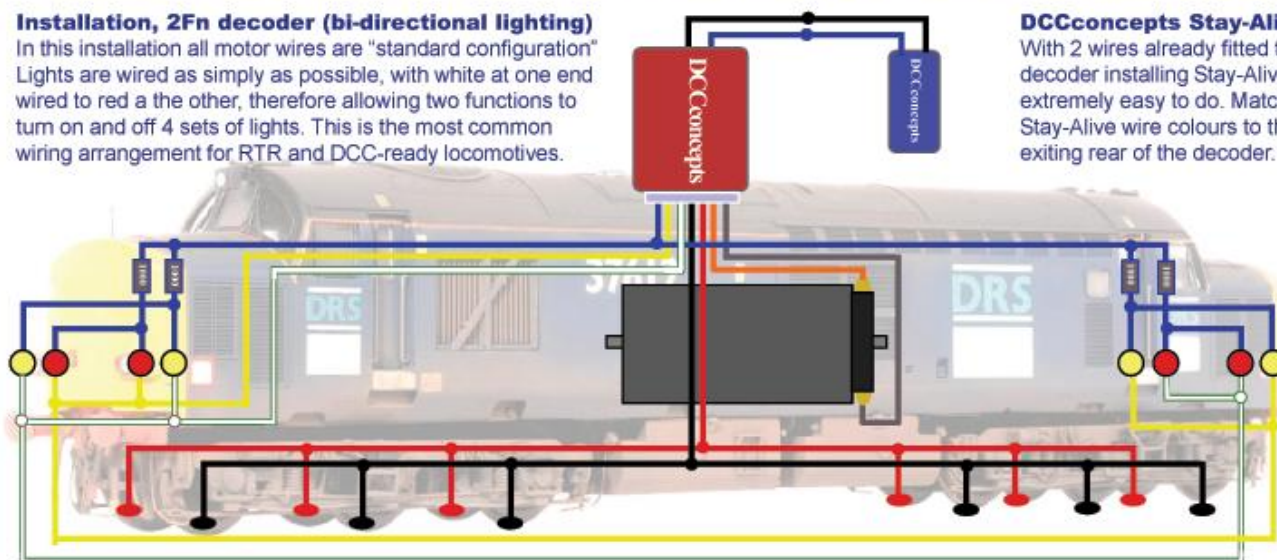
## Installation example - DCCconcepts 2 function decoder

### Installation, 2Fn decoder (bi-directional lighting)

In this installation all motor wires are "standard configuration" Lights are wired as simply as possible, with white at one end wired to red a the other, therefore allowing two functions to turn on and off 4 sets of lights. This is the most common wiring arrangement for RTR and DCC-ready locomotives.

### DCCconcepts Stay-Alive

With 2 wires already fitted to the decoder installing Stay-Alive is extremely easy to do. Match the Stay-Alive wire colours to those exiting rear of the decoder.



### Wire Colour - Motor/track connection

Red = Track pickup, Right rail (loco drivers view)  
Black = Track pickup, Left rail (loco drivers view)  
Orange = Motor wire, Usually top or RH brush  
Gray = Motor wire, Usually lower or LH brush

### Wire Colour Information - Active Functions

Blue = Common positive for all light functions  
Yellow = Rear lights - In this installation, yellow controls the front red lights  
White = Front Lights - In this installation, white controls the front main lights  
Lights directional and will change based on loco direction. They are turned on and off using the F0 or "headlight" controller button



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which may vary things like flash rates etc... These will form a separate instruction sheet, now in final preparation.

### Changing which controller button acts on or activates each function:

With train-set brand decoders and even some from specialists, you may have no choice... however all of the functions in every decoder we make are able to be re-allocated to operate with a wide variety of function buttons, adding far more flexibility of use and giving you full control of how you set up your locomotive lighting.

To do this each function has been allocated one or two CVs that, depending on the number entered, will control which of your DCC systems function buttons it will react to. We do strongly recommend you confirm how many functions your controller can operate and keep all functions allocated to buttons which allow "one push access" for operation.

**We have colour coded this chart to make it easier to understand.**

Match the information in the coloured rows and columns to make the decoder settings you need ...based on the chart & explanation below:

#### The green cells

These show which number should be entered into the relevant CV for functions 1,2,3 & 4 to make that function respond to the numbers above them for buttons 1~6.

#### The cream cells

These show the additional CV numbers that can be added ONLY to functions 3 and 4 to allocate them to buttons 7~12 if required.

The CV's that decide which CV controls function allocation for each wire are at the left, The factory default value and colour of the wire concerned is also shown alongside them

The ~ indicates that a specific combination is not available.

Examples: To make function button 4 control the yellow wire, put 32 into CV34

Function Button #		Front L	Rear L	1	2	3	4	5	6
Value to use		1	2	4	8	16	32	64	128
		Function Button #		7	8	9	10	11	12
		Value to use		4	8	16	32	64	128
CV #	Default value	Function Description				Value 1-6		Value 7-12	
33	1	White F1/F0-F						~	
34	2	Yellow F2/F0-R						~	
35	4	Green F3 / Aux 1						~	
37	0	Green for Button 7+				~			
36	8	Purple F4 / Aux 2						~	
38	0	Purple for Button 7+				~			

## Decoder Instructions page 12

### Tuning & adjusting the motor control of your DCCconcepts Decoder

With the decoder in, the loco address set and your new installation and locomotive tested and running well, it is time for you to take advantage of some of the real benefits of DCC.

To do this we are going to change the way that the decoder tells the motor to run.

This is done by changing information stored in the decoder. These places where data is stored are called CVs and each CV contains information on a single instruction for the motor. It's easy, quick to do and easily changed back to the way it was if you aren't happy, so please, have a go and watch the results!

Using your DCC system manual, go to the program track or if you prefer the program on the main "Set CV's" area and do the following.

**CV2. This is the place that starting voltage is stored.**

**Its total range is 0~255 and default is 2.** Each step is about 1/255th of the track voltage (about 1/20th of a volt). If your locomotive starts nicely as we suspect it will if you followed our install instructions we will leave it there for now.

If not, for now, let's just change it to 8. Still not moving off immediately? Perhaps it is now moving too fast?

Simply adjust it upwards or downwards by 2's until the loco just crawls at speed step 1.

**CV3. This is where Acceleration Momentum is stored.**

**Its total range is 0~255 and its default is Zero.**

CV3's values set the way the loco accelerates from rest to selected speed. This adds realism and makes train driving more interesting. It also smooths speed transitions nicely so every decoder should have at least a little momentum set

We can vary it more later... but for now let's be conservative and just set it to 15.

**CV4. This is where Deceleration momentum is stored.**

**Its total range is 0~255 and its default is Zero.**

CV4's values set the way the loco decelerates from the running speed to a stop. This adds realism and makes a train very much more interesting to drive!. We can vary it again later to its final position but for now let's be conservative & set it to 10 as it can be unnerving if the train takes forever to stop, especially while reversing!

**CV5. This controls the locomotives TOP volts. (also called MAX volts or Vmax)**

Its total range is 0~255 and its default is zero (in this case zero and 255 have the same meaning - not limited).

As with CV2 each of the 255 steps is equal to about 1/20th of a volt. As we have 128 speed steps available at our controllers I like to vary this in even numbers.

For this "first step in programming, let's just say our loco runs far faster than it should and set it to 160.

See how it runs and decide if its top speed is realistic. Adjust up and down in 20's initially, then when close to being right, use smaller even steps until you are happy with it.

**CV6. This controls the loco's speed at the middle speed step (also called MID volts or Vmid).**

Its total range is 0~255 and like CV5 its default is zero

A neat effect is that if we set it to say 1/3 of the value we put in CV5 then all the low speed steps will become smaller so slow speed control will be superb and acceleration more realistic / gradual. Let's set it to 60 for now.

**OK... that's enough for now! If you've been using the program track, put your locomotive back on the running track and add a train if you wish... Select it with your DCC system and let's take it for a run.**

(By the way – for best effect, try this test with the controller set at 128 speed steps, then try again at 28... you will be surprised how smooth it now runs on 28 compared to a non-adjusted loco)



## Decoder Instructions page 13

### Some suggestions that will help you to make your locomotives run just a little bit more like their real world counterparts...

Ready to run locomotives are generally all made with the same sorts of motors and the same general gearbox ratios, especially within a brand, so they usually act pretty well the same on the track.

However the real thing is not like that at all and each type of train or locomotive reacts very differently in service depending on the loco type, the train size and type and the route being run.

With DCC, you can simulate this very well indeed!

*The settings that follow are simply ideas... by all means use them as a basis for learning and then vary them to your personal preference for your layout and loco fleet.*

### Suggested setup for Fast Passenger DMU/EMU:

For a modern fast passenger set, the power of the train is really well balanced for its intended load: Reaction to the throttle is therefore relatively fast, acceleration is generally good, braking is excellent.

Top speed is usually 100mph/160kph or more.

Try CV3 = 12, CV4 = 12, CV5 = 220, CV6 = 96, CV61 = 1

This gives reasonably fast, linear acceleration and good top speed and leaves back EMF automatic as it will keep up/down hill speed consistent as with the prototype.

Experiment with CVs 3/4/5 and 6 to suit your needs!

### Suggested setup for larger Diesel/Electric loco's:

Diesels and electric powered loco's have sophisticated power control resulting in excellent traction and they usually also have all-wheel drive via axle hung motors. They often run in multiples if trains are heavy and when run singly are rarely loaded to their limits. They have excellent braking as normal train brakes are aided by regenerative braking via the traction motors.

Therefore acceleration will usually be good and braking will depend much less on the nature/size of the train. There are exceptions of course but here is a general suggestion for 4 and 6 axle diesels... and electrics

Try CV3 = 18, CV4 = 40, CV5 = 208, CV6 = 80, CV61 = 1

### Some ideas for Steam Locos.

Steam is a very powerful force so steam locomotives theoretically have quite linear power... but in reality their rate of acceleration would often be limited by heavy loading and the need to prevent wheel slip which could easily occur with their much larger diameter driving wheels and imperfect axles weight distribution. Passenger speeds were generally good.

Braking was overall much slower with all but the lighter trains, mostly due to the much less sophisticated brake systems in use during the steam era.

Try CV3 = 20, CV4 = 24, CV5 = 174, CV6 = 58, CV61 = 1

**There are more examples of “Locomotive drive CV settings” in our instruction card set. Details for the cards & how to obtain them are shown on our website.**



## Decoder Instructions page 14

### Back-EMF Options...

DCCconcepts Back EMF self-adjusts and compensates for varying factors so it does not need adjustment for different motor types... however there are some useful options available for those who want the benefit of BEMF with control changes to suit their needs.

#### Set Back EMF to turn off at a specific speed step:

This smooths consisting and gives you the superb starting and stopping of a Back-EMF equipped loco but as Back-EMF influence stops at your chosen speed step, it still allows you to drive the train unassisted up and down hills without the automated load compensation that BEMF adds:

**Set CV61 to 1 (default); set CV10 to your specific chosen speed step.**

*(example: To set Back-EMF turn off at Speed step 15, CV10 should equal 15)*

#### Button control of Back-EMF:

You can turn Back-EMF on and off at will if you set your decoder up to activate Back-EMF button control.

This gives you hands on control of Back-EMF via you chosen function button. You can select which button will switch Back-EMF using this table.

**First, set CV61 = 3, then, CV136 should be set as per this simple table.**

*(We recommend that you choose a F9 or lower for most systems to preserve direct one touch on/off access.)*

#### Other useful things that DCCconcepts decoders can do:

Fn Button	5	6	7	8	9	10	11	12
Set CV136 to	1	2	4	8	16	32	64	128

### Our decoders have many other functions that increase realism & versatility.

#### Button control of the motor:

There are many uses for this: turntables, cranes, conveyor belts & high current devices using up to 1 amp! Setup is simple, and all 2 or 4 function decoders can be set this way.

Just establish the motor speed and then choose the style of button control and its done!

#### Setting the motor speed:

This is important as there is no variable speed control in this mode, just forward or reverse, so unless you are making a model weapon or centrifuge, you are going to want a slower motor speed! This uses CV133, range is 0~255. Start off with 60.

#### Choosing your preferred control method: There are 2 options:

The first will use F2 for forward and F3 for reverse. (Just press the Fn on to start, off to stop). This uses CV61. Set it to 64 and you can give it a try!

**The second control option:** This will use Function 2 to turn the motor on and the forward/reverse buttons of your controller for direction. This uses CV61. Set it to 68 and see what you think.

#### We prefer method 1, however there is ONE advantage of the second method.

If you want to power several motors like this for a crane, re-map the functions on each of them differently, setting them to the same number, controlling each with its own specific function button (see chart on page #11).



## Decoder Instructions page 15

### Locking the decoder

**This is helpful if you have 2 decoders in one loco or perhaps have lots of lighting requiring a second decoder for its added functions OR if you model with DMU/EMU sets that have added light decoders you'll really love it!**

When you use more than one decoder in a dual powered locomotive, or perhaps several within a multi-unit EMU, DMU or diesel set, it is helpful if they can be locked and unlocked one at a time to allow individual adjustments. This is how to do it so it works every time.

**Scenario: A multi-unit set will have 6 decoders in it. All will have the same address but may need individual changes at some point in time.**

**Step 1:** Before making up the set, give each decoder the same address but a different number in CV16. (i.e. Set the lead decoder to 1 then use 2,3,4,5 and 6 for subsequent decoders.)

**Step 2:** Program any changes in each decoder, then change CV15 from its default of zero to a number above the highest CV16 number used in step 1 (in the case of this example set our highest CV16 is 6, so we should set CV15 in all of them to 7).

**This will lock the decoders & prevent accidental changes to all decoders.**

**Step 3:** To adjust an individual decoder later without affecting the others, even though they are all set to the same number, set CV 15 to the step 1, CV16 number of the one you want to change. By making CV15 = CV16 in that specific decoder you will unlock that specific decoder only.

**Step 4:** When you've made the change, set CV15 to its original lock number of 7 again.

### The DCCconcepts "Stay-Alive"!

**This simple device & its easy application to DCCconcepts decoders sets us apart from other brands.**

**Stay-Alive is a simple device.**

In basic terms, it stores power ready for the moment that the locomotive fails to make perfect contact with the track and so loses "pickup", starving the decoder and motor of the energy they need to keep operating properly.

Structurally, it is formed of several components all neatly arranged on a tiny PCB so that it takes up very little space and so there is always somewhere you can find to install it in all but the tiniest of locomotives.

**Stay-Alive Wiring is very easy:** There are two wires which exit the decoder at the opposite end to the main harness. These are colour coded to match the Blue and Black wires of the Stay-Alive, so there is no doubt about how they should be connected to each other (don't forget to insulate the join between stay alive and decoder!).

Because Stay-Alive only deals with low current power it can be installed anywhere - not just close to the decoder.

**What can you expect from the Stay-Alive?** Stay-Alive isn't something that will keep loco's moving over long dead sections of track and it is NOT a "Magic bullet" that will fix loco's with bad pickups or filthy wheels of course - you still need to tune your locos so they run well before installation.

It has been designed as an economical and effective way to compensate for short dead spots, to help locomotives with less than perfectly clean wheels or perfectly adjusted pickups and most importantly, it will help loco's to stay silky smooth at very slow speeds.

**What if you want MORE reserve power?** Actually if you have done a good job of adjusting pickups and cleaning wheels you shouldn't need it... But if you do want more energy storage than a single Stay alive will give, you can safely parallel two onto a single decoder.

More than two is also possible, however you will probably find that because adding more than two in parallel will increase charging loads and decrease current limiting resistor values, with more than two in parallel, your loco may no longer read reliably on the programming track.



## Decoder Instructions page 16

### CV29 – the CV that's often mentioned... but that you will rarely need to adjust!

*(Take care with CV29: wrong settings will stop your decoder dead until it's re-set or set correctly!)*

**The first thing to understand is that Cv29 is normally set automatically by your DCC control system. It does this when you make address and other core changes and so it is the one core CV that you do not need to change other than for special circumstances. Basically unless you understand it, leave it alone!**

We have seen many charts that try to explain CV29 but most are a more than a wee bit confusing to the average DCC user... so for that reason we'll limit our comments to a few settings that MAY arise for you. These will work every time!

#### \* **Oops - I changed CV29 and now my loco will not respond!**

For those who want to play with CV29 and accidentally make an error so the loco stops running, these standard values will get you up and running: If the loco has a short address, set CV29 = 6, If it has a long address, set CV29 = 38

#### \* **My locomotive is going backwards when it should be forwards and the lights won't work!**

\* To reverse the direction the loco runs: Just add 1 to the number that's already set in CV29.

*Of course this is a patch or kludge that shouldn't really be needed: It's going the wrong way because you or the locomotive manufacturer made a mistake when wiring the decoder to the motor. It really is best to do it right, so if you are confident with soldering, reverse the orange and Grey wires at the motor... If not, then just do it within CV29 as above.*

#### \* **To turn off the decoder ability to run on DC: deduct 4 from the number already set in CV29.**

*You may want to do this to solve mystery control problems or to activate "Brake on DC" abilities.*

#### \* **To force the decoder use only 14 speed steps: deduct 2 from the number set in CV29.**

*Now very rare, this 14 speed step setting may be needed for seriously older DCC systems*

#### \* **To enable the built-in speed table, add 16 to the number already set in CV29**

*This will give you access to the fully customisable 28 step speed curve stored in CV's 67 to 94*

## TROUBLESHOOTING

**Nothing can go too badly wrong if the loco ran well before conversion, the decoder has been installed correctly and you pre-checked your installation on the program track as we advised, before putting it on the main line!**

### (1) Nothing Happens:

\* Have you selected the address? If it's a new decoder it will be 3. If you did it a while ago & you can't recall its number then go to the program track & reset the decoder (CV8 to 2). it will now be #3.

\* If it is not reading or running and you KNOW the address, be sure that its not suffering from loco failure or a short circuit in the wiring or it will be damaged.

### (2) Light / functions will not work!

\* Have you turned the lights ON with Function 0 (zero) and also used the direction switch - remember white and yellow functions are both always directional by default.

\* Have you perhaps wired the LED back to front?

\* Did you add a resistor? If not you may have blown the LED! (the function will still be OK).

### (3) Help - I think I must have made a CV setting mistake. Now it won't work.

No problem! Just do a reset (CV8 to 2) and it will be back to the settings it had when you bought it.

### (4) It has got a big black hole in the heatshrink!

The only way this can happen is by incorrect wiring, overload or similar problem. You killed it, sorry!

**(If in Doubt, as a first step in checking decoders, always try a RESET by entering 2 into CV8**



## Decoder Instructions page 16

### DCCconcepts Decoder Warranty

There is very little that can go wrong with a decoder. We use the most modern surface mount machinery available, high quality parts and every decoder is automatically tested even before it is taken from the PCB sheet it was created on. After completion, many are tested again at the factory, this time using both a computer system and popular DCC systems. We then test samples AGAIN when they are delivered to us.

**Our warranty is therefore simple and direct:**

#### **Free replacement:**

If within one year of purchase a decoder with no visible physical or heat damage and a properly wired harness will not work and it will still not respond and run on address 3 after 3 attempts at a reset then we will replace it free of charge.

#### **Part cost replacement:**

If there is any form of heat or other damage to the decoder heat-shrink, if the heat-shrink is removed or there has been any soldering or modification to the PCB then it will NOT be treated as a full warranty replacement... However we DO want you to be confident and DO understand accidents happen, so we will replace it for a "part cost" of 50% of our current web price (for a single equivalent) plus return post costs.

#### **Conditions:**

- (a) Decoders should be returned with notes covering what you think happened.
- (b) We will need a date of purchase & a valid receipt before supplying replacement decoders.
- (c) We will normally replace ONLY the decoder. Please do not return harnesses as these will not be replaced or renewed (obviously the TS series will include its fixed harness).
- (d) We will record part replacements and we will not accept more than 3 such claims for damaged decoders from any one user within a 12 month period