EASY**DCC** System Installation and Command Station Users Guide

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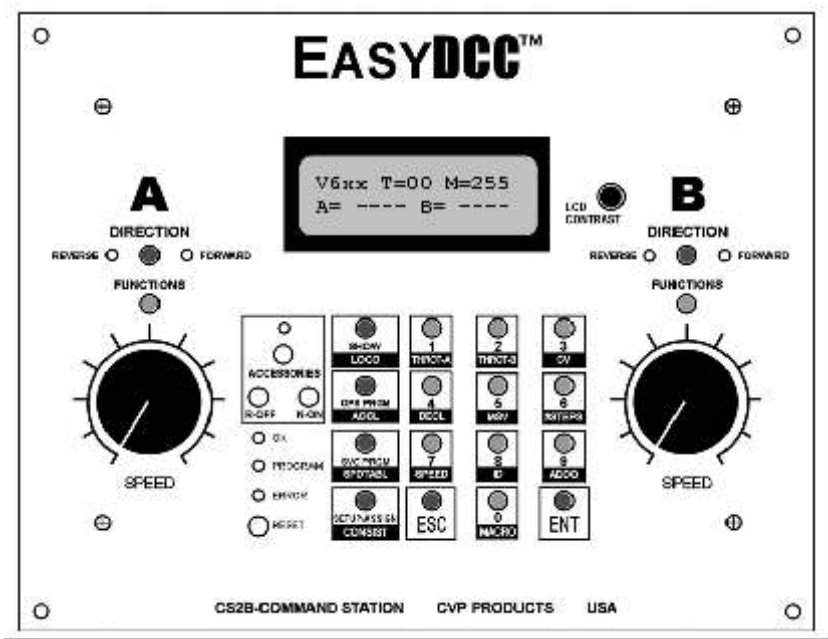
Quick Start Guides - Find Yours - Do It First

**Version 6 Software
Release 1.2**

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Table of Contents

The Basic Starter System content list and Basic Starter System Quick Start will not include any extra items you may have purchased or upgraded as part of your original purchase. Regardless, the basic hookup and use remains the same. Refer to the instructions that come with the extra items.

Contents of the Basic Starter System:

- Command Station
- ZoneMaster Single Booster
- High current power supply DCPS120 and power cord
- Low current plug-in wall transformer for Command Station
- One 7-foot modular cable
- System Installation and Operation Manual
- ZoneMaster User Guide

In addition to the above items, you will need about 3 feet of test track, a bit of hookup wire and a locomotive equipped with a DCC compatible decoder.

Initial Test Track Hookup

We strongly suggest that you first hookup the system to a separate section of test track. Once you have used the system and checked it out thoroughly, you can begin permanent installation knowing that everything is working properly.

Command Station Rear View

Power Supply DCPS120

12VAC Transformer

Modular Cable

Booster

Temporary Test Track

Temporary Programming Track
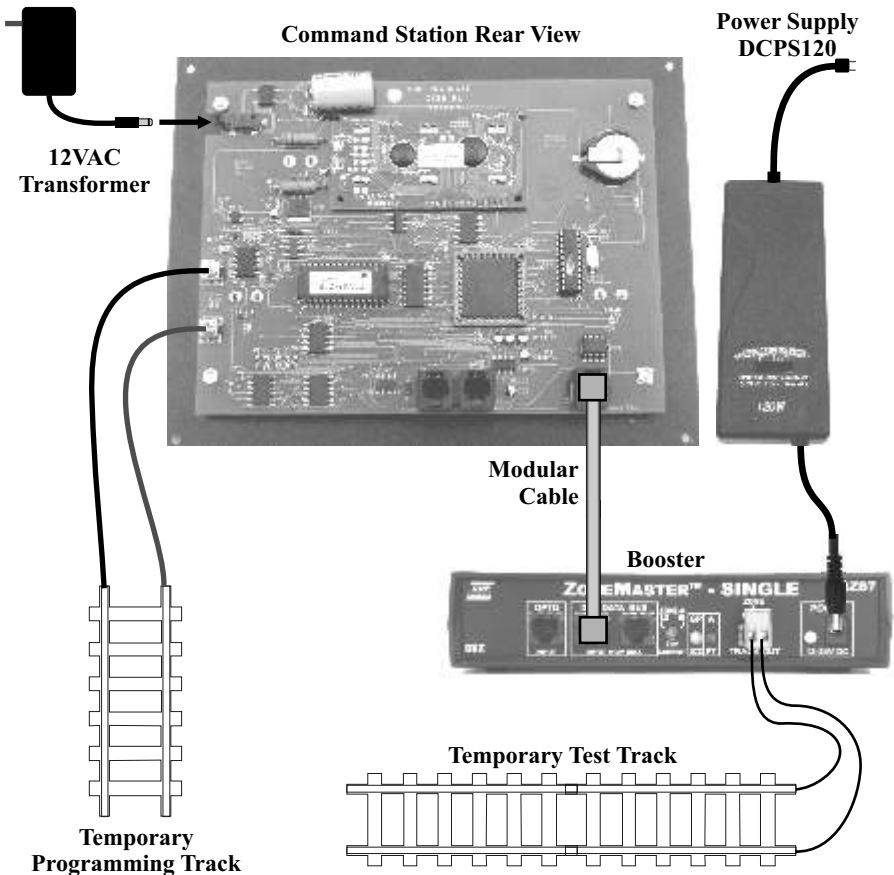
AC Wall Transformer

When connecting the plug from the small wall transformer to the Command Station's AC jack, be sure to push it in as far as it will go. The plug's black plastic strain-relief will be flush to the jack when properly inserted.

The small jack is fragile and can be easily damaged. Always pull the plug straight out.

Caution: The standard CVP 12VAC transformer is rated for 110VAC input only.

Modular Cable

The modular cable connects between the Command Station'S "Boosters" jack and the ZoneMaster booster jack labeled DCC DATA BUS. You may use either one of the two data bus jacks. Don't use the OPTO input jack.

Do not accidentally plug the cable into the wrong Command Station socket.

When plugging the cable into the socket, do not force it. The plug will insert easily and lock with an audible click. To release the plug, push down on the little plastic tab and gently pull the cable out of the socket.

DCPS120 Booster Power Supply

The DCPS120 power supply has a universal AC input. It can use an AC line voltage that ranges from a low of about 100V up to a maximum of about 240 volts.

Before using the power supply, set the voltage selector switch to the far left, at the 15V setting. This is the best setting for N, HO, S and O scale locomotives. This setting allows the decoder to drive the motor with about the same voltage as a standard power pack.

Caution: Only use the CVP DCPS120 power supply for the ZoneMasters. Using any other type of power supply will void the warranty and likely damage the booster.

ZoneMaster Booster

The power supply's output cable is thick and heavy and exerts a lot of force on the ZoneMaster input power jack. Be careful not to allow the cable to dangle unsupported from the ZoneMaster input power jack.

The Track Output terminal is actually a plug and it can be easily pulled out to make hookup easier. Connect the test track to the output terminal using solid or stranded wire. Small diameter wire is OK for the temporary test track.

Command Station Programming Track

The final two connections hookup up the programming track to the Command Station. This is not necessary for the temporary checkout unless you want to play with decoder programming. Small diameter wire is OK since only one locomotive at a time can use the programming track.

You are now ready to power up the system and take it for a test drive.
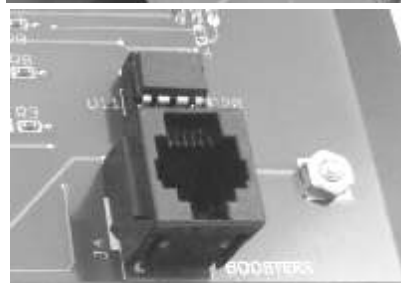
Place Decoder Equipped Locomotive On Test Track

Make sure all wheels are on the rails. If not, there could be a short when power is first applied and the booster short circuit alarm will sound.

Turn On The Power

Turn on power to all parts of the system. Watch the Command Station's LCD display for the startup messages. As soon as the startup messages are completed, you will see the standard default display which is called the home page.

```
V6xx  T=00   M=255
A=0003     B=------
```

Rotate the LCD CONTRAST control to obtain the best looking display. Use this control to improve the contrast between the letters and the background.

Now check the ZoneMaster. The ZoneMaster GP indicator will be on. The GP's green indicator signifies that it is properly connected to the Command Station.

Locomotive Decoder Address

Each locomotive must have a DCC compatible decoder installed. Each locomotive must have a different "address." The loco address is just like the address of your house - it is unique. If you purchased a locomotive with a factory installed decoder, the manufacturer will usually program the locomotive address to the locomotive's cab number. If you purchased a decoder separately then it will usually be on the default address of 3.

Controlling The Locomotive With Command Station Throttle

To control the locomotive, you must assign one of the Command Station's built in throttles to the locomotive address. However, when the Command Station is powered up for the first time, neither throttle A or B are assigned to an address. Therefore the first step is to assign the throttle. For this example the locomotive address will be 3 and it will be assigned to throttle A. If you know your locomotive to be on a different address, then use that address instead.

1. Push the SETUP key. The message shows that it is waiting for additional information.

```
Setup/Assign
What?
```

2. Push the the THROT-A key which is the "1" key. The Command Station will know automatically that you are wanting the THROT-A function and not just the "1."

```
Assign ThrotA To
Loco/Cons#____
```

3. Push the 3 key followed by the ENTER key to assign throttle A to locomotive address 3. There is no need to include leading zeroes.

```
Assign ThrotA To
Loco/Cons#___3
```

4. Push ESC to end the key sequence and return the display to the home screen. Notice it shows A is now assigned to address 3.

```
Throt A Assigned
To Loco # 0003
```

5. The big black knob under the A is the speed control. The direction key and the indicator lights show the direction the locomotive will move. Turn the speed knob up and observe the locomotive more. Push and release the direction key to change directions.

```
V6xx  T=00   M=255
A=0003     B=------
```


Locomotive direction push button and LED indicators

Decoder function control

Speed control knob

Controlling Locomotive Decoder Functions - F0 to F9

To control locomotive functions such as lighting or sound effects, function keys are used. Push the key labeled FUNCTION for the A throttle. The LCD will show the status for the 13 possible locomotive functions for the locomotive assigned to throttle A.

```
Loco 0003 Fcn#=?
Fn=□□□□□□□□□□□□□
      ↑             ↑
     F0            F12
```

The far left square is function 0 and the far right square is function 12. The open squares indicate the function is not activated. If a square is filled in, the function is on or activated.

While the function status display is showing, the Command Station's number keys become the function keys. For example, the 0 key control Function-0 which we shorten to F0. This is typically the headlight control.

```
Loco 0003 Fcn#=?
Fn=■□□□□□□□□□□□□
```

Push and release the 0 key while watching the locomotive headlights. Notice the first square fills in indicating function 0. Push the 0 key again to shut off the headlights. Notice the square shows open.

If the decoder also has sound effects, push the "2" key to blow the horn. Pushing and holding the key will continuously sound the horn. Release the key to stop the horn from blowing.

Push the ESC key to cancel the function status display and return to the home page. The function status is remembered but the status display can be brought up any time by pushing the "function" key.

Controlling Locomotive Decoder Functions - F10 to F12

To activate F10 to F12, first push the SETUP/ASSIGN key to add 10 to any subsequent number key. For example, for F10, push and release SETUP/ASSIGN and then push 0.

Changing The Locomotive Address

Running two locomotives is a lot more fun than just one locomotive. Adding another locomotive and assigning it's address to Throttle-B is easy. But there is one requirement: the new locomotive must have a different address. Fortunately, this is easily done by using the programming track to change the new locomotive's address. Here's how to do this.

1. Place the locomotive on the programming track and be sure all wheels are on the track.

2. Push the SVC PRGM key. This is a severe abbreviation of "Service Program." Notice it is asking what do you want to program using the Program Track.

```
Program Track
Program What?
```

3. Push the key labeled LOCO. The 4 blanks will allow any number from 1 to 9999. For this example, the locomotive decoder will be programmed to address 2920.

```
Program Track
Loco Addr ____?
```

4. Push the number keys to put 2920 in the display. Push ENT to program the decoder to the new address.

```
Program Track
Loco Addr 2920?
```

5. Push ESC to return to the home page.

```
V6xx T=00   M=255
A=0003     B=2920
```

Move the locomotive back to the main line and assign Throttle-B to the new locomotive address. Speed, direction and function control are the same as with Throttle-A.

> This concludes the Quick Start Section for the Basic Starter System. Please go to page 15 for suggestions on permanently mounting your system as well as recommendations and guidelines for ZoneMaster booster installation and track wiring.

Extended Starter System - Quick Start

The Extended Starter System content list and Extended Starter System Quick Start will not include any extra items you may have purchased or upgraded as part of your original purchase. Regardless, the basic hookup and use remains the same. Refer to the instructions that come with the extra items.

Contents of the Extended Starter System:
- Command Station
- ZoneMaster Single Booster
- Extender circuit board with twist-on coax connector and terminator resistor
- One plug-in throttle
- One Fascia plate with two twist-on coax connectors
- High current power supply DCPS120 and power cord
- Low current plug-in wall transformer for Command Station
- Medium current plug-in wall transformer for Extender
- Two 7-foot modular cable
- System Installation and Operation Manual
- Extender installation notes
- ZoneMaster User Guide

In addition to the above items, you will need about 3 feet of test track, a bit of hookup wire and a locomotive equipped with a DCC compatible decoder.

Temporary System Hookup To Test Track
We strongly suggest that you first hookup the system to a separate section of test track. Once you have used the system and checked it out thoroughly, you can begin permanent installation knowing that everything is working properly. Each part of the Extended Starter System will be described along with any special notes. Additional system features, not necessary for a temporary hookup are described in later sections. The hookup diagram on the next page shows all of the components of the extended system and how they connect together.

AC Wall Transformer For Command Station
When connecting the plug from the small wall transformer to the Command Station's AC jack, be sure to push it in as far as it will go. The plug's black plastic strain-relief will be flush to the jack when properly inserted.

The small jack is fragile and can be easily damaged. Always pull the plug straight out.

Caution: The standard CVP 12VAC transformer is rated for 110VAC input only.

Modular Cable Between Command Station and ZoneMaster Booster
The modular cable connects between the Command Station'S "Boosters" jack and the ZoneMaster booster jack labeled DCC DATA BUS. You may use either one of the two data bus jacks. Don't use the OPTO input jack.

Do not accidentally plug the cable into the wrong Command Station socket.

When plugging the cable into the socket, do not force it. The plug will insert easily and lock with an audible click. To release the plug, push down on the plug's little plastic tab and gently pull the cable out of the socket.

Extended Starter System Simplified Hookup Diagram

Command Station Rear View

**Power Supply
DCPS120**

**12VAC
Transformer**

**Modular
Cable**

**Modular
Cable**

Booster

Temporary Test Track

**Temporary
Programming Track**

Extender

V1   R17
U2

Input Jack

Throttle Test Jack

**12VAC Transformer
1.5Amp/20VA**

**XR1300
DIGITAL THROTTLE**

DIRECTION

N-OFF		N-ON
1	2	3
4	5	6
7	8	9
*	0	#

CVP PRODUCTS
USA

**XR1300 Plug-In
Throttle**

EASYDCC

CVP PRODUCTS

*The fascia plate is included in
the Extended Starter System.
However, it is not needed for
the temporary system hookup
and checkout.*

Fascia Plate

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DCPS120 Booster Power Supply

The DCPS120 power supply has a universal AC input. It can use an AC line voltage that ranges from a low of about 100V up to a maximum of about 240 volts.

Before using the power supply, set the voltage selector switch to the far left, at the 15V setting. This is the best setting for N, HO, S and O scale locomotives. This setting allows the decoder to drive the motor with about the same voltage as a standard power pack.

Caution: Only use the CVP DCPS120 power supply for the ZoneMasters. Using any other type of power supply will void the warranty and likely damage the booster.

ZoneMaster Booster

The power supply's output cable is thick and heavy and exerts a lot of force on the ZoneMaster input power jack. Be careful not to allow the cable to dangle unsupported from the ZoneMaster input power jack.

The Track Output terminal is actually a plug and it can be easily pulled out to make hookup easier. Connect the test track to the output terminal using solid or stranded wire. Small diameter wire is OK for the temporary test track.

Command Station Programming Track

The final two connections hookup up the programming track to the Command Station. This is not necessary for the temporary checkout unless you want to play with decoder programming. Small diameter wire is OK since only one locomotive at a time can use the programming track.

Extender Power Transformer

Connect the 2nd and larger 12VAC/1.5A transformer to the power input jacks of the Extender circuit board. Use 20AWG wire for the connections. Since the transformer and the Extender use screw terminal strips, strip the wire back about 1 inch and tin the wire to keep the strands together. Form the wire into a loop and slip it under the terminal and tighten the screw. Also, there is no case for the Extender since it is designed for under layout mounting. Therefore, the bottom of the circuit board must not touch any conductive surface such as a metal table.

Extender To Command Station Modular Cable

You must use the gray modular cable supplied with the extender to connect it to the Command Station. Plug one end of the cable into the socket labeled TBUS and the other end into the Extender's modular jack labeled INPUT.
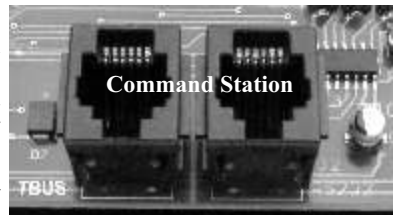
Do not accidentally plug the cable into the wrong Command Station socket.

Do not plug the cable into the Extender's jack labeled OUTPUT. No harm is done but the plug-in throttle will not work properly.

When plugging the cable into the socket, do not force it. The plug will insert easily and lock with an audible click. To release the plug, push down on the little plastic tab and gently pull the cable out of the socket.
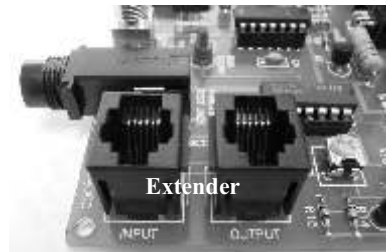
Throttle Hookup

Plug the throttle into the test jack on the Extender. The fascia plate is not needed for this temporary checkout. Fascia plate installation is covered in a later section.

Place Decoder Equipped Locomotive On Test Track

Make sure all wheels are on the rails. If not, there could be a short when power is first applied and the booster short circuit alarm will sound.

Turn On The Power

Turn on power to all parts of the system. Watch the Command Station's LCD display for the startup messages. As soon as the startup messages are completed, you will see the standard default display, called the home page.
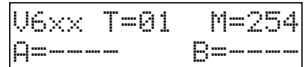
```
V6xx  T=00   M=255
A=-----     B=-----
```

Rotate the LCD CONTRAST control to obtain the best looking display. Use this control to improve the contrast between the letters and the background.

Check the ZoneMaster and its indicators. The ZoneMaster GP indicator will be on. The GP's green indicator signifies that it is properly connected to the Command Station. The yellow LED indicates power is being supplied by the DCPS120. Check the Extender circuit board. It's green LED should be on steady. The red LED should be off.

If you have not yet done so, plug in the XR1300 throttle to the Extender's test jack. Check the LED indicators on the throttle. The green "F" LED will be on indicating the throttle is on and the locomotive direction is set for forward.

Finally, look at the Command Station's display. It should look like the one to the right. Notice that T=1 which means there is one active throttle.

```
V6xx  T=01   M=254
A=-----     B=-----
```

Also notice that M=254 which means that one locomotive memory slot has now been used leaving 254 slots available. A an d B are not used.

Locomotive Decoder Address

Each locomotive must have a DCC compatible decoder installed. Each locomotive must have a different "address." The loco address is just like the address of your house - it is unique. If you purchased a locomotive with a factory installed decoder, the manufacturer will usually program the locomotive address to the locomotive's cab number. If you purchased a decoder separately then it will usually be on the default address of 3.

Controlling The Locomotive With The XR1300 Throttle

To control the locomotive, the throttle must be assigned to the locomotive address. For this example the locomotive address will be 3. f you know your locomotive to be on a different address, then use that address instead. All of the keystrokes below are done on the throttle.

1. Push and release the key labeled #. This symbol is called the "pound" or "number" key and has several uses. For now, it simply means you are about to enter a number. Notice the two direction indicators are both on. This is visual clue that you have just pushed the # key.

2. Enter your locomotive address by pushing the appropriate numeric keys one at a time. If the address is 3, simply push and release the 3 key. There is no need for leading 0s. If you think you made a mistake, push the * key which is the Escape/Cancel key and start over.

3. Push the # key once more to conclude entering the loco address. The F direction indicator will now turn on solid and the R indicator will turn off.

Turn the speed knob clockwise up and observe the locomotive more in the forward direction. Push and release the direction key and notice the yellow reverse LED turns on. The indicator lights show the direction the locomotive will move. Forward is relative to the cab of the locomotive. Push and release the direction key to change directions.

This concludes the Quick Start Section for the Extender Starter System. Please go to page 15 for suggestions on permanently mounting your system as well as guidelines for throttle bus wiring, ZoneMaster booster installation and track wiring.

The Wireless Starter System content list and Wireless Starter System Quick Start will not include any extra items you may have purchased or upgraded as part of your original purchase. Regardless, the basic hookup and use remains the same. Refer to the instructions that come with the extra items.

Contents of the Wireless Starter System:
- One Command Station
- One ZoneMaster Single Booster
- One RX904 Wireless Receiver
- One T5000E Wireless Throttle
- One high current power supply DCPS120 and power cord
- Two low current plug-in wall transformers for Command Station and receiver
- Two 7-foot modular cable
- System Installation and Operation Manual
- RX904 Wireless Receiver installation notes
- T5000E User Guide
- ZoneMaster User Guide

In addition to the above items, you will need 2 AAA batteries for the wireless throttle, about 3 feet of test track, a bit of hookup wire and a locomotive equipped with a DCC compatible decoder.

Temporary System Hookup To Test Track
We strongly suggest that you first hookup the system to a separate section of test track. Once you have used the system and checked it out thoroughly, you can begin permanent installation knowing that everything is working properly. Each part of the Extended Starter System will be described along with any special notes. Additional system features, not necessary for a temporary hookup are described in later sections. The hookup diagram on the next page shows all of the components of the extended system and how they connect together.

AC Wall Transformer For Command Station
When connecting the plug from the small wall transformer to the Command Station's AC jack, be sure to push it in as far as it will go. The plug's black plastic strain-relief will be flush to the jack when properly inserted.

The small jack is fragile and can be easily damaged. Always pull the plug straight out.

Caution: The standard CVP 12VAC transformer is rated for 110VAC input only.

Modular Cable Between Command Station and ZoneMaster Booster
The modular cable connects between the Command Station'S "Boosters" jack and the ZoneMaster booster jack labeled DCC DATA BUS. You may use either one of the two data bus jacks. Don't use the OPTO input jack.

Do not accidentally plug the cable into the wrong Command Station socket.

When plugging the cable into the socket, do not force it. The plug will insert easily and lock with an audible click. To release the plug, push down on the plug's little plastic tab and gently pull the cable out of the socket.

Wireless Starter System - Simplified Hookup Diagram

12VAC Transformer

Command Station Rear View

Power Supply DCPS120

12VAC Transformer

Modular Cable

Modular Cable

Booster

ZONEMASTER™ - SINGLE

Temporary Test Track

12VAC Transformer

Temporary Programming Track

Flexible Antenna

DIGITAL WIRELESS RECEIVER RX904

RX904 Receiver

Receiver Setup Switch Settings

ON

1 2 3 4 5 6 7 8

Set the switches so they are like the picture to the left. All of the white actuators are down except #6 which is up.

T5000
CYP55A.COM

LOCO **1234**
SPEED **000**
FFOC .01

T5000E Wireless Throttle
Be sure to install two AAA batteries before using.

DCPS120 Booster Power Supply

The DCPS120 power supply has a universal AC input. It can use an AC line voltage that ranges from a low of about 100V up to a maximum of about 240 volts.

Before using the power supply, set the voltage selector switch to the far left, at the 15V setting. This is the best setting for N, HO, S and O scale locomotives. This setting allows the decoder to drive the motor with about the same voltage as a standard power pack.

Caution: Only use the CVP DCPS120 power supply for the ZoneMasters. Using any other type of power supply will void the warranty and likely damage the booster.

ZoneMaster Booster

The power supply's output cable is thick and heavy and exerts a lot of force on the ZoneMaster input power jack. Be careful not to allow the cable to dangle unsupported from the ZoneMaster input power jack.

The Track Output terminal is actually a plug and it can be easily pulled out to make hookup easier. Connect the test track to the output terminal using solid or stranded wire. Small diameter wire is OK for the temporary test track.

Command Station Programming Track

The final two connections hookup up the programming track to the Command Station. This is not necessary for the temporary checkout unless you want to play with decoder programming. Small diameter wire is OK since only one locomotive at a time can use the programming track.

Wireless Receiver Power Transformer

Connect the 2nd 12VAC transformer to the power input jack of the Wireless Receiver.

Wireless Receiver To Command Station Modular Cable

You must use the gray modular cable supplied with the Wireless Receiver to connect it to the Command Station. There are other options for connection, but for now, this is the simplest to explain and use. Plug one end of the modular cable into the socket labeled TBUS and the other end into the Wireless Receiver's modular jack.
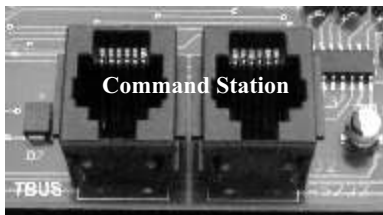
Do not accidentally plug the cable into the wrong Command Station socket.

When plugging the cable into the socket, do not force it. The plug will insert easily and lock with an audible click. To release the plug, push down on the plug's little plastic tab and gently pull the cable out of the socket.

Wireless Receiver Setup Switches

There are 8 small slide switches on the Wireless Receiver's front panel. These switches are used to select the various receiver options. For the simplified test hookup, make sure that switch number 6's small white actuator is pushed firmly up to the ON position. Make sure all the other switches are down in the off position. The switches must be set before power is applied.
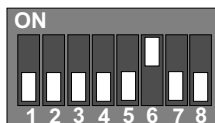
Install Batteries Into T5000E Throttle
The illustration below is from the T5000E User Guide. Make sure the batteries are oriented correctly.

Place Decoder Equipped Locomotive On Test Track
Make sure all wheels are on the rails. If not, there could be a short when power is first applied and the booster short circuit alarm will sound.

Turn On The Power
Turn on power to all parts of the system. Watch the Command Station's LCD display for the startup messages. As soon as the startup messages are completed, you will see the standard default display, called the home page.

```
V6xx  T=00   M=255
A=————    B=————
```

Rotate the LCD CONTRAST control to obtain the best looking display. Use this control to improve the contrast between the letters and the background.

Check the ZoneMaster and its indicators. The ZoneMaster GP indicator will be on. The GP's green indicator signifies that it is properly connected to the Command Station. The yellow LED indicates power is being supplied by the DCPS120. The DCPS120 green power indicator will also be on. Check the RX904 wireless receiver indicators. The green ST light will be randomly flashing which shows it is talking to the Command Station. If you have not yet done so, turn on the T5000E throttle. Notice the green GP indicator is on. This shows that the throttle and receiver are working properly.

Finally, look at the Command Station's display. It should look like the one to the right. Notice that T=1 which means there is one active throttle, your wireless throttle. Also notice that M=254 which means that one locomotive memory slot has now been used. There are 254 slots remaining. The built-in throttles, A and B are not in use.

```
V6xx  T=01   M=254
A=————    B=————
```

Locomotive Decoder Address
Each locomotive must have a DCC compatible decoder installed. Each locomotive must have a different "address." The loco address is just like the address of your house - it is unique. If you purchased a locomotive with a factory installed decoder, the manufacturer will usually program the locomotive address to the locomotive's cab number. If you purchased a decoder separately then it will usually be on the default address of 3.

**Controlling The Locomotive With The T5000E Wireless Throttle**

To control the locomotive, the throttle must be assigned to the locomotive address. The following instructions are from the T5000E User Guide. Refer to that guide for more features and options for your throttle including the meaning for the other symbols showing on the display. For now, only the address entry procedure will be shown.

If you know your locomotive address is still 3, then you'll find that the factory setting for a new throttle is also 3. But for this example, let's say you have a locomotive with factory programmed address of 1234. If you know your locomotive to be on a different address, then use that address instead. All of the keystrokes below are done on the throttle and all entries will be visible on the throttle's display.

Step 1: Push the # key. This brings up the locomotive address entry page. If you wish to cancel, with no changes, push the * key.

Step 2: Key in the numbers of the locomotive decoder which is 1234 for this example. Leading zeroes are not required. The display will show each number as it is pressed, with previous numbers moving to the left. If you make a mistake, just push the * key and start over. At any time, you can cancel the entry by pushing the * key without making any changes.
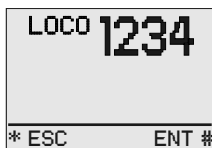
Step 3: Push the # key again to tell the throttle to use the address showing on the display. The speed display appears with dashes, followed by 000. Wait until you see the zeroes before doing anything further.

Speed control is with the big knob**.** Turn the knob clockwise to increase the speed of the locomotive. Turn the knob counter-clockwise to decrease the speed. The speed control is a continuously turning rotary encoder. But, unlike some speed controllers, it does not use a center-off position. Turning the speed control clockwise, increases speed until the maximum value is reached. Turning the control counterclockwise, decreases speed until the minimum value is reached.

Direction control is a push switch built into the speed knob. Push down on the speed knob's top and release it to change directions. Notice the direction arrow changes.

The right facing direction arrow does not indicate the physical direction of the locomotive's movement. Instead, a right facing direction arrow indicates FORWARD relative to the locomotive's cab. A left facing direction arrow indicates REVERSE direction, relative to the cab.

That's all there is to it. You are now operating your locomotive with EASY**DCC** and a wireless throttle. There are many more options and features for your wireless throttle and your Command Station. See the wireless throttle user guide for details. And turn the page and start exploring the Command Station features and capabilities in the remainder of this manual.

Permanent Mounting, Hookup and Wiring Recommendations

Before You Begin - Modular Cables Are Not All The Same

EasyDCC uses regular telephone style 6 conductor modular cables. These are inexpensive, easy to build yourself and readily available. CVP Products offers custom lengths of cable with or without modular plugs attached. See the price sheet for details. Also, Radio Shack sells several lengths of 6 conductor modular cables with plugs already attached. Home Depot and similar large hardware stores sell modular telephone cable in their electrical wiring department.

Two Types Of Modular Cables

The first type is the standard *telco* modular cable sold for telephone applications. We call this Telco cable. You must use this type of cable for connections between the Command Station and wireless receivers and Extenders. It can also be used with ZoneMaster boosters but this is not mandatory. This type of cable is what's included with the Extender and the Wireless Receiver.

The second type is modular *data* cable sold for use in creating local area networks. It cannot be used to make connections between the Command Station, Extender or Wireless Receiver. However, it is OK for use with ZoneMaster boosters.

Proper Polarization Mandatory

When building your own cables, be sure to polarize the plugs properly. The illustration shows an easy way to remember the proper orientation for *telco* style cables – everything UP. The cable's molding ridge is easily seen running down the center of the cable. Just make sure to have it face up along with the tabs on the two plugs.

If making data cables, the tab is up on one end and down on the other end, relative to the cable's molding ridge.

Cable making is easy when the correct tool, plugs and modular cable are used. Modular cable may be constructed with either solid wire or stranded wire for the individual conductors and the correct plug must be used to insure a reliable connection. Do not use a plug designed for stranded wire on solid conductor modular cable.

Modular Cable Supplies

Item	Radio Shack Stock #	Mouser Stock #
6 conductor crimp plug (for stranded type)	279-421	154-UL6236
6 conductor cable (stranded type)	278-874	n/a
Crimp tool (for attaching plug to cable)	279-405	n/a

Telco Cable and Plug Orientation

Tab   Tab

Molding Ridge On top

Molding Ridge

Tab

Data Cable and Plug Orientation

Tab

Molding Ridge On top

Tab
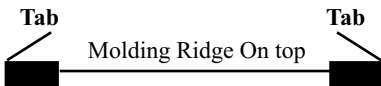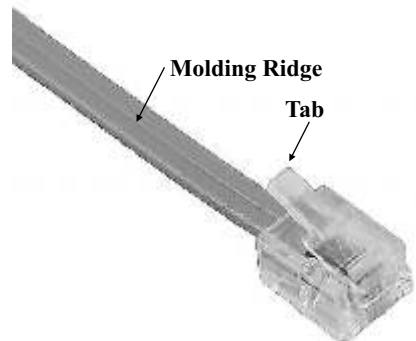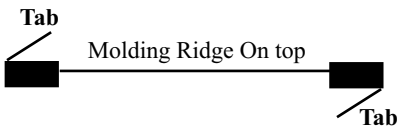
Warning
Do not use 4-conductor modular cables and plugs. Doing so will damage 6-conductor modular connectors. The repair charges are not covered by warranty.

Grounding The Command Station Faceplate

Static electricity, coupled into your EasyDCC System, can result in erratic operation. If you have ever notices that the moment you touch the faceplate or sometimes a plug-in throttle fascia plate, the Command Station resets, freezes or sometimes has odd characters on the display, that is the result of a static electricity discharge.

In many cases, this only occurs during certain times of the year. In other cases it occurs all the time due to carpeting and air conditioning.

Regardless of the cause we suggest that you ground the Command Station's faceplate to earth ground. This usually means running a wire between the Command Station and a metal cold water pipe or other known good earth ground.

The best location to attach the earth ground is located on the Command Station's circuit board. In the lower right corner (looking at the back of the command station) is a nut that fastens the circuit board to the metal standoff (white circle). The hole for the metal standoff is plated and connects to the ground of the Command Station power supply.

Create a loop of wire, #18AWG or #20AWG. Loosen the nut, place the wire under the nut and then tighten. The other end of the wire goes to your earth ground. A spade lug attached to a loop of wire makes for a neat and professional connection. However you make the connection, be sure and tighten the nut securely. A loose connection will not help.

With an earth ground connection, the problems with static discharges into your EasyDCC System are greatly reduced. However, it isn't perfect and on really dry days, when you can draw an inch long arc between your finger and a door knob, your system could still be impacted. If this happens, just hit the Command Station reset button to clear the fault and restart the system.
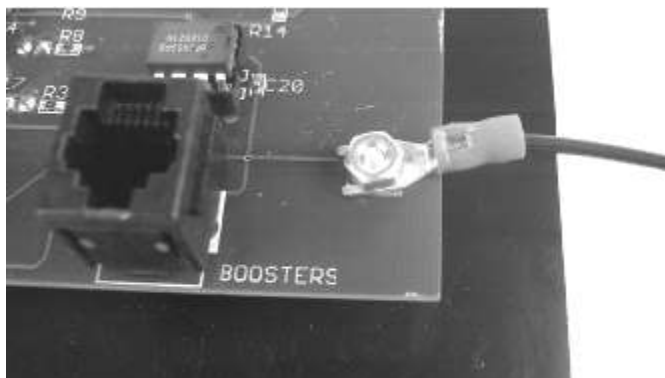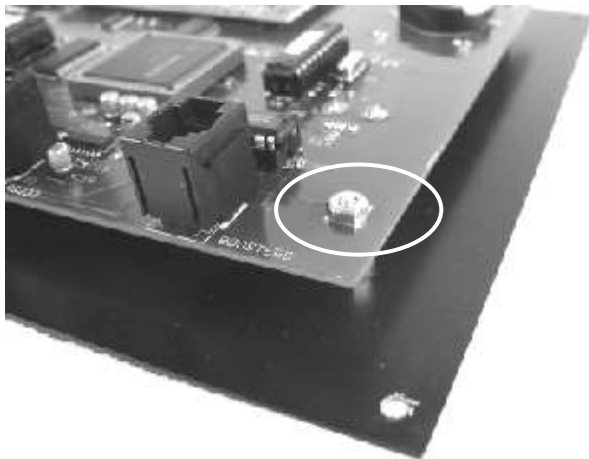
The Command Station is designed for flush mounting to the side of your layout or it may be mounted into a drawer. When not in use, the drawer is closed. Either method is OK since the Command Station creates very little heat.

The 3 corner holes in the faceplate are sized for #4 pan head screws.

Cutout Dimensions

Use the dimensions shown to insure proper clearance for drawer and flush mounted Command Station plate. The right hand 2 inch clearance allows the wall transformers plug to go into the AC jack on the Command Station. The AC socket is fragile; don't pull on it.

Allow about 3 inches clearance behind the Command Station for modular cables to enter and exit. Do not allow metallic objects to touch the circuit board.

Use cable ties to fasten all cables out of the way to avoid snagging them when you work under the layout. Snagged cables are a sure way to damage the Command Station's modular jacks or the fragile AC jack.

9 inches

8 inches

7 inches

6 inches

Cutout

Faceplate
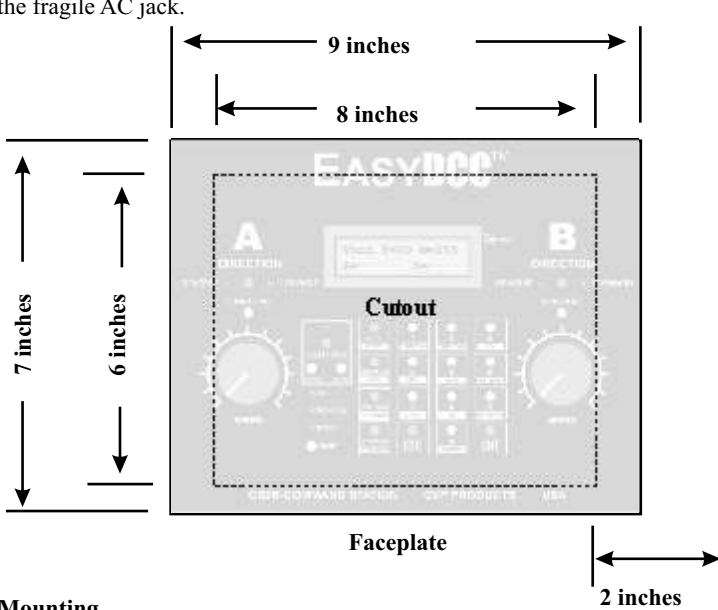
2 inches

Drawer Mounting

Allow about 2 inches above the Command Station to clear the knobs. Drill a 1 inch hole to allow cables to enter drawer. Allow about 3 inches underneath the Command Station to clear cables and jacks. Use cable ties and clamps to fasten cables to bottom of drawer. Also add clamps and ties to fasten all cables out of the way to avoid snagging them when you work under the layout. To allow for drawer travel, loop the cables behind the drawer. Do not stretch or pull cables or damage will result.

Tie

Clamp

Drawer Front
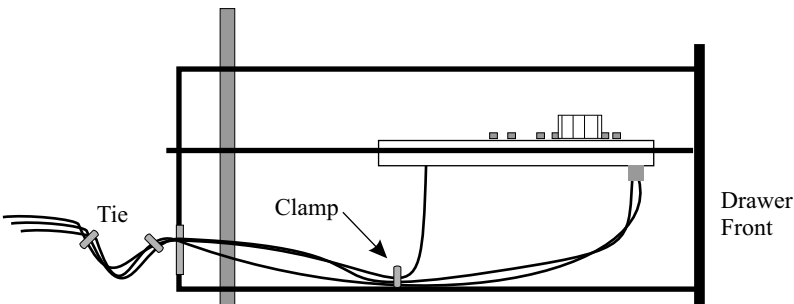
The programming track is nothing more than an isolated and electrically insulated section of track. We recommend you use a piece of flex track mounted in a convenient location near the Command Station.

Use #18 gauge wire to make the connection between the Programming Track terminals and the track. Solder the wire to the track. Limit the wire length to no more than about 5 feet.

Locomotives depend on their wheels and clean track in order for programming commands to reach the decoder. Keep the track clean. Keep locomotive wheels clean.

Only one locomotive can use the programming track at a time. Therefore the track can be as short as your longest locomotive.

Programming Track Is Not For Running Locomotives

The programming track cannot be used to run locomotives. It is only used to program decoders. Except during locomotive programming, the programming track is dead.

When not in use, keep metal objects away from the programming track. Although it is dead when not being used, it should be kept clear of anything that might accidentally short it out.

Sound Decoders - Using A Programming Track Booster

Your Command Station can program any NMRA-DCC compliant decoder. However, a sound decoder has a unique and troublesome characteristic - it consumes a huge amount of current when power is first applied. Because of this, attempting to verify or "read" what is programmed into a sound decoder can be a problem.

Add A Programming Track Booster. One of the best solutions to this problem is to add a programming track booster. We recommend the PTB-100 available from SoundTraxx. Once added, most sound decoders can be programmed and verified without difficulty.

Hooking Up The PTB-100 Programming Track Booster. <u>Do not</u> connect the PTB-100 to the Command Station's 12VAC transformer. You must use an additional transformer. We recommend our inexpensive 12NVT transformer. It has a 12VAC output rated at 1 Amp; more than sufficient power for the PTB-100. If the PTB-100 wires are too short, splice in some extra wire. Be sure to insulate the splice with heatshrink tubing. The yellow wires connect to the Command Station's Programming Track terminals and the orange wires connect to the programming track. For more information on the PTB-100, see the accompanying manual and/or download a copy from the SoundTraxx website.
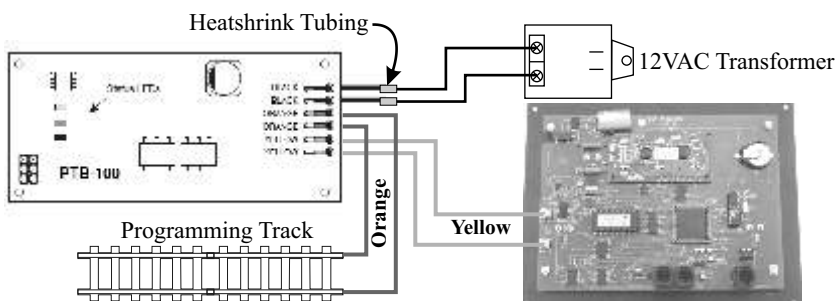
Separate Programming Track

We strongly recommend keeping the programming track physically separate from the mainline. Accidentally bridging across gaps between the programming track and the mainline track will damage the Command Station.

Mounting and Hookup Of The Throttle Bus Extender

If your system is using plug-in throttles, an Extender is used. This section can be skipped if an Extender and/or coaxial throttle bus is not being used.

The Throttle Bus Extender circuit board, called an Extender for short, is used to drive coaxial cable, called the TBUS, used by the plug-in throttle. You may also plug wireless Receivers into the throttle bus.

The Extender is capable of driving about 100 feet of coaxial cable. The actual limit will be based on the number of "breaks" in the cable (the point where a fascia plate is connected) and actual distance between the Extender and the last plug-in throttle. If the Extender is only used to connect to a wireless Receiver, the cable length may be increased to a total of 150 feet.

It is common for large layouts to use multiple Extenders. The hookup of multiple Extenders is in the next section.

Mounting Considerations

CVP's Extender is designed to mount under the layout near the Command Station. Do not allow any metal objects to contact the circuit board or connectors.

Never allow the circuit board bottom or the heatsink fins to contact metal. The heatsinks become warm during normal operation. Keep them away from plastic and metal. Always leave sufficient room around the heatsink fins for air circulation. A small piece of plywood or masonite may be used as a base. Use wood screws, threaded mounting posts, or nuts and bolts to attach the Extender to the base.

AC Power for the Extender

The Extender requires a source of 12VAC at about 1A. CVP's offers 12VAC transformer rated at 1.5 Amps which is perfect for the task. This same transformer also provides power to plug-in throttles connected to the TBUS. You may use our transformer or your own. For best operation, attach the Extender transformer to the same plug strip used for the Command Station transformer. Do not attempt to use the Command Station's AC power transformer to power the Extender - it is too small for the job.

Don't use this mounting hole

TBUS Modular Jack

Telco Modular Cable 7 feet maximum

12VAC Transformer 1A or Greater Rating   **Extender**
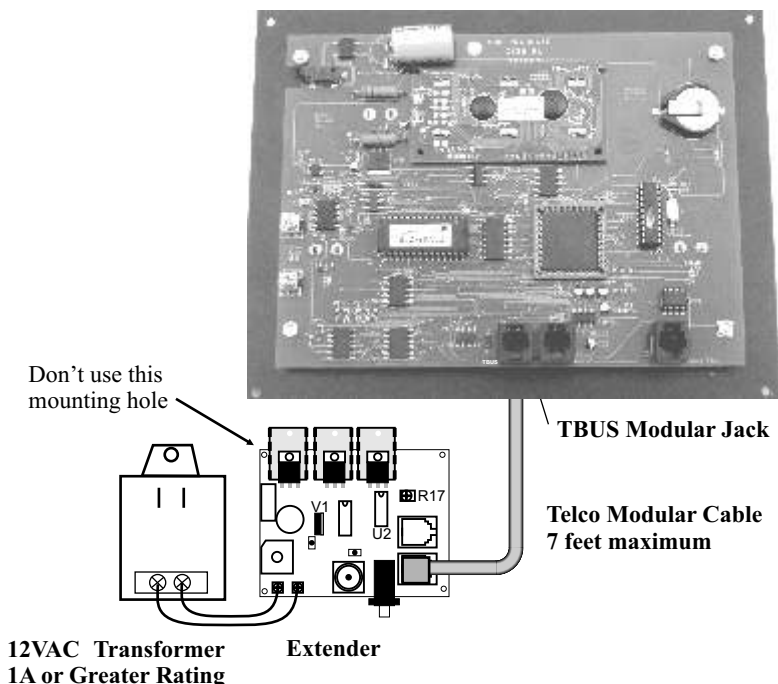
Extender to Command Station Link

You must use the standard 7-ft telco style modular cable the comes with the Extender. The Extender must not be any further than 7 feet from the Command Station.

Extender Indicators and Their Meaning

There are two LED indicators on the Extender. The Green LED shows the presence of AC power. The red LED indicates the presence of a short somewhere out in the coaxial cable. Do not attempt to operate throttles until the short circuit is cleared. The Extender is protected against short circuits and overloads.

Connecting The Extender's Coax Cable Socket

The Extender has a conventional "F-Jack" which connects to the coaxial cable. This jack is the same style as found on TV cable. The black socket next to the jack is used when checking plug-in throttles. However, once your coaxial cable throttle bus is installed, it is usually not used.

Static Electricity Protection

If your layout has carpeting, you must connect the throttle bus coaxial cable ground to a solid earth ground. A water pipe is a good ground. The ground allows any static electricity to be conducted to ground and not through the Command Station electronics. Use a length of wire to connect any one of the fascia plates ground to the water pipe.

Using Twist-On F-Connectors

All the fascia plates should be connected in daisy-chain fashion back to the throttle extender board using coaxial cable. For throttles buses less than 100 feet, use RG58/59 coaxial cable. This cable is readily available and fits the twist-on connectors in the kit. Use RG6 cable for longer runs. RG6 twist-ons are available from electronic supply stores. Minimize the length of the cable run.

For extremely long runs, we strongly suggest the use of additional throttle extender boards.

If you don't want to use the EasyDCC fascia plates, you can substitute standard 2-conductor headphone jacks. Their only disadvantage is the need to solder coax directly to the jack. Their use is described later in this section.

Using The Twist-On Coax Connectors

1. Strip Outer Insulation - Do not cut braid

1 inch
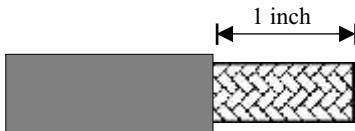
2. Push wire braid back over the outer insulation

1 inch
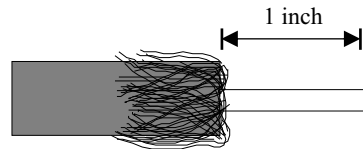
3. Strip inner conductor insulation back
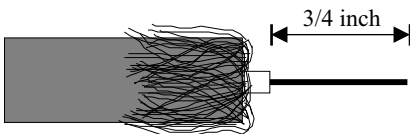
3/4 inch

4. Twist connector clockwise onto shield until tight

Twist-On F-connector
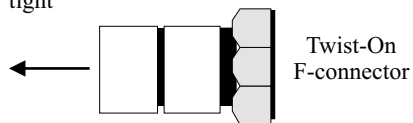
5. Trim center conductor to extend about ¼ inch
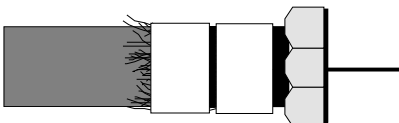
Make sure the center conductor does not touch the connector shell in any way. Also make sure no small slivers of braid are touching the center conductor.

Building and Installing Fascia Plates

Building The Fascia Plate Kit

1. Unpack the kit and inventory the items.

    2 - headphone jacks, 2 nuts, 2 washers

    2 - F-type jacks

    2 - Twist on cable connectors

    1 - Metal face plate

    1 - Circuit board
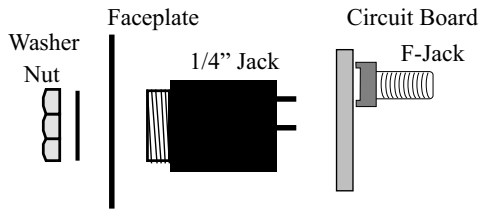
2. Remove and discard the nut and washer from the F-type jacks.

3. Insert the F-type jack into the back side of the circuit board. The word back should be on the same side as the threads. Solder the connector. Be sure to solder all four tabs as well as the center pin. Solder the second F jack to the board.

4. Insert the headphone jack into the front side of the board. The jack must be oriented properly or it will not fit the slots. Solder each jack.

5. Be sure board is oriented properly. The side marked "Toward Plate" must face the back of the black face plate. Attach the face plate to the headphone jacks using the large washers and nuts. Place the washer on the front of the plate and then the nut.

Do-It-Yourself Jacks

There is nothing special about the CVP fascia plate circuit board or jacks. We designed the fascia plate kit to simplify connections and eliminate soldering coax cable directly to jacks. Some EasyDCC users have asked if they could save a couple of dollars and build their own fascia plate with hand wired jacks. The answer is yes.

Any two conductor 1/4 inch phone jack can be used. However, it cannot be a stereo (3 conductor jack. Also make sure you have correctly identified the tip (signal) and ring (ground) lugs of the jack. If you accidentally switch the two, you will damage your plug-in throttle. Double check your wiring on all jacks. The tedium of soldering lots of jacks can lead to carelessness. Jacks can be purchased at Mouser Electronics or other similar mail-order electronic parts suppliers.
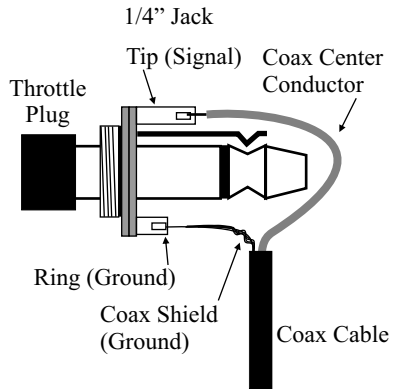
The drawing shows how to identify the plug's conductors and match to the jack's terminals. Some brands of jacks have the same size lug for both ground and signal. Check very carefully so that the tip and ring are connected to the proper location on the cable. Be very careful to attach the shield and center conductor to the proper lugs on ALL jacks. It is very easy to wire one jack backwards during installation and not realize this has happened. The moment the throttle is plugged into the reverse-wired jack, the throttle will be severely damaged and must be returned to the factory for repair.

After installation, take one last look at the coax cable near the jack and verify that the shield wire, which is the ground wire, is not shorted to the center conductor. This is easy to overlook and will result in a short on the TBUS.

22

Installing The TBUS Coax Cable

The throttle bus - called the TBUS - must be in the form of a single linear run of cable. Do not create any T's or Y's unless they are less than 12 inches long.

Never use any cable-TV splitters or similar accessories. They won't work and may damage the Extender

Coaxial Cable RG58 or RG59

Extender

Terminator Resistor

First Plate   Second Plate   Last Plate
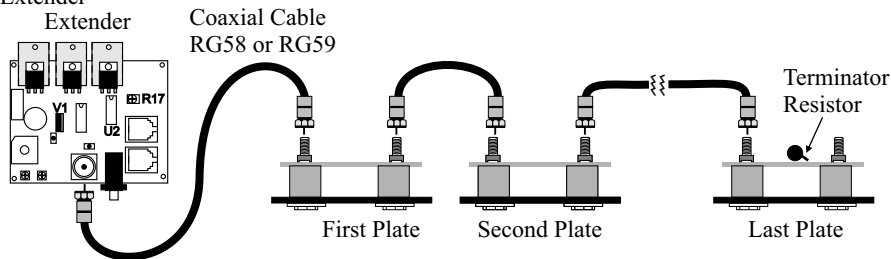
OK - No T's or Y's   **Not Allowed**

1st Plate

Last Plate

"Y"

"T"
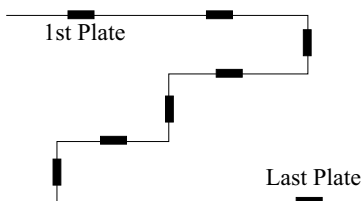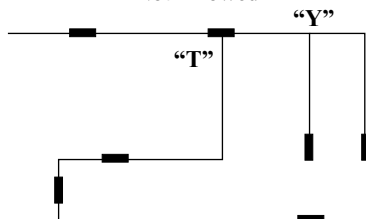
Terminator Resistor

At the end of the cable run, attach the 75 ohm terminator resistor that came with the Extender. The easiest location to put the resistors is on the last fascia plate circuit board.

Note: *Do not use the terminator resistor if you are using the Wireless Receiver at the end of the line. It has a built in terminator which may be switched on. For more information, see the RX904 Wireless Receiver instruction booklet .*

Attaching the terminator to the last plate at the end of the bus run is easy. This resistor is included with your extender board. Solder the resistor at the location shown. Use the hole for one lead and solder the other lead to the trace. Use plenty of solder Make sure leads are firmly soldered to the traces. Note: the terminating resistor is hot to the touch which is normal.

Throttle Bus Testing

Attach the modular cable to the Command Station Throttle Jack and connect to the input jack on the Extender. Apply power. The green LED will be on and the red LED will be off. If the red LED is ON, you have a short circuit in your TBUS wiring. Check and correct before proceeding.

Finding Throttle Bus Shorts

Starting at the far end of the cable run, disconnect the fascia plate from the bus cable and check the red LED. If it's still on, reconnect the cable and move to the next plate. Work backwards toward the extender board, disconnecting each section of cable until the red LED turns off. Once it does, you should be holding the cable with the problem. Redo the twist-on connector at each end since it's the most likely cause of the problem.

Back of Fascia Circuit Board

75 ohm Terminator Resistor

BACK FB2

TBUS Ground
Connect to earth ground for static protection

TBUS Signal

23
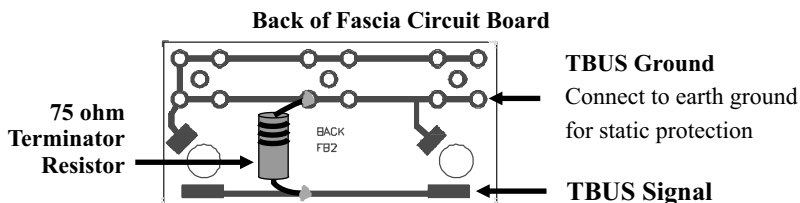
Wireless Receiver Installation Considerations

For complete details on setup options and operation, please see the XF-Series Wireless Receiver Installation Instruction booklet that comes with the receiver. For wireless throttle operation information, please see the appropriate wireless throttle user guide.

Simplest Hookup - Direct To Command Station

This is the simplest and most basic hookup of the wireless receiver. It connects directly to the Command Station's TBUS modular jack with the included 7 foot modular telco cable. The absolute maximum length of the modular cable is 14 feet. Exceeding this range can result in poor receiver performance or simply no operation of the receiver. **Do not** use a "data" style modular cable. It will not work.

Command Station

rear view

Modular Cable "Telco" Style
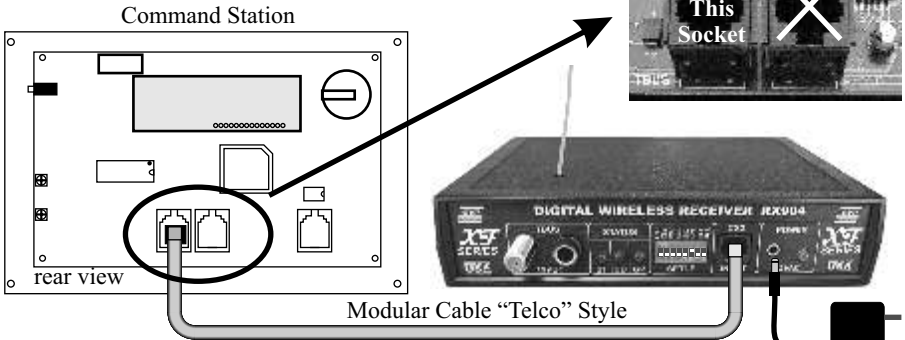
Adding Receiver At Extender's Modular Jack "Output"

12VAC Transformer

This is another simple setup in which the modular telco cable plugs into the Extender's modular cable jack labeled OUTPUT. This is a common hookup where you already have an Extender in use for plug-in throttles and want to add a receiver **next to** the Command Station.

The same modular cable limitation had to be met as with a direct hookup to the Command Stations. The absolute maximum length of the modular cable is 14 feet. The length is the sum of the modular cable between the Extender and the Command Station, plus the length of modular cable between the Extender and the Receiver. Exceeding this range can result in poor receiver performance or simply no operation of the receiver. Do not use a "data" style modular cable. It will not work. The receiver's power supply is the included 12VAC transformer.

Command Station

Modular Cable "Telco" Style

12VAC Transformer

Extender

ON
1 2 3 4 5 6 7 8
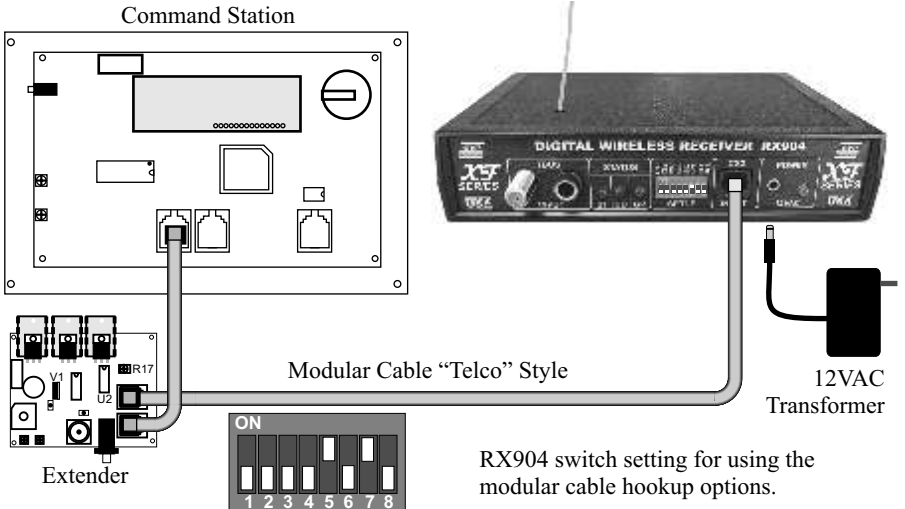
RX904 switch setting for using the modular cable hookup options.

Using The TBUS - No Length Limits and Better Receiver Performance

While using the modular jack is a perfectly acceptable installation, receiver placement is limited to no more than 14 feet from the Command Station. However, finding the best receiver performance location is easier if the coaxial TBUS cable is used. Using the coax cable TBUS instead of modular allows placement of the receiver almost anywhere. The next hookup diagram shows te receiver connected somewhere along the coaxial TBUS.

If the receiver is close to an existing plug-in throttle fascia plate, just solder a 3rd F-Jack into the holes on the circuit board. F-jacks can be purchased from CVP Products. The receiver must not be at the end of the coax run. If its at the end of the run, see the next section.

If the desired location is further than a few feet from an existing fascia plate, install a Fascia-Tee board, also available from CVP. This is nothing more than a fascia circuit board without the 1/4 inch throttle jacks. Cut the TBUS coax cable, attach twist-on connectors and connect them to the Fascia Tee board. The maximum length for the coax from the T-board to the receiver is about 3 feet. Any longer and the signal becomes distorted and unusable by the Command Station. In the illustrations below, the 12VAC transformer is not shown.

Added F-Jack

Max length is 3 feet

Existing Fascia Plate

New Fascia-Tee Board

Max length is 3 feet
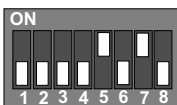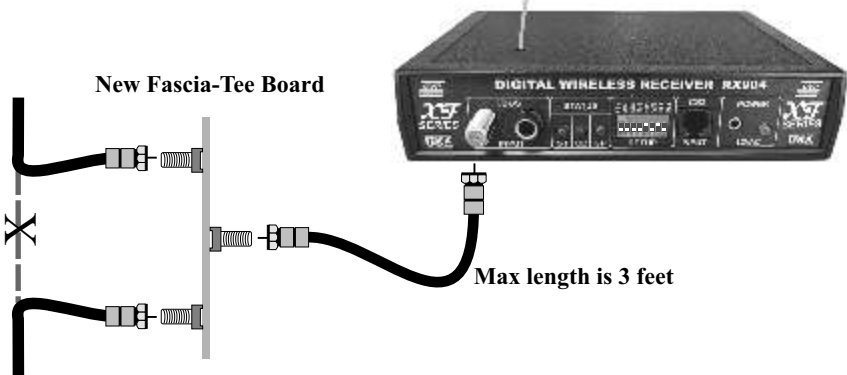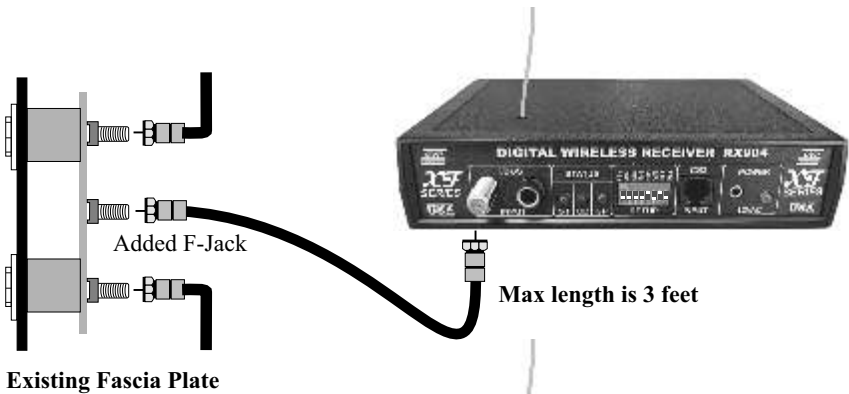
RX904 switch setting for using the TBUS jack with receiver not at the end of the coax TBUS. Switch number 8 is OFF.

Adding A Wireless Receiver At The End of the TBUS Coax Cable Run

This hookup diagram is for use when the wireless receiver is at the end of the TBUS coaxial cable run.

For this hookup, if you have already installed the 75 ohm terminating resistor soldered to the last fascia plate, it needs to be removed. The wireless receiver includes a 75 ohm resistor which can be turned on with switch 8.

Once the old terminating resistor has been removed, attach the coax cable to the fascia-plate F-jack and the F-jack on the receiver. The overall length of the entire length of coax should be no more than about 100 feet for RG58 or RG59 coax. If you have used RG6, the total overall length can be twice as long.

12VAC Transformer

Last fascia plate and
end of coax cable run
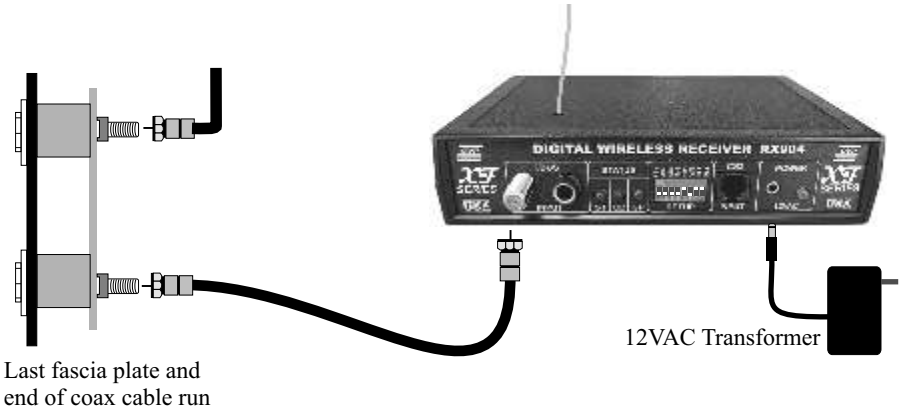
RX904 switch setting for using the TBUS jack with receiver at the end of the coax TBUS. The terminator switch #8 is **ON.**

WARNING

Never use any type of inline amplifier, TV splitter or TV "Y" adapters.
They will not work and may damage the Extender.

Wireless Receiver Placement Considerations

Every layout environment is different. Therefore we recommend an extended period of trial and error receiver placement.

Keep all material and objects away from the receiver's antenna, especially metallic objects.

Human bodies will affect reception patterns and absorb radio energy. Consider experimenting with receiver location when the normal number of operators are present.

Higher is generally better. Rafter installations, especially in basements, seem to be better than the floor. But we've also had a report that lower is better; you should always try both.

Keep it away from areas of high concentrations of throttles. Pick a spot away from an area that will have a heavy concentration of wireless throttles. A nearby wireless throttle can swamp out the receiver preventing a distant throttle from being heard.

Use the lowest throttle power setting possible. For T5000E throttles that tend to stay in one area and that near the receiver, use a lower power level.

Always test multiple locations. To test a location, temporarily set the receiver the test location. Then walk the layout with a SINGLE throttle that is set for a decoder with a good loud horn or whistle. Push the F2 key to sound the horn. If you can hear the horn responding to F2 commands no matter where you are on the layout, you've found a fairly good spot for the receiver.

A new location can be as close as 1 foot. In many cases a move of less than 1 foot in any direction, can make a dramatic difference in reception. After a weak area has been identified, move the receiver towards the weaker area. If you find a chronic weak area, consider adding a second receiver to provide additional coverage in the weak area.

AC lamp dimmers can sometimes jam a receiver. These devices emit a broad spectrum of interfering radio signals and can sometimes jam the receiver. If you have a lighting system like this, consider not using it or equipping it with UL approved line filters.

Keep the receiver antenna away from fluorescent lights.

Train your operators to recognize when the receiver has lost contact or "dropped" the wireless throttle. The command station can not tell the difference between a "dropped wireless throttle" or a wireless throttle that has been turned off. The locomotive either keeps moving or it never starts moving because the receiver can not "hear" the wireless throttle. This can cause some interesting problems if your operators are not trained. Here's an example:

> Assume the operator has just stopped the train for a red signal. The signal clears and the operator sets the speed control to the 11:00 position but the train doesn't move. What do 99.9% of the people do at this point? That's right - they turn the speed control higher! Wrong thing to do! The moment they shift their physical position a few inches, the receiver will pick up their signal, and the train roars off at high speed! A trained operator leaves the speed control alone and just moves his body position by a foot or so. In almost all cases, the receiver will see the signal. Just like your cell phone, if you are experiencing a large number of dropped commands from wireless throttles, you should add additional wireless receivers to improve reception.

Don't use surplus power supplies, especially the high-tech switching supplies are appearing on many railroads. These supplies tend to be very inexpensive for the amount of power they provide. However, these surplus supplies also emit a broad spectrum of interference and can sometimes jam one or more of the wireless throttle's frequencies. Try turning off the power supply to check if it is the cause of interference. If it is, the power supply should be replaced.

Beware of other non-railroad wireless equipment that could jam a receiver. The EasyDCC throttles and receivers operate in an unlicenced band shared by many other wireless systems. These systems can and do create jamming interference which can make some frequencies unusable. Examples include wireless devices attached to computers, TV remote controls, cordless telephones, wireless alarm systems, baby monitors, personal communication devices, lawn sprinkler and outdoor lighting controllers, cordless light switches, toys/games, wireless headphones and speakers. The list grows longer every Christmas season.

Track Wiring Considerations

The wiring of layouts using EasyDCC is no different than with conventional power packs. As long as your locomotive can traverse the layout without encountering any shorts, your EasyDCC system will work just fine.

Booster Placement

If you only have one booster, placement can be anywhere. However, if you have a large layout with multiple boosters, place the booster near the center of the area to be powered.

Track Wiring

Bus wires should be run underneath the track to be powered. Use #14 AWG wire or larger. Stranded or solid does not matter although stranded bus wire is a little easier to handle. Feeders between bus and track should be #18 or #20 AWG and attached every few feet.

Use at least #12 AWG for large scales such as O-gauge and LGB. #12 should be considered the minimum size for the bus and #16-#18 should be used for feeders.

Power Zones and Rail Gaps

Adding extra boosters makes operation much easier in areas we call "center's of operation" such as towns, yards, staging areas or complex industrial switching areas. Each booster is isolated from adjacent boosters by gapping both rails in a convenient and logical location. Additional suggestions for power zones and blocking can be found later in this section.

Proper Stripping Tool Makes Wiring Easier

A split jaw wire stripping tool makes mid-wire connections easy. Any large hardware store will carry the stripper in their electical wiring department. The image is of the one obtained at Lowes Hardware : Gardner Bender Automatic Wire Stripper: Stock # 76050, Model: SE-92, about $15.

This tool has two pairs of jaws controlled by one handle. With the jaws open, you can place the tool anywhere on a continuous run of cable. Then squeeze the handles and watch what happens. The first set of jaws closes on the wire to hold it firmly. The second set of jaws closes around the wire and as you squeeze the handles, gently strips the insulation back leaving a section of bare wire. Attach the feeder to the wire and you are done.

Solder Feeders To Track Sections

Model railroad sectional or flex track is not a good conductor of electricity. Using rail joiners to electrically connect track sections is asking for trouble. We recommend that each section of flex track be given its own feed. For short pieces, consider soldering the rails together.

Use only fresh rosin core solder. Old solder may not have any flux remaining (the rosin) making it very difficult to solder with. Never use acid core solder - it will damage wiring and electronics.
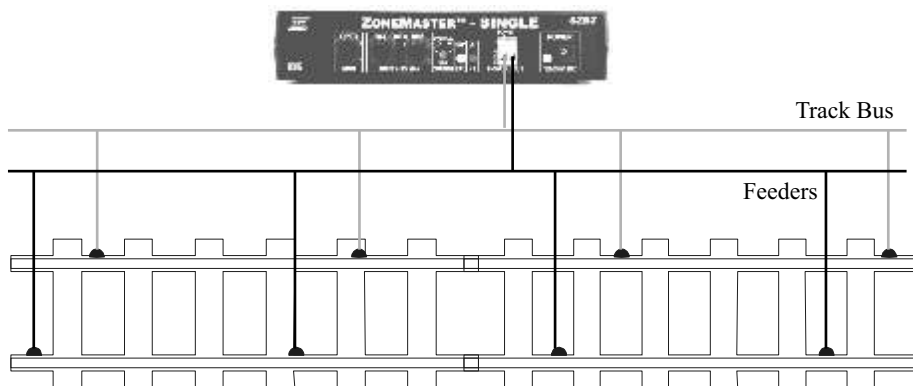
Quick Check For Adequate Wiring

Go to the furthest point on the track and wiring from the booster. Use a clip lead or metal tool to short out the track. If wiring is adequate, the ZoneMaster Booster fault indicator will light up and the buzzer will sound. If the wiring is inadequate, the fault protection circuits will not work properly. Improve the wiring and or add more feeders and test again.

Use Different Colors of Wire

Rail polarity is important so use different colors of wire - the brighter the better. If you have reversing sections, consider wiring them with a third color. You might remember next week where the wires are going, but what about in 5 years?

Using Multiple Boosters

When to add more boosters is up to you. By breaking the layout into multiple power blocks, each with its own booster, a problem in one power block will not affect other power blocks. Derailments and resultant shorts will not shutdown the entire railroad. We suggest creating separate power blocks in areas where operation is concentrated. These areas include yards, staging tracks, large towns, and large industrial areas. You can also use regions as block boundaries. Regions can be the "west wall", center peninsula, or levels.

Avoid creating large blocks where the entire block is not visible during normal operation. A good example of this is single block serving a peninsula with a tall center divider. A derailment on one side shuts down the opposite side. This leaves the operator scratching his head looking for the problem on his side of the divider when in fact it is on the opposite side.

Creating Power Zones or Blocks

Gap both rails at each end of the power block.. Don't forget to also cut gaps in the large power buses feeding the block. Do not parallel booster outputs – this is not allowed and may damage the booster.

Booster Outputs Must Be Connected Properly

Be sure to properly "phase" booster outputs. This will allow locomotives to cross gaps without shorting out the boosters. Adopt the methodology of having the left terminal connect to a specific rail or bus wire (outside, left, etc) and the right terminal connected to the other rail or bus wire.

Connecting Command Station to Boosters - Small Layouts

Connect the Command Station's "BOOSTERS" jack to the first booster using modular telco cable. Connect another modular cable from the first booster to the next booster. Try to limit the total cable length to about 100 feet and no more than 5 ZoneMaster boosters. If you need more length or have more boosters, you will need to use the CVP DISTYAMP.
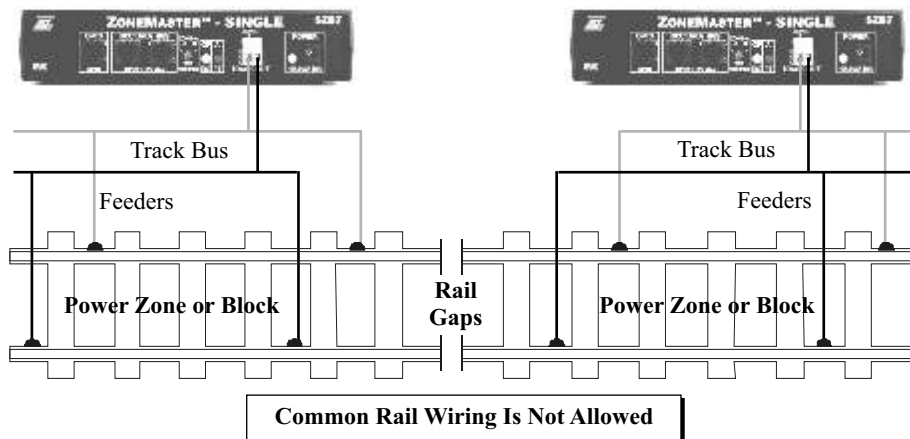
Rail Gaps

Create rail gaps using a Dremel tool with a cutting disk. Gap both rails at the same location. Do not stagger the gaps.

Gaps can close up due seasonal changes in humidity and temperature. Closed gaps are a very real nuisance. Unless you keep excellent records, a closed gap is very difficult to locate. A piece of scrap styrene will help.

File and trim the piece of styrene to fit inside the gap and glue it in place. Taking some time to do this now, during construction, will pay large dividends in the future. With styrene in between gaps, shorted gaps will not be an issue.
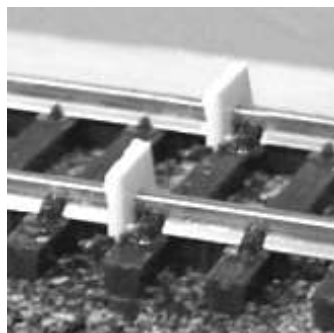
Power Zone Tips

Eliminate reversing loops and sections as much as practical. They cause wiring headaches, operating problems and increase the overall cost of boosters since you must use autoreversing boosters.

Length of track and wiring is not a concern. Some zones may be very short while others are very long.

Use power cutout switches on staging tracks or yard sidings. This keeps trains from accidentally moving should the operator forget to assign to deassign the throttle. It also prevents inadvertent movement should a distant operator accidentally select the wrong train. Consider adding track power indicators on tracks that are to have cutout switches.

Don't cut gaps in areas where trains park. A parked train that has cars with metal wheels may bridge gaps for a long period of time. Be sure that longest train in a siding does not bridge power-zone gaps. If gaps are bridge by a locomotive or car wheel, zone isolation will be lost.

Reversing sections must be longer than the longest train to use the section. A wye must be able to hold loco+cars without any rail gaps being bridged by cars or loco wheels.

Track Power Indicator

Use your favorite colored LED as a convenient track power indicator. Use a 2K 1/4 watt resistor to limit the LED current. Solder across the track feeders or bus serving the area. Polarity doesn't matter. Small hookup wire is OK since very little current is needed. There are lots of LEDs available in panel mount assemblies that will add a touch of elegance to your layout and help your operators.

One Rail ———

Opposite Rail ———

2K 1/4 Watt Resistor

LED
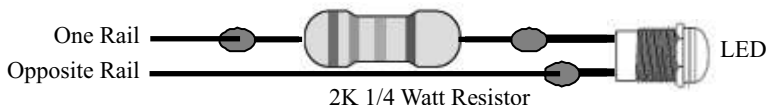
Track Power Cutout Switches

Adding Power Cutout Switches is recommended for Staging Tracks and long sidings that will hold idle trains for long periods of time. A double-pole switch is shown although a single pole will also work. Be sure to use proper wire color to prevent accidentally reversing the wires when connecting them to the track.

To Track

To Track

To Track
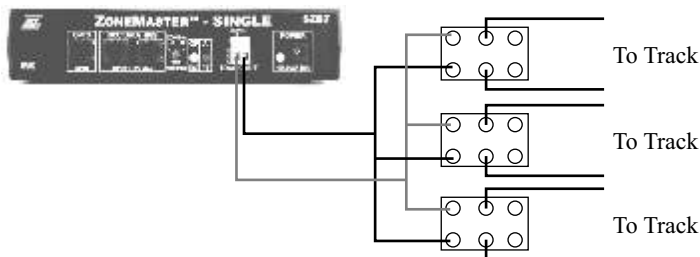
Using Multiple ZoneMaster Boosters

Unless you are operating the trains by yourself, you will want to have multiple boosters to both spread the power load and to isolate operators from each other. As mentioned at the beginning of this section, multiple zones are actually for the convenience of your operators. A derailment by one operator in his town or yard, should not affect another operator in an adjacent town or out on the mainline.

Power Zone Considerations

By breaking the layout into multiple power blocks, each with its own ZoneMaster booster, a problem in one power block will not affect other power blocks. Derailments and resultant shorts will not shutdown the entire railroad. Where to add more boosters is up to you although there are a few common sense considerations.

We suggest creating separate power blocks in areas where operation is concentrated. These areas include yards, staging tracks, large towns, and large industrial areas. You can also use physical regions as block boundaries. A physical region can be the "west wall", center peninsula, or even top or bottom levels.

Avoid creating large power blocks where the entire block is not entirely visible to an operator. A good example of this is single block serving a peninsula with a tall center scenic divider. A derailment on one side of the divider shuts down the opposite side. This leaves an operator scratching his head and looking for the cause on his side when in fact it is on the opposite side and caused by the other operator.

Do Not Share A DCPS120 Power Supply

Although technically this is OK, in reality, it doesn't work. The high surge current demands of sound-equipped locomotives requires the entire capacity of the power supply. If the power supply is already partially loaded by a second ZoneMaster, a sudden demand for surge current by the first ZoneMaster will likely cause an overload and the power supply will shut down. Always use one power supply per ZoneMaster.

Booster Outputs Must Be Connected Properly

Be sure to properly "phase" the ZoneMaster booster outputs. This will allow locomotives to cross gaps without shorting out the boosters. Adopt the methodology of having the left terminal connect to a specific rail or bus wire (outside, left, etc) and the right terminal connected to the other rail or bus wire.

A Power Zone Example

The drawing below shows a double-ended siding off the main line that serves a small town. The circled areas show the locations of the isolating gaps. This type of diagram is called a straignt-line track diagram and one line represents both rails. So, make sure both rails are gapped. The mainline is connected to a ZoneMaster and the town is connected to a separate ZoneMaster. With this type of isolation, a derailment by the local town operator will not affect the mainline operator or vis versa.

The ZoneMaster Single Output is shown although a ZoneMaster Dual Output can be used if there is only one or two locomotives operating inside the town.

ZoneMaster Booster — Mainline

ZoneMaster Booster — Town
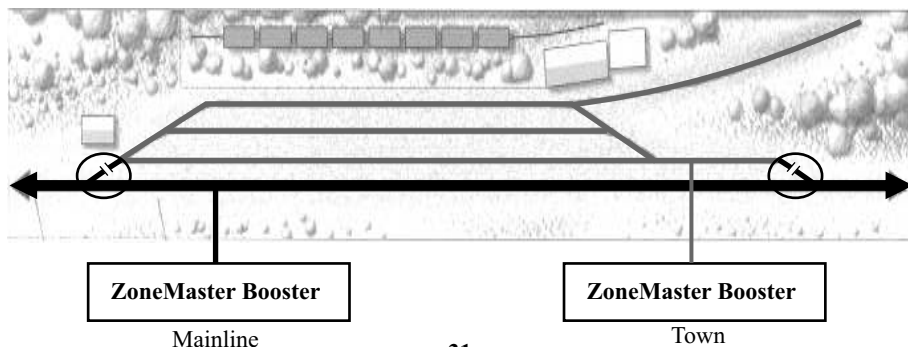
Using Multiple ZoneMaster Boosters

Long Linear Yards With Multiple Operators

Long linear yards that use an operator on each end might benefit from being blocked vertically. In other words, the yard is split down the middle, creating a left and right center of operation. Two separate ZoneMaster Booster singles (SZB7) feed each end of the yard.

This is works because yard switchers tend to work at the far ends of the yards, pushing long cuts of cars down towards the center. There is seldom much power being consumed in the center and the bulk of the turnouts are at each end.

Short yards, or long yards with long cuts of cars each track should not be blocked vertically if the cars use metal wheels. There is a high probability that a parked locomotive or car wheel will bridge the block gaps and isolation will be lost. However, if your cars use plastic wheels, there is little risk of bridging the gaps except by locomotives.

Horizontal gapping is similar to separating a town from the mainline. Complete sets of tracks are isolated and fed from different ZoneMaster Boosters.

Vertical Gapping

Horizontal Gapping
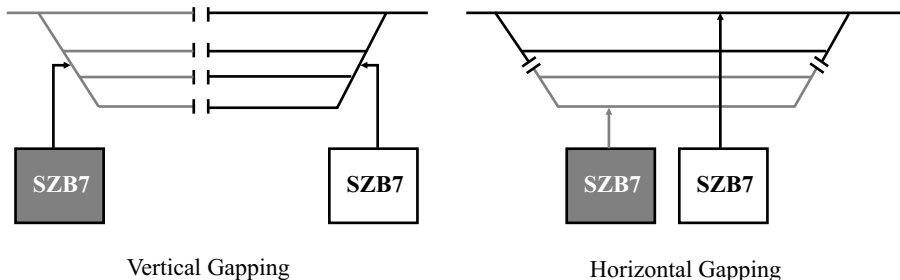
Staging Yards

We strongly recommend keeping all staged trains (that include locomotives) on dead track. Power can be switched on and off using the turnout power routing or the use of power cutoff switches. Either one is a good investments and here are two good reasons to do this.

1. Dead track prevents accidental train movement caused by an operator selecting the wrong locomotive address on the throttle. In most cases, the error will not be detected until the incorrectly selected train details against a closed turnout or crashes into another train.

2. If using sound decoders, a huge surge current flows into the decoder for a split second after the power is first turned on. If the staging yard is full of sound decoder equipped locomotives and they all power up at the same time, the ZoneMaster booster may shut down. Although the booster can supply up to 30 Amps of surge current, there is a practical limit.

Power Considerations

A ZoneMaster booster, having either a single or dual output, has a maximum output current rating of 7 Amps and a maximum surge current rating of 30 Amps. The continuous power rating is 120 Watts when the DCPS120 power supply set to 15 volts.

If the DCPS 120 is set for a higher voltage, the available of amount of continuous current decreases. We strongly recommend using the lowest possible voltage setting. Not only does the amperage go up, but the decoders and locomotive motors will run cooler. An additional benefit is a big decrease in motor brush noise generation. This is especially important for wireless throttle users since excessive motor brush noise will decrease the wireless throttle range.

Wiring Reversing Loops and Sections

The autoreverse features of the ZoneMaster boosters make for easy wiring of a simple reverse loop. For the diagram below, a ZoneMaster Dual Output booster is used. Output A is set for autoreversing. Output B drives the adjacent power zone. Gaps are cut into the rails just after the turnout.

Autoreverse works by sensing a momentary short circuit as a wheel bridges the gap between the reversing block and the adjacent block. Within a fraction of a second, the booster reverses the track polarity. If the short clears, the train continues across the gap. If the short is still present, the autoreverse booster shuts down and sounds the fault alarm.

It is mandatory that the entire train fits inside the reversing loop or reversing section. If not, the autoreverse will not work correctly.

Reversing
Loop or
Section shown
in gray

Gaps

Gaps
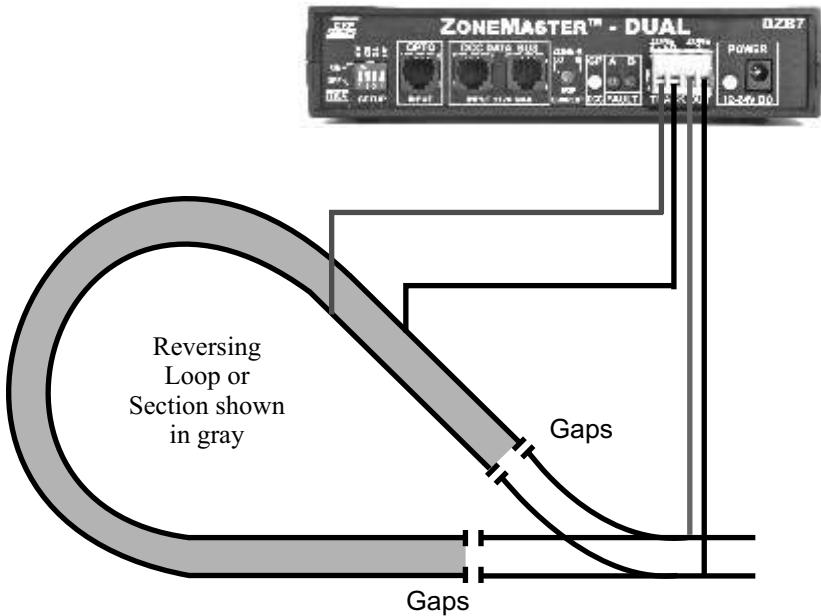
Simplified Reversing Loop Wiring Using A Toggle Switch Or Relay

Older locomotives that use offset track pickups cannot always reliably trip an autoreversing booster. The simplest solution is to use a manual reversing toggle switch wired in place of the autoreversing booster. Replacing the toggle switch with a relay or set of spare contacts on th switch machine will allow the throwing of the turnout to reverse the circuit.

The toggle switch may be replaced with a DPDT relay driven by the loop entrance switch machine to create an automatic reverse loop. Some switch machines may have sufficient spare contacts to provide a DPDT functions. Consult the switch machine instruction sheet for details on the spare contacts.

Track Gaps

Booster

DPDT Toggle Switch

Remember that the loop must be big enough to hold the entire train. Metal wheel cars, crossing reverse polarity gaps are just as bad as locomotives – the booster will short out and shut down. Decoder equipped locomotives will not be affected by the reversal of polarity. They only respond to DCC direction commands, not to track polarity.

Wiring A Wye For A Toggle Switch

The ZoneMaster Booster with Autorevese can also be used. See the ZoneMaster User guide for more details and other setup options.

Set toggle to allow train to cross gaps without shorting

Entire train must fit inside gapped area without any wheels across either set of gaps

Gaps

ZoneMaster Booster
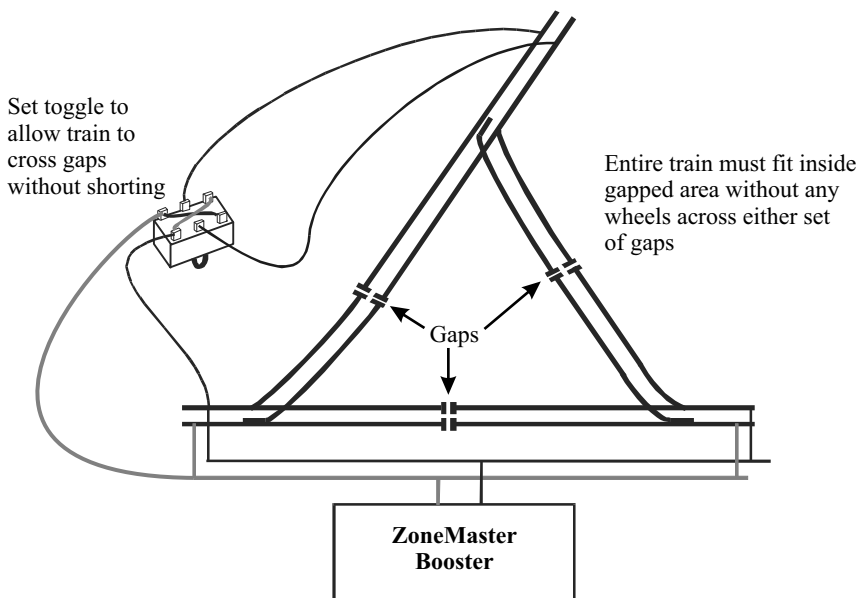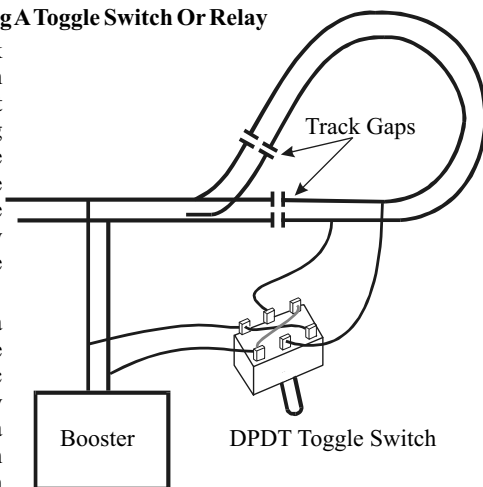
Using The Optional DISTYAMP

For detailed installation instructions, please see the DISTYAMP Installation Guide.

The DISTYAMP, short for Distribution-Amplifier, makes it easier to run the modular cable around your layout especially if it is large or irregularly shaped and if you have more than 5 ZoneMaster Boosters. It allows the one single Command Station BOOSTERS modular jack to expand to 4 independent BOOSTERS modular jack.

The DISTYAMP features 4 independent modular cable ZoneMaster drivers and jacks. Each of the 4 drivers has the same capability as the Command Station's one ZoneMaster driver. All integrated circuits are mounted in their own sockets - just in case. Additional protection is provided to reduce the chances of driver damage should electrical storms frequent your area.

Mounting The DISTYAMP

Mount the DISTYAMP near the Command Station. There are 3 mounting holes in the small circuit board so it can easily mount under the layout. This is a low power circuit so it can be mounted on a section of the wooden benchwork.

The DISTYAMP comes with its own universal power supply having an output voltage of +5VDC at 1.5 amps. The power supply plugs into any AC line from 95 to 240VAC. Plug in the power supply and verify the DISTYAMP's green power LED is on.

Hooking Up The DISTYAMP

Plug a modular cable into the Command Station's BOOSTER jack and connect it to the DISTYAMP's input jack.

Use DATA style modular cable to connect the ZoneMasters back to the DISTYAMP.

Up to 5 ZoneMaster boosters can connect to one of the DISTYAMP's outputs. Each booster connects, daisychain fashion, to the next booster. Limit the modular cable run to about a hundred feet. This is just a guideline so longer is OK.

From Command Station's Booster Output Jack
Data or Telco style modular cable is OK

From DISTYAMP Power Supply

Data-style modular cable works best to connect ZoneMasters together and back to the DISTYAMP.

ZoneMaster	ZoneMaster	ZoneMaster	ZoneMaster
ZoneMaster	ZoneMaster	ZoneMaster	ZoneMaster
ZoneMaster	ZoneMaster	ZoneMaster	ZoneMaster
ZoneMaster	ZoneMaster	ZoneMaster	ZoneMaster

Using The Optional ZoneShare

For details on ZoneShare setup and operation see the ZoneShare User Guide.

The ZoneShare connects to a ZoneMaster Single booster to create 4 independent outputs each protected from short circuits and overloads. Each independent output has its own protection and electronic circuit breaker. Any fault on one ZoneShare output will not affect the remaining outputs.

ZoneShare works best in lightly loaded power zones or areas - those areas that don't see lots of trains running through them under the control of more than one operator. However, for busy areas with lots of active locomotives, a yard for example, a dedicated high power booster, like a ZoneMaster-Single or ZoneMaster-Dual is best. But for smaller areas that don't need that much power, it is more economical to take a high-power booster and use the ZoneShare to divide its output into 4 separate and independent outputs.

The peak track voltage and maximum current is determined by the ZoneMaster booster. The ZoneShare outputs have their individual current limits set at about 4.5 amps. However, the ZoneShare cannot create power, and the sum of all 4 ZoneShare outputs can't exceed the ZoneMaster current rating. If the sum of all ZoneShare output currents exceeds the ZoneMaster's rating, the ZoneMaster will shut down.

Track wiring for the ZoneShare is no different than for the ZoneMaster. Heavy duty wiring is always required. Also, the connection from the ZoneMaster to the ZoneShare should be #12AWG to insure maximum power transfer between the two units.
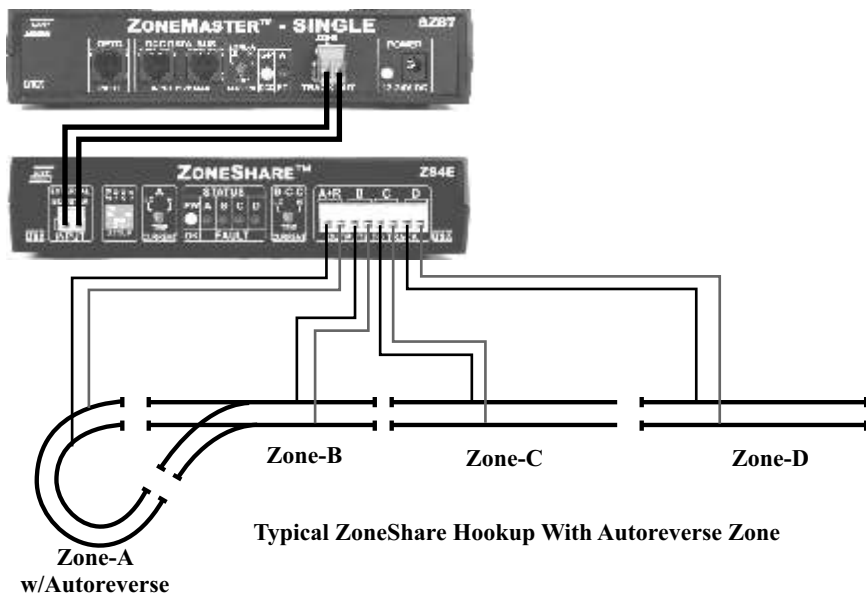
Typical ZoneShare Hookup With Autoreverse Zone

One ZoneMaster Single booster can feed multiple ZoneShares. However, it is easy to run out of power as your locomotive fleet grows. Beware that in some cases, a simultaneous demand of more than 7 Amps will shutdown the ZoneMaster Single and everything loses power. This can also occur when power is first applied and the surge current exceeds the ZoneMaster's 30A surge capacity. If this occurs, you must split up the load and add more ZoneMaster boosters.

For best performance, it is best to have all power zones fed by ZoneShares and not have one zone fed by a ZoneMaster that is adjacent to a power zone fed by a ZoneShare. This will allow all locomotives to cross block boundaries without any hesitation or speed changes.

Adjusting The Track Voltage

DCPS120 Booster Power Supply

The DCPS120 power supply has a universal AC input. It can use an AC line voltage that ranges from a low of about 100V up to a maximum of about 240 volts.

Output Voltage Setting

The small slide switch sets the output voltage. The range is 15V to 24 volts. The markings are not exactly coincident with the proper switch setting. It may be easier to just count the clicks to reach the desired setting.

Maximum Output Current Is Based On Selected Voltage

There is a total of 120 Watts available and that is a fixed amount. The maximum available current is based on the selected output voltage using the formula of Power (watts) divided by output voltage and the answer is in Amps. For example, at 15V, the available current is 120 divided by 15 which is 8 amps. The higher the output voltage, the lower is the available current. The table below shows the output current vs the selected voltage.

Maximum Power (Watts)	Output Voltage	Maximum Current (Amps)
120	15	8.0 A
120	16	7.5 A
120	18	6.7 A
120	19	6.3 A
120	20	6.0 A
120	22	5.5 A
120	24	5.0 A

Using 3rd Party Power Supplies

For lower voltage applications, you can purchase any power supply that has the following specifications: DC output voltage that meets your needs, a regulated DC output, 3% regulation or better, maximum output current equal to your needs, capable of sustaining 30 Amp surge without shutting down.

The ZoneMaster booster uses a standard DC power connector with a 2mm pin and is shown to the right. Make sure your power supply comes with a plug that matches this connector.

Using Series Diodes To Lower The Voltage

Standard silicon power diodes can also be used to lower the track voltage. Each diode will subtract about 1 volt from the peak track voltage. Be sure to use them in sets of two connected as shown. Also, make sure they are rated to handle the output current of the ZoneMaster booster or ZoneShare. The average or continuous rating should be a minimum of 10A with a reverse voltage rating of greater than 30 volts. A lower current diode will work but it might be damaged if there is a short circuit and the ZoneMaster can output its full 7 amps.

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Installation Notes

The next few pages are blank and are intend to used to record notes, diagrams, comments and or other aspects of your installation. While you can clearly recall details about your installation today, what about next year or the year after that? A good example of what to record is the color code for the left and right rail wiring. Make extra copies of the notes page and get in the habit of recording what you have done. A few moments to record you activities will pay big dividends in the future.

A good example of what should be recorded is the serial number, assigned throttle ID number and the wireless frequency. Use a pencil and fill in the table below as you add or change throttles and keep it up to date. It will be very useful for troubleshooting purposes should the need arise.

The numbers in parenthesis are the recommended settings.

Plug-In Throttles

Serial Number	ID Number Assigned	Serial Number	ID Number Assigned
_____	_____(17)	_____	_____(21)
_____	_____(18)	_____	_____(22)
_____	_____(19)	_____	_____(23)
_____	_____(20)	_____	_____(24)

Wireless Throttles - Group 1

ID Number	Frequency	ID Number	Frequency
_____(1)	_____(0)	_____(5)	_____(4)
_____(2)	_____(1)	_____(6)	_____(5)
_____(3)	_____(2)	_____(7)	_____(6)
_____(4)	_____(3)	_____(8)	_____(7)

Wireless Throttles - Group 2

ID Number	Frequency	ID Number	Frequency
_____(9)	_____(8)	_____(13)	_____(12)
_____(10)	_____(9)	_____(14)	_____(13)
_____(11)	_____(10)	_____(15)	_____(14)
_____(12)	_____(11)	_____(16)	_____(15)

Simplified Command Station Operation Guide

These are the Command Station's most commonly used features.

However, your Command Station has additional capabilities and features that are less commonly used so they are in a separate "Advanced Features" section.

Command Station Advanced Features

This page lists some of your Command Station's advanced features that are not commonly used.

The troubleshooting section has an extensive collection of procedures, explanations and easy to use tools for finding and fixing common problems.

Front Panel Controls

This page shows the key names, controls and functions of your Command Station. Place the Command Station in front of you and familiarize yourself with the keys and indicator locations. The remaining pages of this book will show how to use your Command Station through the use of detailed key-stroke sequences and options. On the faceplate, many keys have dual functions and are shown with different types of text and coloring. The primary function is the white text on the black background and the secondary function is the black test on a white background.

Control or LED	Primary Function	Secondary Function(s)
LCD Display	16x2 character message display	-
Direction A	Change direction of throttle A	Emergency Stop (press and hold)
Direction B	Change direction of throttle B	Emergency Stop (press and hold)
Function A	Show functions for Throttle A	-
Function B	Show functions for Throttle B	-
Speed knob A	Controls speed for throttle A	-
Speed knob B	Controls speed for throttle B	-
Accessories	Enables accessory mode	Route building
R-OFF	Accessory OFF or reverse	Select reverse direction for consist loco
		Refreshes SHOW ID ENT display
N-ON	Accessory ON or normal	Select normal direction for consist loco
.		Select decoder update rate
OK LED	On when programming loco	-
PROGRAM LED	On when program track is active	-
ERROR LED	EPROM memory error	-
RESET	Resets Command Station	Clear consists and routes (ENT and ESC)

Pushbutton Key Definitions and Functions

SHOW . . . . Displays requested information about system, locos, throttles and accessories.

LOCO . . . . Usually means a specific locomotive decoder address (CV#1).

OPS PRGM . . . . Use for programming decoders on the main track (OPS mode programming)

ACCL . . . . Selects the Acceleration variable (CV#3).

SVC PRGM . . . . Use for programming decoders on the programming track (Service program).

SPDTABL. . . . . . Used to select the standard/default decoder speed table or a custom table.

SETUP/ASSIGN Used to setup consists, routes, assign built-in throttles, the command station.

CONSIST . . . . . . Used for creating multi-unit consists or routes of accessory decoders.

THROT-A . . . . . Specifies Throttle A.

DECL . . . . Selects the Deceleration variable (CV#4).

SPEED . . . . Sets up speed and function monitoring of a locomotive. Also used for diagnostics.

THROT-B. . . . . . Specifies Throttle B.

MSV . . . . Selects Motor Starting Voltage (CV#2).

ID . . . . When used with SHOW, shows the ID number and current address of a throttle

ADVCON . . . . . . When used with SHOW or SETUP, specifies advanced consisting

MACRO . . . . Selects from a group of preprogrammed functions.

CV. . . . . Selects the main menus when working with Configuration Variables.

#STEPS. . . . . . . Used to setup decoder and Command Station to the desired number of steps.

ESC. . . . . ESCAPE key which cancels a command sequence at any time

ENT. . . . . ENTER key is used to conclude or accept default entries shown in the display.

How To Use Step-By-Step Examples

The world of DCC is full of symbols, acronyms, slang, abbreviations and misused words. Hopefully, we'll clear up most of this confusion as we explain how EasyDCC operates through examples and explanations.

Say Whaaat…?

We are not perfect and more than 40 years of experience does make us slightly presumptuous. We sometimes make the bad assumption you understand some of our short hand notations or we may accidentally use a phrase that doesn't make any sense. If this occurs, please let us know. Your feedback and question help us keep this document as one of the best user's guide produced.

The Command Station Display

The 2 line by 16 character display is used for all Command Station messages. In some examples, we won't show all the intermediate messages that will appear and show only those that are relevant to the procedure.

```
V6xx T=00  M=255
A=————   B=————
```

For example, this message is the "normal" or home page, which appears after the Command Station has initialized after power is turned on. The purpose of the numbers on the top line will be described later. A and B are the built in throttles and the dashes will be filled in with numbers if you are using either to control a train.

Severe Abbreviations

Some words may be severely abbreviated to fit the display. For example this message shows three options from which you can select.

```
Show Loco# 0045:
Spd,#Steps,Cons
```

The abbreviations are for specific keys. Without looking, see if you can guess which key goes with which word. (Answer: Spd=SPEED, #Steps=#STEPS, CONS=CONSIST.

Menu Options In Display

When you see numbered entries with an equal sign, this is your clue as to which key is used to select that option. For this example, key 1 selects 14 speed steps; 2 selects 28 speed steps and 3 selects 128 speed steps.

```
Loco 1935 active
1=14,2=28,3=128
```

Dual Function Keys (and sometimes multiple functions)

Many keys have a primary and a secondary function. The word in white lettering is the primary function. For this key, its primary function is the SHOW command. The word below it is in reversed lettering. For this key, the secondary function is to specify that the command is related to the locomotive. If in doubt, push the key you believe to be the correct one and verify by watching the subsequent message. With very few exceptions, you'll find this to become second nature after a short while.

Keystroke Sequences

All EasyDCC commands are shown in a step by step sequence along with the appropriate messages. When you see the symbol shaped like a circle ❍ that means PUSH AND RELEASE THE KEY with the label shown **IN BOLD TEXT**. We only show the key's appropriate label to avoid confusion and clutter. Although you might be tempted to think of the symbol as a sort of checklist bullet check box, it just means push the key.

For example, the line below means, find the key labeled SETUP/ASSIGN and push and release it. Push it smartly and don't mash down on it or multiple keystrokes may be registered.

❍ **SETUP/ASSIGN**

Sometimes, we use a single line to include multiple keystrokes. Locomotive numbers are a good example. In the following example, the locomotive number 1935 is entered as a series of keystrokes and the enter key is pressed. To save space, they are shown on one line. Notice that each number has a box as well as the ENT key.

◯1, ◯9, ◯3, ◯5, ☐ENT

Using The Keyboard

Each key is a simple "click" key. They work best if you "smartly" push and then release the key. If you push or tap it too quickly, the command station may not "see" or respond to the key push. If you hold the key too long, multiple entries may result. If you make a mistake, push the ESC key and start over.

Important Points To Remember

We will put special instructions, precautions and troubleshooting tips into a box at the bottom of the page. Be sure to read these since they usually are the result of a phone call from a fellow **EASYDCC** user. Their question prompted the special note to help explain something unusual or non-obvious.

This table shows some abbreviations used in the display for specific keys.

Key or Label	LCD Display Abbreviation	Meaning
ACCL	Accel value	Acceleration value (inertia)
SPDTABL	Speed Table	Alternate speed table
THROT-A	A	Built-in throttle A
DECL	Decel Value	Deceleration value (momentum)
SPEED	Spd	Locomotive speed value
THROT-B	B	Built-in throttle B
MSV	Start Value	Motor starting voltage
MACRO	Macro	Sequence of built-in steps
CV	CV#	Configuration variable
#STEPS	#STEPS	Speed steps, number of
R-OFF	R	Reverse direction or OFF
N-ON	N	Forward direction or ON
CONSIST	CONS, CONS#	Multi-unit consist, MU
	Rte, Rte#	Route, Route number
	M=xxx	Unused memory slot quantity
SVC PRGM	---	Service mode programming
OPS PRGM	--	OPS mode programming
ADVCON	Advanced Consist	Setup advanced consists
ID	Throttle ID	Used to show throttle ID number

The Command Station's Home Page

Software Version	Active Throttles	Loco Memory Available

```
V631  T=00   M=255
A=----       B=-----
```

Throttle-A Loco Assignment	Throttle-B Loco Assignment

This is your Command Station's home page. It shows some useful items regarding your system. These items are very useful when it comes time to call us for some help. Take a few moments to learn what these items mean and their importance.

V=631   The Software Version Number

This is the version of software being used in the Command Station. Version 6 is the latest version and the xx is the revision level. As of the printing date of this manual, V631 is in production. If you call us for help, we will need to know the V number in your Command Station.

T=00   Number of Active Throttles

The Command Station keeps track of the number of "*active*" throttles. An active throttle is simply one that has the speed control turned up and is controlling a locomotive. Any throttle automatically becomes active the moment it is plugged-in or turned on and the speed control is advanced.

The count of active throttles goes up and down automatically. The highest number for T is 31. The lowest number is 0 which only means that there are no active throttles being processed.

M=255   Number of Available Locomotive Memory Slots

The Command Station starts with 255 memory slots which is shown in the M counter. As new locomotives are controlled by throttles or when new locomotives are added to consists, a memort slot is automatically assigned to the new locomotive.

After a long period of use, you may be surprised to find that the M counter is nearing 0. This is not a problem and there are simple methods to remove bad or unused locomotives. This is discussed later in the advanced topics section. For now, this number can be ignored

Built-In Throttles   A= ---- and B = -----

These are the two built-in throttles and will show their current locomotive assignment. If not used, dashes will show.

Home Page Is The Default Screen

The home page is what the Command Station shows after power is first turned on or following programming or other Command Station actions. In almost all cases, pushing the ESC key while in the middle of such actions will cancel the action and return to the home page.

Using The Built-In Throttles

Using the Built-in throttles A or B is easy. The exact keystroke sequence is shown below for throttle B. It is the same for throttle B except you select A instead of B.

> *Note: If you try to program both throttles to the same address, the Command Station will first remove it from the opposite throttle.*

The Command Station's display always shows to which addresses are in use by both built-in throttles. When power is first applied, throttle A and B remember their assignment, if they had one. Otherwise, the display shows dashes after A and/or B.

```
V6xx T=00   M=255
A=-----    B=-----
```

For this example, the locomotive is on address 2014 and it will be assigned to throttle B. The word *assign* is a hint as to which key will be first pressed in the sequence. Use the following keystroke sequence to setup the assignment. Note that leading zeroes are not required.

Remember, the symbol ❍ means push and release the key having the listed label. For this example, throttle B will be used. Don't mash down on the key or press it for a long period of time or multiple keystrokes may be registered.

❍ **SETUP/ASSIGN**

```
Setup/Assign
  What?
```

❍ **THROT-B**

```
Assign ThrotB to
Loco/Cons# ____?
```

❍ **2,** ❍ **0,** ❍ **1,** ❍ **4**

```
Assign ThrotB to
Loco/Cons# 2014?
```

❍ **ENT**

```
Throt B Assigned
To Loco# 2014
```

❍ **ESC**

```
V6xx T=00   M=255
A=-----    B=2014
```

Pressing the ESC key ends the key sequence and returns the display to its home page. Notice the display has been updated to show that throttle B now controls loco 2014. You can also see that the M counter has decreased by 1. This means that one memory slot has been used for 2014. The M counter keeps track of how much memory is remaining. Each locomotive uses one memory slot. More about the M and the T counter in the reference section on page 49.

Changing The Built-In Throttle's Address

To change the address being controlled by the built-in throttle, simply repeat the steps above and select a new address. The old address is automatically deleted.

Address 0 Is Not Usable!

The EasyDCC System does not support the analog locomotive address, sometimes call the address 0. We have found the drive signal too harsh for high quality and delicate locomotive motors. It also drastically slows the response time of the entire system.

Controlling Decoder Functions From The Command Station

Your locomotive decoder usually has some extra functions. These functions may be related to lighting effects or sound effects. These are usually called FUNCTION 0 or FUNCTION 1 or FUNCTION 2, etc. We abbreviate them to simply F0, F1, F2, etc. Note that it is the decoder, not the Command Station, that determines what effect, if any, is activated when a function key is pressed.

With the exception of function F2, all functions are latching type. This means, they are activated when pushed the first time and deactived when pushed a second time. F2 is momentary for use with sound system effects such as horn or whistle.

Both of the Command Station's built-in throttles includes a gray key labeled FUNCTIONS. When pushed, the display is updated to show that specific's throttle assignment and the status of all 13 functions. The function status is on when the little square is solid dark. The function is OFF if the symbol is an open clear square. This display must be showing if the decoder functions are to be used with the built-in throttles.

To control a function, push the number key corresponding to the desired function. The 0 key is function F0 (also called headlight control) F1 is the 1 key, F2 is the 2 key and so on. F2 is momentary – the function stays ON for as long as the key is pressed.. When the key is released, the F2 square will be OFF.

Some Commonly Used Function Keys

FL/F0 is used to turn headlights on and off.

F2 is a momentary function usually assigned to a horn or whistle sound effect.The function is enabled for as long as the 2 key is pressed.

Status Display

When a function key is toggled on, the unfilled square □ changes to a filled square ■. When toggled off, the solid square changes back to an open square. The F2 momentary key fills the square for as long as it is pushed.

The following key stroke example turns on the headlights for the locomotive assigned to throttle A. Notice the locomotive number is also displayed. For this example, throttle A is assigned to address 3. If you want to follow along, first assign Throttle-A to address 3.

○ **FUNCTIONS**   Be sure and press the the function key is under the Throttle-A direction key.

```
Loco 0003 Fcn#=?
Fn=□□□□□□□□□□□□□
```

○ **0**   Turns on F0 which are the decoder headlights. Notice the left most square is not filled in showing F0 is on.

```
Loco 0003 Fcn#=?
Fn=■□□□□□□□□□□□□
```

○ **3**   Turns on F3. Notice this doesn't change the status of F0.

```
Loco 0003 Fcn#=?
Fn=■□□■□□□□□□□□□
```

○ **ESC**   Use the ESC key to return to the normal or home page. This occurs without any changes to the functions. You can push the function key again to check the status.

```
V6xx T=00   M=253
A=----3    B=_____
```

Note: If either A or B throttle is unassigned, there are no functions to display the display confirms this for you. For this example, Throttle-B is not assigned and this message appears if the Functions key is pressed for throttle B.

```
Throt B = ------
Function n/a
```

Controlling Functions Above 9

For decoder functions numbers above 9, the SETUP/ASSIGN key is first, to signify that the subsequent function number requires 10 to be added. For this example, function 12 will be turned on.

❍ **FUNCTIONS**

❍ **SETUP/ASSIGN**   Notice that the n after the F has turned to an asterisk.

```
Loco 0003 Fcn#=?
F*=■□□□□□□□□□□□□
```

❍ **0**

```
Loco 0003 Fcn#=?
F*=■□□□□□□□□□■□□
```

Pushing 0, turns on Function 10. Notice that the F10 square is now dark indicating that F10 has been turned on. Also notice that the asterisk has reverted back to an "n." Once again, the functions keys 0-9 are active.

```
Loco 0003 Fcn#=?
Fn=■□□□□□□□□□■□□
```

To enter a function number above 9, just push the SETUP/ASSIGN key again and then the second digit of the function number wanted.

❍ **ESC**

De-Assigning The Built-In Throttles

If you don't plan to use either A or B throttle, we suggest assigning them to NO address. This will insure that you don't inadvertently have two throttles on the same address.

To de-assign the Command Station throttle, simply leave the loco number blank when prompted for the loco address after pushing SETUP THROT-A or B. This function applies ONLY to the Command Station's built in throttles. For this example, the B throttle will be de-assigned.

❍ **SETUP/ASSIGN,**

```
 Setup/Assign
    What?
```

❍ **THROT-B**

```
Assign ThrotB to
Loco/Cons# ____?
```

❍ **ENT**

```
Throt B Assigned
To NO Loco
```

❍ **ESC**

```
V6xx T=00  M=253
A=----    B=----
```

Notice the home page is updated to show that Throttle B now controls nothing. Also notice that the M counter has not changed. This means that locomotive address 2014 is still in the system and has not been deleted. The only change is that locomotive 3 is now available to be controlled by another throttle.

Emergency System Stop

To halt all trains currently being controlled by the system, push and hold either Throttle-A or Throttle-B direction key. This command instantly halts are train movements until the direction key is pushed and held again. The A and B throttles do not have to be assigned to an address.

ALL STOP can not be invoked from either the wireless or plug-in throttle.

○ **DIRECTION** (throttle A or B)

```
V631   T=xx   M=xx
>>>>ALL STOP<<<<
```

To clear ALL STOP and return to normal operation, push either of the DIR keys. You may also clear ALL STOP by pushing the reset key. Once the ALL STOP is cleared, all trains return to their previous speed and direction setting.

Also, the ALL STOP command is not remembered and is cleared by turning the Command Station power off and then back on.

Only One Throttle To A Locomotive!

Make sure that two throttles are not trying to use the same address. This includes the plug-in, wireless or Command Station throttles. No harm will occur to the decoder but it will run very poorly or not at all.

Throttle Assignment Does Not Change The Decoder's Address

Changing a locomotive decoder's address requires the use of the programming track. If you assign the throttle to an address not present in the decoder, it will not run.

Use the programming track to change the decoders's address.

Decoder Programming - SVC and OPS Programming

Using The Programming Track

Programming On The Main Line - OPS Programming

Difference Between Service (SVC) and Operations (OPS) Programming

Programming of decoders can be done in two different places. The first place is the programming track. The decoder address is always programmed using the programming track. The second place is while the train is on the mainline. Fine tuning of motion and sound effects is best done while on the mainline because the changes take effect immediately and you can determine ifthe locomotive performs as desired.

Except for the initial selection of the type of programming, the subsequent keystrokes are the same. The main difference with OPS programming is the need to tell the Command Station what locomotive address will be programmed. With SVC mode, the address doesn't matter - the decoder will be programmed.

Programming Is Easy

Programming of decoders is very simple requiring only a few keystrokes. Plain English messages will guide you through the process. Step-by-step examples will be given for some of the most common programming actions. Here's a few guidelines to keep in mind regarding decoder programming.

What is Programming? Programming is the process of customizing the decoder to suit your requirements. During programming, data is transferred from the Command Station to the decoder. All data transferred to the locomotive is permanent. Removing power will not cause the decoder to loose any data. Programming decoders is usually done after they are installed in the locomotive. Programming takes place on an electrically isolated section of track called a programming track.

You can not harm decoders during the programming process. Any programming done to a decoder can be undone.

Y**ou must have your decoder or locomotive user guide** on hand during programming. It contains information about the decoders features and capabilities. Programming of the decoder is what sets up or modifies these features.

Program One Locomotive At A Time. Only one locomotive can be on the track during programming.

Keep Your Programming Track Clean. Since the locomotive decoder receives programming data through the rails, make sure the rails and wheels are clean and be sure all wheels are on the rails. Dirty wheels and rail will cause poor pickup and interrupt decoder programming.

Programming Track Is Not For Running Locomotives. The programming track only has voltage during a decoder programming procedure. Do not attempt to operate a locomotive on the programming track – it will not run!

Any NMRA-DCC decoder can be programmed by EasyDCC. Your EasyDCC system will program ALL decoders that conform to the NMRA-DCC signal format. However, decoder verification or readout of various decoder values may be restricted to non-sound decoders unless your have installed the programming track booster described on page 19.

Programming The Decoder Address

Service programming (SVC PRGM) of decoders is used to customize the performance of your locomotive's decoder. Decoder programming is quick and easy and uses the dedicated programming track.

Programming the decoder's address takes longer to explain than to actually perform the operation. For this example, locomotive 2920 will be programmed to have the unique address of 2920. No other parameters will be changed. For easy remembering, we suggest using the locomotive number.

Most modern decoders can have any address from 1 to 9999. If you are not sure, read the decoder's manual or contact the manufacturer for assistance.

Remember: the symbol ❍ means to push and release the key shown. The displayed messages will be shown and explained at each step.

❍ **SVC PRGM**

The moment you push SVC PRGM, there is a test performed on the locomotive's decoder to test the type of decoder present in the locomotive. But, if the Command Station can't automatically determine the decoder's type, this message will first appear. Don't be scared of this - it simply means you have to tell the Command Station what type of decoder is on the rails. Push the 3 key to continue.

```
Decoder Type=2
ENT=OK or 1,2,3
```

Note: Almost all modern decoders are a type 3. A type-3 decoder can also understand type-2 programming commands. For fastest programming, we recommend selecting type-3 even if the Command Station can't figure out the type decoder.

Once the type is recognized or manually selected, then you will see the message below asking what you want to program.

```
Program Track
Program What?
```

❍ **LOCO** *[the SHOW key]*

Pressing the LOCO key instructs the Command Station to accept up to four digits as the address to be sent to the locomotive on the programming track. For this example the locomotive has a cab number of 2920 so its address will be programmed to 2920. Leading zeros are not required. Also, for this step, all 4 numbers are shown on a single line.

```
Program Track
Loco Addr ____?
```

❍**2,** ❍**9,** ❍**2,** ❍ **0,** ❍**ENT**

Upon pressing the ENT key, you will see the yellow PROGRAM LED turn on followed by several flashes of the green OK LED when the loco acknowledges receipt of the programming.

```
Program Track
Loco Addr 2920?
```
```
Progm address OK
PrmPT:What else?
```

This completes the programming step. Push the ESC key to return to the home page.

❍ **ESC**

Note: while the display may seem to indicate the decoder "took" the programming, that is not the meaning of this message. This message simply means the programming

When programming the locomotive decoder address, some other setup information is automatically programmed into the decoder. This is discussed in great detail in the advanced topics section. For now, just let the Command Station automatically handle all of the decoder setup chores for you.

Programming Decoder Configuration-Variable #11 (CV11)

The acronym CV is short for "configuration variable." A decoder has many CVs that affect how it works. A CV permanently stores a value that you program into the decoder. For example, sound decoders have the most CVs since there are many options for how they perform. Programming a decoder CV with a number is easy. The same keystrokes are used for any CV supported by the decoder.

The following step-by-step example will program CV11 to a value of zero. This CV tells the locomotive decoder what to do if it loses the DCC signal. The value of zero tells the decoder to simply keep running with the last known motion command.

We strongly recommend programming CV11 to zero in all of your decoders. You should do this right after programming their address.

❍**SVC PRGM**

If you don't have a programming track booster installed and you are programming sound decoders, you may see this message first. Just key in a 3 to continue on. If you have the programming track booster, the 2nd message will appear.

```
Decoder Type=2
ENT=OK or 1,2,3
```

```
Program Track
Program What?
```

❍**CV,** Tells the Command Station you want to program a CV.

```
Program Track
Config Var#____?
```

❍**1,** ❍**1,** ❍**ENT** Tells the Command Station which CV.

This message is asking you what you will be doing to CV11. The second line is lists some keys what the will select. For a decoder, writing to it means programming it. So push the 1 key to select "Rite" which is a shortened version of "write."

```
Config Var 0011
1=Rite,2=Verify?
```

❍**1**

The next message is asking what kind of number is to be written (programmed) into CV11. For now, push the 1 key to indicate that a "Valu" will be used (valu is an abbreviation fo value which means a regular numeric entry. There is more detail about the other option in the advanced topics section.

```
CV 0011 Write:
1=Valu or 2=Bit?
```

❍**1**

```
CV 0011 Write:
Value ___?
```

Now, the command station is waiting for you to key in the desired value for CV11. For this CV, the value will always be zero. Push the 0 key to enter the value and push the ENT key to indicate you are done completing entries.

❍**0,** ❍**ENT**

The value is programmed into the decoder.

```
CV 0011 Write:
Value 0__?
```

❍**ESC** Push ESC to return to the home page.

Make sure the green PROGRAM LED is OFF before removing the locomotive from the programming track.

```
CV#0011 Write OK
Config Var#____?
```

Motion CVs For Fine Tuning Decoder Performance

Motion CVs are used to fine tune the decoder's motor performance. Each of these has a unique key on the Command Station. For example, MSV is the 5 key. For the group of CVs below, the bracketed number is the actual CV being modified when you push the Command Station's key having this word. You cannot hurt the decoder by changing CVs, so try experiment with different values to determine the value that provides the desired action.

❍ MSV

Motor Starting Value [CV2] It is a value between 0 and 255 which sets the initial or starting speed of the motor at the first speed step. The higher the value, the higher the initial starting speed. This is used to compensate for mechanical mismatch and motor characteristics. It is especially useful for matching different manufacturers locomotives when running them in a consist. There is no range checking for the MSV and a large number will result in a jackrabbit zero to 60 MPH on the first speed step. Be careful!

❍ ACCL

Acceleration Rate [CV3] This is a number between 0 and 255 which programs the time it takes the decoder to move between speed steps in response to an increase in the throttle setting. A value of 0 means no delay so the decoder immediately jumps up from one step to the next step. Above 0, the value will have the affect of slowing down the rate of speed change and smoothing the transition. The effect of a specific value is somewhat dependent on the decoder brand and type. Try different values to see which one is preferred. However, large numbers will give an uncomfortably long delay to throttle changes.

❍ DECL

Deceleration rate [CV4] This is a number between 0 and 255 which programs the time it takes the decoder to move between speed steps in response to a decrease in the throttle setting. A value of 0 means no delay so the decoder immediately jumps down from one step to the next step. Higher values will have the affect of slowing down the rate of speed change. The effect of a specific value is somewhat dependent on the decoder brand and type. Try different values to see which one is preferred.

❍ CV, ❍ 5

Top Speed [CV5] CV5 doesn't have a dedicated key, so you need to select CV followed by the 5 key. CV5 sets the motor's top speed when the throttle is a full speed. If a lower top speed is needed, for example in speed matching application, set CV5 to a smaller value. The value can range from 0 (stop) to 255 (highest speed)

❍ CV, ❍ 6

Mid-point Speed [CV6] CV6 doesn't have a dedicated key, so you need to select CV followed by the 6 key. CV6 sets the motor voltage at the throttle's midpoint setting which corresponds to speed step 14 (in a 28 speed step setting).

Example: Service Programming Motion CVs

For this example, the decoder will be programmed to have a motor starting voltage, MSV, of 10 and an acceleration rate of 4 and a deceleration rate of 2.

Service Programming always starts by putting the locomotive on the programming track. Make sure the wheels are clean as well as the programming track. Poor contact between the locomotive and the programming track can cause the programing commands to be ignored. Remember that you can't hurt the decoder by programming.

○ **SVC PRGM** If the command station cannot determine the type decoder, key in the value of 3.

```
Program Track
Program What?
```

○ **MSV** this is the "5" key on the Command Station

```
Program Track
Start Value ___?
```

○ **1,** ○ **0,** ○ **ENT**

The moment ENT is pressed, the MSV value of 10 is sent to the decoder.

```
Program Track
Start Value 10_?
```

```
Progm StValue OK
PgmPT:What Else?
```

Note the message asking if you want to program something else. Let's keep going and program the ACCL and DECL values. There is no need to push SVC PRGM again; just enter the next item to be programmed.

○ **ACCL**

```
Program Track
Accel Value ___?
```

○ **4,** ○ **ENT**

```
Program Track
Accel Value 4__?
```

```
Progm accl OK
PgmPT:What Else?
```

Keep going - there is no need to push SVC PRGM again; just enter the next item to be programmed which is the deceleration value.

○ **DECL**

```
Program Track
Decel Value ___?
```

○ **2,** ○ **ENT**

```
Program Track
Decel Value 2__?
```

```
Progm decel OK
PgmPT:What Else?
```

This is the last entry for this example.

○ **ESC**

```
V=631 T=08 M=231
A=____   B=____
```

Push ESC to finish and return to the normal display. This concept of continuous entry is a handy method for loading a bunch of CVs are one time and cuts down on the number of keystrokes. If an incorrect value is accidentally used, just restart with the item you want to change and put in the wanted value.

> ### EasyDCC Uses Decimal Values For All Entries
>
> EasyDCC uses decimal for all CV value entries (0-9). However, your decoder manual may suggest the use of "hexadecimal" numbers (0-F) for CV values. Before using a hex value, you must convert it to its equivalent decimal value. A conversion table is in the back of this manual. But, if you forget to convert the value no harm is done.

DO NOT change locomotive decoder addresses or accessory decoder addresses using the main line programming method - use the programming track.

"OPS Programming" or "Mainline Programming" allows changes to a decoder while it is on the main track. OPS programming is a safe way to make changes to a specific locomotive without worrying about changing other locomotives. You can change any CV in the selected decoder. All other decoders will ignore the programming commands.

For best results, make sure the locomotive is not running and is on a clean section of track. The decoder must be powered to receive the programming commands.

The decoder address is always used in OPS programming since the Command Station must know where to send the programming commands.

○ OPS PRGM

This key always starts any operation where you intend to program a locomotive decoder on the main line. You then must specify the locomotive decoder's address. For this example locomotive # 1534 will be used.

```
Program Main Trk
Loco #____ ?
```

```
Program Main Trk
Loco# 1534 ?
```

○1, ○5, ○3, ○4, ○ENT

Now you must specify what it is you will be programming. You may program any CV inside the decoder except CV1. For CV1, the primary address, use the programming track.

```
Program Main Trk
L# 1534's What?
```

You may use the direct entry keys for ACCEL, DECL, LOCO, MSV, #STEPS (number of speed steps), SPDTABL (speed table), and MACRO.

For this example, the ACCEL value will be changed to 5.

○ACCEL   *[push the OPS PRGM key again]*

○5,

○ENT

You can select another item to program or push ESC to end the procedure. All other OPS programming commands using direct entry keys are done the same way.

```
Loco 1534:
Accel Value ___?
```

```
Loco 1534:
Accel Value 5?
```

```
L#1534 accel set
PgmMT What Else
```

Programming a specific CV value on the mainline is slightly different but just as easy and is described on the next page.

Locomotive Must Be On The Main Track And Powered

A common problem during main track programming is forgetting to put the locomotive on the layout and in a powered section. Make sure the locomotive is not running. Intermittent contact will interfere with the programming commands.

CV Programming On The Main Track

DO NOT change locomotive decoder addresses or accessory decoder addresses using the main line programming method - use the programming track.

CV programming is a bit different so that multiple entries to the same CV can be done. Sound decoders have lots of CVs for which you may make many value changes on each CV to get the sound "just right." Therefore, you can continue to enter new values to the same CV without having to reenter the specific CV again. For this example, locomotive number 15 will have its CV#195 programmed with a value of 49 and then changed to a value of 52.

○**OPS PRGM,**

○**1,** ○**5,**

○**ENT,**

○**CV,** *[the 3 key]*

○**1,** ○**9,** ○**5,**

○**ENT**

```
Program Main Trk
Loco# 15__?
```

```
Program Main Trk
L# 1534's What?
```

```
Main trk: L#0015
Config Var#195_?
```

```
CV#0195 Write:
1=Valu or 2=Bit?
```

You have the option of programming either a decimal value or a specific single bit of the 8 bit CV. If you are not familiar with bit programming, we recommend using the value entry method. Your decoder manual will help you determine the proper value for the desired effect.

○**1**

All CV value entries are in decimal. If your decoder manual says their suggested values are expressed as "HEX" numbers, you must convert to decimal numbers before using.

```
CV#0195 Write:
Value 49_?
```

○**4,** ○**9,** ○**ENT**

Notice that the displayed CV# has not changed. You can continue to enter new values to the same CV without having to reenter the specific CV again. For the sound decoder, the change takes effect immediately. We used the CV write routine to set up the desired volume levels on some of the effects.

```
CV#0195 Write OK
Value ___?
```

To finish the example, the new value of 52 is entered.

○**5,** ○**2,** ○**ENT**

```
CV#0195 Write OK
Value 52_?
```

You can continue sending values to the same CV until you like the result.

To select a new CV number to program, push OPS PRGM again. If you are done programming, push ESC to return to the home page.

Decoders With Long Address May Not Respond To Main Track Programming

Some older decoders may refuse to accept main track programming. This is a fault of the decoder, not your Command Station. Fortunately, nearly all modern decoders support main track programming without any problems.

If you experience problems when trying to use main track programming, the most common solution is to send the same programming command twice. For unknown reasons, the stubborn decoder must be told twice before the change takes effect.

Introduction To Multi-Unit Consisting

A consist is a group of locomotives that operate together as if they were a single unit. This section describes the various ways that consists can be created with the EasyDCC System.

A Few Definitions Are Needed First

There are many different names used to refer to a group of locomotives acting as a single unit or in other words, a multi-unit consist or simply consist for short. The EasyDCC System supports both standard and advanced consists. Each type has pros and cons and the following section will help you choose the most appropriate type.

There is one other type of consist called a "Basic Consist." However, that refers to a consist created by simply having all the locomotives programmed to the same address.

Advanced Consist

Advanced Consists (ADV) are the recommended method for creating multi-unit locomotive consists. It has the advantage of providing much more flexibility for how function commands are interpreted by each locomotive in the consist, an important consideration when using sound decoders. For example, the lead unit might be the only unit that sounds the horn but all units will have their dynamic brakes turned on when that function is enabled.

An advanced Consist is created when two or more locomotives operate together by programming each locomotive decoder in the consist to a shared "secondary" or "advanced consist" address. To do this, locomotives must be powered up to receive the reprogramming commands and reprogramming occurs on the main line. You do not use the programming track to set up advanced consists.

The Advanced Consist address range is 1 to 127 as defined by the NMRA-DCC standards. However, EasyDCC limits the range to 1 to 99. As a result, a locomotive with an address of 10 will also respond to Advanced Consist address of 10. Therefore, consider reserving this block of numbers for use only by advanced consists.

The benefit of this type of consist is that up to 8 locomotives can be in the consist yet the Command Station only sends out a single command to the advanced consist address. Thus, the Advanced Consists provide the fastest possible system performance for a group of locomotives.

Locomotives placed into an advanced consist will remain in the consist even if moved to another layout. The locomotives will all operate as a consist the moment the throttle is set to the advanced consist address.

Standard Consists

A Standard Consist (STD) is created when two or more locomotives are connected together and operated as a single unit but are allowed to use their own individual locomotive addresses. When the standard consist is built, a table is created inside the command station. The lead locomotive address becomes the consist address. The table is used to tell the Command Station all of the other addresses tied to the lead locomotive so that it will sequentially send out commands when a throttle command is received. The locomotives still use their original speed step setting.

The consist address can be any number from 1 to 9999. Throttle commands are sent to the lead locomotive plus all the other locomotives in the consist table. The locomotive decoders are not changed in any way. A standard consist can be built without having the locomotives on the layout.

While this sounds easy, the downside is that a single consist having 8 locomotives will cause the Command Station to take up to 8 times as much time to send out throttle commands. As a result, overall system performance slows down and sound functions like horn activation may experience a noticeable delay. As more and more standard consists are used, the response time will slow to a crawl. We have tested 31 throttles simultaneously controlling 31 consists with each consist having 8 locomotives - a total of 248 active locomotives. The response time was simply unusable. For the highest performance system, always use either advanced or basic consists.

Locomotives placed into an standard consist will not retain any knowledge about their inclusion in a standard consist if status if moved to another layout. The standard consist must be created again on the new layout.

Why We Recommend Using Advanced Consists

For the fastest system and locomotive response to all commands, and when you have many active throttles, use Advanced Consisting. There some limits on what can be used for Consist numbers, but you can be assured that your locomotives will have the fastest possible response to items such as horn or whistle activation.

Locomotives that will be in an advanced consist must be on the main line and powered up to receive the Advanced Consist reprogramming commands.

Advanced consists also have much more flexibility with regards to how each locomotive responds to function commands. This becomes very important if you are using sound decoders or have equipped your locomotives with advanced lighting effects.

There is a section starting on page 80 that has the step by step details for setting up functions for a locomotive in an Advanced Consist. We also provide a worksheet for you to use.

Make sure you have your decoder manual. Only it will explain the options and values needed to setup the decoder for what you want.

Why You Might Use Standard Consists

If you have only a few locomotives or don't have many active throttles, standard consisting may be perfect for your railroad.

Unlike an Advanced Consist, the locomotive to be put into a standard consist does not have to be on the track and powered up.

There is no limitation on the standard consist number. The lead locomotive number becomes the consist number.

The decoder is not modified in any way when in a standard consist. It continues to respond to either its primary address even if in a consist. But beware of other locomotives that are in the standard consist. If the throttle is set for the standard consist, all locomotives of that consist will move in response to speed changes.

You Can Have Both Advanced and Standard Consists At The Same Time

Both types can be built and used at any time. The only limitation is if you try to use the locomotive in two different consists. The rules for how this conflict is handled is discussed in each type of consist.

There Is One More Type Of Consisting - Basic

The most obvious and basic type of multi-unit consisting is to simply assign each locomotive in the consist to the same locomotive address. This type of consist is best if the locomotives are never intended to be used separately. A good example is a multi-unit consist found on passenger trains comprised of powered A and B units. Since these locomotives are never separated, each locomotive decoder can use the same address. We recommend using the lead locomotive's number as the address.

The downside for this type of consisting is the difficulty in matching the operating characteristics of widely differing locomotives so that they run well together. Also, if all locomotives have a sound decoder, they will all respond to function commands in unison.

Advanced Consists - Examples and Features

An Advanced Consist (ADV) is created at the Command Station. All locomotives to be included in the ADV must be on the layout and powered. It is a good idea to arrange all the locomotives to be placed into the Advanced Consist in the desired order before building the consist. An Advanced Consists provide the fastest possible system performance for a group of locomotives because only a single command is sent to which all locomotives in the Advanced Consist react. An Advanced Consist also provides the best options for tailoring each consisted locomotive to behave as desired for a specific function control.

The EasyDCC Advanced Consist address range is 1 to 99. When the consist is built, the selected consist address will be programmed into each locomotive's decoder as a "secondary" address. This is why all locomotives to be used in an Advanced Consist must be on the layout and powered up.

Understanding the ADVANCED CONSIST Setup Display

Creating or editing an Advanced Consist always starts with the same initial set of keystrokes. Push the SETUP key and then push the ADVCON key (the 9 key).

```
Setup ADV Cons.
Cons# __? (1-99)
```

Enter the desired consist number which must be in the range of 1 to 99. For this example, 7 is the advanced consist address. The display then shows the 3 available commands.

```
ACons#0007,1=Add
2=Remove,3=Kill?
```

ACons# 0007 is the Advanced Consist address you just entered.

1=Add. Means push the 1 key to tell the command station you want to add the 1st or lead locomotive to the advanced consist. Seven more loco addresses may be added, for a maximum of 8 loco addresses in ACons# 0007.

2=Remove means push the 2 key to remove or delete a specific locomotive address from ACons# 0007

3=Kill means push the 3 key to remove the ACons# 0007 from memory. Any locomotives that were in the consist now respond to their original address.

Setting Locomotive Direction Orientation

You will be asked to enter either R for reversed orientation or N for normal orientation for each locomotive added to the consist.

```
Add Loco 6267
Press R or N
```

Normal is relative to the forward direction of the consist, i.e. the direction the consist will move when the throttle's direction switch is set to forward. If the locomotive cab is pointing in the consist's forward direction, its orientation is Normal. If the locomotive is facing backward, its orientation is Reversed. Use the R and the N keys located under the ACCESSORIES button for entering reversed and normal direction entry. The locomotives, their cab numbers and their orientation are show below for this example.

→ Forward

Trailing Unit		**Lead Unit**
Reverse	Normal	Normal
#2841	#51	#1891
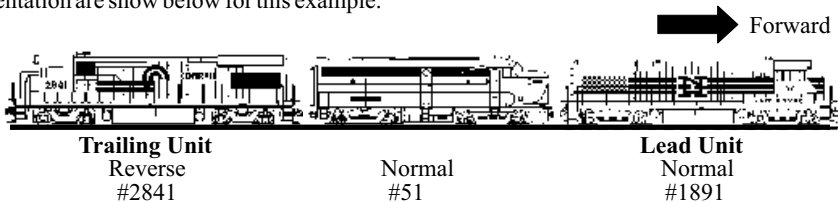
Automatic Registration Of Consisted Locomotives

Any locomotive address that is "new" to the Command Station, is automatically registered and managed by the command station when assigned to a consist. No action is required on your part unless you want to change the default system speed steps. The new addresses do not have to be connected to a throttle or manually registered to be used in a consist.

Building an Advanced Consist - Step-By Step Example

The 3 locomotives from the last page will be used for this example. From left to right, the locomotives are 2841, 51 and 1891 which are also their primary addresses programmed into the decoder. For this example, the lead locomotive is1891 and forward will be defined as moving to the right as shown by the arrow. The Advanced Consist number will be the last two digits of the lead locomotive, 91. The following keystrokes are used to create Advanced Consist #91.

○**SETUP,**

```
Setup ADV Cons.
Cons# __? )1-99)
```

○**ADVCON** *[the 9 key]*

○**9,** ○**1,** ○**ENT**

```
ACons#0091,1=Add
2=Remove,3=Kill?
```

○**1** to add locomotive

Always start with the lead locomotive and work your way to the rear locomotive.

○**1,** ○**8,** ○**9,** ○**1,** ○**ENT** This is the lead locomotive's decoder address and it must be present on the mainline and powered up. If not, it will not "hear" the programming command.

```
Add Loco 1891
Press R or N
```

○**N-ON,** Press this key (found in the Accessories section of the keyboard) to tell the Command Station that the locomotive is in the "normal" direction relative to forward movement of the lead loco. Proceed on to the next locomotive.

○**1** to add the second locomotive

```
ACons#0091,1=Add
2=Remove,3=Kill?
```

○**5,** ○**1,** ○**ENT**

this is the 2nd locomotive's decoder address and it must be present on the mainline and powered up. If not, it will not "hear" the programming command.

```
Add Loco 51
Press R or N
```

○**N-ON,** Press this key to tell the Command Station that this locomotive is in the "normal" direction relative to lead loco. Proceed on to the 3rd and last locomotive.

○**1** to add the last locomotive

```
ACons#0091,1=Add
2=Remove,3=Kill?
```

○**2,** ○**8,** ○**4,** ○**1,** ○**ENT**

this is the 3rd locomotive's decoder address and it must be present on the mainline and powered up. If not, it will not "hear" the programming command.

```
Add Loco 2841
Press R or N
```

○**R-OFF,** Press this key (found in the Accessories section of the keyboard) to tell the Command Station that the locomotive is in the "reversed" direction relative to lead loco.

```
ACons#0091,1=Add
2=Remove,3=Kill?
```

○**ESC**

This concludes the building of the consist. Press the ESC key to exit and return to the home page. If these locomotives have not been previously used, the M count will have decreased to reflect the new locomotives.

Show Locomotives In An Advanced Consist

○**SHOW,**

○**ADVCON** *[the 9 key]*

○**9,** ○**1,** ○**ENT** 91 is the consist built in the previous example. If your consist number is different, use it instead.

On the bottom line, the three consisted locomotives are listed. The lead unit is listed first, which is 1591. The small n after the number indicates a normal orientation. The second locomotive is then listed with its normal orientation. The third locomotive is listed with its reverse orientation.

The + sign indicates there may be additional locomotives in the consist. To see the remaining locomotives, if any, push ENT. Since this consist has only 3 locos, the bottom line is blank. Push ESC to return to the home page.

```
Show What?
```

```
Consist# 91__?
```

```
ADV Consist 0091
1591n0051n2841r+
```

```
ADV Consist 0091
```

Show All Active Advanced Consists

○**SHOW,**

○**ADVCON** *[the 9 key]*

○**ENT**

In this example, only one consist has been loaded, number 91. Additional advanced consist numbers would be separated by a plus sign. If there are more than can fit on the line, push ENT to see the remaining consist numbers. Push ESC to return to the home page.

```
Show What?
```

```
Consist# ____?
```

```
Active ADV Cons:
0091
```

Show A Locomotive's Assigned Advanced Consist Number

This command displays the consist number for the entered locomotive address, the type of consist and the orientation in the consist. This is a very handy tool when a locomotive is not responding to the throttle. If this occurs, the most likely causes is that the loco address has been placed into a consist, either on purpose or accidentally. This command can quickly confirm if this is the cause of the problem. For this example, locomotive 2841 will be checked.

○**SHOW,**

○**LOCO** *[push the SHOW key again]*

○**2,** ○**8,** ○**4,** ○**1,**

○**ENT**

○**CONSIST** *[which is the SETUP key]*

For locomotive 2841, the screen shows that it is in an ADVanced consist. The consist number is 91. The locomotive orientation is reversed.

If the abbreviation STD is show, it means the locomotive address is in a standard consist discussed next.

If a locomotive that is in more than one consist only the lowest consist number is shown when this command is used.

```
Show What?
```

```
Loco # ____?
```

```
Loco #2841
```

```
Show Loco #2841:
Spd,#Steps,Cons?
```

```
Loco# 2841 is in
ADV Cons.# 0091r
```

If the locomotive is not in a consist, the display will say "Loco nnnn is in NO consist."

Push ESC to return to the home page.

More Than One Advanced Consist Is OK

A locomotive can be in more than one Advanced Consist. However, it can't be in both an Advanced Consist and a Standard Consist at the same time.

Remove A Locomotive From An Advanced Consist

For this example, locomotive 51 will be removed from Advanced Consist number 91. Make sure the locomotive is on the tracks and powered on because it will be reprogrammed back to its original primary address.

○**SETUP,**

```
Setup ADV Cons.
Cons# __? )1-99)
```

○**ADVCON** *[the 9 key]*

○**9,** ○**1,** ○**ENT**

```
ACons#0091,1=Add
2=Remove,3=Kill?
```

○**2** to remove a locomotive from the consist

```
ADV Consist 0091
Remove Loco____?
```

○**5,** ○**1,**

○**ENT**

```
ADV Consist 0091
Remove Loco51__?
```

Locomotive number 51 has been removed from consist number 91. If you are done, press ESC to return to the home page.

```
ACons#0091,1=Add
2=Remove,3=Kill?
```

Kill (Delete) An Advanced Consist

For this example, Advanced Consist # 91 will be deleted. This command cannot be undone so make sure to use the proper consist number. All locomotives in the consist must be on the tracks and powered because they will all be reprogrammed back to their original primary address.

○**SETUP,**

```
Setup ADV Cons.
Cons# __? )1-99)
```

○**ADVCON** *[the 9 key]*

○**9,** ○**1,** ○**ENT**

```
ACons#0091,1=Add
2=Remove,3=Kill?
```

○**3** to delete/kill the entire consist and restore all locomotives to their primary addresses.

Press ESC to return to the home page.

```
ADV Consist 0091
De-Activated
```

Controlling An Advanced Consist

From the Command Station: To control an advanced consist use the SETUP THROTTLE-A or THROTTLE-B command to assign the two digit advanced consist number to either A or B throttle.

Plug-In or Wireless Throttles: Enter the consist address just as you would a locomotive address. The entire advanced consist will respond to the throttle commands.

A consist can be controlled by only one throttle at a time. Two throttles cannot have the same address.

"Consist Number Is Full" The Message

This message appears the moment you attempt to add a 9th locomotive to a consist. Only 8 locomotives are allowed in a consist. In this example, locomotive 2145 was to be added to Advanced Consist #91. But, it already has 8 locomotives so it is full.

```
No 2145 to 0091
0091 is FULL!
```

Clear Command Station Memory Does Not Clear Advanced Consists

Since a decoder is reprogrammed when assigned to an advanced consist, just clearing the Command Station's memory will not change the decoder. If the Command Station's memory has been cleared, or the Advanced Consist was accidentally deleted, just reload the Advanced Consist. Once the consist is back in the Command Station, all edit commands will now work. Make sure the locomotives are on the track and powered on.

Adding or Restoring Existing Advanced Consists

If someone brings an advanced consist to your layout, the advanced consist address can be used just like any other locomotive address. However, if you desire to add or delete locomotives to the advanced consist, you must first setup the advanced consist in the your Command Station.

If your Command Station looses its memory either through the loss of the backup battery or accidentally erasing the memory, all advanced consist setup information will also be lost. You must use the SETUP ADVCON command to reenter the advanced consist information.

In each of the above cases, you only need to enter the locomotive addresses that make up the advanced consist. Don't forget to also enter the direction orientation. The locomotives do not need to be on the layout **if** you are restoring or adding an existing advanced consist. This is because the locomotives were previously given their consist address.

Deleting All Consists In The Command Station

This command erases all consists, Standard and Advanced, from the Command Station's memory. This command will not restore the primary addresses for any locomotive that has been put into an Advanced Consist. This command cannot be undone.

❍**ESC,** You must push and hold the ESC key first, then,

❍**RESET** Push and release the reset key. This will start the deletion sequence and restart the Command Station. The moment you see the display change, release the ESC key. At the end of the initialization sequence, all consists are deleted but all other settings are unchanged.

Manually Changing A Locomotive's Consist Number

We strongly recommend the use of the SETUP ADVCON commands to setup an advanced consist or to remove locomotives from an advanced consist. The command station will handle all of the necessary decoder programming.

However, if you want to manually program a decoder to an advanced consist or program it back to its original address it can be done using the programming track.

Manually Deleting A Decoder's Advanced Consist Address

CV19 holds the decoder's Advanced Consist address. If the value is 0, the decoder will automatically go back to it's original address. Use SVC Program and write a value of 0 to CV19. Some decoders may need a power cycle and most decoders will bump the motor slightly when the programming occurs.

Manually Programming a Decoder's Advanced Consist Address

CV19 uses a special value to store the address and the direction orientation. The following table provides a pattern that you can use to manually load your own value. For deails for how CV19 is configured, please go to the NMRA-DCC website http://www.nmra.org/standards/DCC/DCCHome.html

CV19 Value Based On The Advanced Consist Address

Address	Normal	Reverse	Note
0	0	n/a	Deactivates Advanced Consist Mode
1	1	128+1=129	
2	2	128+2=130	
3	3	128+3=131	

If The Locomotive Doesn't Run After Programming

If you have not properly programmed the address or setup the CV to the correct values, the locomotive may not operate.

If this ever happens, use the decoder's RESET TO FACTORY DEFAULT commands to restore the decoder to its factory default of address 3. Use the programming track to set the decoder address to the desired value.

Building Standard Consists - Examples and Features

A STD or Standard Consist is created without requiring reprogramming of the locomotive decoder. The address range for Standard Consists is 1 to 9999. Standard consists are somewhat easier to work with but don't offer all of the flexibility for customizing how consisted locomotives behave. The system performance also suffers when more than just a few Standard Consists are active. Below are some of the features of a standard consist.

• Standard consists are setup at the Command Station

• Locomotives can be placed into multiple consists

• Any type of decoder can be used in a standard consist

• Locomotives can point in either direction

• The lead locomotive number is always the consist number

• Locomotives will use their individual operating characteristics such as speed steps, MSV, DECL and ACCL values

• A consist address cannot be used in another consist

• No changes are made to the decoder.

• Function commands only work with the lead loco.

• The number 0 can not be used as a consist number.

Understanding the SETUP CONSIST Display

Creating, editing and deleting a standard consist always starts with the same initial set of keystrokes. Push the SETUP key and then push it again. Enter the desired consist number which is usually the lead locomotive number. The display then shows the 3 available commands.

```
SETUP CONSIST
Consist #_____
```

Cons# nnnn is the lead locomotive's address and also becomes the "consist number" to which the commands will be applied. The range of loco addresses is 1 to 9999. **Do not enter the lead locomotive number using the add command since it is already being used as the consist number.**

```
Cons# nnnn:1=Add
2=Remove, 3=Kill
```

1=Add means push the 1 key to tell the command station you want to add the 2nd and subsequent locomotive addresses to the consist nnnn.. Seven more loco addresses may be added, for a maximum of 8 loco addresses in a consist.

2=Remove means push the 2 key to allow the removal or deletion of a specific locomotive address from consist nnnn.

3=Kill means push the 3 key to remove the consist address from memory. Any locomotives that were in the consist now respond to their original address.

Setting Locomotive Direction Orientation in a Consist

After pushing the 1 key to ADD a locomotive and entering the address, you will be asked to enter its orientation relative to the forward direction of the consist, i.e. the direction the consist will move when the throttle's direction switch is set to forward. If the cab is pointing in the consist's forward direction, its orientation is Normal. If the locomotive is facing backward, its orientation is Reverse.

```
STD Consist 0003
Add Loco  #45__
```

```
Add Loco 0045
Press R or N
```

Use the R and the N keys located under the ACCESSORY button for reverse and normal direction entry.

➡ Forward

Trailing Unit	Normal	Lead Unit
Reverse	#51	Normal
#2841		#1891
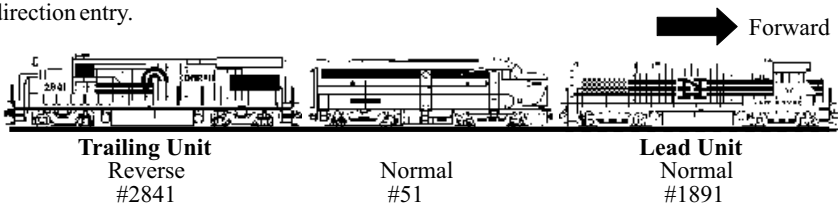
Building A Standard Consist - Detailed Example

First decide the lead locomotive. It's decoder address will be the consist number. Second, decide which locomotives you will put into the consist and in what orientation. For this example, the lead locomotive's address is 1891 and will have 2 more locomotives: 51 and 2841. Loco 51 is facing forward. Locomotive 2841 is facing backwards. It is a good idea to have all the locomotives oriented correctly and coupled together before creating the consist. To cancel the build process, push the ESC key before adding any locomotives.

○**SETUP,**

○**CONSIST** *[push SETUP key again]*

```
Setup/Assign
    What
```

```
SETUP CONSIST
Consist #_____
```

○**1, ○8, ○9, ○1, ○ENT**

```
Setup Consist:
Consist #1891?
```

○**1** to add the second locomotive. We recommend adding the locomotives in the same order as they are in the consist.

```
Cons# 1891:1=Add
2=Remove, 3=Kill
```

○**5, ○1, ○ENT**

```
STD Consist 1891
Add Loco #51__?
```

○**N-ON,** Press this key to tell the Command Station that this locomotive is in the "normal" direction relative to lead loco. Proceed on to the 3rd and last locomotive.

```
Add Loco 0051
Press R or N
```

○**1** to add the last locomotive

```
Cons# 1891:1=Add
2=Remove, 3=Kill
```

○**2, ○8, ○4, ○1, ○ENT**

```
STD Consist 1891
Add Loco #2841?
```

○**R-OFF,** Press this key (found in the Accessories section of the keyboard) to tell the Command Station that the locomotive is in the "reversed" direction relative to lead loco.

```
Add Loco 1891
Press R or N
```

This concludes the building of the standard consist with locomotive 1891 in the lead. Press the ESC key to exit and return to the home page.

To control the consist, set the throttle to 1891 and all locomotives attached to 1891 will respond to the throttle's speed and direction setting. All function commands will be sent to only the lead locomotive.

Automatic Registration

Any locomotive address that is "new" to the Command Station, is automatically registered and managed by the command station when assigned to a consist. No action is required on your part unless you want to change the default system speed steps.

Dual Control

Once a locomotive is assigned to a standard consist, it will respond to commands on the Consist address and its primary address. This can cause erratic operation if two different throttles attempt to control the standard consist and the locomotive address at the same time.

"Consist Number Is Full" Message

This message appears the moment you attempt to add a 9th locomotive to a consist. Only 8 locomotives are allowed in a consist. In this example, locomotive 2145 was to be added to consist #1891. But, it already has 8 locomotives so it is full.

```
No 2145 to 1891
1891 is FULL!
```

Show Locomotives In An Standard Consist

○**SHOW,**

○**CONSIST** *[the SETUP key]*

○**1,** ○**8,** ○**9,** ○**1,** ○**ENT**   1891 is the consist built in the previous example. If your consist number is different, use it instead.

All of the locomotives, including the lead unit, are shown. Also notice that the direction orientation are also shown through the use of a lower case n or r. By default, the lead locomotive is always normal. If the consist has more than 2 locomotive addresses, a + symbol will be shown on the second line. Push the ENT to see the next set of locomotive addresses. Push ESC to cancel the command.

The + sign indicates there may be additional locomotives in the consist. To see the remaining locomotives, if any, push ENT. Since this consist has only 3 locos, the bottom line is blank. Push ESC to return to the home page.

```
Show What?
```

```
Consist# 1891?
```

```
STD Consist 1891
1891n0051n2841r+
```

```
STD Consist 0091
```

Show All Active Standard Consists

○**SHOW,**

○**CONSIST** *[the SETUP key]*

○**ENT**

In this example, only one standard consist has been loaded, number 1891. Additional standard consist numbers would be separated by a plus sign. If there are more than can fit on the line, push ENT to see the remaining consist numbers. Push ESC to return to the home page.

```
Show What?
```

```
Consist# ____?
```

```
Active STD Cons:
1891
```

Show A Locomotive's Assigned Standard Consist Number

This command displays the consist number for the entered locomotive address, the type of consist and the orientation in the consist. This is a very handy tool when a locomotive is not responding to the throttle. If this occurs, the most likely causes is that the loco address has been placed into a consist, either on purpose or accidentally. This command can quickly confirm if this is the cause of the problem. For this example, locomotive 2841 will be checked.

○**SHOW,**

○**LOCO** *[push the SHOW key again]*

○**2,** ○**8,** ○**4,** ○**1,**

○**ENT**

○**CONSIST** *[which is the SETUP key]*

For locomotive 2841, the screen shows that it is in a Standard consist numbered 1891. The orientation shows reversed.

When the abbreviation ADV is shown, it means the locomotive address is in an Advanced consist and not a Standard consist. .

If a locomotive that is in more than one consist only the lowest consist number is shown when this command is used.

If the locomotive is not in a consist, the display will say "Loco nnnn is in NO consist."

Push ESC to return to the home page.

```
Show What?
```

```
Loco # ____?
```

```
Loco #2841
```

```
Show Loco #2841:
Spd,#Steps,Cons?
```

```
Loco# 2841 is in
STD Cons.# 1891r
```

Remove A Locomotive From A Standard Consist

For this example, locomotive 51 will be removed from Standard Consist number 1891. This is the consist created in the last example.

○**SETUP,**

○**CONSIST** *[the SETUP key]*

○**1,** ○**8,** ○**9,** ○**1,** ○**ENT**

Setup Consist
Cons# ＿＿＿＿

Setup Consist
Cons# 1891

○**2**   to remove a locomotive from the consist

Cons# 1891,1=Add
2=Remove,3=Kill?

STD Consist 1891
Remove Loco＿＿＿＿?

○**5,** ○**1,**

STD Consist 1891
Remove Loco51＿＿?

○**ENT**

Cons# 1891,1=Add
2=Remove,3=Kill?

Locomotive number 51 has been removed from consist number 91. If you are done, press ESC to return to the home page.

Note: The Command Station does not check that the entered locomotive address is in the specified consist. If an incorrect number is entered, no error message is displayed. It is a good idea to use the SHOW CONSIST command to confirm the address has been deleted.

Kill (Delete) A Standard Consist

This command allows you to delete all locomotives in a standard consist. For this example, consist 1891 will be cleared of all locomotives.

○**SETUP,**

○**CONSIST** *[the SETUP key]*

○**1,** ○**8,** ○**9,** ○**1,** ○**ENT**

○**3**   to delete/kill the entire consist.

Press ESC to return to the home page.

Setup Consist
Cons# ＿＿＿＿

Setup Consist
Cons# 1891

Cons# 1891,1=Add
2=Remove,3=Kill?

STD Consist 1891
De-Activated

Deleting All Consists In The Command Station

This command erases all consists, Standard and Advanced, from the Command Station's memory. This command cannot be undone.

○**ESC,** You must push and <u>hold</u> the ESC key first, then,

○**RESET** Push and release the reset key. This will start the deletion sequence and restart the Command Station. The moment you see the display change, release the ESC key. At the end of the initialization sequence, all consists will have been deleted but all other Command Station settings will be unchanged.

Loco Runs On 2 Addresses
If a loco is responding to two different addresses, somebody may have placed it into a consist. Use the SHOW LOCO CONSIST command to verify.

Loco Runs On Wrong Address
If a loco seems to be operating on the wrong address somebody may have placed it into a consist.

Standard Consist Notes And Tips and FAQs

Decoder Function Control - Only the lead locomotive can have its functions controlled by the throttle. The other locomotives can not have their functions controlled by the throttle.

Speed Steps - One neat feature of standard consists, is that the Command Station's transmitted speed steps and the locomotive's speed step settings are maintained for the consisted locomotives.

For example, loco 4600 is set for 14 speed steps. Loco 459 is set for 128 speed steps. When placed into a standard consist each will continue to receive the sent the proper speed steps.

For an unregistered locomotive, the transmitted speed steps is set to the system default when added to a standard consist.

Each Consist Counts As An Address - The internal memory (M count on home page) of the Command Station, maintains a table that has 255 locomotive entries. These entries are for all locomotive addresses, consist addresses and "consisted" locomotives. All of these count towards the total number of addresses stored in the table.

Frequently Asked Questions: While standard consists are the easiest to create and use, there are some unique properties that may seem puzzling. Should you encounter something peculiar, chances are good, the explanation will be found below.

Can I change the orientation of the consist's lead locomotive? No. The lead locomotive orientation can not be changed from the default of NORMAL.

If I remove the lead locomotive address from the consist, does this "kill" the entire consist? No. You must use the KILL command.

Can I have a consist number that does not correspond to a locomotive address? Although the answer is yes, the decoder functions will no longer work.

Can a locomotive address be assigned to more than one standard consist? Yes. A locomotive that is added to more than one consist will only have the lowest consist number displayed when the SHOW LOCO nnnn CONSIST command is used.

Can the SHOW LOCO SPEED command be used to monitor a loco's speed if the loco is in a standard consist? Yes.

Does removing a loco from a consist remove it from all consists? No. It is only removed from the specified consists.

What if I try to add a locomotive address to a consist and it is already there? Does it get added twice? If the locomotive address is already present, the command is simply ignored.

What happens if the maximum number of 8 loco addresses in a consist is reached and I try to add a ninth address? The command will be ignored. The consist is unchanged.

What happens when I try to delete a loco address from a consist that doesn't exist? The command will be ignored.

What happens if a loco address is already in an advanced consist and I try to assign it to a standard consist? A locomotive can not be in both a standard consist and an advanced consist at the same time. If this is attempted, an error message will be displayed. You need to first remove the locomotive from the advanced consist, before assigning it to a standard consist.

What happens if a loco address is in a standard consist and I assign it to an advanced consist? The locomotive will be automatically removed from the standard consist first and then assigned to the advanced consist. A locomotive can not be in both a standard consist and an advanced consist at the same time.

What happens when I assign a loco address to a standard consist while it is already in another standard consist? The locomotive address will be placed into both consists. When used in standard consists, locomotives can belong to multiple consists at the same time.

Additional Standard Consist Error Messages

If trying to assign the Standard consist's lead loco to another consist:

A consist can not include another lead loco of another consist. This is sometimes called "nested" consists and is not allowed. If you attempt to assign a locomotive that is already used as the lead locomotive in another consist, the Command Station will display the following message where nnn1 is the loco address that is being assigned to consist nnn2.

```
No nnn1 to nnn2!
nnn1 is STD cons
```

If trying to assign more than more than 7 additional locomotives to a consist:

A total of 8 locomotives (7 plus the lead loco) may be in a standard consist. In this message, nnnn is the loco number to be added standard consist number xxxx which is full and will not take any more locomotives.

```
No nnnn to xxxx
xxxx is FULL!
```

If an internal error occurs during ADD, DELETE or KILL:

The Command Station handles many simultaneous functions. Sending speed and direction commands takes top priority. Because of this, it is possible to miss a keystroke during consist editing. If this occurs, and you see this message, just repeat the command.

```
Repeat SETUP!
```

If assigning a loco address that is already in an Advanced Consist

A locomotive can not be in both a standard consist and an advanced consist at the same time. If this is attempted, this message is displayed. Locomotive nnn1 is already in an Advanced Consist so cannot be assigned to standard consist nnn2. First remove the locomotive from the advanced consist, before assigning it to a standard consist.

```
No nnn1 to nnn2!
nnn1 in ADV cons
```

Locomotive Speed Matching In Standard Consists

In a perfect world, all locomotives will run exactly the same. That is they will all start at the same throttle setting, accelerate at the same speed, reach the same top speed and then decelerate at the same rate when stopping. Unfortunately, this is not the real world. No two locomotives have the same operating characteristics. If placed in a consist, two mismatched locomotives will perform very poorly – with both fighting each other as they make their way around the layout. The following techniques will help match locomotives but they take time and a bit of trial and error for best results.

Quickie Match Technique #1 – Same Model Decoder and Locomotive

This is the easiest to do. Higher quality locomotives will work best. Kato and Atlas have the some of the best mechanical drives and perform well together. Make sure the decoders are set to the same speed steps and MSVs. Don't forget that if you use 128 speed steps, almost all decoders ignore settings for ACCL and DECL values. Older Lifelike and Bachmann have much stiffer mechanisms and tend to buck if mixed with a Kato or Atlas.

Quickie Match Technique #2 – Set MSVs, ACCL and DECL Values

This method works best if the decoder supports mainline programming (ops mode programming). Mismatch is most noticeable when locomotives first begin to move. However, if you set the lead locomotive to move out a bit quicker (higher MSV) than a trailing unit , the lead unit will be pulling slightly on the trailing unit for a smoother start. This also keeps tension on couplers and helps prevent false uncoupling. This effect can also be done by carefully selecting ACCL and DECL values. Be sure to use either 14 or 28 speed step settings for the decoders.

Quickie Match Technique #3 – User Defined Speed Tables

This will provide the most control over individual locomotive operation. This technique will allow the matching of widely differing locomotives. See the section titled Fine Tuning Locomotive Performance, for easy methods to change speed tables.

Troubleshooting Standard Consists

Consisted Locomotive Doesn't Run On Original Address or Runs On Another Address

The original address (also called the primary address) of a consisted locomotive may be restored by simply removing the locomotive from the standard consist.

Command Station Looses Consists

This occurs if the battery backup is bad, or the battery is removed while power is off. This can also occur if you accidentally push and hold the ESC key while turning on power. Doing so, erases all consists. You will have to reenter the consists if this occurs.

Restoring Standard Consists

The standard consist is a merely a table inside the Command Station. Standard consists do not change the locomotive decoder. Loss of a standard consist means the Command Station has lost the consist table. To restore the consist, you must reenter all locomotives used to create the consist.

ACCEL and DECL in 128 Step Mode

When set for 128 speed steps, most decoders ignore the ACCEL and DECL values. If in doubt, consult your decoder manual to determine if 128 speed steps makes use of ACCEL and DECL values.

Use 14 or 28 Speed Steps When Matching Locos For Consists

Most decoders ignore the MSV, ACCL and DECL values when in 128 speed steps. When matching widely differing locomotives, do not use 128 steps.

Controlling Accessory Decoders

The use of accessory decoders allows the control of turnouts, signals, lamps or other animation devices from the Command Station, plug-in throttle or wireless throttle. Like locomotive decoders, accessory decoders also have addresses and functions which may be controlled and programmed. Accessory addresses are different than locomotive addresses. You can have a locomotive address 22 and an accessory address 22 without any interference.

○**ACCESSORIES**   Pressing this key activates the mode in which you may specify a specific accessory output number or a route number. A route is a group of turnouts that are activated together.

```
Accy or Route
Output/Rt#____?
```

For this example, output address #5 will be used. It drives a switch machine. Notice the Yellow LED above the Accessories key turns on. This is a reminder that the address entered is for accessory decoders or routes.

○**5,** ○**ENT**

```
Accy or Route
Output/Rt#5___?
```

You must now specify which direction or what state you wish the decoder output to take. For this example, output #5 will be thrown in the reverse direction.

```
Accy Output 0005
Push R,N or SHOW
```

○**R-OFF**

You can immediately push the N key to throw the turnout in the other direction. This is handy when working with industry and yard tracks.

```
Accy Output 0005
=Reverse
```

```
Accy Output 0005
=Normal
```

To specify a new address, just push the ACCESSORIES key again.

○**ACCESSORIES**   Push this key again to select another accessory address.

○**ENT**   Push ESC to return to the home page and cancel accessory mode.

N-ON, R-OFF

These keys send the commands to activate or throw the specified turnout in the Normal or Reverse direction. For accessory decoders that are set for constant on output or flash, these keys turn on or off the output.

Accessory Doesn't Activate

Make sure you are using the correct OUTPUT address. The output address range is 1 to 2044. To learn more about CVP's accessory decoder, the AD4, be sure and see the booklet that comes it.

Turnout Throws Wrong Direction
Lamps Turn On Instead of Off

Your installation and wiring of the switch machine and/or lamps, will determine the actual direction of travel and whether the lamp is on or off. If a turnout throws the wrong direction, reverse the two wires at the turnout. If your lamp turns on instead of off, use the other half of the output pair.

Route Control - Simplify Complex Trackage the EasyDCC Way

EasyDCC includes true "route control" for turnouts driven by our AD4 accessory decoders. A route is nothing more than a group of turnouts that are aligned to send a train down a specific path. For example, complex junctions, yard ladder tracks, and large staging yards can be setup to route trains down specific tracks through the use of a simple two digit address, controllable from any throttle or the Command Station. Route control allows a large number of turnouts to be thrown, in a specific direction, with only the push of a few keys.

Route Control - Capabilities, Requirements and Terminology

- The Command Station has room for 63 unique routes
- Routes are numbered from 1 to 63
- Up to 32 turnouts per route
- Each turnout may be set to a specific direction
- Turnouts may be placed into multiple routes with different directions
- Local control can override route setting for any single turnout

Turnout Number is shown in illustration A as yyyy. This is the address of the decoder which powers the turnout. A route may use any valid accessory decoder address number.

Turnout Direction is described as being either "normal" or "reverse" and is shown as R or N in the illustrations. This means the turnout is set for either for the mainline (normal) or off-main line (reverse). You may choose other orientations such as straight or curved. Whichever wording is used, you must be consistent, as it will help during creation of the various routes.

Route Number is unique and related to a set of turnout numbers and directions. For example B, there are three turnout numbers with four routes; #1, #2, #3 and #4.

Routes Can Be Set NORMAL or REVERSE. The setting of a route NORMAL, throws all the turnouts as specified when the route was created. The route may also be set REVERSE which throws all turnouts opposite of what was specified in the route. The use of this feature will be described the complex route examples.

Sketch The Track Diagram Before Starting

A track diagram does not have to be neat or an exact replica of the trackage. Just be sure to mark the turnout's orientation and its decoder address. Any address may be used as long as you keep a record of which turnout is assigned to which address. Keep a copy of the sketch in case you forget how the route works.

Identify The Routes

Illustration B will be used to show how easy it is to create a route using some simple shorthand notes. The "shorthand" will also be used when the route is entered into the command station. This first example will describe the routes shown in B.

In words, Route # 1 is Turnout 101 thrown Normal. In shorthand: #1 = 101n. For Route #2, turnout 101 is thrown Reverse AND turnout 102 is thrown Reverse.

In shorthand: #2 = 101r + 102r.

Shorthand is used for the remaining routes

#3 = 101r + 102n + 103r

#4 = 101r + 102n + 103n

Complex Routes

Creating complicated routes is nothing more than imagining the path the train will travel to move from a one point to another. Keep a record of all turnouts encountered on this path and their orientation. Then create the shorthand description of the route. Illustrations C and D illustrate two more complicated routes.
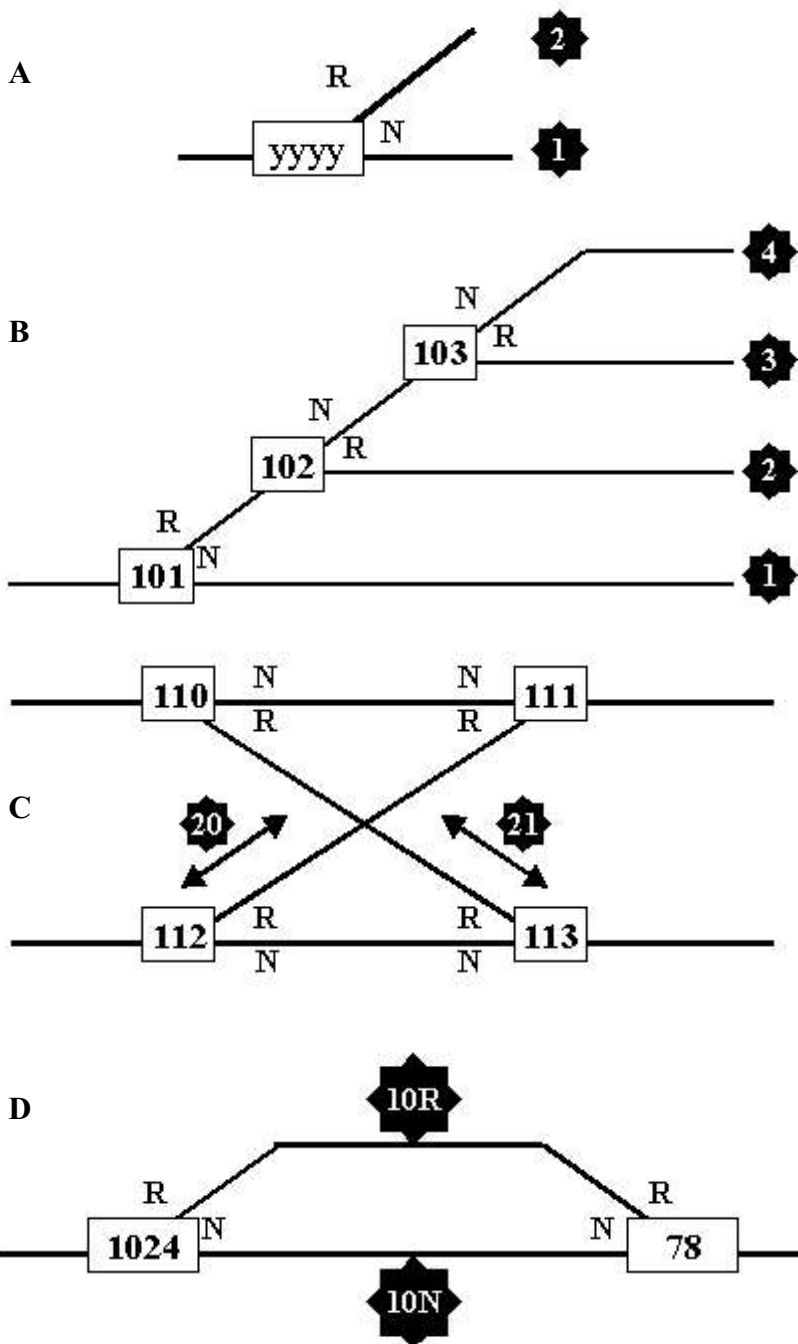
Double Crosssover Routes

This shows how only two routes are needed to control 4 turnouts. Route 20 controls 112 and 111. Route 21 controls 110 and 113. This example will also take advantage of routes which can be used normal or reverse.

Route #20 - NORMAL sets 112 and 111 normal or straight.   In shorthand: Route #20 = 112n + 111n. This is what will be entered into the Command Station.

You may think another route is needed to set the turnouts to reverse. But, remember that a route can also be thrown reverse. The command to throw route #20 reverse sends comands to the two turnout opposite of what was originally created for the route. Thus, Route #20 - REVERSE sets 112 and 111 both reverse. This same technique can be used with the other two turnouts.

Route 21 (NORMAL) = 110n + 113n.

Since it is highly unlikely that two trains would intentionally attempt to crossover at the same time, one last example with this trackage shows how a single route can control all 4 turnouts. For this example the route number will be #1.

Route #1 - NORMAL sets all turnouts straight.   Route #1 = 112n+ 113n + 110n + 111n. When this route is set REVERSE, all 4 turnouts are thrown reverse.

Passing Siding Route

This one is easy: Route #10 - NORMAL is just 1024 and 78 both set normal. Route #10 - REVERSE sets both 1024 and 78 reverse. In shorthand: Route #10n = 1024n + 78n.

Route Rules and Restrictions

• Routes may be numbered from 1 to 63. Any other number will be rejected.

• Up to 32 turnouts may be included in a route.

• Command packets are sent serially for each output in the route.

• Any output addresses that are contained on a single AD4 card will automatically have a 1/2 second delay added to ensure sufficient time for all outputs to throw. This delay IS NOT added if the address are not contained on a single card.

The following note is very important and restricts the   number of high current switch machines that can belong in a route.

Because of the time delay in sending route commands, there are special rules for outputs programmed for pulse duration in excess of 0.4 seconds.

If a route output is a -pulse- of greater duration than 0.4 seconds, it must be the last output in the route (the highest #), OR the last output of the decoder # to which it belongs.

For example: Outputs 1 (of 1,2,3,4) and 5 (of 5,6,7,8) and 11 (of 9,10,11,12) can be routed and all can be of maximum pulse duration because they all belong to different decoders. If outputs 1 and 2 and 3 are routed, only output 3 can be a pulse of greater duration than 0.4 seconds.

AD4 Output Address Not Working	**Deleting All Routes**
This may mean the address is part of a route. Use the show command to determine if this is true. Then remove the address from the route.	To remove all routes, **and** all consists, push and hold the ESC key and push and release the RESET button.

For this example, illustration B will be used and route number 2 will be entered. Start by pushing the Accessory Key followed by the Setup key. This sequence is always used to edit, create or change routes.

○**ACCESSORIES** Pressing this key activates the mode in which you may specify a specific accessory output number or a route number. A route is a group of turnouts that are activated together.

```
Accy or Route
Output/Rt#____?
```

○SETUP

You need to provide the desired route number in the range of 1 to 63. For this example, the new route number will be 2.

```
Setup Route -
Route # __?
```

○**2** The new route number

```
Rt02,1=Add,2=Del
3=Kill, 4=List
```

The Route Setup Commands shown are:

1=Add an output address to the specified route;

```
Route # 02:
Add Output#____?
```

2=Remove an output address from the specified route;

3=Kill or delete the specified route (all turnouts are removed);

4=Lists the current turnouts in the specified route

○**1** to add an output address to the specified route

○**1,** ○**0,** ○**1,** this is the output address, not the card number or CV. Don't push enter yet because you must indicate if the turnout is normal or reverse for this route.

```
Route # 02:
Add Output#101_?
```

Now push the desired setting, either NORMAL or REVERSE using the one of the two keys under the ACCESSORIES key. For this example, route 2 requires 101 to be set REVERSE. This key is found under the ACCESSORIES key. For this example, the direction is reverse If you accidentally push the wrong direction key, push the correct direction to override the previous setting. The display will show the turnout number and the direction that will be stored. Verify it is correct, and if so, hit ENTER to store the setting.

```
Route # 02:
Add Output#101_r
```

○R-OFF

○**ENT** The display will return to the route option screen.

○**1**

○**1,** ○**0,** ○**2,**

○R-OFF

○**ENT** The display will return to the route option screen. Now push 4 to list and check the outputs just loaded.

```
Rt02,1=Add,2=Del
3=Kill, 4=List
```

```
Route # 02:
Add Output#____?
```

○**4**

```
Route # 02:
Add Output#102_r
```

The screen shows the two turnout addresses along with the lower case letter for direction. Due to display limitations, no spacing is used between addresses. However, the letters serve to separate the numbers making it a little easier to read.

```
Rt02,1=Add,2=Del
3=Kill, 4=List
```

```
Route # 02:
101r0102r
```

Removing Individual Output Address From A Route

Removing output addresses from an existing route is done using option 2 from the Setup Menu. For this example, output address 102 will be removed from Route 2.

○**ACCESSORIES**

○**SETUP**

```
Accy or Route
Output/Rt#____?
```

○**2**   The route number to be modified, #2 in this example, must first be selected.

```
Setup Route -
Route # __?
```

○**ENT**

○**2**   Select option 2 to delete or remove individual output addresses from a route. Notice that remove is abbreviated to rem.

```
Rt02,1=Add,2=Del
3=Kill, 4=List
```

○**1, ○0, ○2**   Enter the output address to be removed.

```
Route # 2:
Rem Output#____?
```

○**ENT**   Pressing ENT removes the unwanted output address from Route #2. The display returns to the Route options menu, ready for another selection. This is handy when adding and removing multiple addresses.

```
Route # 2:
Rem Output#102_?
```

```
Rt02,1=Add,2=Del
3=Kill, 4=List
```

As before, it is a good idea to list the contents of route 2 to confirm the desired address has been removed. Just press 4 to list the remaining output addresses in Route # 2.

○**4**

The display shows there is only one turnout address remaining in route 2. Press ESC to return to the home page.

```
Route # 02:
0101r
```

○**ESC**

Show All Output Addresses on a Route

At any time, you may see what addresses are associated with a specific route number. For this example, route 2 will be used. If you have been following the examples and practicing on your system, you already know there is

○**ACCESSORIES**

○**SHOW**

```
Accy or Route
Output/Rt#____?
```

```
Show Output
Route # __?
```

○**2**   Enter the route number which is 2 for this example

```
Route # 02:
0101r
```

The display shows there is only one turnout address remaining in route 2.

If dashes appear in the display, the route is empty and unused. If more than 3 addresses are in a route, push the ENT key to see the remaining addresses. For this example, there is only one output address in Route 2.

○**ESC**   Press ESC to terminate the command.

Checking An Output Address For A Route Assignment

You may find yourself wondering if an output address is in a specific route. This command will display the route to which the specified address belongs – if any. This example uses route 2 which has one address remaining, address 101.

○**ACCESSORIES**

```
Accy or Route
Output/Rt#____?
```

○**1**, ○**0**, ○**1**   this is the output address to be checked

○**ENT**

```
Accy or Route
Output/Rt# 101_?
```

Notice that in addition to activating the output address, you can also SHOW its assignment to a route.

○**SHOW**

```
Accy Output 0101
Push R,N or SHOW
```

As expected, if you have been following and using these examples, output # 101 is assigned to route 2 and it is activated in the reverse direction when the route is activated..

```
Accy Output 0101
Is in Route# 02r
```

○**ESC**   Press ESC to return to the home page.

Show Active Route Numbers

At any time, you may see what routes are currently active. This is a slight modification of the Show addresses associated with a specific route number. In this case, don't enter a number, just push ENT.

○**ACCESSORIES**

```
Accy or Route
Output/Rt#____?
```

```
Accy Output 0101
Push R,N or SHOW
```

○**SHOW**

```
Show Output
Route # __?
```

The absence of a specific route number tells the Command Station to display all routes currently active (having output addresses).

○**ENT**

```
Active Routes:
002
```

What is shown are the route numbers in use. In this case there is only one, Route #2. If there were more than 3 active route, the + would appear at the end of the second line. This means push the ENT key to see the remaining active route numbers. For this example, only route #2 is active.

○**ESC**   Press ESC to return to the home page.

Delete (Kill) A Route Number

When route option 3 is selected, the displayed route's output address assignments are permanently deleted. This cannot be undone. Route 2 will be used for this example

○**ACCESSORIES**

```
Accy or Route
Output/Rt#____?
```

○**SETUP**

○**2**   this is the route to be deleted

```
Setup Route
Route #___?
```

○**ENT**

○**3**   Selects the Route kill option. All turnout output addresses are removed from the route and the route number is deleted.

```
Rt02,1=Add,2=Del
3=Kill, 4=List
```

○**ESC**   Press ESC to return to the home page.

```
Route # 02:
De-Activated
```

Command Station Advanced Features and Topics

Customizing Decoder Functions In An Advanced Consist

The Command Station automatically sends the function commands to the advanced consist address. This is a benefit because it provides a convenient way to customize how each consisted locomotive is to respond to the function command. For example, you might want only lead unit to be the only unit that sounds the horn but you want all units to have their dynamic brakes turned on when that function is enabled.

Another feature of advanced consists is that each locomotive in the consist can have its acceleration and deceleration rate fine tuned for optimum performance while in a consist. All of this flexibility is provided through the use of four configuration variables (CV) that are only used when the locomotive is in part of an advanced consist.

CV-21 controls whether the decoder's F1, F8 functions are controlled by the consist address or the primary address.

CV-22 controls the locomotive's response to the light commands. This is the F0 or FL function as well as the F9 through F12 functions.

CV-23 controls the locomotive's rate of acceleration when used in an advanced consist.. This rate is separate and distinct from the value used in CV-3.

CV-24 controls the locomotive's rate of deceleration when used in an advanced consist. This overrides the locomotives CV-4 value.

The values stored in these four CVs remain, even if power is removed or the locomotive is moved to another layout. The values are programmed via mainline or OPS programming. The programming can take place prior to or after the advanced consist is created. In all cases, the locomotive must be on the rails and powered.

Step-By-Step Example

The previously built advanced consist #91 will be used to illustrate how to setup each locomotive to respond to the function commands. The first step is to determine how each locomotive is to respond to each desired function command. For this simple example, the lead locomotive is 1891. It helps to fill out chart for each available function (as offered by the decoder) and if the locomotive is to respond or not respond.

Trailing Unit		**Lead Unit**
Reverse	Normal	Normal
#2841	#51	#1891
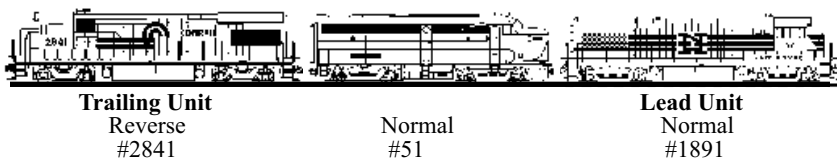
Recall that a CV contains 8 bits numbered from 0 through 7 with each bit controlling a function on the decoder. By using a little arithmetic, it is much easier to load a single decimal value into the CV than 8 separate binary values. Either method will work so choose the one that is easiest for you to understand. The decimal value method will be used for the example.

Build A Simple Chart

The first step is to build a chart, like the one on the next page, that shows all of the desired functions found on your decoder. For this example, the older DSX sound decoder is used. If you have made any modifications to the decoder function mapping, then the key and its associated function may be different.

> ### Check Your Decoder's Documentation
> Decoders are becoming more and more complicated and many manufacturers do not follow all of the NMMRA-DCC standards and recommended practices (RP) for CV21 and CV22. Always refer to the decoder's documentation to determine its capabilities and special requirements. If you have a decoder question, please contact the decoder manufacturer first because they are the only people that can help you with a decoder specific question.

For a simple sound decoder like the older DSX, the throttle's function keys are mapped to the following decoder functions and effects:

F0 turns on the headlight (direction key selects front and back);

F1 turns the bell on and off;

F2 controls the horn;

F3 turns on the coupler sound;

F4 turns on the fans.

Next, add a column for each locomotive and be sure to include it's decoder's primary address, not the consist's address. You need the locomotive decoder's primary address in order to send OPS programming commands to it.

There is a section for both CV-21 and CV-22. Note that the SDX decoder uses CV-22 for only the F0 light controls.

Once the table is complete, put a YES if you want the locomotive to respond to the function command or leave the entry blank if you do not want it to respond.

Below is a chart filled out with how each locomotive is to respond to the function commands when all three are in Advanced Consist number 91.

The next page summarizes how the CV values were derived.

Advanced Consist #91					Trailing Unit	Middle Unit	Lead Unit
Key	CV	Bit	Weight	DSX Function	1891r	51n	1891n
F1	CV-21	0	1	Bell			Yes
F2	CV-21	1	2	Horn	Yes		Yes
F3	CV-21	2	4	Coupler Sound	Yes	Yes	Yes
F4	CV-21	3	8	Fans	Yes	Yes	Yes
F5	CV-21	4	16				
F6	CV-21	5	32				
F7	CV-21	6	64				
F8	CV-21	7	128	Mute	Yes	Yes	Yes
				CV21 Decimal Value	2+4+8+128	4+8+128	1+2+4+8+128
					142	140	143
F0-f	CV-22	0	1	Headlight	Yes		Yes
F0-r	CV-22	1	2	Backup Light			
F9	CV-22	2	4				
F10	CV-22	3	8				
F11	CV-22	4	16				
F12	CV-22	5	32				
				CV 22 Decimal Value	1	0	1

Customizing Decoder Functions In An Advanced Consist

Determining the CV Value

The value for CV-21 in each locomotive is determined by adding up the weights for each Yes in the column for each locomotive. For example, the lead unit will have the bell, horn, coupler sound and fans controlled by the appropriate function key so the CV21 value is $1 + 2 + 4 + 8 + 128 = 143$.

The middle locomotive is to respond to only F3, F4 and F8. Thus its CV-21 value will be 140.

The tailing locomotive is to respond to F2, F3, F4 and F8. Thus its CV-21 value will be 142.

The value for CV-22 in each locomotive is determined in the same way by adding up the weights for each Yes in the column for each locomotive Again, for the lead unit, CV-22 needs value of 1 to allow F0 to control the headlight. Incidentally, the DSX doesn't allow independent control of the forward and reverse lights. You will automatically get directional headlights with CV22 set to a value of 1.

The middle locomotive will not use any lights so its CV-22 value is 0.

The trailing locomotive will also use its lights so its CV-22 value is 1.

Programming the Locomotives – Use OPS Programming

Programming of CV-21 and CV-22 can be done at any time. The locomotive does not need to be in an Advanced Consist but it does need to be powered and shouldn't be moving. Always use the locomotive's <u>primary address</u> and not the Advanced Consist address when programming. You must use OPS programming. The changes will take effect immediately. The CV values can be changed at any time and the locomotive can remain in the Advanced Consist when using OPS programming.

It's a good idea to record your Advanced Consists and their settings. You might remember the various settings a week from now but how about a month or a year from now. The next page has two blank charts. Make extra copies or create your own style and file them away in a safe place.

Customizing Decoders In An Advanced Consist - Worksheet

Key	CV	Bit	Weight	Function	Advanced Consist Number: Lead Loco 1	Loco 2	Loco 3	Loco 4	Loco 5	Loco 6	Loco 7	End Loco 8
F1	CV-21	0	1									
F2	CV-21	1	2									
F3	CV-21	2	4									
F4	CV-21	3	8									
F5	CV-21	4	16									
F6	CV-21	5	32									
F7	CV-21	6	64									
F8	CV-21	7	128									
				CV21 Decimal Value								
F0-f	CV-22	0	1									
F0-r	CV-22	1	2									
F9	CV-22	2	4									
F10	CV-22	3	8									
F11	CV-22	4	16									
F12	CV-22	5	32									
				CV 22 Decimal Value								

Speed Matching Locomotives In Advanced Consists

In a perfect world, all locomotives will run exactly the same. That is they will all start at the same throttle setting, accelerate at the same speed, reach the same top speed and then decelerate at the same rate when stopping. Unfortunately, this is not the real world. No two locomotives have the same operating characteristics. If placed in a consist, two mismatched locomotives will perform very poorly – with both fighting each other as they make their way around the layout. The following techniques will help match locomotives but they take time and a bit of trial and error for best results.

Quickie Match Technique #1 – Same Model Decoder and Locomotive

This is the easiest to do. Higher quality locomotives will work best. Kato and Atlas have the some of the best mechanical drives and perform well together. Make sure the decoders are set to the same speed steps and MSVs. Don't forget that if you use 128 speed steps, almost all decoders ignore settings for ACCL and DECL values. Older Lifelike and Bachmann have much stiffer mechanisms and tend to buck if mixed with a Kato or Atlas.

Quickie Match Technique #2 – Use Advanced Consist ACCL and DECL Values

CV23 (ACCEL) and CV24 (DECL) apply only when the locomotive is in an Advanced Consist. Changing the values in these two variables will modify how the locomotive accelerates and decelerates in an Advanced Consist. This technique allows the locomotive to be matched to other consisted locomotives. When the locomotive is set back to its primary address, the normal ACCEL and DECL in CV-3 and CV-4 are used.

Quickie Match Technique #3 – User Defined Speed Tables

This will provide the most control over individual locomotive operation. This technique will allow the matching of widely differing locomotives. See the section titled Fine Tuning Locomotive Performance, for easy methods to change speed tables.

Advanced Consists Notes and Tips

Advanced Consists Are Decoder Dependent. Most modern decoder support Advanced Consists. Older ones may or may not. Carefully review the decoder's manual to determine if advanced consisting is supported. A decoder which supports advanced consisting has a primary address used for regular operation. It also has a secondary address that is the "consist" address. An advanced consist can contain decoders with different primary addresses but they will all have the same secondary address.

Decoders Must Be Powered and on the Track During Consist Creation And Deletion. For the advanced consist to be built, all locomotives must be present on the mainline, they all must be powered up and they all must "hear" the programming commands. Locomotives might not hear the create or delete command because of poor wheel pickup or dirty track/wheels or track unevenness, or because the loco is on a siding with the power off.

Only One Speed Step Setting Is Used For The Advanced Consist. The Advanced Consist address is used to determine the number of speed steps transmitted. All locomotives in an advance consist must be operating in the same speed step mode. The advanced consist number must be setup in the Command Station for the desired number of speed steps.

The Advanced Consist Number Is Stored In The Decoder Until You Change It. The consist address is permanently stored inside the decoder making an advanced consist "portable" to other layouts.

Locomotives can not be placed into multiple Advanced Consists. If a locomotive is already in one consist, adding it to a another consist second will delete it from the previous consist.

Command Station Can "Lose" Consists. This occurs if the battery backup is bad, or the battery is removed while power is off. You will have to re-enter the consists if this occurs. This can also occur if you accidentally push and hold the ESC key while turning on power. Doing so, erases all consists. They will have to be re-entered again

Locomotive Address Registration and Speed Step Setting

Your EasyDCC System will automatically register and setup of new locomotive addresses that arrive from wireless throttles, plug-in throttles, built-in throttles or during the creation of a consist. In addition, if you use Main Track Programming to set the number of speed steps for a new locomotive address, the address is registered automatically.

New locomotive address registration is performed without any action on your part. The Command Station allows up to 255 active decoder addresses. This means the Command Station can have 255 locomotives active at any one time. The Command Station automatically manages the memory for active and inactive addresses. There is also a manual method to register new addresses (without needing a throttle) and to unregister old addresses. Fortunately, for almost all layouts, you can let the Command Station handle address registration and memory management automatically.

Upon registration, either automatic or manual, the Command Station sets the number of *transmitted* speed steps to the default setting which is 28 steps. At any time you may change the number of transmitted speed steps using the SETUP LOCO command described below.

> *Decoder address registration or changing the Command Station speed steps, does not reprogram or change the locomotive decoder in any way.*

Most users, use 28 step mode in the Command Station since it matches the speed step setting found in most modern decoders as received from the factory.

Changing Command Station's Default Speed Step Setting

You may change the default speed step setting at any time. However, the new setting will be given to all registered locomotives. For this example, the default will be set to 128 steps.

○ **SETUP/ASSIGN,**   ○ **#STEPS**

```
Default Sp-Steps
1=14 2=28 3=128
```

○ **3**

The selected speed step setting will be retained until changed and is remembered if the Command Station's power is turned off.

```
Default Sp-Steps
Now Set to 128
```

○ **ESC**

Loco Doesn't Move

Decoders that do not support 128 speed steps will not move if the Command Station is set to 128 speed steps.

Flashing Headlights

If the locomotive headlight flashes as the speed is changed, there is a mismatch between the decoder and Command Station speed steps. The decoder is set to 14 steps and the Command Station is set for 28 steps.

Setting The Transmitted Speed Steps For Specific Address

It is important to match the Command Station's transmitted speed steps to what is programmed into the decoder. Each of the Command Station's addresses may be setup to any one of the three speed step options: 14, 28 or 128 steps. You may change this setting at any time. You may also check the current setting at any time for a specified address. The default speed step setting for the Command Station is 28 steps unless you have changed it.

Use the following key sequence to change the speed step setting for a specific address. For this example, locomotive address 1935 is used.

From this point forward, only the important displays in the sequence are shown. For example, the Setup/Assign What message is not shown in the illustrations but it will still appear when the key is pressed.

❍ **SETUP/ASSIGN**

❍ **LOCO**

❍**1, ❍9, ❍3, ❍5**

❍ **ENT**

```
Register Loco
Loco # ____
```
```
Loco 1935 Active
1=#steps   2=DEL?
```

Notice that the display shows the entered address as being active. This is automatic the moment this command is used, and the speed steps are initially set to what ever is the current default speed step setting. Press the 1 key to modify the default speed step setting. You can also delete (which means unregister) the address you just entered using the 2 key. If you push ESC, no changes are made and the SETUP command is terminated. In this example, the speed step setting will be set to 14 steps.

❍**1** Indicates the #steps option has been selected and the three available settings are shown.

```
Loco 1935 Active
1=14,2=28,3=128
```

❍**1** Tells the Command Station that 14 steps is the desired setting. A confirmation is then shown.

```
Loco 1935 Active
Speed Steps=14
```

❍ **ESC** Concludes the command and returns to the normal display.

Show Speed Step Setting For Any Address

Use the following procedure to see what the current speed step setting is for the specified address. Remember that this setting is being used by the Command Station to use the appropriate speed steps to the specified locomotive address. ***It is not what is programmed into the decoder.*** For the following example, loco 1935 is used.

❍ **SHOW, ❍ LOCO**

❍**1, ❍9, ❍3, ❍5**

❍ **ENT**

❍ **#STEPS**

```
Show Loco #1935?
```
```
Show Loco# 1935:
Spd,#Steps,Cons?
```
```
L#1935 Steps=028
Fn=■□□■□□□□□□□□□
```

This display also shows the status of all 13 possible functions (number of actual decoder functions is dependent on the decoder). In this example, F0 and F3 are "on."

Monitoring Any Active Locomotive At The Command Station

At any time you can monitor the speed and direction of any active locomotive. An active locomotive means a throttle is currently sending commands to the locomotive address or within the last two minutes. From the same display you can also check for the number of transmitted speed steps and the the status of all 13 functions. This monitoring function is independent of the throttle in use. It works equally well for the built-in throttles, plug-in or wireless throttles.

For this example, the decoder address 5321 is an active locomotive.

○ **SHOW** The square symbol means push the key with the label shown.

```
Show What?
```

○ **LOCO** Yes, push the same key twice. The Command Station knows that you want the secondary key meaning.

```
Loco # ____?
```

○ **5, ○3, ○2, ○1** When entering addresses at the Command Station, leading zeroes are not necessary.

```
Loco # 5321__?
```

○ **ENT**

```
Show Loco# 5321:
Spd,#Steps,Cons
```

○ **SPEED**

```
#5321:Spd=F-050%
Fn=■□□■□□□□□□□□□
```

This display shows several items pertaining to locomotive 5321. The first line is the speed and direction currently being received from the throttle. "000%" is the current percentage of full speed; 000 is off, 100% is full speed. The F in front of the speed percentage says the direction command is set to forward. The bottom line shows the current status of the decoder's functions as set from the throttle. For this locomotive, the headlights F0 are on and the bell is ringing which is assigned to F3.

○ **ESC** Pushing ESC returns to the home page.

Using SHOW LOCO SPEED For Troubleshooting

Is The Loco Address Active?

The SHOW LOCO SPEED command will always tell you what current speed and direction command is being sent to an active locomotive address. This is handy if you suspect a bad throttle. Just use the address of the throttle in question. The display will show you exactly what is being received from the throttle. If nothing appears, then the throttle is not assigned to the address you think it is or there is something wrong with the throttle.

If The Display Shows Dashes For Speed ---

A loco address will have xxx in place of the speed percentage for the following conditions: plug-in or wireless throttle not assigned; no active throttle set to the loco address; or if the wireless throttle has temporarily lost contact with the receiver or if there has been no throttle activity within the past two minutes. xxx also appears if the specific loco address is currently assigned to a consist.

> **Speed Monitoring**
>
> When the speed monitoring display is showing, the speed is shown by a percentage of full speed. However, it is the decoder that determines the actual motor voltage applied for the transmitted percentage.

Advanced Programming Track And Mainline OPS Programming

Advanced Capabilities Of Programming Track and Mainline Programming

Programming Any CV to Any Value

For the following examples, the programming track will be used to program a modern motion decoder installed in the locomotive. CVs are always specified by a number. Some CV numbers are standard and some unique to a manufacturer. NOTE: EasyDCC will allow you to program the complete 8 bit range of possible values a CV can have. This range is 0 to 255. Some decoders may limit the range of values and some won't. Always consult the decoder manual to determine which CVs are available and the acceptable range of values.

Writing Decimal Values Into CVs

CVs can be programmed with either a decimal value or a binary value. Decimal values are usually easier to use. Binary values allow you to program a single bit of an 8 bit CV without changing any other bits. If your decoder manual lists hexadecimal values, you must convert them to decimal first.

For the example, CV 49 will be programmed to a value of 195. All CVs are programmed the same way. Be sure to place the locomotive on the programming track. Make sure all locomotive lamps and other miscellaneous loads are shut off or disconnected. Multiple keystrokes are shown on the same line to save some space. Note the "CV" key is the 3 key.

○**SVC PRGM**

```
Program Track
Program What?
```

○**CV, ○4, ○9,**

```
Program Track
Config Var#____?
```

○**ENT**

```
Config Var 0049
1=Rite,2=Verify?
```

This message is asking you what you will be doing to CV49. For this example, you want to w**Rrite** to CV49 so push the 1 key.

○**1**

```
CV 0049 Write:
1=Valu or 2=Bit?
```

The next message is asking you what kind of number you will write into CV49. The two choices are *Valu* which is used for all decimal values or *Bit* which is used to program individual bits of an 8 bit CV. More on this in a later section. For most programming, you will be using decimal values. Select 1 to indicate a decimal value is to be used.

○**1**

```
CV 0049 Write:
Value ___?
```

Now, the command station is waiting for you to key in the desired value of 195 followed by the ENT key.

```
CV 0049 Write:
Value 195?
```

○**1, ○9, ○5, ○ENT**

```
CV#0049 Write OK
Config Var#____?
```

The value is written and you can move on to another CV. If you are finished programming CVs, push ESC to return to Normal display. Make sure the green PROGRAM LED is OFF before removing the locomotive from the programming track.

Programming Individual Bits Of A Decoder's CV

For Advanced Users Only - This Method Is Not Commonly Used

For some CVs it may be easier to actually write a single bit into a CV so that other bits of the same CV are not changed. Bits are numbered from right to left starting at bit 0 and concluding at bit 7. A bit has only two values, either a 1 or a 0. Think of the bit numbers as bins in which a 1 or 0 may be programmed. For the example below, the left table shows the current bit values in CV29 which are all zeroes except for bit #2 which is a one. The right table shows the results after programming bit 4 with a value of 1. Notice that none of the other bits has changed.

When programming bits, you must know in advance which bit will be programmed and the desired value - either a 1 or a 0. The example shows how this is done.

CV29 Before Programming

7	6	5	**4**	3	2	1	0
0	0	0	0	0	1	0	0

CV29 After Programming

7	6	5	**4**	3	2	1	0
0	0	0	**1**	0	1	0	0

○**SVC PRGM , ○CV, ○2, ○9, ○ENT**

○**1** For this example, you will (w)rite to CV29.

```
Config Var 0029
1=Rite,2=Verify
```

○**2** to write a bit to CV29.

```
Config Var 0029
1=Value,2=Bit
```

○**4** You must specify which bit will be written. For this example, it is bit number 4.

```
CV0029:Write:
Which Bit (7-0)?
```

○**1** Only a 1 or 0 are acceptable numbers. Notice the display shows which bit is to be written. Always confirm the bit number or the decoder may experience unpredictable behavior.

```
CV0029:Wrt Bit4:
Value of Bit _1?
```

○**ENT** The display shows the OK message meaning that the programming command has been sent.

You can now select another CV (or the same one) or push ESC to return to the normal display.

```
CV Bit Write OK
Config Var#____?
```

This concept of continuous entry is a handy method for loading a bunch of CVs are one time and cuts down on the number of keystrokes. If an incorrect value is accidentally used, just restart with the item you want to change and put in the wanted value.

CV29 - A Special CV With Interesting Options

If you program the locomotive address from the programming track, CV29 is automatically programmed for you at the same time as the loco address is programed into the decoder. You do not have to program CV29 unless you want to make a change that is different from what is normally used when programming a locomotive address.

CV29 lets you setup various decoder functions and features. CV29 controls the following decoder functions: analog mode conversion, motor direction, number of speed steps in use and the speed table to be used. Below is a description of each with the corresponding bit number next to the feature. More on this later.

Motor Direction [Bit 0]: The default "normal" means the motor will turn in the forward direction when the throttle is sending forward speed commands. However, if you accidentally reversed the motor wires during decoder installation, the motor will run in reverse. CV29 provides an easy way to electronically reverse the motor wires – no need to tear apart the locomotive.

# of Speed Steps {Bit 1]: Many decoders allow you to program either 14 or 28 speed steps. This setting is ignored if using 128 speed steps. Be careful! Some decoders do not support 128 speed steps. For these decoders, you'll have to settle for just 14 or 28. You do not have to program CV29 to use 128 speed steps. Also see page   for information about setting the 128 speed step option.

Analog Mode Conversion [Bit 2]: For best decoder performance, we strongly suggest that this mode be disabled. If you don't disable this mode, the decoder may lurch or run when system power is first turned on. When a decoder has analog conversion disabled, it will only respond to throttle commands with correct DCC signals. If no DCC is present, the decoder will not move even if there is 12 volts DC on the rails.

Speed Table {Bit 4]: Your decoder may support a default speed table and a user programmable speed table. This entry tells the decoder which to use. Be careful! Most alternate speed tables are blank until you load them. Do not enable this feature without first loading the speed table. Starting on page   are several methods for creating and using custom speed tables.

Long Address [Bit 5]: This bit controls whether a long or short address is in use. For EasyDCC, a short addresses are in the range of 01 to 99. Long addresses are in the range of 100 to 9999.

The remaining bit numbers of CV29(8, 64, and 128) are reserved for future use.

By loading specific values into CV29, you enable or disable these features. Be sure to check your decoder manual to verify which features are available. You can not harm a decoder with an incorrect value. However, it may not operate as expected.

The table on the next page shows CV29 values and what the value does for decoder features and functions.

Some decoder manuals use the hexadecimal numbering system. You must convert the hexadecimal value to a standard decimal value to use with EasyDCC.

CV29 Bit Number	7	6	5	4	3	2	1	0
CV29 Bit Value	0	0	0	0	0	1	0	0

CV29 - Values and Options

Bit 5 32 Address	Bit 4 16 Speed table	Bit 2 4 Convert	Bit 1 2 #Steps	Bit 0 1 Direction	CV29 Bit Bit weight CV29 Value
Short (0)	Default(0)	Off (0)	14(0)	Norm (0)	0
Short (0)	Default(0)	Off (0)	14(0)	Rev (1)	1
Short (0)	**Default(0)**	**Off (0)**	**28(1)**	**Norm (0)**	**2**
Short (0)	Default(0)	Off (0)	28(1)	Rev (1)	3
Short (0)	Alt (1)	Off (0)	14(0)	Norm (0)	16
Short (0)	Alt (1)	Off (0)	14(0)	Rev (1)	17
Short (0)	Alt (1)	Off (0)	28(1)	Norm (0)	18
Short (0)	Alt (1)	Off (0)	28(1)	Rev (1)	19
Long (1)	Default(0)	Off (0)	14(0)	Norm (0)	32
Long (1)	Default(0)	Off (0)	14(0)	Rev (1)	33
Long (1)	**Default(0)**	**Off (0)**	**28(1)**	**Norm (0)**	**34**
Long (1)	Default(0)	Off (0)	28(1)	Rev (1)	35
Long (1)	Default(0)	ON(1)	14(0)	Norm (0)	38
Long (1)	Alt (1)	Off (0)	14(0)	Norm (0)	48
Long (1)	Alt (1)	Off (0)	14(0)	Rev (1)	49
Long (1)	Alt (1)	Off (0)	28(1)	Norm (0)	50
Long (1)	Alt (1)	Off (0)	28(1)	Rev (1)	51

Parenthetical values are the bit values (0, 1) when the option is selected.

CV29 = 2: A typical setting when the locomotive address between 1 and 99. The bit values add up to a value of 2.

CV29 Bit Number	7	6	5	4	3	2	1	0
CV29 Bit Value	0	0	0	0	0	1	0	0

CV29 = 34: A typical setting when the locomotive address is 100 or higher. The bit values adds up to a value of 34.

CV29 Bit Number	7	6	5	4	3	2	1	0
CV29 Bit Value	0	0	1	0	0	1	0	0

CV29 Is Programmed Automatically

If you use the programming track to program CV1 [the locomotive address], CV29 is automatically programmed, at the same time, to either a value of 2 or 34 depending on the address (short or long).

CV29 May Have Additional Features - See Decoder Manual

See your decoder manual to determine what additional features, beyond the standard features, may be present in your decoder.

Using CV29 - Detailed Example

Let's say you want to set CV29 to a value which uses the default or built-in speed stable, has the analog conversion disabled (digital only), uses 28 speed steps and has normal direction orientation. Use a straight edge and start at the left column and work towards the right, selecting the options you want. When you get to the last column, that will be the value you program into CV29 which is 2. Leading zeroes are not necessary when programming the value. The following procedure will program a modern type-3 decoder with this value.

○**SVC PRGM**   If the command station cannot determine the type decoder, key in the value of 3.

```
Program Track
Program What?
```

○**CV** *[the 3 key]*

○**2,** ○**9** ○**ENT**

```
Program Track
Config Var#?____
```

○**1,** for writing to the CV;

```
CV 0029 Write
1=Valu, 2=Bit?
```

○**1**   to specify a decimal value is to be written;

For almost all basic CV programming, decimal "values" are used instead of the more complicated "bits." Values are simply numbers like 1,2,3…50…100… etc. See your decoder manual for the range of usable values.

```
CV 0029 Write
Value ____?
```

○**2**   For this example, the value is 2. Leading zeroes are not needed.

```
CV 0029 Write
Value 2___?
```

○**ENT**

The value is written into the decoder and you can now move on to another CV. If you are finished programming CVs, push ESC to return to the home page.

```
CV 0029 Write OK
Config Var#____?
```

Find Decoder Address Using Macro 97

Here's a little bit of philosophy to save some time: it is a common misconception that determining a decoder address is important. In actuality, there is very little to gain. Instead of determining the address, simply program the decoder to the address you want. Programming a new address always overwrites the old address. Don't waste time learning the address - just reprogram the decoder.

EasyDCC provides a quick and easy way to verify the current address of a motion decoder. Most sound decoders can't use this feature due to their high surge current which confuses the programming track circuit.

Macro number 97 determines the address of a decoder placed on the programming track. Macro 97 is the "find address" macro. Macro 97 only works with locomotives placed on the programming track. It does not work on the main line. It also works best with modern, Type-3 decoders although it will work with older Type-2 decoders too.

For this example, the motion decoder is believed to have been programmed with the address of 5321. Macro 97 will be used to confirm it.

❍ **SVC PRGM**   If the command station cannot determine the type decoder and asks you to confirm it, then macro 97 will not work with this particular decoder. The first message must be "Program What."

```
Program Track
Program What?
```

```
Program Track
Macro# __?
```

❍ **MACRO**

❍ **9,** ❍ **7,**

❍ **ENT**

```
Reading Decoder
Address
```

At this point, the display will show word "address." Notice that the Program LED and the OK LED will be blinking signifying the sending and receiving of decoder data. You may see the locomotive move a tiny bit as the motor is pulsed during the verifying process.

Once found, the display will show the decoder's address. The message will stay until you press the ESC key.

```
Decoder Address
      5321
```

If Macro 97 Doesn't Work

If the yellow PROGRAM LED light is on but not the green OK LED, there is a short circuit on the programming track or the locomotive is not on the programming track. Once the problem is fixed, press the ESC key and start over.

If Address Can't Be Determined

If the address can not be determined, usually because of some kind of mechanical problem, decoder failure or it has excessive surge current, the display will show the "not found message.

```
Decoder Address
Not Found!!
```

Make sure the loco is on the track completely. Also check for dirty track or dirty wheels. If everything looks OK, check for broken wires and or a bad decoder. Turn off all lamps and/or sound effects and try again. Excessive current draw will also result in the address always stopping 0000 or 0001.

If Macro 97 Doesn't Work

If macro 97 always halts at an incorrect address such as 0000 or 0001, there is probably too much current being drawn by the loco - a common problem with sound decoders.

The Command Station relies upon current sensing to determine when the decoder pulses the motor in response to Macro 97. However, the Command Station can not detect the difference between a pulse of motor current or current from other loads such as lights or sound systems. In such a case, the decoder <u>will always accept a programming command</u>, but verifying or confirming will not be possible with macro 97.

Programming The Decoder's Speed Steps

EasyDCC provides three options for the number of transmitted speed steps sent to a locomotive decoder. The 14 and 28 step options require programming changes to the locomotive decoder. The third does not involve the decoder (other than it must support 128 step mode) and is an option in the Command Station setup. Always be sure to check the decoder manufacturer's booklet to determine which speed step options are supported. The most common setting is also the default for your Command Station which is 28 steps.

14 or 28 Speed Step Options

Decoders offer either 14 or 28 speed steps as their baseline option. You select this option by programming the decoder on the programming track. The most common default setting is 28 steps. 14 steps is rarely used any more.

128 Speed Step Option

For decoders that support 128 speed steps, there is no change to the decoder programming. Instead, you tell the Command Station to send 128 speed steps.

Special Note About Command Station Setup

Your EasyDCC Command Station allows for each registered decoder address to have its own speed step setting of 14, 28 or 128. You are allowed to mix and match locomotive decoders speed step settings for the best operation.

An Example of Using The Programming Track To Change Decoder Speed Steps

In this example, the decoder will have its speed step setting changed to 28 steps.

○**SVC PRGM**   If the command station cannot determine the type decoder, key in the value of 3.

```
Program Track
Program What?
```

○**#STEPS** *[the 6 key]*

Push 2 for the 28 step setting.

```
PTrk:Speed Steps
1=14, 2=28
```

○**2**

tThe decoder is now programmed for 28 speed steps. You can now select another variable to program or go back to the home page by pushing the ESC key.

```
Prgm 28steps OK
PgmPT:What else?
```

○**ESC**

**Don' Forget To Set Command Station
To Match Decoder's Speed Steps**

When the speed steps are changed with the programming track, the Command Station's speed step setting <u>is not</u> updated for the decoder just programmed. To insure the Command Station's transmitted speed commands match the decoder, use the **SETUP LOCO** command to match the transmitted speed steps to the decoder's programmed speed steps. Page 86 shows how to how to use the SETUP LOCO command.

Finding The Value Of Any CV Using Macro 99

Sometimes you might like to know what value is programmed into a CV. The EasyDCC Command Station includes an easy to use macro, Macro 99, and the programming track to determine the decimal value of any decoder CV.

When a locomotive is placed on the programming track and Macro 99 is used, it finds the value of any configuration variable you specify. The following example shows how to use Macro 99 to find the value of CV 29 in a type 3 decoder. Macro 99 will work on all types of locomotive decoders. Note: more than one keystroke may be shown on one line.

○**SVC PRGM**   If the command station cannot determine the type decoder, key in the value of 3.

```
Program Track
Program What?
```
```
Program Track
Macro # ____?
```

○**MACRO** *[the 0 key]*

○**9,** ○**9** ○**ENT**

Now enter the specific CV that you wish to know. For this example, it is CV 29.

○**2,** ○**9,** ○**ENT**

Note: Most Decoder CVs can not be directly "Read."

With only a few rare exceptions you can not "read out" an internal CV value directly. Instead the command station plays a game of twenty questions. It asks, "Is CV29 equal to 0 ?" Silence is understood to mean NO. When the decoder is presented a value which is a match to its internal stored value, it buzzes or burps the motor. The Command Station senses this increased current and halts the game. The matched number is displayed as the CV value.

```
CV0029 Value xxx
```

```
CV0029 Value 004
  Verified !!
```

If the CV value is not found, usually because of some kind of mechanical or decoder failure, it will count up to 255 and then present the "Verify Failed" message. Make sure the loco is on the track completely. Also check for dirty track or dirty wheels. If everything looks OK, check for broken wires and/or a bad decoder.

```
CV0029 Value 255
Verify Failed!
```

○**ESC**

You can also push and hold ESC to halt Macro 99 at any time and return to the home page.

Verifying CV Values - Macro 97

The Command Station and its programming track can be used to determine what value is stored in any CV. But, why bother? Why not simply program the CV to the value desired? This is not only quicker but guarantees the CV is the value wanted. Besides, what if you find the value is not what is wanted? You'll still have to program the CV. So, we suggest skipping over the verify step and simply programming the CV to the desired value.

The CV verification is similar to programming a CV. The verification task uses the programming track. Using this method can take longer than using Macro 99. But if you only want to know if a CV has a specific value, this is the quickest way to find out. For this example, CV 3 will be verified as having a value of 5.

○**SVC PRGM,**

*Note: M*ake sure that this message is shown as soon as you push the SVC PRGM key. I*f not it means the command station cannot determine the type decoder, and the verify command will not work.*

```
Program Track
Program What?
```

```
Config Var 0003
1=Rite, 2=Verify
```

○**CV** *[the 3 key],*

○**3,** ○**ENT,** for CV#3's value to be verified

```
Config Var 0003
1=Value or 2=Bit
```

○**2,** for the "verify" option

○**1,** since the value of CV#3 is being verified

```
CV 0003 Verify
Value 5___?
```

○**5** this is the value thought to be in CV3. Leading zeroes are not required.

```
CV0003 Value 005
Verified!!
```

○**ENT**

If the value matches what is in the decoder, the "verified!!!" message is displayed. If not, the message says "Verify Failed!" Note that failure means that the decoder does not contain the value you specified or that the Command Station is having trouble talking to the decoder. It does not mean the decoder has a problem. Push ESC to return to the normal display.

Verifying CV Bit Values - Macro 97

For some CVs you may want to verify a specific bit of a complex CV, such as CV29.

Configuration values can also be expressed in 8 unique "bits." The bits are numbered from right to left starting at bit-0 and concluding at bit-7. A bit has only two values, either a 1 or a 0.

For the example below, the bit value table to the right shows the example bit values in CV29. Bit 4 will be verified for a 1.

7	6	5	4	3	2	1	0
0	0	0	1	0	0	0	0

○**SVC PRGM,**

*Note: M*ake sure that this message is shown as soon as you push the SVC PRGM key. I*f not it means the command station cannot determine the type decoder, and the verify command will not work.*

```
Program Track
Program What?
```

```
Config Var 0029
1=Rite, 2=Verify
```

○**CV** *[the 3 key],*

○**3,** ○**ENT,** for CV#29's value to be verified

```
Config Var 0029
1=Value or 2=Bit
```

○**2,** for the "verify" option

○**2,** since a bit in CV#29 is being verified

```
CV 0029 Verify
Which Bit(0-7)?
```

○**4** for bit 4 in CV29.

○**1** this is the value to be verified as being in CV29 bit #4.

```
CV0029:Verif Bt4
Value of Bit _1?
```

○**ENT**

```
CV0029, Bit04=01
```

If the bit value matches what is in the decoder, the "verified!!!" message is displayed. If not, the message says "Verify Failed!" Note that failure means that the decoder does not contain the bit value you specified or that the Command Station is having trouble talking to the decoder. It does not mean the decoder has a problem. Push ESC to return to the normal display.

Custom Speed Tables For Your Decoder

Your EasyDCC Command Station comes with 8 custom speed tables that may be used with most DCC decoders. A speed table is what the decoder uses to interpret and respond to throttle commands. In other words, the speed table controls the speed at a specific speed step. With a custom table, you can control exactly how fast, how slow the decoder moves at any of the decoder's 28 specific speed steps.

A neat feature of the EasyDCC Command Station is that you can download a new speed table to a decoder using either the progamming track, or while the locomotive is on the mainline. It only takes a couple of key pushes.

The 8 factory defined speed tables can be used as is or you may change them to suit your railroad's requirements. Any changes made to the speed table is permanently stored in the Command Station. The table below shows the differences between the 8 default speed tables.

Table	Type	Max Speed	Typical Locomotive Response
1	Linear	100%	Reaches top speed much earlier than ormal
2	Linear	100%	Reaches top speed somewhat earlier than normal
3	Linear	100%	Normal speed
4	Linear	80%	A bit slower than normal at less than top speed
5	Linear	70%	More slowly than normal at less than top speed
6	Linear	60%	Even more slower than normal at maximum
7	Linear	50%	Only about half of normal speed at maximum
8	Linear	40%	Very much slower than normal at maximum

Creating Custom Tables

Custom speed tables are created in the Command Station by storing a value representing a specific speed in each of the 28 available speed step CVs. CV 67 is the first CV that corresponds to speed step number 1. CV94 is the last CV which corresponds to speed step number 28. The CVs can have any value so be careful. Crazy speed step CV values will create crazy locomotive speeds.

The completed table is then programmed into the decoder's matching CV values. Finally, the decoder is programmed to use the custom speed table instead of its own.

The graph below shows a plot of 3 speed tables. Page 100 has a listing of the CV value for each CV of the 8 factory speed tables.
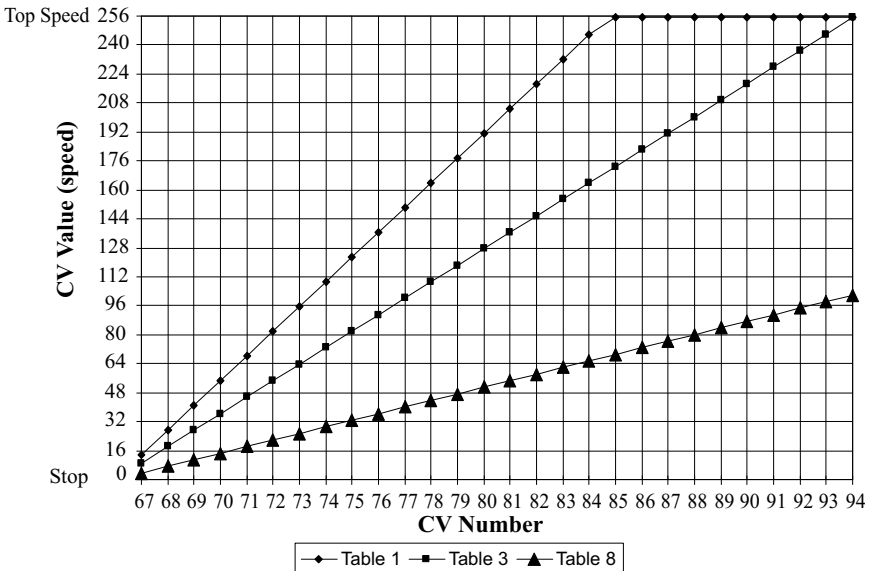
EasyDCC Custom Speed Table Listing

This table lists each CV and its value for the 8 different factory supplied speed tables stored in your Command Station.

This table is calculated using a simple linear formula: value = (speed step #/28)*255*(% top speed). Value of 1 is the slowest speed value and 255 is the highest speed.

Note: most decoders use the MSV value plus the first speed step value to calculate the first speed step value to be sent to the locomotive.

You may change any of the entries using macro 94 which is part of the Pogramming Track commands.

Use macro 63 to load a new speed table into a specific decoder while it is on the mainline.

CV Number	Speed Step	Speed Table Values							
		1	2	3	4	5	6	7	8
67	1	14	11	9	7	6	5	5	4
68	2	27	22	18	15	13	11	9	7
69	3	41	33	27	22	19	16	14	11
70	4	55	44	36	29	26	22	18	15
71	5	68	55	46	36	32	27	23	18
72	6	82	66	55	44	38	33	27	22
73	7	96	77	64	51	45	38	32	26
74	8	109	87	73	58	51	44	36	29
75	9	123	98	82	66	57	49	41	33
76	10	137	109	91	73	64	55	46	36
77	11	150	120	100	80	70	60	50	40
78	12	164	131	109	87	77	66	55	44
79	13	178	142	118	95	83	71	59	47
80	14	191	153	128	102	89	77	64	51
81	15	205	164	137	109	96	82	68	55
82	16	219	175	146	117	102	87	73	58
83	17	232	186	155	124	108	93	77	62
84	18	246	197	164	131	115	98	82	66
85	19	255	208	173	138	121	104	87	69
86	20	255	219	182	146	128	109	91	73
87	21	255	230	191	153	134	115	96	77
88	22	255	240	200	160	140	120	100	80
89	23	255	251	209	168	147	126	105	84
90	24	255	255	219	175	153	131	109	87
91	25	255	255	228	182	159	137	114	91
92	26	255	255	237	189	166	142	118	95
93	27	255	255	246	197	172	148	123	98
94	28	255	255	255	204	179	153	128	102

Building A Speed Table - Macro 93 Makes It Easy

The Command Station has memory for 8 speed tables which are numbered from 1 to 8. We have already loaded the tables with some common values as discussed in an earlier section. But, you can create your own tables and store them in place of the factory supplied tables.

To make this easier, macro 93 allows the editing of any of the Command Station's custom speed tables. Macro 93 is part of the SVC PRGM routine. although no locomotive needs to be on the programming track to edit the speed tables.

There are 28 separate speed steps, and each is stored as a specific CV number. You may edit any entry in a speed table. Also, there is no range checking for the entries. All speed table values are in the range of 0 to 255. The following example show the key strokes to create or edit a speed table.

❍**SVC PRGM,** ❍**3,**

No locomotive is required to be on the programming track so you need to push the 3 key to continue.

```
Program Track
Program What?
```

```
Decoder Type=02
ENT=OK or 1,2,3
```

❍**MACRO** *[the 0 key]*

❍**9,** ❍**3 ,**❍**ENT**

Enter the desired speed table number. Remember, this table is stored in the Command Station under the given table number. For this example, table 1 will be viewed and edited.

```
Program Track
Macro # ____?
```

```
Build Spd Table:
Speed Table #_?
```

❍**1,** ❍**ENT**

The first CV in custom table #1, CV67, is now ready for entry. The value in parenthesis (014) is the current value of CV67. Enter the desired value which is 10 for this example.

```
Speed Table   #1
CV#67 =(014)___?
```

```
Speed Table   #1
CV#67 =(014)10?
```

Note that there is no checking for valid or "goofy" speed values. Goofy values can result in odd locomotive behavior. When the ENT key is pushed, the new value is stored into Command Station memory and the next CV number is displayed.

```
Speed Table #1
CV#68 =(027)___?
```

This procedure continues until all speed table entries are completed. If you accidentally enter a wrong number, add another digit or two before pushing ENT and the value will be rejected. You can then push ENT to reenter the desired value.

When the last entry is completed and the ENT is pressed, the table loaded message is shown and the table is stored. It can be downloaded to a decoder using either macro 63 or macro 94.

```
Speed Table #1
Table Loaded
```

You may also push ESC to halt table building and store all entries up to the time you pushed the ESC key. This is the one time ESC doesn't erase any entries; it signifies you accept the remaining entries.

Changing a Value In An Existing Speed Table

You can modify one or values in a speed table. The sequence is the same as entering the values. However, if you don't want to change a value, just push ENT to skip to the next entry.   When you reach the value you wish to change, just enter the new value and push ENT. When you are done changing values, just push ESC to exit from the table and to store the entries.

| **Decoder Programming** |
| Macro 63 is used to send one of the 8 speed tables to a decoder. Macro 94 is used to program a decoder when it is on the programming track. |

| **Speed Tables Are Permanently Stored** |
| The Command Station stores the speed tables in its permanent memory. Any changes you may have made to any table are also stored. |

Loading A Decoder with A Custom Speed Table - Macro 94

Note: Be sure to verify you decoder accepts and supports a custom speed table. Some decoder instruction manuals call this feature an ALTERNATE speed table. Consult the decoder's manual for any limitations and restrictions.

Macro 94 and the programming track provide a quick way to program all the decoder's speed table CVs with only a couple of key pushes.

The locomotive must be on the programming track for this macro to work properly.

○**SVC PRGM** If the command station cannot determine the type decoder, push the 3 key.

○**MACRO** *[the 0 key]*

```
Write to Decoder
Speed table #__?
```

○**9,** ○**4,** ○**ENT**

Enter the desired speed table number. For this example, the custom speed table number one will be used.

```
Write to Decoder
CV#xxx Value yyy
```

○**1,** ○**ENT**

The moment ENT is pressed, each speed step value is programmed into the decoder. Once this process has started, it can not be interrupted.

The values xxx and yyy are the CV# and the Value number. These two values increment as each step is programmed. It takes about 10 seconds to program all entries.

When the table programming is complete, the display shows the table has been written and the sequence ends. Push ESC to return to Normal display.

```
Write to Decoder
SpeedTab Written
```

Enabling The Decoder's Custom (Alternate) Speed Table

Once the custom table is loaded, you need to tell the decoder to use the new table. The best way is to use the command shown below. This command edits the proper bit in CV29 to enable the decoder's alternate speed table or resets the decoder to the standard (Std) speed table. All other entries for CV29 are retained. Of course you can also edit CV29 and load a value or change a bit.

○**SVC PRGM**   If the command station cannot determine the type decoder, key in the value of 3.

```
Program Track
Program What?
```

○**SPDTABL** *[yes, push the same SVC PRGM key again]*

○**ENT**

```
PTRK:Speed Table
1=Std, 2=Custom
```

○**2**   Selects the custom speed table to be activated. If option 1 had been selected, the decoder would be told to use its standard speed table.

```
Progm CustSpd OK
PgmPT:What Else
```

Select something else to program or push ESC to return to the home page.

Which Macro To Use - 63 or 94?

Macro 63 and OPS programming is used to send one of the 8 speed tables to a decoder when it is on the mainline. Macro 63 also includes a command to enable the alternate speed table.

Macro 94 is used to program a decoder when it is on the programming track. However, it only loads the alternate speed table. It does not enable it. To enable the alternate speed table when the loco is on the programming track, program CV29 to enable the alternate table.

Fine Tuning Locomotive Performance

By using MainTrack or "OPS " programming, fine tuning locomotive motion performance is relatively easy. With the push of a few buttons, a locomotive decoder's running characteristics can be quickly changed. The changes take effect immediately so the locomotive can be tested to confirm the desired result has been achieved.

Since each locomotive has unique running characteristics, plan on a little trial and error experimentation. Try different options and values. Decoders CAN NOT BE HARMED. Modern decoders can always be reset back to their original factory defaults - just in case.

Decoder Requirements

Check your decoder manual to insure it supports OPS MODE programming; most modern decoders do. Look for phrases such as OPS MODE PROGRAMMING, MAINTRACK PROGRAMMING or DIRECT ADDDRESSING. Decoders that do not support OPS MODE programming, cannot accept reprogramming commands while on the mainline. If you are not sure, contact the decoder manufacturer and ask them.

Fine-tuning Options And Definitions

Most modern decoders offer an "on-the-fly" adjustment of their internal standard speed table. This is not the same as downloading a new speed table. Instead, there are 3 primary CVs that control the actual speed versus throttle setting. These can all be modified using OPS Programming. The graph on the next page diagrams what happens to the resultant motor speed as these variables are changed.

CV2 sets the motor starting voltage (MSV) of the motor voltage that corresponds to speed step 1 (in a 28 speed step setting). This is the first speed step from off, or zero voltage. You can decide if you wish the motor to be moving at a good rate of speed or just barely moving by changing the MSV. A small MSV value means only a small extra increase in motor voltage. A larger MSV value means the motor receives a higher motor voltage.

CV6 sets the midpoint motor voltage at the throttle midpoint setting which corresponds to speed step 14 (in a 28 speed step setting). If a lower half speed is needed, for example in speed matching application, set CV6 to a smaller value. Speed curve #3 lowers the half speed to 55. So at speed step 14, the locomotive is running at 25% of the maximum motor voltage. Conversely, if the locomotive is running too slow at speed step 14, CV6 can be raised to increase the half speed.

CV5 sets the motor's top speed which corresponds to speed step 28 (in a 28 speed step setting). If a lower top speed is needed, for example in speed matching application, set CV5 to a smaller value. Speed curve #2 lowers the top speed to 155. So at speed step 28, the locomotive is running at 60% of the maximum motor voltage.

> *Setting CV5 to a value less than CV6 is OK but the resultant speed curve will be an upside down V. Curve #5 on the previous page shows the extreme case with CV5 equal 0 and CV6 equal to 128, The motor will reach top speed at step 14 and then gradually slow down to a stop at step 28.* Any of the following motion performance configuration variables (CV) may be used, alone or in combination, to change how a locomotive responds to throttle commands: Motor Starting Voltage (MSV), Acceleration (Inertia) delay (ACCL), Deceleration (Momentum) delay (DECL), which Speed Table is Used (SPDTABL), and loading a new Alternate Speed Table.

As always, consult your decoder manual for more details and to check for other performance CVs that may be available.

ACCL [CV#3] - This determines the *rate of change* of speed upon an increase in throttle speed. Higher values result in slower rate of change - more inertia. For example with a very high value, moving the throttle from OFF to mid-range, will result in the locomotive not moving for a very long time, and when it does begin moving, its speed increase will be extremely gradual.

DECL [CV#4] - This determines the *rate of change* of speed upon a decrease in throttle speed. Higher values result in slower rate of change - more momentum. For example with a very high value, moving the throttle from mid-range to OFF, will result in the locomotive not stopping for a very long time, and when it does begin to slow, its speed decrease will be extremely gradual.

SPDTABL [CV29] - This is not actually a variable but tells the decoder which internal speed table is to be used. Almost all present decoders have a single "default" speed table plus space for a user defined speed table (sometimes called an alternate speed table). The SPDTABL command is used to switch between the default and the alternate speed table.

Note: several brands of decoders offer more than one alternate speed table. Some decoders have as many as 14 built-in speed tables as well as space for the user defined alternate speed table. If you are using this type of decoder, please review their manuals for additional information.

Alternate Speed Table [CV 67 through CV94] - These 28 CVs hold the values that translate into different voltages applied to the motor. A value of 0 is OFF. A value of 255 means FULL SPEED. EasyDCC provides 8 preloaded tables as well as an editor if you wish to change the tables values.

MACRO 63 [accessed via OPS PRGM] - is used to load any of the 8 speed tables directly to the locomotive's decoder while it is on the main track.

MACRO 93 [accessed via SVC PRGM] is used to view and change entries in any of the 8 speed tables. Changes are permanent and are stored in the battery-backed up RAM. If the battery fails, the 8 tables will revert back to their original default values.
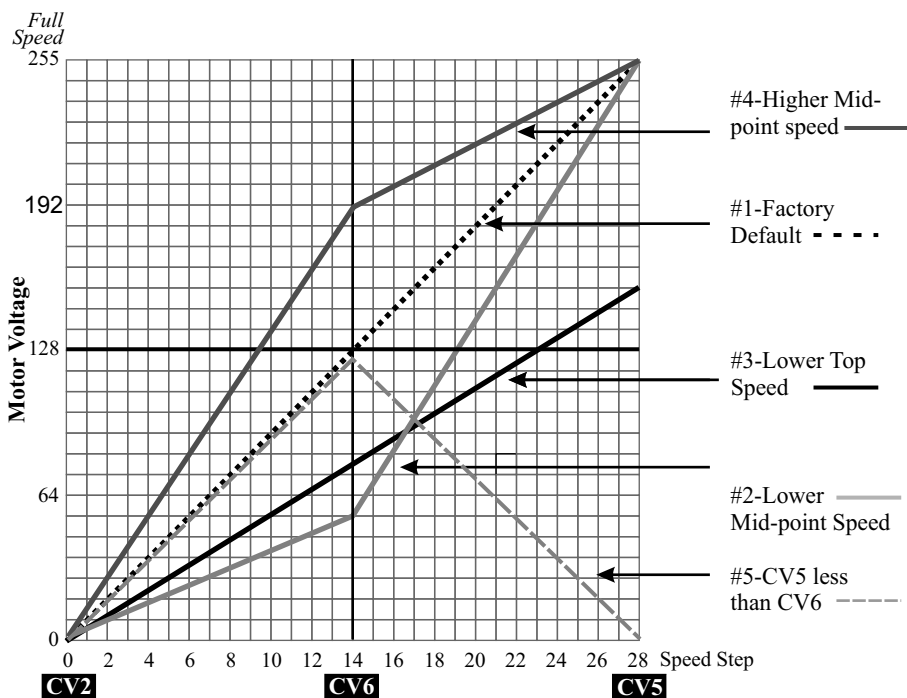
Main Line (OPS) Programming - Load Custom Speed Table

This handy macro allows any of the 8 custom speed tables to be downloaded to a specific decoder **while it is on the mainline**. There is no need to use the programming track. For this example the loco address is 4600 and speed table number 1 will be loaded into it. Make sure the locomotive is on the mainline and powered on.

○**OPS PRGM**

```
Program Main Trk
Loco #____
```

○**4,** ○**6,** ○**0,** ○**0**

○**ENT**

```
Program Main Trk
L# 4600's What?
```

○**MACRO** *[the 0 key]*

○**6,** ○**3**

○**ENT**

```
Loco# 4600
Macro# 63 (<64)
```

Enter the desired speed table number. Remember, this table is stored in the Command Station under the given table number. For this example, the table is number 1. The leading zero is not required.

```
Write to Lo#4600
Speed table #__?
```

○**1 ,** ○**ENT**

```
Write to Lo#4600
CV#0xx Value yyy
```

As soon as ENT is pushed, all 28 CVs are sent to the decoder starting at CV67 and ending at CV94. The display shows the CV being programmed (xx) and the value (yyy) being written into the decoder. After the last CV is written, the display shows what loco was being written to and which table was used.

○**ESC**

```
Write to Lo#4600
Spd-Table 1 done
```

Things To Know During Programming

It is very common for decoders to buzz, or move slightly move during the programming process. This is normal and indicates the decoder is receiving the programming commands. Some of the newer decoders using high pulse power frequencies may not noticeably move during programming, which is also normal.

After the CVs are programmed, two more programming commands are automatically sent to the decoder. The first command programs bit #4 of CV29 to a value of "1" which "enables" the alternate speed table (which you just loaded). This command instructs the decoder to use the alternate speed table instead of the factory default table. The second command is used to set bit 4 of CV25 to a value of 1. This command is specific to Soundtraxx decoders which have additional speed tables built into them. By setting CV25 to this value, the Soundtraxx decoder is instructed to use the alternate speed table contained in CVs 67-94.

It is impossible for the Command Station to know if any specific decoder accepts or uses alternate speed tables. You will have to consult your decoder's instruction for that information. Regardless, if strange things happen after using macro 63, its probably because the decoder doesn't allow the use of alternate speed tables. Issue a factory reset command to the decoder to restore normal operation. See your decoder instructions for how to do this.

CV29 - Bit 4	CV25 - Bit 4
For most NMRA-DCC decoders, CV29, bit 4, is used to enable or disable the use of an alternate speed table. Although the alternate table may be disabled by setting bit 4 to a 0, it is not erased from the decoder. It may be enabled again by setting bit 4 to a value of 1.	Some Soundtraxx decoders use this CV to allow the selection of the alternate speed table, OR, any of the decoder's 15 built in tables. Be sure to review the decoder's manual to confirm the existence of this feature since decoder software changes constantly.

Accessory Decoder [AD4] Programming

Things to Know Before Programming An Accessory Decoder - AD4

•Accessory decoder addresses are unique and separate from locomotive addresses. You may have a locomotive on address 0045 and an accessory decoder output address 0045 at the same time.

• Address 00 is not recognized. The first output address is 0001.

•There are 511 unique decoder card numbers that can be programmed into the AD4.

•The AD4 *card number* is the number used to program the AD4 "address." In actuality, the AD4 automatically assigns it's own 4 output addresses when it's card number is programmed. For example, when an AD4 is programmed to a value of 2, the output addresses of 5 through 8 are assigned to outputs A through D of that card.

•The output address is the actual address used to activate a specific turnout or accessory. All of CVP's AD4 accessory decoders can unlink the paired outputs to provide 8 individually controlled outputs per card.

• Maintrack CV programming is supported by the AD4. All CVs, including the decoder address may be changed without using the programming track.

• AD4 activation terminology: we use the terms "Normal/On" and "Reverse/Off" because you can select either for activation.

AD4 Configuration Variables Listing

There are nine accessory decoder Configuration Variable (CV) values. Through these values the AD4 is controlled. The storage is permanent and won't go away when power is removed. The table shows the CV number the CV function and its original factory value. All CV values are decimal.

CV#	ALT CV	Function Or Description	Value	Meaning of The Default
513	1	Card Numbers - LSB	01	Card Number is 1
514	2	Local Input Control	85	Local inputs active
515	3	Output Pair A **On-Time**	2	Pulse @ 0.2s
516	4	Output Pair B **On-Time**	2	Pulse @ 0.2s
517	5	Output Pair C **On-Time**	2	Pulse @ 0.2s
518	6	Output Pair D **On-Time**	2	Pulse @ 0.2s
519	7	Software version number	nn	Version #
520	8	Manufacturer ID	135	CVP's ID number
521	9	Card Number - MSB	0	MSB of card number

AD4 Jumpers

Always remove the RUN/PRGM jumper before programming. Don't forget to put it back on the posts before using the AD4.

CV Values For On-Time and Pulse Duration

Additional tables for CV values and their corresponding effects such as flash-rate, pulse width and card-to-output address cross reference are available from the CVP Products website.

Go to www.cvpusa.com, select EasyDCC and go to the Document Center and look for the following title: *AD4 Accessory Decoder Supplemental Instructions and Reference Tables*

Accessory Decoder [AD4] Programming

Hookup to Programming Track

Attach the AD4 track inputs, pin 16 and 17, to the EasyDCC programming track output. Always remove the RUN/PRGM jumper to allow proper operation of the programming track and to prevent excessive loading. Be sure to reinstall the shunt after programming.

Remember that the accessory decoder itself is programmed with a card number which then allows the decoder to automatically assign the appropriate output addresses.

To Programming 16   17
Track
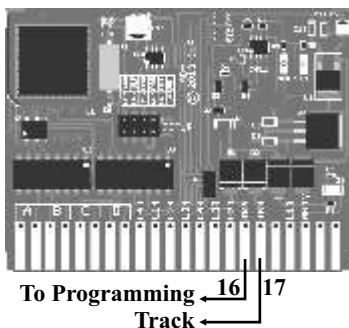
Programming AD4 with Card Numbers Less Than 63

This example shows the steps to change the AD4 card number to 2. Be sure to remove the RUN/PRG jumper before starting. If for some reason, the Command Station can't tell the type of decoder, push the 3 key to continue.

❍**SVC PRGM,   [❍3]** if the first message is not as shown

❍**CV,**   *the 3 key*

| Program Track |
| Program What? |

❍**5,** ❍**1,** ❍**3,**

| Program Track |
| Config Var#___? |

| Program Track |
| Config Var#513_? |

❍**ENT**

This method of programming writes the desired card number directly to the CV.

| Program Track |
| Config Var#513_? |

❍**1** for (w)rite

| Config Var 0513: |
| 1=Rite,2=Verify? |

❍**1** for valu(e)

| CV 0513 Write: |
| 1=Valu or 2=Bit? |

❍**2** the new card number - remember the limit - no higher than 63 in CV513!

| CV 0513 Write: |
| Valu ___? |

| CV 0513 Write: |
| Valu 2__? |

❍**ENT** to send the new card number to the AD4. When the "write OK message appears, you can select another CV to program or push ESC to return to the home page.

| CV#0513 Write OK |
| Config Var#____? |

❍**ESC** to return to the home page

All CVs in the AD4 are programmed using the above method.

For card numbers above 63, it is easier to use a built-in Command Station program macro that simplifies the loading of the two CVs that make up a long address and all you need to give it is the desired output address. The Command Station will convert the desired output address to a card number and program the AD4 with the appropriate card number. .

Accessory Decoder [AD4] Programming

Program The AD4 Card Number Given Any Output Address - Macro 96

Macro 96 is only used when the AD4 is connected to the programming track. It accepts an output address, 1-2045, and programs CV513 and 521 for the appropriate card number. The display will then show you the three additional output addresses now available on the card. There is no need to worry about manually loading the LSB and MSB CVs. This macro does that automatically. For this example, the AD4 needs to be programmed so that one of the output addresses is 600.

○**SVC PRGM,**   **[○3]** if the first message is not as shown

```
Program Track
Program What?
```

○ **MACRO**

```
Program Track
Macro# __?
```

○ **9,** ○**6,** ○ **ENT**

```
Program Track
Macro# 96__?
```

```
Progr Accessory
Output/Rt# ____?
```

○**6,** ○ **0,** ○**0**   This is the output address, not the card number.

```
Progr Accessory
Output/Rt# 600_?
```

○ **ENT,**

```
Progr Accessory
Addr=0597---0600
```

○ **ESC**   to return to the home page

The last message, before pushing ESC, shows that the accessory decoder has been programmed so that the output address associated with the A output is 597, B output is 598, C output is 599 and the D output address is 600.

> Use Macro 97 to check the values loaded into the AD4. See page 98 for step-by-step details on how to use Macro 97.

Accessory Decoder [AD4] Programming

Program The AD4 Output's On-Time CVs Given Any Output Address - Macro 95

Macro 95 accepts an output address, 1-2045, and an on-time value, to program the appropriate on-time CV for the specified address. There is no need to decipher the card number from the address and pick the correct output CV. This macro performs that function for you.

For this example, address 101 requires the output to be ON continuously, when activated. Slow-motion switch machines use this value. The required value for the On-Time is 0.

Using this macro, enter the desired output address (not card number) and enter the desired CV value when prompted. The appropriate CV will be programmed to the new value. The macro then returns to the address prompt ready to program the next address's on-time.

This macro DOES NOT change the decoder card number – only the appropriate CV value.

❍**SVC PRGM,   [❍3]** if the first message is not as shown

❍ **MACRO**

```
Program Track
Program What?
```

❍ **9,   ❍5, ❍ ENT**

```
Program Track
Macro# __?
```

```
Program Track
Macro# 95__?
```

```
Program Time-On
Output/Rt# ____?
```

❍**1, ❍ 0, ❍1, ❍ ENT**   output address, not the card number.

Note: there is a bug in the program that doesn't put the cursor in the proper location on line 2. It doesn't matter, so enter the number and push ENT.

```
Program Time-On
Output/Rt# 101_?
```

```
Program Time-On
Outp(101)Rt# 101_?
```

```
Accy Addr 0101:
Time-On Val ___?
```

❍ **0, ❍ ENT**

```
Accy Addr 0101:
Time-On Val 0__?
```

the desired On-Time value (continuous on). The display will briefly flash the new value for on time and return to the output number screen for another address to program. If you are done, just push ESC.

```
Accy Addr 0101:
Time-On = 000
```

```
Program Time-On
Output/Rt# ____?
```

❍ **ESC**

Programming Track Usage Tips

Changing the CV will not invoke its function. For example, the flashing output is off until turned on by the command station or throttle.

Changing the on-time CV takes effect on the next activation (if pulse) or next cycle if flashing if using maintrack programming.

Don't forget to remove the RUN/PRGM jumper.   Removing the jumper insures against inadvertent tripping of the Command Station current sensor when programming.

Don't forget to replace the RUN/PRGM jumper.   Without the jumper, none of the attached accessories will work.

The AD4's green STATUS LED will turn on when the programming track is active.

Accessory Decoder [AD4] Main Line (OPS) Programming

Your Command Station can remotely program your AD4 without using the programming track. This is called Main Track or Ops Mode programming. This handy feature allows fine tuning of the AD4 CVs after installation. Some good examples include controlling a decoder card's local inputs, adjusting twin-coil switch machine's pulse duration and changing flash rates.

Main track programming uses the decoder card number - not the output address. You must know the decoder card number in order to send it main track programming commands. As long as you know the decoder card number, you can send CV change commands directly to the decoder. No need to move the decoder to the programming track. If you only know the output address, use the chart starting on page to determine the card number.

You can change all CVs including the address. And you can also issue the restore command to restore factory defaults for a specific decoder number. We strongly advise against changing the decoder numbers while on the main track.

The ACK LED will flash for main track programming. This serves as an indicator that the reprogramming packet has been received. You can also perform CV verify as long as the ACK LED is visible. During CV verify, the ACK LED will flash signifying the value has been verified.

To initiate main track programming, push the ACCESSORY key. This tells the Command Station that subsequent commands are for accessory decoders only. For this example, decoder card number 10 will have CV515 changed from a value of 0 to 127. This means the A output at (output address number 37) changes from continuous on to a pulse with a duration of 12.7 seconds.

❍**ACCESSORIES** always start with this key when programming accessories

```
Accy ir Route
Output/Rt# ____?
```

❍ **OPS PRGM** this indicates that programming commands will be sent via the main track. The (<512) reminds you that you are to specify the decoder card number, not an output address. The decoder card number is between 1 and 511. For this example card number 10 will used.

```
ACCESS. Decoder
Number___?(<512)
```

❍ **1,** ❍ **0,** ❍ **ENT**

```
ACCESS. Decoder
Number10_?(<512)
```

```
Decoder # 0010:
CV#____?(513-521)
```

The screen shows that only CV numbers from 513 to 521 are available to be programmed. For this example, the ouput A On-Time, CV515, will be programmed to a value of 0.

❍ **5,** ❍ **1,** ❍ **5,** ❍ **ENT**

```
Decoder # 0010:
CV#515?(513-521)
```

```
Dec#0010,CV#515
1=Rite,2=Verify?
```

❍ **1** select 1 to (w)rite the desired value to the the CV

❍ **1** select 1 to write a decimal value to the the CV.

```
CV 0515 Write
1=Valu or 2=Bit?
```

```
CV 0515 Write
Value ___?
```

❍ **0,** ❍ **ENT** the desired value for A output On-Time

```
CV 0515 Write
Value 0__?
```

If you can see the red ACK LED on the AD4, it flashes when the command is accepted. The STAT LED will also flash during this procedure. The write OK doesn't mean the Command Station verified the value – it just means the programming command has been sent. Push ESC to conclude the CV programming operation.

```
CV 0515 Write OK
CV#___?(513-521)
```

Accessory Decoder [AD4] Main Line (OPS) Programming

Direct verification is used when you want to check a CV for a specific value when the AD4 is connected to the main track. The procedure is similar to writing a CV and in fact that is where you start. Only decimal values may be verified on the AD4.

You must be able to see the red ACK LED on the AD4. This LED is your only indication that a verify has occurred. For this example, decoder number 10 will have CV515 verified to contain a value of 0.

○**ACCESSORIES**

```
Accy ir Route
Output/Rt# ____?
```

○ **OPS PRGM**   this indicates that programming commands will be sent via the main track. The (<512) reminds you that you are to specify the decoder card number, not an output address. The decoder card number is between 1 and 511. For this example card number 10 will used.

```
ACCESS. Decoder
Number___?(<512)
```

○ **1,** ○ **0,** ○ **ENT**

```
ACCESS. Decoder
Number10_?(<512)
```

○ **5,** ○ **1,** ○ **5,** ○ **ENT**

```
Decoder # 0010:
CV#___?(513-521)
```

```
Decoder # 0010:
CV#515?(513-521)
```

○ **2** select 2 to verify the desired value in CV515

```
Dec#0010,CV#515
1=Rite,2=Verify?
```

○ **1** select 1 to verify a decimal value

```
CV 0515 Verify:
1=Valu or 2=Bit?
```

```
CV 0515 Vefify
Value ___?
```

○ **0,** ○ **ENT** Only push ENT when you can see the card's LED

```
CV 0515 Verify
Value 0__?
```

If the value contained in CV515 is 0, the red ACK LED flashes. This is the only indication that the value has been verified. The value on the display doesn't mean anything except that the macro is done. Only the ACK LED turning on (or staying off) is the valid response.

```
CV 0515 Valu=000
Completed
```

○ **ESC,** to return to the home page

Accessory Decoder Factory Reset

Reset the AD4 to its original factory settings by following the steps below. The programming track should be used for the reset command.

1. Use the programming track and program CV520 to a value of 0.

2. Disconnect the programming track and connect the decoder to the main track apply track power to finish the task.

This two step process guarantees the decoder can finish the task of writing all of the CVs with their factory default values. The write value must be a 0. The value is not stored and simply tells the decoder to prepare to restore all factory defaults upon the next power application.

Be sure to use the main track for the subsequent power application. The programming track may not stay on long enough for the decoder to finish restoring all the CVs.

You will know the procedure has been successful when, after connecting up to the main track, you see the red ACK flash followed by the steady green status LED.

Command Station Memory Management

System Memory Management

Layouts that feature large group operation or have a large number of locomotives and consists, might occasionally encounter system messages that require attention. Although these messages may never been seen, once they appear, they must be understood and handled properly. This section describes the system memory management messages, their meaning and procedures.

EasyDCC Memory Management Terminology

Registration: Automatic or manual process by which a locomotive decoder address or consist address is added to the system's internal memory and becomes active. Upon registration, the activity timer is started.

Unregistration: Automatic or manual process by which an address is declared inactive. Once unregistered, the inactive address's memory space becomes available for reuse, but only if the system requires it. Until the memory space is needed, the inactive address plus its speed-step setting and it's function status, remains in the system and can be reactivated simply by setting a throttle to the inactive address. Upon reactivation, the activity timer starts over.

Active address: Locomotive or consist address that has received throttle or function commands within a specified amount of time. Each time the address receives either a throttle or function command, the timer is restarted. The memory space occupied by an active addresses can not be used.

Inactive address: An unregistered address or an address that has had its activity timer expire. This memory space occupied by this address is available for reuse and will not appear in the table of active addresses.

Activity Timer: An automatic count-down timer, unique to each registered address, which is used by the system to monitor all active addresses. Each timer is preset to 16 hours and counts down whenever the Command Station power is on. For most layouts, 16 operational hours is about 1 month of moderately heavy use. The timer resets back to 16 hours any time a mainline command is sent to the address or if a throttle is used. Once the timer expires, the associated address and its memory space is declared available and becomes available for reuse.

Maximum Number Of Registered Locomotives and Consists

The maximum number of registered locomotives and consists is 255. Once this limit is reached, the system will automatically unregister any unused locomotive or consist to make room for new entries. Remember that locomotive registration and unregistration is largely automatic. However, if necessary, unregistration can be done manually.

Automatic Address Registration Process

Locomotive addresses are automatically registered and become active if:

1) a locomotive address is assigned to one of the Command Station's built-in throttles;

2) a new locomotive address is dialed into a wireless or plug-in throttle;

3) a locomotive is added to a consist; or

4) you use Main Track Programming to set the number of speed steps for a new address.

Automatic Unregistration Process

Only UNUSED or inactive numbers are unregistered and this only occurs once the system is full. The time period has been defined as 16 continuous hours of non-use. Unregistered locomotive addresses are not physically deleted. The unregistered address (along with its speed step setting) memory space remains in the system. The Command Station simply "marks" the space as suitable for reuse. Also, marked addresses, whether done automatically or manually, will not appear in the active address list when viewed with the SHOW LOCO ENTER command.

Memory Management: T= and M= Counters

The Command Station's home page will always show how much memory is available for new locomotives. It will also tell you how many active throttles are being used.

```
V631 T=00  M=255
A=------    B=------
```

T=00   Number of Active Throttles

The Command Station keeps track of the number of active throttles. An active throttle is one that is in use with a non-zero speed value. Previously active throttles will be declared inactive after about 2 minutes of inactivity. When this occurs, the T count will decrease. This is used to speed up system response. The count of active throttles updates automatically. Any throttle automatically becomes active the moment it is plugged-in or turned on and the speed control is advanced. Active throttles are given the highest priority in the system to minimize delays.

The highest number for T is 31. The lowest number is 0 which only means that there are no active throttles being processed. This number will vary during system use as plugged-in or inactive throttles are removed from active list.

Only active throttles are shown in the T counter. Active throttles will increment the T counter which always shows the current count of active throttles. The top example shows there are 7 active throttles. This means that 7 throttles have sent a command within the last few minutes.

```
V=631 T=07 M=244
A=------    B=------
```

```
V=631 T=04 M=244
A=------    B=------
```

Inactive throttles will decrement the T count even if the throttle is plugged in or a wireless throttle is turned on but the speed is set to 0. The bottom example shows that 3 throttles have gone inactive. To make an inactive throttle active, just tweak the speed knob.

M=255   Number of Available Locomotive Memory Slots

The Command Station starts with 255 memory slots which is shown in what we call the M counter. When a locomotive is registered, either manually or automatically, a memory slot is assigned to the locomotive and the M counter decreases by one. If the system memory has been cleared, and no wireless or plug-in throttles are active, the display will show M=255. The number of slots available updates automatically.

Unused locomotives will be deleted automatically after about 60 hours of continuous non-use. However, consists and their locomotives are NEVER deleted.

The lowest number for M is 001. If this number is reached, no new locomotives can be registered and throttles will not be able to control them. You must clean out the memory of unused locos, and erroneously entered loco addresses before new locos can be used. This is described in the next section.

Show Inactive Locos Registered In Command Station

Locomotive address registration occurs automatically anytime a loco or consist address is set on a throttle, whether the address is valid or not. Thus, accidental addresses may added to the system unbeknownst to the operator. After many months, it is possible to have a system full of "bad" addresses.

To help you manage this problem, use the SHOW LOCO command to display the loco addresses that the Command Station has declared as inactive. Push ENT to step through each address.

Make a note of the inactive addresses that are not valid for your layout. These can be removed as described in the next section. Removing the bad addresses frees up their loco memory slots for use by valid addresses.

○**SHOW,** ○**LOCO,** ○**ENT**

```
Inactive Address
Loco 0091
```

Push ENT to step to the next inactive address.

○**ENT**

```
Inactive Address
Loco 1591
```

○**ENT**

The last entry will be Loco 0000* which means the end of the list has been reached.

```
Inactive Address
Loco 0000*
```

Unregister a Locomotive Address

At any time you can delete an unused address from the Command Station. For this example, locomotive address 5321 will be "deleted" from the registration table. The decoder is not changed in anyway using this command.

○ **SETUP/ASSIGN**

○ **LOCO**

```
Loco 5321 Active
1=#steps  2=DEL?
```

○**5,** ○**3,** ○**2,** ○**1**

○ **ENT**   Notice that the initial display shows the entered address is active.

○**2**   Use the 2 key to DEL-ete or unregister the address. This action, permanently removes the decoder address from the list of active addresses being serviced by the Command Station. To re-register the address, it must be selected by a throttle or manually entered at the Command Station.

```
5321 has been
UN-registered
```

As stated earlier, this procedure will not likely be needed for most EasyDCC users.

Clearing Inactive Addresses From Loco Memory

At any time while viewing the list of inactive addresses, you may change the status from active to inactive by pushing the 0 key. However, if the loco is assigned to a consist, it cannot be removed.

When the 0 key is pressed, the address is tagged with an asterisk. With this tag attached to the address, the Command Station clears out the memory slot for use by another locomotive address when ESC is pressed.

○**SHOW,** ○**LOCO,** ○**ENT**

```
Inactive Address
Loco 0091
```

This loco address will be cleared by pressing the 0 key.

○**0**

You can continue clearing inactive or bad address numbers by pushing ENT and 0 for each address showing. If the address is good, push ENT to skip to the next one.

```
Inactive Address
Loco 0091*
```

○**ESC**

Pressing ESC finished the process. Check the M counter and it will have increased by the number of addresses you tagged with an asterisk. If you repeat the SHOW command, the tagged addresses will no longer appear in the list.

Unregistering A Specific Locomotive Address

This procedure will unregister the specified locomotive address. The address is permanently removed from the Command Station's address registration table. To re-register the address, it must be manually registered at the Command Station. If the address is selected on a throttle, registration is automatic. For this example, loco 2841 will be used.

○ **SETUP,** ○ **LOCO,** ○**2,** ○**8,** ○**4,** ○**1,** ○**ENT**

```
Loco 2841  active
1=#steps   2=Del?
```

Wondering why it shows as being active? Its because the locomotive address was just entered into the Command Station, even though it will soon be deleted. Select option 2 to unregister and delete the locomotive address from the Command Station.
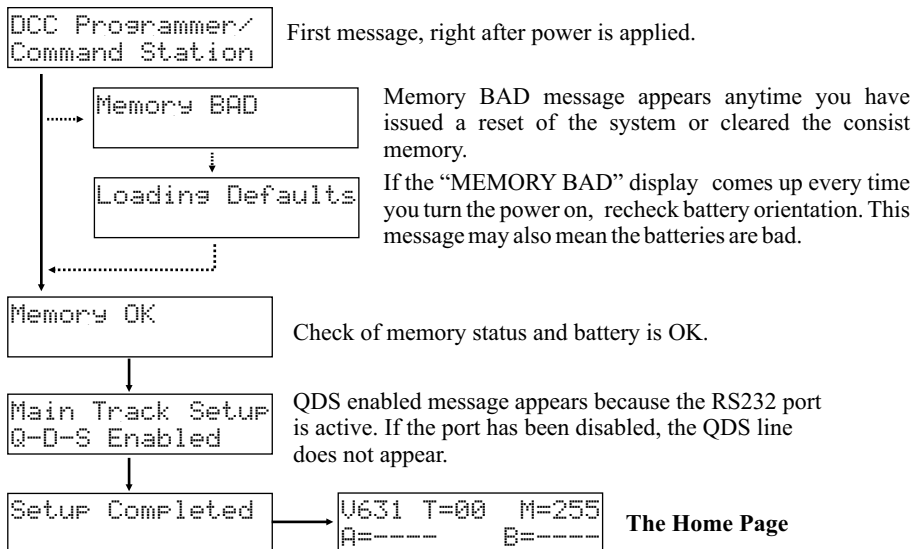
```
2841 has been
UN-registered
```

○**2**

○ **ESC**

Command Station Initialization Messages

There are a series of system initialization messages that appear when the Command Station is powered on and goes through a self test. If you want to see the messages again, push the RESET button, then push and hold the RESET key when the message appears.

```
DCC Programmer/
Command Station
```
First message, right after power is applied.

```
Memory BAD
```
Memory BAD message appears anytime you have issued a reset of the system or cleared the consist memory.

```
Loading Defaults
```
If the "MEMORY BAD" display comes up every time you turn the power on, recheck battery orientation. This message may also mean the batteries are bad.

```
Memory OK
```
Check of memory status and battery is OK.

```
Main Track Setup
Q-D-S Enabled
```
QDS enabled message appears because the RS232 port is active. If the port has been disabled, the QDS line does not appear.

```
Setup Completed
```
→
```
V631 T=00  M=255
A=-----    B=-----
```
The Home Page

Command Station Memory Clear - Factory Reset

To force a total system reset, and clear the Command Stations' entire memory, use the following procedure. This will clear all advanced and standard consists too. If you had advanced consists, you will need to re-enter them. Also, this will re-enable the computer port. Be sure and disable the port if not used.

❍ **ENT,** Push and hold the ENT key

❍ **RESET** Push and release the RESET key. Do not release the ENT key until the message "MEMORY BAD" appears on the display. This will confirm the system memory has been cleared and factory defaults at left have been restored.

```
Memory BAD
```

If the MEMORY BAD message does not appear, the ENT key was probably released to early. Repeat the sequence and hold until the MEMORY BAD message does appear.

Command Station Factory Defaults	
Throttle A	not assigned
Throttle B	not assigned
Speed steps	28
Decoder Functions	all Functions off
Accessory decoder	all outputs off
Consists	None
Routes	None
Update Rate	80
RS232 Port	Q-D-S Initalized

Replacing Command Station Memory Battery

Your command station uses a single 20mmx16mm (abbreviated 2016) Lithium coin-cell battery to retain system setup information inside an internal memory chip called an "SRAM." The lithium battery is installed and tested before the Command Station is shipped. Do not use any other type of battery - only 3V lithium cells can be used.

Under normal operating conditions, a high quality battery will last about 3 years before needing replacement. However, cheap batteries usually only last about a year. Regardless, w strongly recommend that the battery be replaced about once a year. Failure to replace the battery before it discharges will result in erratic operation, loss of locomotive information and/or an unreadable display.

Changing the battery is easy and takes only a minute or so.

Do not turn off power when changing the battery or you may lose all of your locomotive information.

Tab (+)
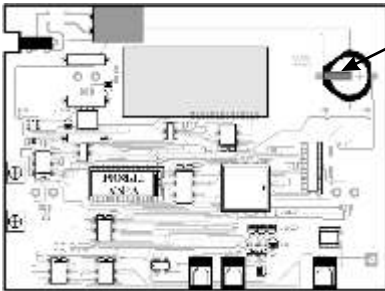
Back of Command Station
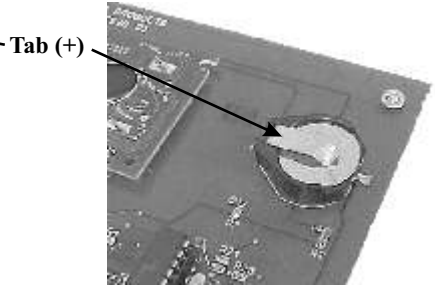
Changing The Battery

The coin cell battery is a standard 20mm 3V Lithium coin cell. The Energizer part number is 2016 Be sure to replace with the same type.

<u>**Always leave power turned on**</u> when replacing batteries. Without power, the data in the memory will be scrambled and useless when the battery is removed. If this occurs, you will have to re-enter consists and changes to any factory defaults such as speed-steps.

Decoders and throttles are not affected - but reentering consists is a nuisance, so leave the Command Station plugged in when changing the battery.

<u>**Proper battery orientation is required.**</u> The positive side of the battery, which is also marked with a plus, faces up. The positive side of the battery is labeled with a big + and the brand name.

To remove the old battery, gently pull up the positive tab and slip the battery out of the holder. Install the new battery in the same way. Pull back the tab and slip the battery in from the side.
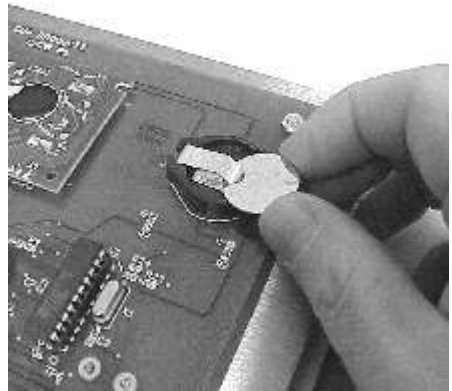
The EasyDCC Command Station is very busy handling all of your layout's locomotives and turnouts. Extensive testing by us and by customers with large layouts and large groups of operators allows us to recommend the best of several methods with which you can manage the overall system performance. Before getting into the various system optimization options, the following guidelines should be followed since they directly impact the overall performance and are independent of the option selected.

Use only advanced consists. Large numbers of standard consists will drastically slow system performance.

Don't use the programming track during group operation. The moment the programming track is activated, the mainline trains will not receive throttle commands and will continue operating with the last issued command until the programming task is completed. For some programming sequences, it can be several 10's of seconds before programming is completed and throttles and locomotives resume normal operation.

Always set the Command Station's default speed step setting to the desired value. This insures proper speed step matching for new locomotive addresses. Use the SETUP #STEPS command.

Setup throttle A and B for no addresses. SETUP A (or B) ENTER. Display will show dashes.

Assign plug-in and wireless throttles to a common and unused address before unplugging or turning them off. This automatically allows another throttle to gain control without having to wait for the two minute timeout.

Plug-in throttles will always have the fastest response since they have a hardwired connection to the command station.

Wireless Throttle System offers several performance otimization settings. In most cases, performance is a compromise between the number of wireless throttles and the number of wireless receivers. The best case performance is where each wireless throttle has its own receiver. The worst case performance is where a single frequency is shared by many wireless throttles.

Sound Decoders also have inherent delays. As we tested newer decoders, we discovered that sound decoders have their own delays, especially for horns and whistles. This is done in part to insure that sound decoders don't inadvertently sound their horn or whistle as a result of dirty track or dirty wheels. Thus some decoders require a longer than normal press on the F2 key before the horn actually sounds.

The NMRA-DCC standard is a relatively slow transmission method. Common sense says that as more locomotive addresses and throttles become active, the time to service each active address increases. However, there is a limit beyond which the DCC standard itself is responsible for the delays.

The graph shows that there is great response time when fewer than 15 throttles are in use (one throttle equals one active address). As more throttles are added, the F2 response time degrades. With a maximum number of throttles in use, the response time is graded as only fair.

F2 Response - Worst Case All Addresses Active

This graph assumes all locomotives are being sent commands continuously which will rarely occur in actual operation.
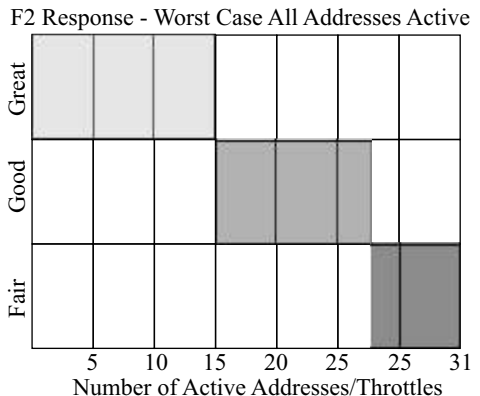
Choosing the Locomotive Decoder Update Rate

The rate at which the Command Station sends out decoder speed and function updates is called the "update rate." The rate is selectable from very fast to very slow. This "update rate" is important since it is what restores the current speed to a locomotive that is coasting or stopped following a power interruption. Locomotives are updated at the update rate as long as the associated throttle speed is not zero. If the speed goes to zero, the locomotive address is updated for an additional 2 minutes before it is declared inactive and updates stop.

What is Update Rate

The illustration below shows what happens over time when the decoder signal is interrupted. The line labeled "Decoder Power" is used as an indication of what is happening over time. "Normal" means the locomotive is running normally. Then, the decoder signal is "Interrupted" due to dirty wheels or dirty track or a dead section of track. After a short period of time decoder signal is restored back to "Normal." For very short interruptions, the locomotive might coast for a fraction of a second. However a long power interruption will result in the decoder having to reinitialize and then wait for the DCC signal with its address to come along.

The second line shows what is happening inside the decoder for a power interruption that causes the decoder to restart. Notice during the power interruption, the decoder is basically dead. It is as if you just turned on the track power. When power is restored, the decoder resets the motor speed to zero. Now the decoder is ready and waiting for the DCC signal having its speed and direction. When it arrives the decoder resumes running.

The third line shows what is happening at the Command Station. Each active locomotive with a non-zero speed is periodically sent an update signal. The update rate is what is used to determine how often this signal is sent. In the "Fast Update Example" the decoder has only a short time to wait until its own DCC signal is received.

Fast Update Rate Example

Decoder Power	Normal	Power Interruption	Normal					
Decoder Response	Normal	Dead		Reset	Ready	Run		
DCC Track Signal	Update	Update	Update	Update	Update	Update	Update	Update
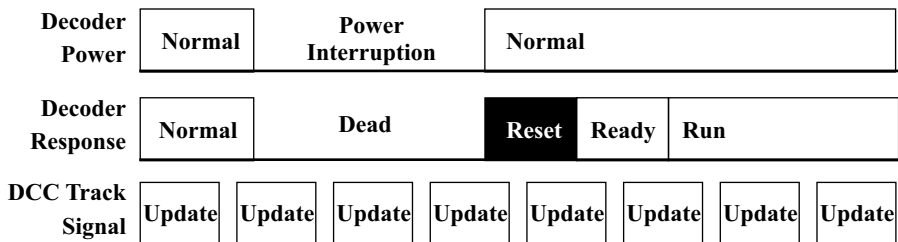
Update Frequency - Faster Is Not Always Better

Frequent updates can slow down the overall system response since the system is busy sending out lots of updates. As a result, locomotive decoders will quickly return to their previous speed if they encounter momentary power interruptions. These interruptions are most commonly caused by dirty track, dirty wheels, dirty pickups, and track imperfections. Flickering headlights are a sure sign of dirty track and wheels. A faster update rate may be used when there are relatively few active locomotives. But a large number of active locomotives will incur a longer delay and the overall system performance will slow down. For this type of layout, a slower update rate may be best.
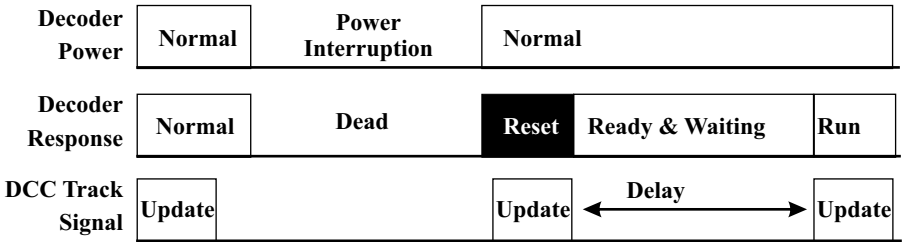
Fewer Updates Has Consequences Too

Less frequent updates improve the system response because the system has more time to spend processing and handling new commands. Speed changes and function commands are transmitted quicker. But, relatively clean track and wheels are a must since there will be a longer delay following power interruptions.

On a layout that is used frequently, the track is relatively clean and a locomotive will coast over the dirty spot, or track imperfection and resume running with no hesitation. But if the wheels or track are very dirty, the locomotive may come to a stop before the update command is received. This is very noticeable with sound locomotives that reset back to idle. Upon receipt of the decoder update, the locomotive resumes it previous speed. Another good example is a multi-unit consist. It is possible for one of the locomotives to have a power interruption and go dead while the others continue to run normally. The dead locomotive is dragged around until it receives its update command.

Slow Update Rate Example

Decoder Power	Normal	Power Interruption	Normal		
Decoder Response	Normal	Dead	**Reset**	Ready & Waiting	Run
DCC Track Signal	Update		Update	←— Delay —→	Update

Default Command Station Update Rate

The Command Station's default update value is 80; this provides an update about every 1-2 seconds. For most users, this is more than adequate.

You may change the rate at any time and the change takes effect immediately. You can also show the current update rate. The update rate is stored in memory and is remembered when power is turned off. A clear memory command will reset the update rate to the default value of 80.

Experimenting With The Update Rate

The Command Station provides a selection of 255 update rates, from a value of 1 to 255. A larger number creates a larger delay between updates but you get better system performance.

A small value for the update rate provides a very short delay between updates. A value of 1 provides an update rate of about once every 30 milliseconds but slows down the overall system performance.

However, decoders do not instantly resume running after their power is interrupted. Most decoders require about a tenth of a second to resume running at their previous speed. Thus, an update rate below a value of about 40 sends out updates faster than the locomotive can respond. You may certainly use a lower value than 40 but you'll be wasting system performance and sending updates faster than the decoder can use.

Show Present Decoder Update Rate

○**SHOW,** ○**N-ON**   shows the current update value

○**ESC** returns to the home page

```
Loco Update Rate
Set To 80
```

Change The Locomotive Update Rate

○**SETUP,** ○**N-ON,**

```
Loco Update Rate
Value?___(1-255)
```

○**1,** ○**0,** ○**0,** ○**ENT**

```
Loco Update Rate
Set to 100
```

For this example, a rate of 100 was selected. The fastest rate available is 255 and the slowest rate is a value of 1. Leading zeroes are not required.

Errata Location And Copyright Information

All corrections will be posted on the CVP website: http://www.cvpusa.com. Any reference to this work must include the copyright statement. Copies may not be made, distributed or sold without written permission.

No Technical Support Is Offered

This information is written with the assumption you are familiar with computer communications. It is not written for novice programmers. The Basic Language program fragments are given for illustrative purposes only. Most initial communication problems are due to faulty cabling between EasyDCC and your computer. Check there if you seem to be unable to establish communications.

Serial Port Is Required

If your PC doesn't have a serial port, you must use a USB to Serial Port adapter. We have tested and verified the proper operation of the KEYSPAN adapter, part number USA-19HS. It has a USB connector on one end and a DB9 male connector on the other. The KEYSPAN adapter was used to test the new Command Station Software and has been verified as working properly.

Interface Cable And Adapter

The Command Station uses three connectors of a 6-pin RJ11 (6p6c) telephone-type plug. The Command Station jack has the following pin assignments: Pin 1 = TXOUT, Pin 2 = Ground, Pin 5 = Ground, Pin 6 = RXIN. If you don't want to build your own, then use an adapter.

Communications

Uses a baud rate of 9600. Each byte is 8-bits, no parity, and one stop bit. Only ASCII characters are sent.

3rd Party Software

 It is the responsibility of the 3rd party to support their own software including updates to support EasyDCC's new features. If you are having problems with their software and EasyDCC, please contact them directly.
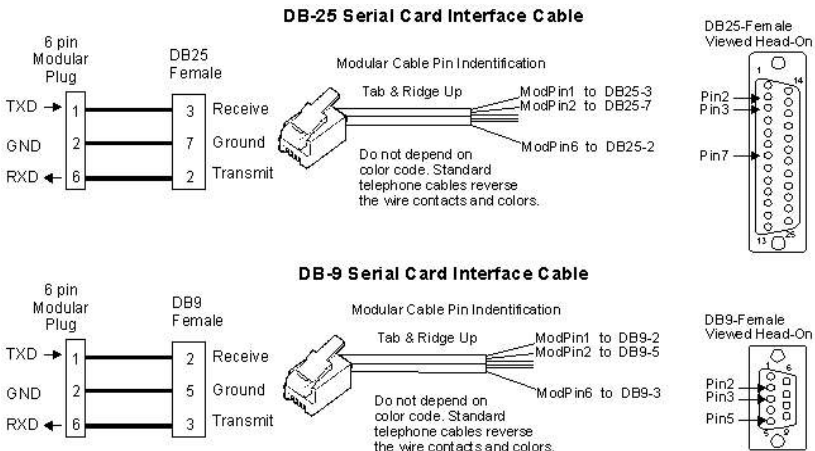
The special Al cable and adapter

Enable/Disable QDS Commands To Use RS232 Port

Before using the computer port, you must enable the full set of RS232 commands. This is a manual operation, done with a couple of keystrokes. This command toggles between enabled and disabled. If enabled, the SETUP/ASSIGN Q-D-S Enabled message will appear and you must press ESC to return to the normal screen. If it is active, pressing SETUP 0 will disable the feature and the normal screen will appear. This setting is retained with power off.

○**SETUP**

○**0**   Enables the 3 commands in the RS232 section

○**ESC**   to return to the home page

```
Setup/Assign
```

```
Setup/Assign
Q-D-S Enabled
```

To disable the port, use the same keystroke sequence.

The port is re-enabled if the Command Station memory is cleared. To tell you that the system has the RS232 port enabled, the last initialization message will show QDS Enabled on the second line before the home page appears.

Computer Port Syntax and Protocols Documents

Since very few people ever need the technical details about how to use the EasyDCC computer port, the documentation is not included with this book.

However, if you want a copy, the EasyDCC Computer Port User Guide can be found and downloaded from our website at the URL shown below. Go to this page and look for the guide at the bottom of the Installation and User Guides listing.

The document contains a complete listing of the syntax, data formats, data tables and example programs written in BASIC.

Just remember: No technical support for the computer port is available so you are on your own.

http://www.cvpusa.com/easydcc_doc_center.php

The PC Must Have A Serial Port

If your PC doesn't have a standard DB9 serial port, then you will need to add a USB serial port adapter cable. These can be purchased from any computer shop or places like Staples or Office Depot. We have tested an inexpensive adapter from KeySpan purchased from Staples.

CVP's DB9 To RJ Adapter

CVP offers an adapter plus custom cut lengths of modular cable up to 15 feet long. The adapter consists of a modular jack on one end and a DB9 connector on the other end. The modular cable plugs into the Command Station's RS232 modular jack and the other end goes into the adapter. The DB9 connector is wired to connect the modular cable's signals to the proper pins on the DB9 connector.

DB9RJ is the catalog number and it lists for $25 with your choice cable length up to 15 feet long.

Notes

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System Troubleshooting

How To Reset XR1300 Plug-In Throttle ID To Factory Defaults

To reset the throttle to factory defaults, assign the ID to a value of 0. Then unplug the throttle, count to 10 and then plug the throttle back in. Once plugged back in, the XR1300 throttle resets to ID=17, and loco address=3 and the accessory address is 1.

How To Set The XR1300 Throttle ID

1. First, make sure the throttle is plugged in.

2. Push the # key. Watch for the two direction LEDs to flash slowly.

3. Now push the DIRECTION key. Notice the direction LEDs are flashing at a faster rate.

4. Now enter the number for the desired ID number and push the key labeled # (called the pound key) to complete the procedure.

5. Before you forget, put a label on the throttle and write the ID number on the label. You might remember today, but what about 6 months from now.

If you want to change the throttle ID number, just repeat the above sequence. The old ID number will be overwritten with the new ID number.

How To Set The T5000E Throttle ID

Push MENU twice followed by the 4 key.

Enter the ID number and then push #. Leading zeroes are not required.

After pushing #, the home page appears. The bottom line of the home page shows the "id" symbol followed by the number. Verify that the ID number showing is the one desired.

How To Set The T5000E Frequency

Push MENU once followed by the 3 key.

Enter the desired frequency number and push ENT.

Verify the desired ID and Frequency numbers appear on the home screen.

Nuisance Issues That Have Easy Fixes

We receive many requests for help that fall into a category of nuisance issues. The only problem was that the user needed some help to understand the cause and the solution. This page has some of the more common questions arranged by observable symptoms.

Loco Runs Full Speed For A Few Seconds When Power First Applied

Decoders that offer "analog" operation (decoder can run with an ordinary power pack), may accidentally switch over to analog mode while the Command Station is initializing. If this occurs, program the decoder's CV29 to disable the analog mode. If this mode is desired, consider keeping the locomotive on an unpowered section of track until the Command Station completes the initialization sequence.

Another possible problem is an incorrect cable used between the Command Station and the Booster or between multiple boosters. If you suspect this might be a problem, consider replacing the cable with a new one.

Headlights Flash As Train Speed Changes and Other Odd Behavior

For each address used, the Command Station can be set to one of 3 speed step settings. Each decoder can be set to either 14 or 28 speed steps (the 128 speed step setting is automatic and does not require decoder programming). Obviously, the speed step settings must match. For example, if the Command Station is set for 28 speed steps and the decoder is set for 14 steps, the locomotive's headlight flashes as you change speed. Use the table below to help troubleshoot speed step mismatch.

CS	Decoder	Result
14	28	Pushing F0 (headlights) changes locomotive speed
28	14	Headlamp flashes with speed change
128	14	F0 (headlights) will not work
128	28	OK but the decoder must support the 128 speed step mode

Locomotive Stops When Tethered Throttle Is Unplugged

Check for another throttle set to the same address. Don't forget to check the Command Station's throttles too.

Some newer decoders may have a very short time set for the DCC packet time-out value, CV11. Reset this value to provide a longer time.

A momentary interruption of the track signal (derailment, dirty track etc) can also halt a locomotive running on memory. Memory is resident inside the decoder, not in the Command Station. Consider cleaning the track and/or improving the locomotive's pickup if this becomes a problem.

Locomotive Starts, then Stops, then Starts, Then Stops...

Some newer decoders may have a very short time set for the DCC packet time-out value, which is CV11. Reset CV11 to a value of 0. This value disables the packet time-out.

Locomotive Doesn't Reach Top Speed Or Runs "Strangely"

If using XR1300 throttles, check for another throttle set to the same address. Don't forget to check the Command Station's throttles too. This is where it pays to have recorded all of your throttle ID numbers in the sheet following the Permanent Mounting section. To de-assign the Command Station throttle, push SETUP, THROT-A (or B), ENT.

If using wireless throttles, check for duplicate ID numbers and/or duplicate frequencies. Each wireless throttle must assigned a unqiue ID and a unique frequency.

If using both types of throttles, check both of them.

Train Doesn't Run In One Section

If you were just working in the affected area, or an adjacent area, that is where to focus. Think about what you were doing in that area and then check for broken unplugged power supplies, feeder wires, broken bus wires or missing feeders.

Plug-In throttle doesn't have a stop position but rotates continuously

Oops, that is a sign that the potentiometer attached to the knob has been broken. It will need to be replaced. Give us a call to setup its repair.

You need to take some time to inform your operators that turning the speed knob faster or harder against the stop does not make the train stop quicker. It only breaks the potentiometer.

The Mikes Train House (MTH) Decoder Can't Be Programmed With The Loco Address

These decoders do not handle the NMRA-DCC standard back-to-back programming packets correctly. Therefore, to program this locomotive, the address CVs must be programmed one at a time using the "Program CV" service programming command on the programming track.

For a loco address between 1 and 99, CV1 is programmed with the loco address and CV29 must be program to a value of 2.

For a loco address between 100 and 999, there are 2 CVs, CV17 and CV18, that hold the locomotive address. In addition, CV29 must be programmed to a value of 34.

To determine the proper values for the 2 CVs, use the online calculator found at this site (cut and paste this long URL into your browser:

www.modelrailforum.com/forums/index.php?autocom=custom&page=DCC-long-address-calculator

Use this CV calculator to calculate the two CV values for the desired address. Program these values into CV17 and CV18 using **Program Any CV** command. Then, program the value of 34 into CV29. Your locomotive will now respond on the desired address.

The Plug-In Throttle Indicators Flash When The Cord Is Moved or Plug Is Rotated

This usually means the throttle is not getting a good signal. Rotating the plug or moving the cable usually means one or both are bad and need to be replaced.

Try another fascia socket. If the problem goes away, replace the socket on the fascia where you saw the problem - it is worn out. Contact us to purchase new sockets. They are easy to replace.

If the problem is present on multiple fascia sockets, then the throttle's cord and/or plug are bad and need to be replaced. Call us to setup the repair.

Troubleshooting Intermittent Horn/Whistle With Wireless

Throttle function 2 activates the horn or whistle of a sound decoder. It is given special priority in the hierarchy of software within the Command Station because it literally tests the absolute response time of the entire DCC system.

With thousands of installations of EasyDCC wireless equipment, it is impossible to create an exhaustive list of all causes of this symptom. So, we'll start with the most common cause and work downwards towards the least common. In all cases, all of these causes result in exactly the same symptom – the horn/whistle shuts off before commanded to do so.

Cause #1: Specific to QSI decoders

As delivered from the factory, there is an incorrect value programmed into CV11, which is the DCC packet timeout value. For proper operation of the horn function, CV11 must be programmed to a value of 0. Use either the programming track or OPS programming to change the value.

Cause #2: Duplicate Wireless or Tethered Throttle IDs

All throttles must have a unique ID number programmed into them. ID programming is not obvious but we have been surprised how many operators have accidentally changed the ID. It is also possible that a plug-in throttle might have accidentally been assigned an ID within the wireless throttle range. Use the Command Station diagnostic tools (SHOW ID, etc) to verify proper and unique IDs for ALL throttles.

Cause #3: Duplicate Wireless Frequencies Used

For each XF-Series wireless receiver, it can accept up to 8 throttles each on their own unique frequency. Each throttle must be set for SCAN mode and each throttle must set to its own frequency.

For RF1300 throttles, the throttle can only be received by an XF-series Group-1 receiver. Inspect each DIP switch setting and confirm no two throttles are on the same frequency and make sure the.

For T9000 throttles, verify that each unit is on the desired frequency without duplicates.

Cause #4: Loss of Signal – Reception Black Holes

When a wireless throttle loses contact with the wireless receiver, the command station has special software routines that protect against horns and whistles being stuck on. This occurs when the operator pushes the F2 key, and then steps into a poor reception area. When this happens, the Command Station no longer receives the throttles signals but knows that the F2 key was previously command ON. After a period of NON-RECEPTION, the command station turns off the horn automatically. The solution to this cause is simple, improve the reception. This can be done by repositioning the receiver or by adding additional receivers in areas known to have reception problems.

Cause #5: External Jamming of Frequencies

Somewhat related to #3 and #4, this cause is a bit more difficult to assess. The most common symptom will be one throttle that always seems to have trouble. This is usually a sign that an external jammer has rendered the frequency unusable. Your only solution is to remove the jamming source after confirming your own equipment is not the cause (see #3). If your equipment is OK and you can not locate or disable the jammer, you must declare that frequency unusable and move to a different frequency. There are some guidelines related to jamming in the orange Operation manual.

Cause #6: Transmitter Congestion at the Receiver

This cause is not very common so it is listed last. For this case, the cause is the physical proximity of several transmitters to the radio receiver. Initial installations where the receiver is simply placed near the command station and connected with the modular cable are where this cause usually pops up. This is why the orange Operation manual includes suggestions for how to find the best location.

Simplified Troubleshooting When The Trains No Longer Run

Troubleshooting is not a scary. In fact, if you read and follow the suggestions in this section, you'll be troubleshooting like a pro. A professional troubleshooter tackles problems by using simple tests to decide where to focus his efforts. For an EasyDCC system, the tests are very simple and easy to perform without any expensive equipment. The assumption for this section is that one or more trains where running just fine but now they have stopped.

If none of the previous page's tips have helped, the following procedures will help find the cause of the trouble. It is important that you follow these procedures exactly as described and in sequence. Do not skip around. The big assumption for this section is that everything was working normally when the trains were last used.

Step 1: Check for power on the rails. The easiest way to do this is to use a clip lead and short across the rails in the area in which the train doesn't run. The short circuit buzzer should sound off and the red fault light will light up on the ZoneMaster booster feeding this area. This proves there is DCC power on the rails and that the booster is working correctly. If the short circuit test works and the alarm sounds, proceed on to step 2. If the alarm doesn't sound, go to next page and find "step 1 failed."

Step 2: Checks for correct Command Station and booster operation. Next, turn off all wireless throttles and unplug all plug-in throttles. This is very important. Setup the Command Station's built in "A" throttle to the loco number that is not running. Check the display on the Command Station. Use the following key sequence to setup the Command Station's A throttle to the loco number. Note that the loco number is shown by "nnnn." You substitute your loco number for nnnn. You also need to deassign the B throttle.

SETUP, THROT-A, nnnn[the loco number used for the test], ENT, ESC.

SETUP, THROT-B, ENT, ESC

Verify that the display shows A=nnnn [your loco number] and the B throttle shows dashes.

Now turn up the A speed control and check if the loco moves. Change the A direction and check if the loco moves in the other direction. **If the loco does not move, go to step 3. If the loco does move, go to next page - Loco moves at step 2.**

Step 3: Reprogram the loco number. Move the test loco from the step 2 to the programming track with all wheels on the rails. Use the following keys to reprogram the loco decoder to the desired number. Again, as before, the loco number is shown as "nnnn" and you use whatever number you want. Most people use the locomotive's cab number since it is easily seen.

Push the **SVC PRGM** key. There are two possible messages that will appear after pushing this key. Find the column that matches your display for what to do next.

```
Program Track
Program What?
```

Push the SHOW/LOCO key.

```
Program Track
Loco Addr ____?
```

Enter the desired loco number and then press ENT.

```
Prog Address OK
PgmPT:What else?
```

Push ESC.

Go to step 4.

```
Decoder Type=02
ENT=OK or 1,2,3
```

Push the 3 key.

```
Program Track
Program What?
```

Push the SHOW/LOCO key.

```
Program Track
Loco Addr ____?
```

Enter the desired loco number and then press ENT.

```
Prog Address OK
PgmPT:What else?
```

Push ESC.

Go to to step 4.

Step 4: Move the reprogrammed loco to the mainline. Recheck that the A throttle has the same number you programmed into the loco. If not, setup A throttle to the number that you programmed into the loco in step 3.

Turn up the A speed control and check if the loco moves. Change the A direction and check if the loco moves in the other direction. If the loco does not move, go to step 5.

Step 5: Summary and conclusions. At this point, you have verified there is power on the rails, no external throttles are in use, the locomotive has been reprogrammed to a known number and that throttle A, which has been set to the same number as was programmed into the locomotive, <u>does not</u> operate the train. This indicates that there is some kind of trouble with the locomotive and/or its internal decoder. As a final check, repeat the same sequence with a different locomotive.

Note: There is a slim chance that the Command Station's programming circuit has been damaged which means it cannot reprogram the decoder. However, such a problem would not prevent normal Command Station operation using its built in throttles. This can be proved by simply operating a known good locomotive with the Command Station's throttle A.

Testing Failures - What to do next?

Test Failed At Step 1: The failure of step 1 test, shows there is no track voltage. Look at the track booster that powers the section of track where the test took place.

POWER indicator is dark. There is no power getting to the booster. Make sure the plug from the power supply is firmly pushed into the power socket. Check that the power supply AC line cord is firmly plugged in. Check that the indicator on the power supply is on.

GP LED is dark and FT lights are on or flashing. There is no signal coming from the Command Station. Check all of the modular cables. Try swapping cables. Sometimes, nearby lightning strikes can cause excess voltages to damage a chip on either the Command Station or the booster or both. If you think this has happened, see the Troubleshooting booster section.

FT LED is ON and/or the short circuit alarm buzzer continuously sounds. There is a short on the track or the track wiring somewhere in the area fed by the booster. Pull out the TRACK OUT plug and confirm that the buzzer and FT LED turn off.

Loco Moves At Step 2. Since the locomotive *<u>does</u>* respond to the Command Station's built-in throttle, this shows the Command Station, track booster and decoder are all OK. However, there is some kind of problem with the plug-in throttle or the wireless throttle and further testing is required to find the cause.

Time To Give Us A Call! At this stage of testing, you have collected sufficient information such that a phone call to us will yield useful results.

When you call you must be in front of your Command Station. Have this paper with you along with your notes you took during the tests. We will ask you some simple questions to determine what happened as you went through the preliminary tests.

```
V6xx  T=00   M=255
A=0003    B=-----
```

We will also ask you about your Command Station and what the home page screen shows. We will want to know what V, T and M show.

Finally, we may have you do a few more followup tests. That is why it is important for you to be in front of the system before you call. So, when you are ready, give us a call. You will be surprised at how quickly we can pinpoint the cause of your problem.

Plug-In Throttle and TBUS Troubleshooting

If your train no longer responds to a plug-in throttle, don't panic. In almost all cases, the trouble will be something simple. The assumption for this section is that the train responds to a Command Station throttle and just the plug-in throttle is not working properly. If you are not sure, then start in the previous section and perform those tests.

Another big assumption is that none of the addressed locomotives will operate with the plug-in throttle. In other words, there is more than one locomotive having trouble with the throttle.

Lets check the simple things first.

1. Unplug all throttles.

2. Go to the Extender board and look to see if the red short circuit indicator is off. If it is on, disconnect the coax TBUS cable and check that it goes off. If the LED is on when the TBUS is connected, there is a short circuit somewhere in your TBUS wiring. The most common location for TBUS short circuits is at twist-on connectors used to connect the TBUS to the fascia plate jacks. If the Extender and the TBUS are OK, go to step 3.

3. Go to your Command Station and push the reset key. When the home page appears, note the number on the T counter - it should be 00. If not, there is still a throttle plugged in somewhere. Find it and unplug it and reset the Command Station again. The T count must be 00 before moving to the next step.

4. Plug-in a throttle. Check that the forward direction LED is on and that no other indicators are on. If the throttle powers up OK, move to the next step. However, if the FWD indicator is off, or multiple indicators are on, there is a problem with the throttle, the fascia plate jacks or maybe the coaxial twist-on connectors.

5. Rotate the speed knob slightly. Check the T count on the Command Station. It should now be 01. If not, rotate the speed control again. If still 00, there is something wrong with the throttle, or the fascia plate and TBUS coax, or the Extender. To decide which one of these might be at fault, find another throttle and repeat step 3 and 4. If all throttles are not working, there is likely a problem with the Extender, or the coax TBUS or the fascia plate.

6. Try a different throttle. Go to step 5 to reset the plug-in throttle ID.

7. Reset the plug-in throttle ID to the desired number. Push the # key, the DIR key and then enter a number between 17 and 31 followed by the # key again. Plug the throttle out and plug it back in and check the T count one more time.

If you still can't get the throttle to respond, it may need repair. Give us a call to setup the repair.

Show All Active Throttle IDs

This command allows your Command Station to show you a list of all active throttle IDs.

```
ENT ID# __?
```

○**SHOW,**

○**R**   (under the ACCESSORY Key)

```
01 02 17 19
```

○**ENT**

All of the active throttles IDs will be listed. IDs between 1 and 16 are reserved for wireless throttles. IDs of 17 and higher are for plug-in throttles.

○**ESC** to return to the home page.

Show Throttle ID

For this command to work properly, only one XR1300 throttle can be plugged in. All other throttles, including wireless throttles must be unplugged and turned off. This is very important since with more than one throttle plugged in, the throttle having the lowest ID number will be displayed. For this example, the throttle has ID number 18 and is assigned to loco address 4891.

Continued on next page

Push the keys in sequence shown to show the throttle's ID.

○**SHOW,**

○**ID** *[the number 9 key]*

```
Throttle ID = 18
Loco No.  = 4891
```

If there is no throttle plugged in, only the first line is displayed and the number is replaced by a blinking cursor. If checking several throttles (one at a time of course) push the ENT key to refresh the display.

○**ESC**

Monitoring Throttle's Locomotive Speed, Direction and Function Status

You can monitor the status of any selected plug-in throttle including its current address through the use of the throttle ID number. For this command to work properly, you must know the desired throttle's ID number in advance. For this example, ID number 18 will be used.

○**SHOW,**

○**R-ON,** ○**1,** ○**8,** ○**ENT**

```
Enter ID# ____
```

The loco or consist address plus the status of the function keys is shown. Speed value and direction or shown on the bottom line. The display automatically updates whenever a change takes place.

```
L#4891 Steps=028
Fn=□□□□□□□□□□□□
```

If an unused or inactive throttle ID number is used, the display will display no data.

○**ESC**

Plug-In Throttle Checks and Tips

Strange Locomotive Behavior - Duplicate Throttle Addresses Not Allowed

If you discover your train doesn't run smoothly or stops the moment you unplug a walk-around throttle, you probably have the Command Station throttle or another plug-in throttle assigned to the same address. De-assign the Command Station throttle before using a walk-around on the same address. Likewise, if another plug-in or wireless throttle is on the same address, the locomotive will perform poorly or not at all. Remember, only one address per throttle!

Assign Throttle To An Unused Address Before Unplugging

To allow another throttle to use the current address on the throttle, set the throttle to an unused and easy to remember address such as 99 or 9999. Do not use 0. When this is done, the Command Station stops updating the locomotive address making it immediately available for a new throttle. If this step is not done, you must wait for about 2 minutes before attempting to use the locomotive with another throttle.

Beware Of Duplicate ID Numbers

Sometimes operators will inadvertently assign their throttle to another ID number. If a throttle suddenly stops working or suddenly has poor control of the locomotive, there may be another throttle with the same ID number. Make sure that all throttles have unique ID numbers. If you program two throttles with the same ID, locomotives will not operate properly. Fortunately, no harm will be done so make sure each throttle ID is unique.

Mark the Throttle ID Number On The Throttle

Take a moment and label the ID number on the back of the throttle. The ID number must be unique – no two throttles can have the same ID number. With the ID number on the throttle, it becomes relatively easy to check the ID number with the Command Station.

Wireless Throttle Troubleshooting

Nearly all of the symptoms for wireless issues can be traced back to just a couple of sources and these items are described below along with their solution. This page assumes that the throttles were previously working OK. In other words, the wireless receiver has been setup correctly. See the RX904 installation guide for how to setup the wireless receiver.

Symptom: Intermittent Loss Of Control In Certain Areas

This is easy - the receiver is no longer receiving the throttle's transmitted signal. One possibility is that the power level of the T5000E throttle has been changed. Set it to a higher power level and try again.

If the problem is specific to a certain area, then you may have what we call a black hole.

The solution is to improve reception for that area. There are many techniques and options described in great detail on page 27.

Symptom: A Specific Wireless Throttle No Longer Works

There are several potential sources of this problem. Check your records and make sure that its assigned ID number and its unique frequency have not been changed. Curious fingers have been known to work through the menus and change either or both of these critical settings. Also confirm that there is a small letter s following the RF number. The throttles must always be in the SCAN mode which is what the s means.

Symptom: The Locomotive Doesn't Run Smoothly With The Wireless Throttle

There are three possible causes of this.

First cause is another throttle set to the same address. This can be a plug-in, Command Station or another wireless throttle.

The second cause can be a duplicate frequency or ID number on the wireless throttle.

The third cause is the wireless receiver and how it handles the same locomotive address now being controlled by a new throttle. In this case, the receiver starts sending update information from the new throttle. However, the old throttle information is still in the receiver which has not yet timed out. This takes about 2 minutes after the throttle has been turned off. This scenario is identical to two throttles controlling the locomotive although in this case, it is a throttle and the wireless receiver. To insure this doesn't occur, always assign the throttle to a unused address before turning it off. Use an easy to remember address such as 1 or 99 or 9999. Just make sure it isn't a legitimate address.

Symptom: A throttle, when turned on, causes interference with another throttle

Again, this is usually caused by two throttles are on the same frequency. Make sure every throttle is on a unique frequency.

Another cause may be the throttle is set to incorrect transmission mode. If frequency 7 is affected, one of the wireless throttles is set to burst mode (small letter b after the RF number). Burst mode will jam frequency 7. Do not use it.

Symptom: A specific throttle frequency always seems to have reception problems

Your wireless equipment operates in an unlicensed band shared by many other transmitters. Some of these external transmitters can and will create interference, intermittent throttle operation or complete failure of one or more of the wireless receiver's 8 frequencies. The sources of these external interfering signals can be from your own home of from adjacent homes and businesses.

Here's a list of devices known to have cause problems when operated near our wireless EasyDCC System: wireless devices attached to computers, TV remote controls, cordless telephones, alarm systems, baby monitors, unlicensed personal communication devices, lawn sprinklers, remote starter switches, cordless light switches, outdoor lighting controllers, toys and games.

If you encounter a strong interfering signal on a specific frequency, don't assign a throttle to

Record Keeping - Before You Contact Us For Help

If after trying all of our troubleshooting and placement suggestions, and still have wireless reception difficulties, please contact us. Email is better but you can also give us a call. Before contacting us, please collect the basic information below so we can help you better.

Why We Need This Information - And So Do You

The majority of operational issues with wireless equipment is incorrect settings, modes or hookup. Many times, a customer has told us he figured out his problem while collecting this information. This continues to validate our number 1 assumption about the cause of a problem - it's always something simple!

Command Station Information - Very Important

On the home page of your Command Station, the top line contains 3 important numbers we need to know. First, note the V-number which is the software version number. The T-number stands for the number of active throttles. This is not as important for us but you should record that number too. At the far right is the M-number which is the memory counter indicating the remaining free locomotive slots. Write your numbers in the space provided and be sure and include them when contacting us.

```
V6xx  T=00   M=255
A=0003    B=------
```

V _____

T _____

M _____

Wireless Receiver Hookup and Switch Settings - Very Important

For each receiver, we need to know the model number, its group, how it is connected to your Command Station, and the settings of the 8 switches. As for model number, if it has a metal rod antenna or a black wire antenna in the center of the lid, it will be a standard RX904. However, if it has an antenna down in the lower left front of the lid, and has the stylized XF on the faceplate, that is the RX904-XF(1 or 2) model. For all receivers in use, fill out the blanks with the information. The hookup method is either coax or modular. Note: XF-1 is a group 1 receiver; XF-2 is a group 2 receiver.

Receiver Model   _____   Switch Settings ⟶

Receiver Group   _____   Show the actuator position

Hookup Method   _____   as either up or down.
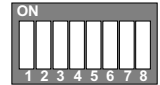
Receiver Model   _____   Switch Settings ⟶

Receiver Group   _____   Show the actuator position

Hookup Method   _____   as either up or down.
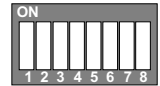
Receiver Model   _____   Switch Settings ⟶

Receiver Group   _____   Show the actuator position

Hookup Method   _____   as either up or down.
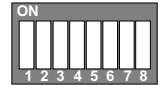
Wireless Throttle Information - Very Important

For each of your wireless throttles in use, we need to know the model (T5000E, T9000E or RF1300). We also want to know each of their ID numbers, their scan/burst mode setting and their frequency. Use the table below to record the information. See your throttle user guides for how this

Model	ID#	Freq	Mode	Model	ID#	Freq	Mode	Model	ID#	Freq	Mode
____	___	____	____	____	___	____	____	____	___	____	____
____	___	____	____	____	___	____	____	____	___	____	____
____	___	____	____	____	___	____	____	____	___	____	____
____	___	____	____	____	___	____	____	____	___	____	____
____	___	____	____	____	___	____	____	____	___	____	____

There are several problem symptoms that reveal issues that are not directly related to the ZoneMaster operation. Instead, these are directly related to long lengths of modular cable and large layouts. There are several ways to remedy these problems although a few will require the use of a Distribution Amplifier.

Short Circuit When Crossing Gaps

Cause #1: Mixing telephone and data style cables. For best results, pick one style and stick with it. Don't mix the two styles. To remedy the situation, reverse the two track feeds. However, beware that this will move "the problem" down to the next set of gaps that cross over to another booster. This can be frustrating so it is better to find the errant cable and replace it. Telco vs Data cables are easily determined by looking at the orientation of the release tab relative to the cable's center molding stripe.

Data Cable   Tab   Telco Cable

Tab

Cause #2: Booster is Not Autoreversing, Or Autoreversing is Turned Off. Be sure to verify that the autoreversing feature is turned on. The Single Zone Autoreversing ZoneMaster is labeled with a stylized AR in yellow on the front panel.

Cause #3: Too Many Boosters Sharing The Modular Cable. There should be no more than 5 ZoneMaster boosters sharing a run of modular cable.

Cause #4: Too Much Modular Cable Between Boosters. This is usually an issue with very long runs of modular cable. Limit the longest run of cable to no more than 200 feet.

Cause #5: Distant Booster Track Connects To Near Booster Track. This usually occurs due to a quirk in the track plan and how you have daisy chained boosters. A long modular cable run creates a delay in track signals between a distant booster and a booster with a very short length of cable. In some cases, the delay is sufficient long enough that the train may hesitate when a train crosses the gap between the two boosters. You may also hear a sizzling sound when the wheel is across the gap. If the delay is long enough, the booster's may think there is a short circuit and shut down.

A greatly simplified example is shown below. The heavy black oval shaped line is the track. The thinner line is the modular cable connecting all the boosters together in a series. The breaks in the heavy track, A - D, line represents power zone block gaps. The D gap separates the most distant ZoneMaster #4 to the nearest ZoneMaster #1. Gap D represents where a distant booster's track ties directly to the nearest booster's track. Gap D is where a train might stall or hesitate.

B

ZM2   ZM3

A   C

Command
Station   ZM1   ZM4

D
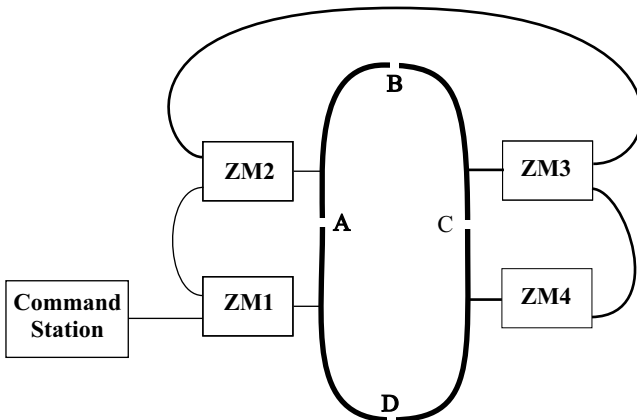
Solving The Nearest To Most Distant Delay Issue is done with the use of a Distribution Amplier which we call a DISTYAMP. The DISTYAMP allows you to distribute the Command Station signal among many boosters. It also allows opposite direction cable runs without excessive amounts of delay.

The simple track is modified to match up signals and cable lengths. Notice the cable routing is also easier since it can go in opposite directions. Notice the loop of cable between the DISTYAMP and ZM1. This is just extra cable that is used to insure the cables lengths are the same between ZM1 and ZM4. This is not always necessary but is an easy way to insure any cable delays are minimized.

Up to 5 ZoneMasters can share a single DISTYAMP driver.
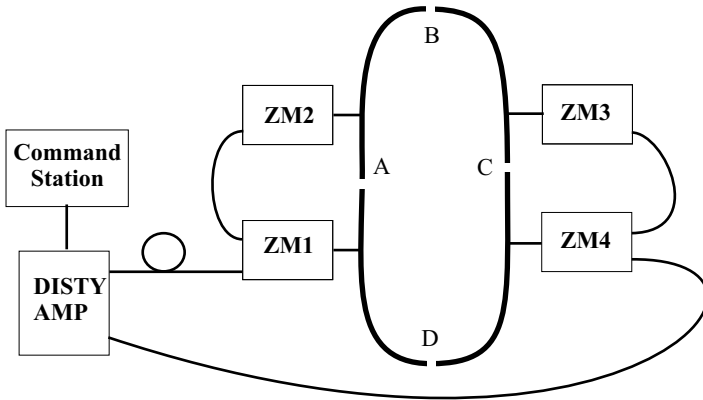
Some Locomotives Stall Or Hesitate At The Autoreverse Gaps

Cause #1: Locomotive is not all wheel pickup. The autoreverse feature works most reliably with all-wheel pickup locomotives. Older locomotives that do not have all wheel pickup will not work well with ZoneMaster Autoreverse feature.

Cause #2: Entire train does not fit inside the reversing section. The entire train, including all helper locomotives and caboose must fit between the reversing section gaps.

Cause #3: Short Circuit Sensor Set To High. The autoreverse feature uses a momentary short between the rail gaps to know when to reverse the polarity. However, if the current setting is too high, the feature may not work. If this happens, the train will hesitate and then the fault alarm will be triggered. The best current setting is just above the minimum amount needed to run the train.

Lightning Induced Failure Of Cable Driver/Receiver Chips

The modular cables connect to chips that serve as both drivers and receivers for the cable's signals. The Command Station and every ZoneMaster Booster use the same cable driver chips. On rare occasions, the driver chip can be damaged by nearby lightning strikes. The strike doesn't have to be directly to your house. An nearby strike can couple enough energy into the modular cable that it can destroy the chip that connects the ZoneMaster to the modular cable. In rare cases, the strike can also destroy the Command Station's cable driver chip. Fortunately, the chips are all in sockets for easy replacement. Use the simple check below to see if you have a damaged chip.

Symptoms: You'll first notice that the trains are not running. You'll also discover there is no voltage on the rails. Look at the front panel of your ZoneMaster. The GP light will be off and the red FT light will be flashing. These are symptoms of no Command Station data getting to the ZoneMaster. Unfortunately, there is no easy way to determine if the bad chip is in the Command Station, or in the ZoneMaster. The same chip is used in both and we recommend replacing both at the same time.

Ordering Chips: Send us an email and explain your problem. In the email, include your address and phone number. We will send you two new chips at no charge. While you are waiting for the chips, find their locations using the guide below.

Chip Part Numbers and Appearance: The chip part number is DS8921N from Texas Instruments. It is an 8 pin part. The chip is polarity sensitive and must be oriented correctly in the socket. If plugged in backwards, it will not work and may be damaged.
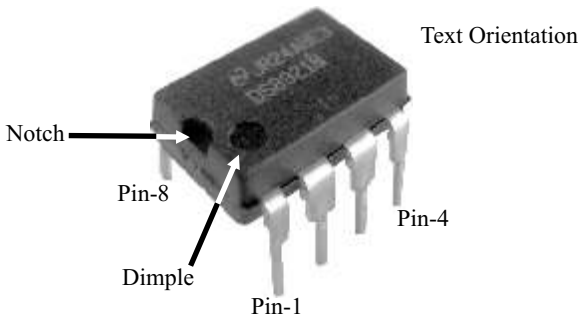
Chip Locations: The chips that drive the modular cable between the Command Station and the ZoneMaster booster are plugged into sockets to make them easy to replace.

Command Station - Model CS2B
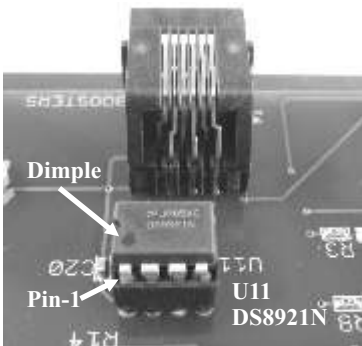
ZoneMaster - Single/Dual
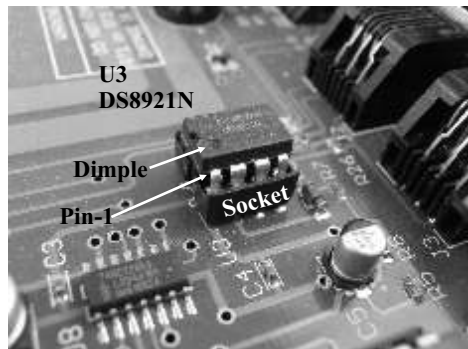
Removing Old Chips: This is easy but must be done correctly. The most common mistake made is removing the socket instead of just the chip. The socket stays on the board. The chip is plugged into the socket. Insert a thin flat-bladed screwdriver in the narrow gap between the socket and the chip. Gently twist the screwdriver to lift the chip out of the socket. A closeup of the ZoneMaster U3 is shown below illustrating the correct position of the screwdriver blade. Remove the Command Station's chip the same way.
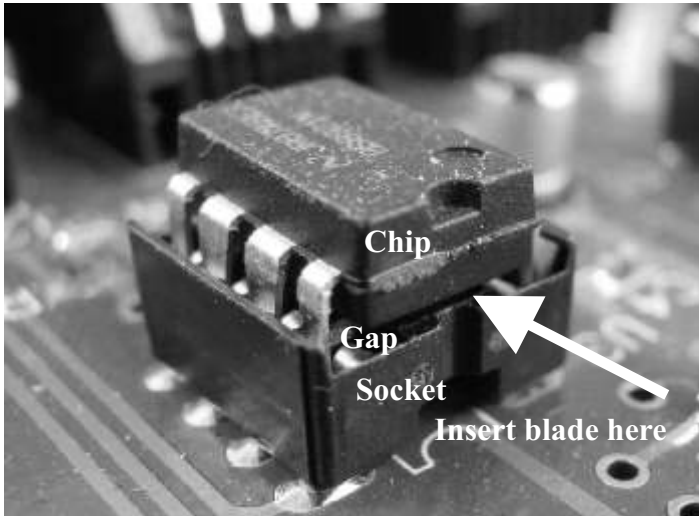
Insert New Chips: Locate pin 1 on the new chip. Orient it correctly with the socket. Insert all 8 pins into the socket. Verify that all pins are in the socket and not outside, or bent up underneath the chip. Insert the new chips in both the Command Station and the ZoneMaster.

Ready To Checkout: Plug in the modular cable between the Command Station and the ZoneMaster booster. Turn on power to both. Verify that the ZoneMaster's green GP light is on. Reassemble the booster and reconnect it to the layout.

Common Problems: The most common mistake is inserting the chip without all pins going into the socket. A pin that becomes bent up and underneath the chip is difficult to see. If in doubt, unplug the chip, inspect and reinsert. The second most common mistake is inserting the chip backwards into the socket. Check the pictures and then check orientation.

Safely Discard The Old Chips: Bend all the pins up under the chip to identify it as a bad part. Discard the old chips in an appropriate trash receptacle. Do not leave them lying around where children can find them as they are a choking hazard.

What Are Decoder Speed Steps

A speed step is actually a value representing a percentage of full speed at which the motor runs. DCC has three specific values for the numbers of individual steps used between off and full motor speed. The available speed step settings are 14, 28 and 128.

This graph shows the relationship between decoder speed steps and the motor speed. For this illustration, there are two speed curves shown, one for more coarse 14 speed steps and the other for the better 28 speed step curve. The 128 mode is not shown but would be a curve having 128 discreet speed steps.

The motor starting voltage (MSV) sets the speed at which the motor "jumps" to when the throttle is set to output the first step. The MSV may be any value up to full speed. CV2 holds the value to be used for the MSV.

The acceleration rate value (ACCL) and the deceleration rate value (DECL) program the "rate" at which the decoder changes between speed steps.

Consult the decoder documentation to determine how MSV, DECL and ACCL values are used when the decoder is set for 128 speed steps. Some brands of decoders ignore these values, other brands of decoders ignore all but the MSV.

For applications where locomotives operate in consists, either 14 or 28 steps are recommended. This allows the use of various ACCL, DECL and the MSVs to insure smooth locomotive operation.
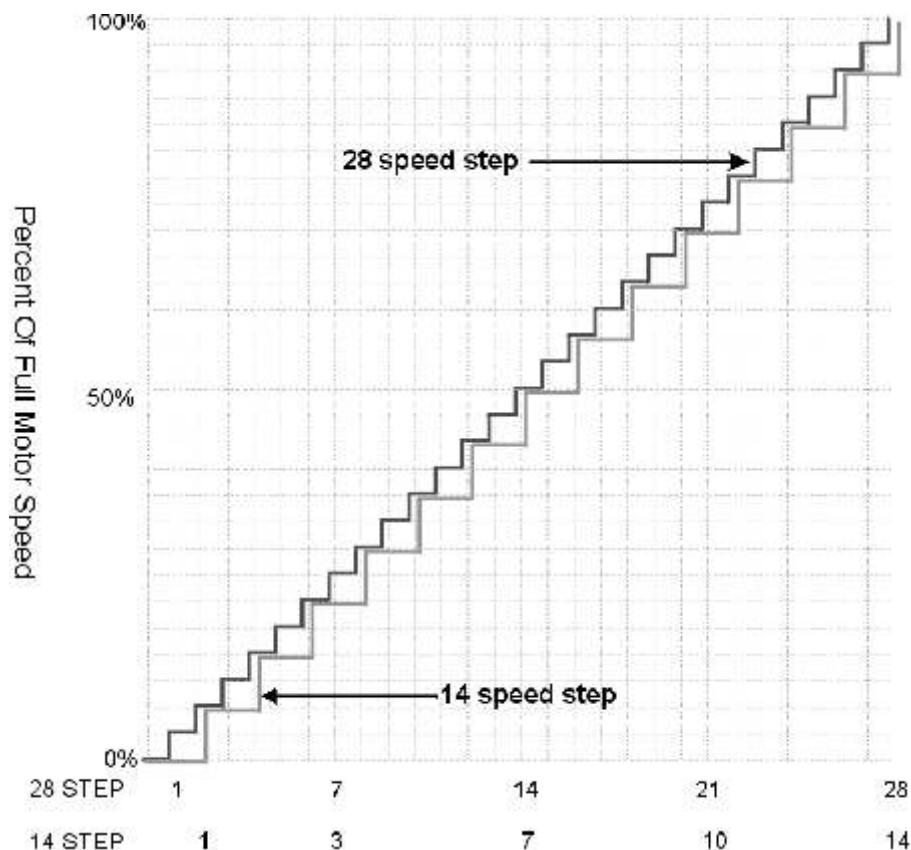
List Of All Command Station Commands