OPTI Series Decoder Manual

DCC25 Standard size decoders with 8 pin JST harness
DCC26 Mini Decoders with 8 pin JST harness

Thank you for purchasing an OPTI series decoder. We are sure that out of the packet, it will do everything you need and deliver smooth, reliable results with a minimum of fuss because from the very beginning what we set out to do was to create a versatile, easy to install and simple to adjust range of products that offer exceptional 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 MUCH more than just set addresses and so 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…

Table of contents:

General Specifications for OPTI series decoders:

Size:

DCC25	:	25.25mm x 16.6mm x 5.3mm (0.95" x 0.65" x 0.2")
DCC26	:	18.5mm x 10.5mm x 4.8mm (0.73" x 0.42" x 0.18")

Power Handling:

All OPTI series decoders have more than adequate power for any N, TT, HO, OO, On30 or similar modelling scale. They are also suitable for many S or O scale models when powered with modern low current draw can or coreless motors.

We set our decoder specifications at "Standards compatible" NMRA track voltages – please be aware that while US based systems meet this specification all of the time, many EU made controllers will often have track voltages well in excess of DCC standards recommendations and while our decoders will still perform reliably and well irrespective of your systems actual output voltage, we do suggest that if it IS higher than the standards say it should be then a slightly more conservative current draw rating should be assumed.

In general, providing your locomotive draws less than 1 amp consistently with an average train, then you should use them with confidence. If your locomotive is old with an inefficient motor that draws more than ¾ of our rated decoder power consistently, then we do suggest that when slipping or under excess load it may

exceed reasonable power use, so 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.

The decoder power ratings below are limits, not average running current draw:

DCC25 1.3 amp max motor drive (Decoder total maximum 2 amps peak). 4 x light or other device / switchable functions, each 150mA, 200mA max

DCC26 1.1 amp max motor drive (Decoder total maximum 1.8 amps peak).). 4 x light or other device / switchable functions, each 150mA, 200mA max

Addressing: OPTI Series decoders are always 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 OPTI Series 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.

DCC25 90mm overall length. The decoder end has a removable 9 pin JST, while the locomotive end has
Harnesses an 8 pin NEM652 plug with wires dressed to the UK standard (N-S or lengthwise) orientation. The 4 Fn decoder will also have Fn4/Aux2 as a free purple wire.

2 and 4 fn have different harnesses, with the 2fn harness being made without the unnecessary green (Fn3/Aux1) wire and the 4 Fn decoder will also have Fn4/Aux2 as a free/unattached purple wire.

DCC26 90mm overall length. The decoder end has a removable 7 pin JST, while the locomotive end has
Harness an 8 pin NEM652 plug with wires dressed to the UK standard (N-S or lengthwise) orientation. As the decoder end offers only 7 pins, the 4 Fn series decoders will also have Fn 3/Aux1 and Fn4/Aux2 as free or unattached green and purple wires.

Primary feature listing for OPTI Series decoders:

These are the primary features of OPTI Series decoders however it is not intended as a comprehensive listing – for example, we detail here how many light functions there are, but we list the individual abilities of each of our lighting and auxiliary functions in a later section of this manual.

Standards Compatibility: OPTI series 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 number between 1 and 9999. 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.

Because we know that many of our decoders will be used by new or inexperienced modellers we have limited "short address" changes to the programming track, as entry level controllers are not always easy to use and often lack 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 loco is running on your layout.

Motor Control: OPTI Series decoders support adjustment of motor control parameters that may be required to set-up starting, acceleration characteristics and momentum. Speed tables are supported.

DC Running: When fitted with an OPTI series decoder your locos should still also run very well on a DC powered layout but you will need to turn the knob a little further than with a DC loco to start the loco moving. Locos fitted with our decoders retain back EMF support & constant lighting 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 and some locos, especially budget models may not perform quite as well as others.

All OPTI Series 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. (This is recommended if you will never use DC running)

Back EMF: OPTI Series decoders have an advanced preset Back EMF ability that will usually give perfect low speed control without any adjustment other than CV2. Our testing has shown that all RTR locomotives run well at default settings with no need for adjustment of back EMF.

For those who use 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 OPTI Series decoders have high frequency silent drive for quiet, silky smooth running.

Brake on DC: All OPTI Series 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: OPTI Series decoders have either 2 or 4 functions which are switched on and off via the function control buttons of your handset. To keep identification simple, 2 function decoders are coloured Red and 4 function decoders are blue.

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.

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.

Functions: All functions can be re-allocated to different buttons and (made to respond to different buttons) if you wish and we have **re-mapping:** included clear instructions for this later in this manual. Of course all 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.

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 wish 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

Consisting: OPTI Series decoders support all forms of consisting (double-heading)

Reset: Should you want to reset your OPTI Series 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 CV30 to 2. Once this is done, the decoder address will revert to number 3.

Warranty: Gaugemaster have a generous warranty and we encourage you to utilise it if needed.

Addressing and first steps to setting up your decoder

Once your locomotive has had its decoder installed and you have tested that there are no problems by placing it on the programming track and reading it, it is time to have some fun!

All decoders are set to address #3 at manufacture. Place your newly chipped loco on your main line and select address 3 on the controller.

Give it a run… If you did the pre-checks on DC first and it ran well it is now going to run very well indeed… but we can make it even better once the address is set, so let's do that now:

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

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

(2) If your DCC system can read CVs, it will first read manufacturer number and then the software number… followed by an invitation to set the long and short address.

(3) Your decoder can be set to any number between 1 and 9999 so you have a lot 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 before you do anything please!

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 123!

(In line with the Standards, OPTI Series decoders will accept any number from 1 to 123 as a short address)

This is important information as that means that any number between 100 and 123 can be interpreted as long or short depending on the DCC system brand. We therefore recommend that you avoid numbers 100~123 unless you will only use the loco at home!

A simple approach to short addresses:

Regard a short address as being 1~99 and ignore the 100~123 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 are going to use a long address then the short address should just be left at 3.

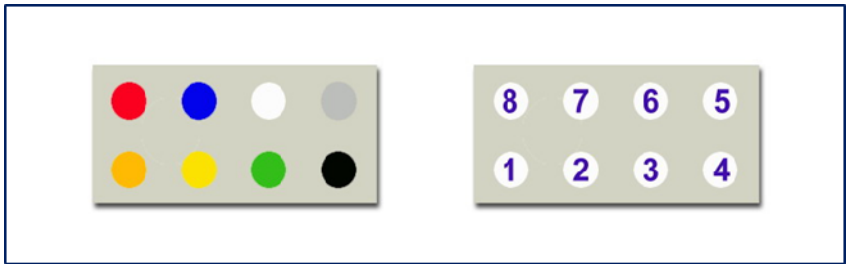
Setting the long Address: As we already discussed, this is really a 2-byte" number which means it can be anywhere between 124 and 9999.

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 a trial run…

Basic wiring and 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 OPTI Series decoder harnesses and connectors do meet standards, so you can approach their installation with confidence.

This illustration shows the correct connection structure for an NMRA compatible 8 pin plug when it is viewed from the top (wire side) of the decoder plug, and therefore also represents the 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... it’s not always obvious!

Accidentally inserting the plug wrong way round will not harm the locomotive or decoder, however the loco will run backwards when the control system indicates forwards and lighting will not work correctly.

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

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 with “light” button
Pin 3 **- Green:** Function 3 (also known as Aux 1). Default setting, operate with Function1 button
Pin 4 **- Black:** To track/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
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

4 Function decoders also have a purple wire which is not attached to the connector. This is used for activating a 4th 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, insulate it.

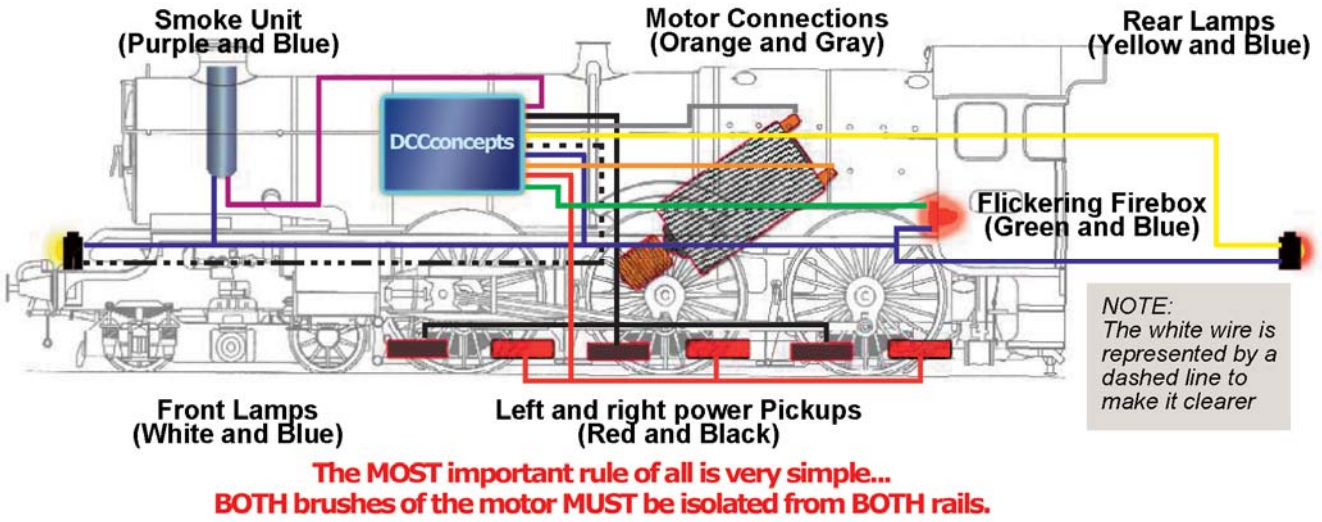
If your locomotive does not have a socket, do not worry. Cut off the 8 pin plug and simply follow the above wiring guide and hard-wire the decoder to your locomotive. Make sure that any joins in the wire are protected with heat shrink that will prevent short circuits that damage decoders. When hard-wiring a decoder it is best to trim all wires to the correct lengths, work tidily and take your time!

We do not recommend adding sockets to locomotives that do not have them as it is unnecessary – our decoders already have a socket at the decoder. Besides, hard wiring a non DCC-ready locomotive takes less space and it is simply far easier to simply hard wire a decoder!

The general recommendation is the removal of all capacitors and suppression parts from all locomotives prior to installing your decoder. This will ensure the best quality running without exception. As the decoder already has a far greater suppression effect than the original suppression parts, removing them will not increase the radiation of radio interference from your locomotives under any circumstances.

To assist you to visualise the wiring in various loco types, these two illustrations may be helpful. Our thanks go to Richard Johnson at DCCconcepts for letting us use this helpful diagram within these instructions

STEAM LOCO: (Using 4fn Decoder)



Wiring and description of <u>functions</u> and related wire colour codes.

All of the active (light or smoke etc) functions of OPTI Series 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 OPTI Series decoders via the harness or at the harness end of the decoder.*

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 <u>or if you want only half power to any light or accessory</u> you can connect it to a white or yellow or green or purple wire, without the blue - using one side of the locomotive 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 or "re-mapped" 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 or "re-mapped" 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

Function 3/Green wire: (also known as Aux1): usually used for cab or additional lighting (diesel) or flickering firebox (steam). Default is for steady light, non directional. Operate with function 1 (Can be re-mapped 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 re-mapped 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 and 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.

Which CV? The specific action of each function wire is controlled by a CV number specific to that wire

White wire: CV49 Yellow wire: CV50
Green wire: CV51 Purple wire: CV52

These always stay the same, even when you use "function mapping" to change which function button actually makes the function turn on and off.

To change the way that a function acts, simply change 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 be options in the way that it can be set up so there are additional specific detailed instructions and explanations available for that particular light effect.

Changing which controller button acts on or activates each function:

This is often called “function mapping” but that’s a little geeky so we prefer to call it “function allocation”

In cheaper Decoders you have no choice, however all of our OPTI Series Decoder functions 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 operate.

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 easy operation.

We have colour coded this chart to make it easier to understand.
Match the coloured rows and columns to make the settings you need based on the chart & information below:

- The green table cells show which number should be entered into the relevant CV for functions 1 and 2 to make the function respond to the numbers above them for buttons 1~6.
- The pale yellow cells show 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 which control which CV controls function allocation for each wire are at the left with the factory default value and the colour of the wire concerned is also shown alongside them
- The ~ indicates that a specific combination is not available.

Function Button number	**Front L**	**Rear L**	**1**	**2**	**3**	**4**	**5**	**6**
Value to use	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**
	Function Button number		**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+	~	

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

To make function button 9 control the purple wire, put 16 into CV38

Tuning and adjusting the motor control in your OPTI Series Decoder

With the loco address set and locomotive tested, it is time to take advantage of the benefits of DCC.

To do this we are going to change the way that the decoder tells the motor to run. This done by changing information stored in the decoder. These places are called CVs and each contains information on a single instruction for the motor. It is easy, quick and easily changed, so please, have a go and watch the results!

Using your DCC system manual, go to the program track or POM "Set CV's" area and do the following.

CV2. This is the place that starting voltage is stored. Its total range is 0~255, with each step being about 1/255th of the track voltage (about 1/20th of a volt). Its default is 2 and if your loco 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. We can vary it more later... but for now let's be conservative and just set it to 20.

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 but for now let's be conservative & set it to 15 as it can be unnerving if the train takes forever to stop!

CV5. This area controls the locomotives TOP volts.

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 180.

CV6. This area controls the locomotives speed at the middle speed step (commonly called MID volts).

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)

Some suggestions to make your locos run more like their real world counterparts...

Ready to run locomotives are generally all made with the same motors and gearbox ratios and so tend to act pretty well the same on the track, however the real thing is not like that and each type of train or locomotive reacts very differently in service depending on train type and loading. With DCC, you are able to simulate this

very well indeed!

Set up for Fast Passenger DMU/EMU: For a modern fast passenger set, the power of the train is really well well balanced for its intended load: Reaction to the throttle is therefore relatively fast, acceleration is 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!

Set up for larger Diesel locos: Diesel Locos have excellent traction and usually all wheel drive via axle hung motors powered via overhead or a diesel motor. 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 brakes are aided by regenerative braking via the traction motors.

Therefore acceleration will usually be good and braking will depend only a little 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, CV6 = 208, CV6 = 80, CV61 = 1

Steam Locos have quite linear power but the rate of acceleration would often be limited by heavy loading and the need to prevent wheel slip with their much larger diameter drivers. Passenger speeds were good.

Braking was much slower mostly due to less sophisticated brake systems in the steam era.

Try CV3 = 20, CV4 = 24, CV5 = 188, CV6 = 60, CV61 = 1

Back EMF Options...

OPTI Series Back EMF self-adjusts & self compensates for varying factors so it does not need changing for different motor types... however there are some useful options available for those who want the core BEMF benefits but 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 BEMF equipped loco but allows you to drive the train unassisted up and down hills without the automated load compensation that BEMF adds:

*** CV61 = 1 (default) * CV10 = Chosen speed step.** *(example: To turn off at Speed step 15, CV10 = 15)*

*** Button control of Back EMF:**

You can choose to turn back EMF on and off at will if you set your decoder up to make this function available. This gives you hands on control of B-EMF via you chosen function button. You can select which button will switch BEMF using this table.

*** CV61 = 3**

*** CV136 should be set as per this table.** *We recommend that you choose a function 9 or lower for most systems to preserve direct on/off access.*

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

Other useful things that OPTI Series decoders can do:

OPTI Series decoders have other non-standard functions that can aid realism and increase their 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:

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, you can remap the functions on each of them differently, set them to the same number and control each with its own specific function buttons (see the chart on card #38).

Lighting example - Doing it the right way – manual control of Rule 17 Lighting

Rule 17 Lighting: This is primarily a US lighting style, however UK diesel models often have a "day" and "night" lighting level, and this "rule 17" setup can also help you to get that to work properly in your locomotives if you think about it!

In general this rule stipulates that light in the rear of a loco should be on & dimmed when the front light is at full brightness & importantly, that the headlight should also always be dimmed in the direction of travel when….

(1) At stations/yards where switching is underway.
(2) If a locomotive is stopped close behind another train .
(3) On non-signalled lines when a locomotive is stopped on the main and waiting for an approaching train .
(4) When a locomotive is approaching and passing the head end & rear end of a train on the adjacent track.
(5) At other times to permit clearly visible passing of hand signals or when safety of employees requires it.

Some decoders offer a very basic form of Rule 17 but we decided to do it properly. Because it requires several CVs to be set we will describe it in a series of simple steps, each properly explained.

We are going to set up front & rear lighting so that lights:
* Are not directional on/off (manual on/off selection)
* Are on separate buttons (F0 and F1) and also...
* Light in the end opposite to direction auto-dims if on.
* Are NOT automatically dimmed when stopped but...
* Can be dimmed when stopped or when switching with F4 no matter which direction the loco is moving.

Now... Lets do it as a step-by-step setup - we will use the White and yellow function wires for Rule 17.

(1) We need to set CV61 to engage "Opposite Dim". Opposite dim needs 32 added to the value already in CV61. As CV61 also controls BEMF it will already be either 1 (BEMF on) or 3 (BEMF on via a function button).

So... For CV 61, enter either 1+32 = **33** or 3+32 = **35.**

(2) We need to set CV64 to set the Dimming level. The range for this CV is 0~15. We find the best range to use to dim LEDS is 1~6. We use 3 with our own locomotives.

So... For CV 64, enter 3.

(3) Now we need to set White wire control / CV49 and Yellow wire control / CV50 to Rule 17 always on. The options for this are 8 (Rule 17 fwd only) 24 (rule 17 Rev only) or 40 (rule 17 always / manual)

So... For BOTH CV49 and CV50, enter 40.

(3) Now to reallocate function control. We are going to make White F0, Yellow F1, Green F2, Purple F3. White is already F0 so leave it. To remap the others just set their function allocation CVs to the following values.

CV34 enter 4, CV35 enter 8, CV36 enter 16.

Did you follow that OK> If so, then it is time to take a break & have a Play with Rule 17!

Speed Tables

OPTI Series decoders include a user editable speed table in 28 steps (the decoder interprets the gaps between each step in 128 mode). This allows you to tailor each individual speed step to achieve your own specific custom acceleration results.

You can activate the custom speed table by adding 16 to whatever number is already in CV29. The speed table itself is contained in 28 CV's between (including) CV67 and CV94. We strongly recommend that you spend time reviewing the existing set-up of each step prior to attempting to create your own customised speed table.

We also strongly recommend that you write down the original settings before changing them. As always, if you make a mistake or lose track, a simple "reset" of the decoder will get you going again (CV8 = 2).

I've tried to avoid tables in these instructions as much as I can, but in this case, there is no other way!
(Note: we may tweak or adjust these values from time to time, so exact default numbers may vary slightly)

CV67	CV68	CV69	CV70	CV71	CV72	CV73
2	**5**	**7**	**11**	**15**	**20**	**25**
CV74	CV75	CV76	CV77	CV78	CV79	CV80
30	**35**	**40**	**47**	**52**	**58**	**65**
CV81	CV82	CV83	CV84	CV85	CV86	CV87
72	**79**	**84**	**93**	**100**	**112**	**121**
CV88	CV89	CV90	CV91	CV92	CV93	CV94
135	**147**	**161**	**177**	**196**	**219**	**255**

Locking the decoder

This is a REALLY helpful feature, especially if you model with modern multi-coach DMU or EMU sets!

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. (ie: lead decoder 1 then 2,3,4,5,6 for subsequent decoders.)

Step 2: Program any wanted changes in each decoder, then change CV 15 from its default of zero to a number above the highest CV16 number used in step 1 (ie: for our example set CV15 in all to 7). This will lock that decoder and 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 decoder you will unlock that specific decoder only.

Step 4: When you have made the changes, again set CV15 to its original lock number of 7.

CV29 – the CV that's often mentioned… but you should rarely need to adjust!

(Cv29 is usually set-up automatically for you by your control system when you make changes and it is the one CV that you should not manually change other than for the special circumstances mentioned below <u>unless</u> you understand it:

(Take care with CV29 please: wrong settings will stop your decoder dead all until it is re-set or set correctly!)

We have seen many charts that try to explain CV29 and its operation but most are a bit confusing to the average modeller & DCC user... so for that reason we will limit our CV29 comments to a few settings that MAY arise for you.

Basically, your DCC system will set up CV29 automatically during the initial "programming track setup" so you will rarely ever need to manually change anything, however or those who DO want to play with CV29, these two values will "get you running" if you make a mistake.

*** If the locomotive has a short address, set CV29 = 6, If it has a long address, set CV29 = 38**

*** To reverse the direction the loco runs in: Just add 1 to whatever number is already set in CV29.**

I*t really IS best to reverse the orange and Grey wires at the motor, but if you want to do it within CV29 you can*.

*** To turn off the decoders ability to run on DC: Just 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 to use only 14 speed steps: Just deduct 2 from the number already 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***

TROUBLESHOOTING

There's little to go wrong if the decoder has been installed properly & you pre-check on the program track as we advise before putting it on the main!

(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 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 it's not suffering from a short or it will be damaged (and not under warranty—see card #43!).

(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 made a CV 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.

If in Doubt – always RESET by entering 2 into CV8

GAUGEMASTER Controls Ltd
Gaugemaster House, Ford Road, Arundel, West Sussex, BN18 0BN, United Kingdom
Phone +44 (0) 1903 884 321 **Fax:** +44 (0) 1903 884 377 **Email:** technical@gaugemaster.co.uk
www.gaugemaster.com