



DCS240 Manual

Includes Instructions for:
DCS240 Advanced Command Station Booster



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Introduction

Congratulations on your purchase of a Digitrax DCS240 advanced command station!

The design of the Digitrax Complete Train Control® system lets you operate your layout the way you choose. With LocoNet® you simply connect system components to build the layout control system that you've always wanted! The Digitrax system reduces and simplifies layout wiring.

The DCS240 is an advanced command station that is intended to be used in conjunction with an existing Digitrax installation. The DCS240 offers a number of features that make it ideal for large layouts, clubs, and modular groups who will be running many operators and trains. These features included in the DCS240 are as follows:

- Run up to 400 locos and supports up to 400 throttles in command station mode
- Direct USB connection for easy computer interface
- Independent SoundFX and decoder programming function via USB port using SoundLoader II
- Hardware Loco Reset button for easy clearing of mobile decoder info from DCS240
- Hardware EZ Routes button for simple route setup
- Automatic Command Station collision detection via LocoNet
- Full continuous F0-28 refresh support
- Improved Program Track output with automatic support for Power Extender equipped locos
- All storage is in non-volatile memory, no battery changes required!
- User selectable multi-scale operation for Z, N, HO, and large-scale layouts
- Electronic Non-Volatile track voltage customization for each scale setting

In addition to your DCS240 you'll need:

- A DC 13.8V to 24V power supply with 5 or 8 amp capability (you may be able to use one you already own)
- A Digitrax Advanced Throttle
- One or more mobile decoders for your locomotives.

Note: This manual is written assuming you will be using a DT4xx or later throttle. Some throttles may not have access to all features. For specific instructions for other throttles please see your throttle manual.

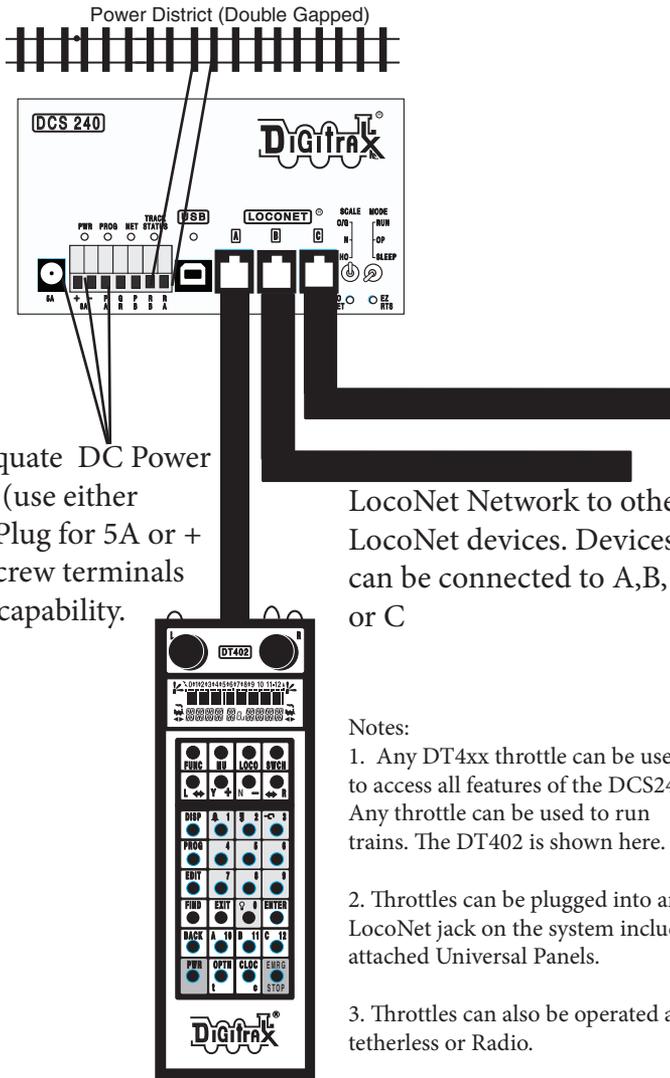
All throttles prior to DT402 with rev 2.0 software update will operate up the max of 120 slots as they do now. To access slots above 120 automatically please update your DT402 to the latest code available at www.digitrax.com/downloads.

There are many different combinations of Digitrax components that you can use to set up a layout control system that is just right for you. You can combine Digitrax products with compatible decoders, boosters and computer software made by other companies that build compatible equipment.

Your success with and enjoyment of our products are very important to us. After all, this is a hobby and it is FUN!!! Please read this manual carefully before you install your DCS240. We recommend running the Quick Start Guide to become familiar with the DCS240 before adding it to existing installations. The manual has all the information you will need to get your DCS240 up and running. The manual also includes lots of hints and operating ideas based on our experiences. If you have questions not covered by this manual please visit our web site at www.digitrax.com where you'll find the Digitrax on-line Tech Support Depot is always open! For more specific questions go to helpdesk.digitrax.com to open a support ticket so our tech support reps can help you out.

1.0 DCS240 Quick Start Guide

These instructions will get you up and running in just a few minutes! It is recommended that you use this quick start guide before adding the DCS240 to an existing Digitrax installation to ensure the DCS240 is in working order and to test any features you are unfamiliar with. A full description of all controls and technical reference information are included later in this manual to help you fully incorporate the DCS240 into your layout control system. Once you've completed the initial testing of your DCS240 on a test track, you can remove your existing command station from your layout and replace it with the DCS240.



To adequate DC Power Supply (use either Barrel Plug for 5A or + and - screw terminals for 8A capability.

LocoNet Network to other LocoNet devices. Devices can be connected to A,B, or C

Notes:

1. Any DT4xx throttle can be used to access all features of the DCS240. Any throttle can be used to run trains. The DT402 is shown here.
2. Throttles can be plugged into any LocoNet jack on the system including attached Universal Panels.
3. Throttles can also be operated as IR tetherless or Radio.

DCS240 Quick Start Hook Up

1.1 Connect the DCS240 to the power supply

1. Set the DCS240's SCALE switch to the scale you are running: N, HO, O/G. Use the lowest setting that will run your layout.
2. Set the MODE switch on the DCS240 to the RUN position.
3. Connect the DCS240 to an adequate power supply using either the barrel plug for 5 amp capability or the terminals marked + and - for 8 amp capability. *See Section 4.2 regarding power supply selection.*
4. Plug in the power supply to power up your DCS240.
5. DCS240 will beep twice and its PWR indicator will light GREEN winking off every 3 seconds as a "Heartbeat".

1.2 Connect Your Throttle to the DCS240

1. Plug the throttle into the LocoNet "A" jack on your Digitrax Command Station.
2. Press the **PWR** key then the **N / -** key on your throttle. The TRACK STATUS LED on the command station should be off.
3. Press the **Y / +** key on your throttle. The TRACK STATUS LED should come on green.
4. Turn the **R** Throttle Knob of the throttle about 1/4 turn. You should see the right side "SEL" in the display begin to blink.
5. Press the **LOCO** key, then the **LAMP/0** key, then the **LOCO** key. You should see "00" replace the blinking "SEL".
6. Turn the **R** Throttle Knob clockwise to "99".
7. Press the **REVERSE / R** key and look for a change in brightness (or color) of the TRACK STATUS LED on the command station. Turn **R** Throttle Knob counterclockwise to "00".
8. Connect the RAIL A and RAIL B terminals from your Command Station to your test track and place an analog locomotive (without a decoder) on the track. The loco should "sing". Use the **R** Throttle Knob to control speed and the **REVERSE / R** key to control direction.
9. Place a locomotive with a decoder with a known address on the track. Turn the **L** Throttle Knob. You should see the left side "SEL" in the display begin to blink. Press the **LOCO** key, then the numbers for the address, then the **LOCO** key. The loco address will replace the blinking "SEL".
10. Use the **L** Throttle Knob to control speed and the **L / REVERSE** key to control direction of the decoder equipped loco and the **R** Throttle knob and the **REVERSE / R** key to control the analog locomotive.

1.3 Track power on and off

The TRACK POWER indicator on your Throttle and TRACK STATUS indicator on your DCS240 command station show whether track power is on or off. Please refer to your Throttle Manual to determine your throttle's TRACK POWER indicator. The first time you plug in your throttle, track power will usually be off. Before you can run trains, you will need to turn on the track power. Look at your DCS240 or throttle to determine whether the track power is on or off.

When track power is off:

- DCS240 TRACK STATUS indicator is off.
- Throttle TRACK POWER Indicator is off.

When track power is on:

- DCS240 TRACK STATUS indicator is lit.
- Throttle TRACK POWER Indicator is on (small dot in the top line on the right side of the display).

Turn track power on and off

1. Press the **PWR** key on your throttle.
2. Press the **N / -** key to toggle the track power off. The TRACK POWER Indicator on your throttle and on your Command Station will go off.
3. Press the **Y / +** key to toggle the track power on. The TRACK POWER Indicator on your throttle display and the TRACK STATUS LED on your Command Station will come on.
4. Press the **PWR** key again to return the throttle to the operating mode.
5. If the TRACK POWER Indicator is blinking and the display shows Trk=Idle then the layout is frozen in the "IDLE" state and no locomotives will move. To exit this state simply turn on track power a second time.

NOTE: These are general Throttle instructions, please refer to your specific throttle manual for more detailed instructions.

1.4 Shutting Down the System

When you are finished with your session, shut down the DCS240 by turning off power to the system.

Some users prefer to "dispatch" or release all addresses active in their system before shutting down. This can prevent unexpected results when you power up the layout again. *Find details on loco dispatching in your throttle user manual or you can simply press the Loco Rest Button on the DCS240 to clear all addresses from the command station at the end of a session.*

1. Press the **PWR** key followed by the **N / -** key, the TRACK POWER Indicator on the throttle and the TRACK STATUS Indicator on your DCS240 command station will go off.

2. Move the command station's MODE switch to the SLEEP position and wait 5 seconds.
3. Turn off the power supply to the system.

The power to the command station can be left on all the time if desired. In "sleep" mode, the command station consumes very little energy. In this state the command station provides keep alive power to all throttles that are connected to LocoNet.

1.5 Resuming your session

When you are ready to resume your session:

1. Turn on the power to the system.
2. Switch the DCS240's MODE switch to the "RUN" position. All attached throttles will beep within a couple of seconds to indicate that LocoNet is active again.
3. Check the TRACK STATUS indicator on the DCS240. If it is not lit then turn track power on as follows: Press the **PWR** key followed by the **Y / +** key, the TRACK POWER Indicator on the throttle and the TRACK STATUS Indicator on your command station will come on. By default the DCS240 will resume in whatever state it is powered off in.

1.6 Connecting to an Existing Digitrax Installation

Installing your DCS240 on an existing Digitrax system is as simple as removing the existing command station and installing the DCS240 in its place. Disconnect the wires from your existing command station and reconnect them to the corresponding connection on the DCS240. You will need to double check that the Rail A(RA) and Rail B(RB) match the polarity of the rest of your layout and that you are using an appropriate DC power supply.

In many cases you can convert the command station to a booster to provide additional power to your layout. If your DCS240 detects two command stations on the layout it will issue 10 long beeps and turn off track power. *Refer to your replaced command station manual for details on converting it to a booster.*

1.7 Quick Start Problems?

If you encountered problems at any step in this Quick Start Section:

First, try backing up a step until you get results described. The steps included in this installation procedure are set up so that if you follow them carefully, any problems you encounter will be easy to isolate and correct.

If that does not work or if you have other questions or problems, we encourage you to visit the Tech Support Depot at www.digitrax.com/support. You may also submit help ticket to our tech support staff at helpdesk.digitrax.com.

There are thousands of successful Digitrax installations around the world and we want to be sure that yours is one of them.

Note for users of Digitrax decoders that have already been programmed and decoders not made by Digitrax:

1. The DCS240 command station defaults to 128 speed step operation so, if you are using a locomotive with a decoder that does not have 128 step capability you will have to adjust either the decoder or the DCS240 command station so that both are using the same number of speed steps to communicate. You can status edit each individual decoder or you can change the DCS240's system default and run all of your decoders with fewer speed steps to accommodate these decoders (*see Section 5.0 customizing OpSw 21-23*).
2. If you can't control the operation of the lights in your decoder equipped locomotive with the throttle (in default 128, or 28 speed step mode), be sure that the decoder itself is programmed in advanced 28 speed step mode. Please refer to your throttle manual for instructions on how to correctly status edit your decoder.

2.0 LocoNet: The Digitrax Difference!



2.1 System Architecture

System architecture is the biggest difference among layout control systems. System architecture is the way the components of a control system communicate among themselves. Digitrax LocoNet is a Peer to Peer local area network (LAN) designed specifically for model railroad operation. LocoNet wiring is cost effective, flexible and expandable to accommodate almost anything you want to do with your railroad today and in the future.

The system architecture used for communication within DCC and other control systems is not standardized. Therefore DCC compatibility encompasses only decoders, command stations and boosters but not throttles and other devices. In addition, devices that require feedback and other types of signals that are outside the domain of DCC, such as detection systems and transponding, are not standardized. LocoNet is a hybrid system that incorporates DCC and other technologies to expand the capabilities of your system. Your Digitrax system gives you the best of both worlds with a system that is compatible with today's DCC standards and also goes beyond those standards to deliver enhanced system performance and advanced features that are far beyond the scope of DCC. With Digitrax, you get Complete Train Control®!

2.2 Event Driven or Polled?

LocoNet is an event driven network. The command station on LocoNet waits for input from other components before sending commands to the layout. For example, if there are 10 throttles on LocoNet and throttle #1 sends a command, the command station sees it and executes immediately. With a distributed network like LocoNet, new features can be added by simply plugging in new hardware or software. Since LocoNet is a peer to peer network, devices on LocoNet can act independently of the command station, too. Feedback is incorporated in LocoNet's communication scheme so you don't need to wire a separate feedback bus or layout control bus.

Other systems typically use polled buses or "networks." In this case, the command station must "ask" each of the throttles or other devices in turn: "Do you have input for me?" The device must wait for the command station to poll all the devices on the bus before it sends the command. This arrangement can slow down response times and limit the number of devices that can be handled by the system as more and more devices are added. With centralized processing in a master/slave control type system like this, adding new features usually means updating the command station software when new components are added since devices can't operate on the system unless the master command station knows how to handle them. To add feedback capabilities to this type of system, a separate feedback bus may also be necessary.

2.3 Network Speed

Is faster network speed better? Not necessarily, it depends on whether the system uses event driven or polled architecture. The NMRA's track control packet format sets the "speed limit" for all DCC systems. Going faster than the "speed limit" won't make a system work any better and causes problems on the network.

LocoNet is engineered for the lowest speed that will get the job done. Because LocoNet is event driven, slower network speeds are possible. With slower network speed, signal distortion on the network is not a problem. Because LocoNet uses a slower network speed, it's free-form wiring scheme is simple and flexible. With LocoNet you can "branch" or "tee" anywhere in your network wiring and no termination is needed.

Polled systems generally have to go a lot faster than the "speed limit" to accommodate the large amount of traffic generated by polling and to prevent delays between the time a command is issued by the throttle and the time the system executes the command. The big problem is that as the network speed increases, so does signal distortion. Polled systems generally use linear terminated bus wiring to solve this problem. Free-form wiring like LocoNet is not usually possible with polled systems.

2.4 LocoNet Personal Edition

LocoNet Personal Edition is available to all model railroaders through our web site. This edition of LocoNet is available so that you can develop your own personal non-commercial LocoNet applications.

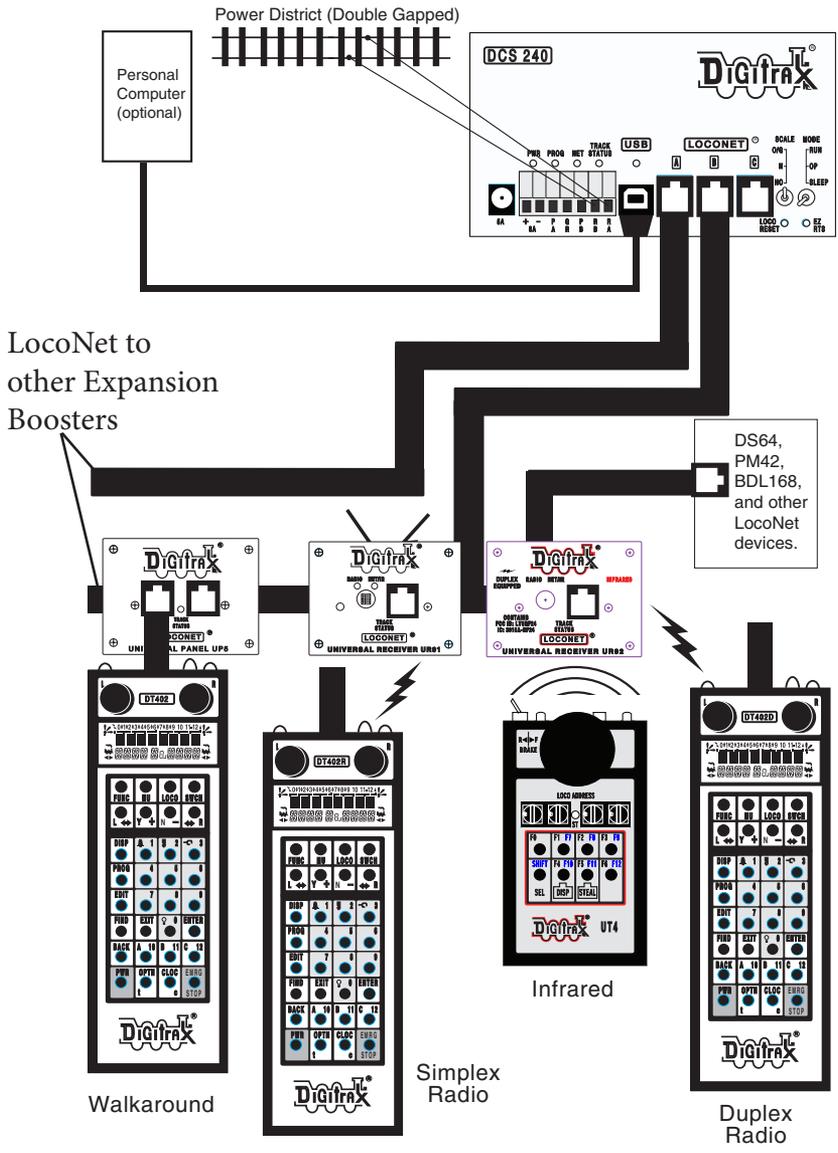
2.5 LocoNet Expansion for Complete Train Control

The following figure shows some of the expansion possibilities available with LocoNet. This figure is an extension of the DCS240 setup in Section 1.0.

With LocoNet you can add:

- More boosters to give you more power to let you run more trains,
- More throttles for more operators,
- Different types of throttles,
- More throttle jacks for convenient walk-around operation,
- Infrared or radio capability for more freedom for operators,
- Accessory decoders for turnout and accessory control,
- Detection,
- Transponding,
- Signaling,
- A personal computer to automate operations or for dispatching,
- Automatic reversing with a booster or power manager,
- The list goes on and on.

With LocoNet, you customize your layout to run the way you want it to run!



DCS240 As Part of a LocoNet System

2.6 LocoNet Wiring Components

Connecting the LocoNet components is easy to do. Digitrax LocoNet devices are connected using 6-conductor cables with RJ12, 6-pin connectors.

Making your own LocoNet Cables is simple and cost effective. However, we offer Digitrax Pre-Made Pre-Tested LocoNet Cables in a variety of lengths. Cable Maker kits and additional cabling supplies are also available. Other electronic suppliers also have these components available.

We recommend using the LT1 tester that came with your DCS240 to test the cables to be certain they are good before installing them. Many layout problems we see are related to LocoNet cables that were not built or crimped correctly or that have become damaged.

LocoNet can support a total cable length of up to 2,000 feet with no two devices connected by more than 600 feet of cable. LocoNet wiring is totally free-form. We do not recommend looping LocoNet back on itself.

2.7 Making LocoNet Cables

We use the following wiring convention for all LocoNet cables and connections:

Pin #	Wire Color	Name
1	White	Rail Sync +
2	Black	Ground
3	Red	LocoNet
4	Green	LocoNet
5	Yellow	Ground
6	Blue	Rail Sync -

LocoNet cables are wired pin 1 to pin 1. When you hold the plug with the tab up and look into the end of the connector you will see the wires listed above starting at the left side and moving to the right. (This is sometimes called a “reversing cable” in the telecom industry even though it really does not reverse the connection.)



2.8 Testing LocoNet Cables with an LT1

1. Disconnect the wire harness from the LT1.
2. Plug one end of the LocoNet cable being tested into the LT1.
3. Connect the other end to any powered Digitrax booster LocoNet Jack A, B, or C. Be sure you have at least one Digitrax throttle connected to LocoNet.
4. All four LEDs on the LT1 will light if the cable is good. LEDs may not all be the same brightness, this is normal.
NOTE: Only three LEDs will light if no LocoNet throttle is plugged in to the system.
5. If any of the LEDs fail to light, re-crimp the plugs on the LocoNet cable and retest.

2.9 LocoNet Throttle & Connection Jacks

Digitrax LocoNet devices are connected using 6-conductor LocoNet cables. All LocoNet devices have LocoNet Connection Jacks that allow you to daisy chain the network around the layout.

Some Digitrax devices like the Universal Panels also have LocoNet Throttle Jacks. The Throttle Jacks should not be used for connecting LocoNet devices that will be daisy chained beyond themselves or that use rail sync. You can use these jacks for throttles and other accessory devices not requiring rail sync. Consult the installation instructions for the particular device you are installing to determine whether it can use the Throttle jacks or if a Connection jack is necessary.

All Digitrax throttles are memory walk-around throttles, some are equipped with infrared LEDs and others are radio throttles. Even if you use wireless throttles, you will still need to install at least one or two LocoNet throttle jacks on your layout. Any RJ12 6 conductor phone jack can serve as a LocoNet throttle jack. The problem with using RJ12 telephone style jacks is that you will have to wire them and secure them to the layout so that they don't come loose. Digitrax Universal Panels are very cost effective and typically perform better.

3.0 Advanced Installation On Your Layout

Because the signal and the power that runs the trains are one in the same, you must provide adequate power to all areas of your layout for reliable Digitrax operation. ***If the decoder in the locomotive does not see track power, it will not see the signal and it won't run.*** Digitrax boosters need enough track power to sense short circuits to operate properly. Your layout must have a power bus and feeder system that can safely support the continuous full current rating of any booster anywhere on the layout.

Unless you need to set up power districts on your layout for added power, the only gaps you need are for hard shorts like reverse loops and uninsulated frogs. If you are already wired for block control, you probably don't need to rewire. Just open all your blocks so that the entire track has power and you are ready to go. If you are using common rail wiring, we recommend that you divide the layout into power districts by double gapping between power districts.

3.1 Setting Up A Programming Track

Decoders are programmed when the command station sends programming information to them through the rails. There are two ways of programming decoders.

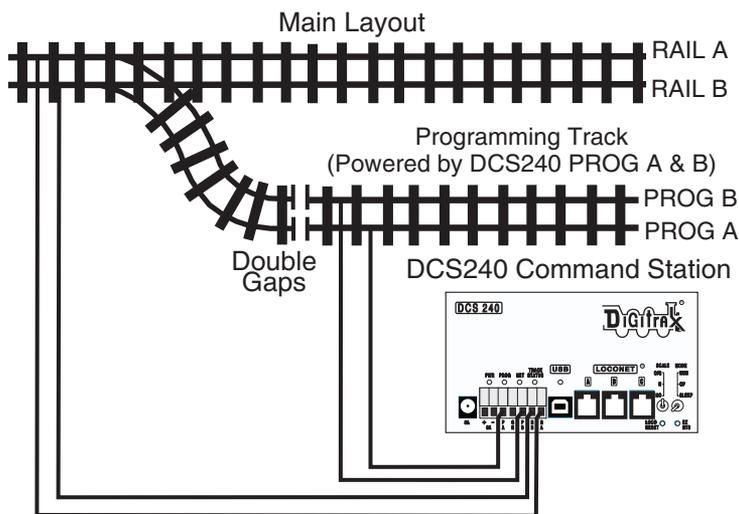
3.1.1 Ops mode programming

Ops mode programming is done on the layout with programming directed to a specific decoder address on the layout tracks. Operations mode programming is used to make changes to locos while they are running on the layout. *See your throttle manual for further instructions on Ops mode programming.*

3.1.2 Service mode programming

Service mode programming broadcasts a message to all decoder equipped locos that are on the programming track. Because this is a broadcast method and will affect all locos, you will need to set up a programming track so that the programming instructions only go to the loco you want to program.

Your DCS240 sends these programming commands using the Program A(PA) and Program B(PB) outputs. See the following figure for hook up information. Program A(PA) and Program B(PB) are actually a second set of outputs that allow you to program decoders while still running the layout on the RAIL A(RA) and RAIL B(RB) outputs. You will need to set up a programming track for service mode programming that will allow you to program a loco without shutting down the rest of the layout during programming. Follow the steps outlined in your Throttle Manual to program your decoder equipped locomotives.



NOTE: Some wiring omitted for clarity

Programming Track With DCS240

3.2 Direct Home Wiring vs. Common Rail Wiring

Digitrax strongly recommends direct home wiring where each power district and its booster are electrically isolated. This type of wiring is safer and more convenient to work with for debugging and for adding reversing sections and detection. *If you are planning to use whole layout common rail wiring you will need to order opto-isolated boosters for your layout.*

Note for detection and signaling wiring common rail can be used within power districts that are wired for direct home and use regular Digitrax boosters.

3.3 Recommended wire sizes

On an average size layout Digitrax recommends that the power bus from the booster be at least 16AWG. When feeding areas up to 50' from the booster, we recommend using 12AWG wire for the power bus.

From the main power bus, we recommend dropping feeders (22-24AWG) approximately every 6 to 10 feet of track. Sets of feeders should be wired to both rails and we recommend at least 2 sets of feeders per power district.

The wire gauge used (AWG) can be increased or decreased, depending on your actual layout dimensions and operating power/current loads. *The wire gauges used should be sufficient so that track short circuits are reliably detected on the whole layout.*

3.4 Other Track Wiring Considerations

1. Power connections to a large layout should be via a parallel conductor power bus similar to that used in most conventional layouts, with feeder wires to the track about every 6-10 feet.
2. When using more than one booster, be sure that the RAIL A(RA) and RAIL B(RB) connections for all boosters are made in the same track orientation, i.e. RAIL A(RA) to left rail and RAIL B(RB) to right rail or vice versa.
3. Do not short either the RAIL A(RA) or RAIL B(RB) output of the DCS240 to GROUND.
4. To minimize the possibility of radio interference, twist all conductors.
5. Circulating ground loops may cause problems with your layout. We often see this on existing layouts that have been added to over the years. If you are experiencing problems in a localized area of your layout, you may need to look for this problem and fix it.
6. Wire the power feeds away from the boosters and command stations, in a radial “star like” configuration to minimize the possibility of creating “magnetic induction” loops.
7. **Do not place ANY filters or capacitors across the track.** These will short out the control signals. Be sure that no capacitors are bridging your power districts.

3.5 Layout Power Districts

A power district is an electrically isolated section of the layout including the power wiring, booster and power supply that drives it. Power districts are used for power distribution, not for train control as with DC blocks. Power districts may be divided into sub-districts for short circuit management within the power district or for auto reversing. Even though blocking is not required for train operation with DC, dividing the layout up into power districts (and sub-districts) is needed for the following reasons:

3.5.1 Number of Locos

Additional power districts may be needed to provide enough power to operate more locomotives than one power supply alone can handle. For example a 5 amp booster and power supply will operate between 10 and 15 average N-scale locomotives and between 6 and 10 HO locomotives. If you wish to run more locos on your layout, then you will need to set up more power districts to provide more total power.

3.5.2 Short Circuits

Additional power districts and sub-districts can be used to prevent the whole layout from shutting down when short circuits (like de-rails or an operator running a switch) occur in any given power district or sub-district. If a short occurs in one district or sub-district, only that area of the layout shuts down, the rest of the layout keeps operating.

3.5.3 To set up power districts & sub-districts:

1. Determine how you want to arrange power districts and sub-districts.
2. Double gap the rails at each end of the power district and single gap for sub-districts within districts.
3. Connect a Digitrax booster and power supply to each district. Use a Digitrax Power Manager (PM42, etc.) with your booster to set up sub-districts.
4. Connect the Digitrax boosters to the command station via LocoNet.

3.5.4 Do I have enough power to run my trains?

Use the “quarter trick.” Once your Digitrax command station and booster(s) are installed and the layout is powered up, use a quarter (or other piece of conductive material) to short both rails at various places on the layout. If you have enough power at that location, the booster for that power district will chirp and shut down. If the booster does not shut down, then you need to add more feeders to allow reliable short-circuit detection.

3.6 Adding a Booster

Your DCS240 is a command station and booster in one unit. The DCS240 is not intended to be used as a booster only. When you are ready to expand your DCS240, we recommend that you add a Digitrax Booster (DB150, DB200+, etc.). Be sure that you follow the directions that come with your Booster to insure that it is properly configured as an Expansion Booster.

If you experience problems with operation after you add a Booster to your system, check to be sure that you have actually set it up as a booster by double checking the booster manual. We have seen this simple mistake cause operating problems with modular layouts when someone added a booster set up as a command station to a layout that was already up and running with another command station. In this case, two command stations can be trying to run the same layout causing some undesirable operating results such as trains that appear to be running away. The DCS240 has automatic Command Station collision detection. If the DCS240 detects another command station on LocoNet it will issue 10 long beeps and turn off track power. The DCS240 will not allow track power to be turned back on until the offending Command Station is removed from LocoNet or configured properly as a booster.

3.7 Reversing Section Wiring

You can operate reversing sections automatically with Digitrax Complete Train Control using an auto-reversing booster or a reversing section controller such as an AR1 or PM42. You must double gap (completely isolate) both ends of the reversing section just like with any other layout. Note that automatic reversing will not cause analog (non decoder equipped) locos to auto reverse.

To handle auto reversing, you need two devices, one that acts as the system polarity reference and another to detect a polarity mismatch and correct it. For

example, if you are using two Digitrax boosters, one acts as the polarity reference and the other handles the polarity reversal for the reversing section. You can also use a DCS240 and PM42 to handle automatic reversing sections.

Note that when the polarity change occurs, decoder equipped locomotives will continue at the speed and in the direction commanded but any analog engines running will respond to the polarity change by reversing direction.

A single Auto Reversing Booster can be used to handle more than one reverse section however, the unit can only fix a polarity mis-match at one gap at a time. If more than one train is entering or leaving the reverse loops connected to a single booster at the same time, a short will occur. More than one train can be in the reverse loop at any time but, only one can cross a double gap at a time.

3.8 Power Managers for Sub-Districts & AutoReversing

If you want the benefits of setting up power districts on your layout but you don't need to add more power to run more trains, you can use a Power Manager like the PM42 to set up sub-districts within booster power districts. With a Power Manager you can separate the output of one or more boosters into multiple sub-districts that can be set up as either auto-reversing or as smart circuit breakers for short circuit management. For more information about this option check our web site at www.digitrax.com.

3.9 Using AR1 for AutoReversing

If you have a single reversing section that doesn't need its own booster, you can use the AR1 single unit auto reverser to set up a reversing section.

3.10 Troubleshooting Layout Wiring

Installing Digitrax, or any other layout control system, on your layout will not fix problems with layout wiring. Layout wiring can be very complex. We see many examples of layouts that have "grown over the years" where wiring was added and changed creating some very interesting electrical systems. If you suspect that layout wiring might be a problem, we recommend that you disconnect the Digitrax equipment from the layout and test it on a small section of track not connected to the layout to confirm that the problem is not with your Digitrax equipment. If you find that there is a problem with your Digitrax equipment, contact Digitrax tech support. If you find that your Digitrax equipment is working fine, then it is time to de-bug the layout.

Observe the problem carefully and methodically.

Does it occur with both DC and DCC operation?

If so, check track wiring.

Is it occurring everywhere on the layout or in one particular area?

With your Digitrax system hooked up, a coin or screwdriver to short out the track. If no short occurs, you may not have enough feeders or your power supply may not be adequate. Use your LT1 to test the LocoNet cables attached to the booster in the problem area.

Does it only occur with certain locomotives?

Check the locomotives for mechanical problems and for damaged decoders. If you programmed the decoders just before the problem started, re-program them in case you entered values by mistake that are causing the problem.

Does it only occur with certain throttles, boosters or other equipment?

If the problem happens with just one piece of equipment, then you may need to have it repaired. Check the RJ12 jacks to be sure the pins are not misaligned.

Does it occur only when plugged into a certain LocoNet jack?

Check the wiring to that jack, particularly if you are using telco type jacks that you wired yourself. Use your LT1 to test the LocoNet cable you are using in that area of the layout.

Have you recently changed anything in your layout wiring? If so, try disabling the change to see if they layout will run without the “upgrade.” You may need to debug the upgraded wiring.

Have you changed any of the Command Station or Throttle option settings? Try resetting them to the default values and check to see if the layout will run.

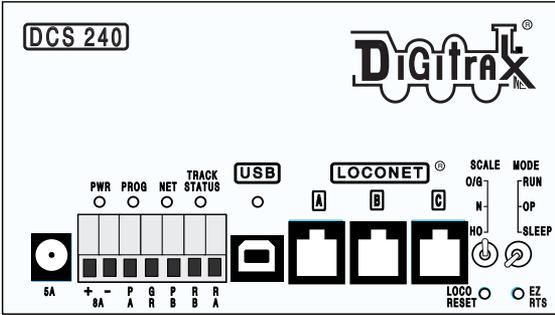
Have you recently installed additional boosters on your layout?

If so, check to be certain that these boosters are set up properly as boosters. If more than one command station is operating on your layout, you may experience unexpected operation when the decoders are taking commands from two different sources (command stations.)

If you have two separate operating LocoNets and you connect them with a LocoNet cable, both command stations can continue to operate and operating problems can occur. Modular layouts are at a high risk of encountering this problem if more than one part of the layout is up and running and then those parts are added together. Be sure in this case that you completely power down all operating LocoNets before combining them into one big LocoNet.

The DS240 helps eliminate this issue with automatic command station collision detection. If the DCS240 detects another command station on LocoNet at power up or during periodic 2 minute checks, it will issue 10 long beeps and turn off track power. The DCS240 will not allow track power to be turned back on until the offending Command Station is removed from LocoNet or configured properly as a booster.

4.0 DCS240 Control Panel



4.1 Power (PWR) Indicator

This LED indicates there is power supplied to the DCS240. It will light either green (command station mode) or red (booster mode). The PWR indicator will light GREEN or RED winking off every 3 seconds as a “Heartbeat” when the unit is in RUN mode. *See Section 4.17 for full light (LED) indication list.*

4.2 Power In Barrel Plug (5A) or Terminals (“+” and “-“ 8A)

The DCS240 may be powered either using the barrel plug connector or the screw terminals labeled “+” and “-“. The barrel plug connector is only rated for a maximum of 5 amps. The screw terminals can be used with any suitable power supply up to the unit’s maximum 8 amps. Make sure your DC power supply is rated for your desired voltage and amperage. When using the screw terminals make sure that the polarity of the power supply matches the correct terminals on the connector. The DCS240 is reverse input protected, however it will not power on if the DC polarity is incorrect.

The DCS240 is for use with DC POWER input ONLY, MAXIMUM INPUT 8 AMPS, 24VDC, 192 VA MAXIMUM CONTINUOUS, DO NOT Exceed 25VDC maximum Input. Minimum Input 13VDC.

There are many power supplies and power packs that can supply the input power for the DCS240. Most regular DC model railroad power packs are not able to supply sufficient amperage to the DCS240, because they were designed to run only 1 or 2 locomotives in a DC blocked system. With Complete Train Control you’ll be running multiple locomotives in the same power district so, you’ll need to provide more power to each district.

It is recommended that when selecting a DC power supply the voltage should slightly exceed the track voltage you plan to run your layout at. However, the DC input voltage should not exceed track voltage by more than 3V. If the DC supply voltage exceeds track voltage by more than approximately 3V the DCS240 will enter Safe Operation Mode see Section 4.11.4.

Power to the DCS240 should not be rapidly cycled ON-OFF-ON. When power to the unit is switched off, wait 30 seconds before turning on the power again.

4.3 Program A and B terminals (PA and PB)

The PA and PB terminals are the output for the second set of command signals for the programming track that can be used while the rest of the layout continues to run. These outputs are used for both programming via USB or by programming using a throttle. When programming using USB and SoundLoader II or other software, the program track will not be available for throttle programming. You will receive a “fail” message on your throttle if you try to program in Service Mode. Operations mode programming is unaffected by USB programming.

4.3.1 Program A(PA) and B(PB) terminals as a Braking Section

PA and PB can also be used with an additional booster to set up braking sections on your layout. This is useful if you want to stop trains at given points on the railroad, for example at a station. Instructions for setting up brake sections can be found on our web site, www.digitrax.com/brakesection/.

4.4 Program (PROG) Indicator

The PROG indicator will blink red when the program track is active. This light will flash constantly when using the DCS240 with SoundLoader II.

4.5 Ground (GR) Terminal

The terminal marked ground provides electrical safety features and an RF ground reference for minimum radiated noise. This should be the ONLY point of any DCS240 installation that is connected to the AC safety ground pin provided on most 3 pin 110V AC power sockets. Grounding the system is a sensible safety precaution that should not be ignored.

4.6 Rail B (RB) and Rail A (RA) Terminals

Connect these terminals to the track sections powered by the DCS240. If you are using more than one booster, be sure to use double gaps between each section and always connect the same rail to the same terminal on each booster. For example connect all Rail A terminals to the right rail and all Rail B terminals to the left rail or vice versa on all track sections.

4.7 USB Connector

The USB connector is used to connect the DCS240 to a computer. See Connecting the DCS240 to a Computer Section 9.0.

4.8 USB Indicator

The USB indicator will light Blue when there is an enumerated USB connection to a Computer. This means the computer is connected using the proper drivers.

4.9 TRACK STATUS Indicator

The TRACK STATUS indicator shows that there is voltage on RAIL A and RAIL B terminals. The indicator will be lit when there is track voltage, and not lit when track voltage is off. The indicator will change color indicating various degrees of “Zero Stretching” used to operate a conventional (analog) locomotive.

4.10 LOCONET Jacks A, B and C

These jacks let you expand your Digitrax system by simply plugging LocoNet devices in to the system. They can be used for throttles and other LocoNet devices. These jacks are functionally the same and can be used interchangeably.

4.11 SCALE Switch (O/G, N, HO)

This switch sets the nominal track voltage.

4.11.1 DCS240 Voltage Trim Settings.

The DCS240 is capable of custom voltage output ranging from approximately 8v to 24v with a suitable power supply. Each of the 3 scale settings can be trimmed to a custom voltage setting.

The following ranges correspond with each track setting:

	Nominal Voltage default	Nominal Voltage @ max decreased trim	Nominal Voltage @ max increased Trim
O/G	20.4v	18v	24v
HO	14.7v	14.5v	18v
N	12.4v	9v	14.5v

Note: The DCS240 can only OUTPUT approximately as much voltage as it is receiving. If you are only using a 15V DC power supply the DCS240 cannot output more than 15V DC. Use a power supply that approximates your planned track voltage.

The DCS240 is for use with DC POWER input ONLY, MAX INPUT 8 AMPS, 24VDC, 192 VA MAX CONTINUOUS, DO NOT Exceed 25VDC Input.

To Adjust Voltage Trim:

1. Set Mode Switch to OP. PWR indicator will flash GREEN alternating with the PROG indicator flashing RED.
2. Press the LOCO RESET button. The unit will start beeping continuously.
3. Select Address 00 on a throttle plugged in directly to the DCS240.
4. Set Scale Switch to the Scale voltage you wish to adjust.
5. Using the Throttle with 00 selected, adjust Forward Speed to increase Voltage trim up above default. Adjust Reverse Speed to decrease voltage trim down below default.
6. The voltage can only be adjusted up or down by the range referenced in the chart above. The DCS240 will beep continuously as long as it is in range. When you reach a value that is out of range the DCS240 will stop beeping. Once you decrease the trim UP or Down the DCS240 will beep again once you are in range.
7. To determine the actual track voltage, measure the DC voltage (unloaded) from Rail A to Ground and Rail B to Ground, then add the two values together.
8. Once you have set your desired voltage press the EZ RTS button and the DCS240 will beep once indicating the trim setting is saved. If the button is not pressed voltage changes will be discarded. You may select a different scale and set its trim in the same manner as above before exiting Voltage Trim Mode.
9. To exit Voltage Trim Mode set the Mode switch to RUN.

To Reset to Voltage default:

1. Set Mode Switch to OP. PWR indicator will flash GREEN alternating with the PROG indicator flashing RED.
2. Press the LOCO RESET button. The unit will start beeping continuously.
3. Select Address 00 on a throttle plugged in directly to the DCS240.
4. Set Scale Switch to the Scale voltage you wish to reset.
5. Using the Throttle with 00 selected set speed to 0.
6. Press the EZ RTS button the DCS240 will beep once indicating the trim setting is saved. If you wish to reset other scales voltages repeat steps 4 thru 6.
7. To exit voltage trim adjust set the Mode switch to RUN.

Note: Voltage trim values for all scales will reset if OpSw40 (factory default) is Closed. All other settings will be reset to defaults.

4.11.2 Heat Dissipation

It is normal for the DCS240 to be warm to the touch when it is in use. It is designed to absorb and dissipate the power difference between the input voltage and the selected scale output stabilized voltage, at the current load being drawn. If the unit is not able to dissipate excess heat, over temperature thermal shutdown may occur. When the DCS240 experiences a over-temperature shutdown, the booster will turn off and the DCS240 will beep and the PWR indicator will flash alternating GREEN/RED once a second. We recommend that you locate the unit in a location where it can dissipate heat. If you experience frequent over temperature shutdowns, you can add a small fan to increase airflow over the rear heat sink and cool the DCS240.

4.11.3 Troubleshooting DCS240 Shutdowns

1. Move the DCS240 so that the heat sink has a flow of cool air.
2. Place the DCS240 out of direct radiant heat like sunshine or a room heater.
3. Try direct cooling by using a small fan to blow air onto the heat sink.
4. Lower the track load current.
5. Reduce the input voltage from the power supply.

If the DCS240 beeps 4 times and shuts down briefly and then comes back on again, it is probably being run too close to its pre-set current limit. In this case it may clip or mutilate some outgoing packets to keep the track current within acceptable limits. To solve this problem, reduce the track current load by setting up additional power districts to provide more total power for the layout.

4.11.4 DCS240 Safe Operation Mode

We recommended when selecting a DC power supply, that the voltage slightly exceed the track voltage at which you plan to run your layout. However, the DC input voltage should not exceed track voltage by more than 3V. If the DC supply voltage exceeds track voltage by more than approximately 3V the DCS240 will enter Safe Operation Mode and proportionally lower the maximum current limit.

In safe operation mode the DCS240 will limit the current available to power the track in order to prevent damage to the DCS240. When the DCS240 is in safe operation mode the PWR indicator will wink off 2 times every 4 seconds. To avoid your DCS240 entering safe operating mode and get the full 5 or 8 amps of power, your power supply voltage should not exceed your track voltage by more than approximately 3V.

4.12 MODE Switch

The MODE switch settings are:

- RUN normal operations.
- OP customize the DCS240 by changing its option switch settings.
- SLEEP shutdown the system and all throttles that are plugged in to the system.

4.13 NET Indicator

The NET indicator is a red LED that displays information about what the DCS240 sees on LocoNet. When your layout is wired correctly and LocoNet is operating properly, the NET indicator will be on and it will wink off any time a good LocoNet message is detected by the DCS240. The table below explains the patterns you will see for this indicator.

NET LED Indication	Meaning
Solid Red	LocoNet OK
On, wink off	DCS240 detects a valid LocoNet message
Off	DCS240 detects low voltage on LocoNet

4.14 LOCO RESET Button

The LOCO RESET button allows you to clear all decoder info and consists from your DCS240. Pressing this button preforms the same function as closing OpSw 36. This button is useful in clearing all locos from the system after a large operating session or if you are getting a slot full error.

4.15 Easy Routes (EZ RTS) button

The EZ RTS button give your simple access to setting up routes in your DCS240. For information on setting up routes refer to the Routes section 6.2.3.

4.16 DCS240 Audible Sounds

The DCS240 uses several beeps and clicks that can be used as diagnostic tools that help you debug a number of conditions. Some Audible sounds mean different things depending on the DCS240's current mode.

Sound	Meaning
Continuous short beeps	In Voltage Trim Mode, selection is in range.
1 Short Beep	Diagnostic Beep when OpSw41 = c, LocoNet commands incoming. In EZ routes mode indicates a switch has been saved. During operation, DCS240 has recovered from a fault
2 Short Beeps	Initial DCS240 Power on or DCS240 had purged a loco address
3 Short Beeps	Entered quick routes mode
4 short Beeps	Booster short circuit shutdown.
5 Short Beeps	Route Error, looping route
8 Short Beeps	Route Error, Maximum switch commands issued.
1 Long Beeps	In EZ routes, initial Route ID saved
2 Long Beeps	In EZ routes, route saved and exit EZ Routes
3 Long Beeps	When pressing the Loco Reset Button, all loco addresses purged from the system.
4 Long Beeps	Input Voltage is out of the range 13.8V to 24V DC
10 Long Beeps	DCS240 has detected another Command Station on LocoNet and has turned off track power.

DCS240 AUDIBLE SOUNDS

4.17 DCS240 Indication Lights

The DCS240 uses different combinations of the PWR, PROG, NET, TRACK STATUS, and USB indicators to provide information. The indicators can show what mode the DCS240 is in as well as indicate errors and operations.

Indications	Meaning
PWR GREEN winking off every 3 seconds as a “Heartbeat”	The DCS240 is powered on in Command Station Mode, Normal Operation Mode.
PWR RED winking off every 3 seconds as a “Heartbeat”	The DCS240 is powered on in Booster Only Mode, Normal Operation Mode.
PWR off blinking on GREEN or RED every 4 seconds	The DCS240 is in SLEEP mode. (GREEN = Command Station Mode) (RED = Booster Only Mode)
PWR flashing RED, all other indicators off	Input Voltage out of Range 13.8V to 24V DC.
PWR flashing GREEN	DCS240 Internal fuse blown, replace fuse.
PWR RED or GREEN winking off 2 times every 4 seconds	The DCS240 is in Safe Operation Mode. Check your power supply to make sure it is appropriate for your track voltage settings. (GREEN = Command Station Mode) (RED = Booster Only Mode)
PWR flashing GREEN alternating with PROG flashing RED	The DCS240 is in Options Switch Mode.
PWR flashing alternating GREEN/RED once a second	The DCS240 is overheated and has shutdown.
PWR flashing GREEN alternating with NET flashing RED fast	The DCS240 is updating IPL firmware Via direct USB connection.
PWR flashing Green alternating with NET flashing RED slow, about once a second	The DCS240 is updating IPL firmware Via LocoNet.
PROG blinking RED	The DCS240 program output is active.
PROG flashing RED fast continuous	Program output is active via SoundLoader II or other software.
PROG blinking RED slow, once a second	DCS240 is in EZ Routes mode.
USB lit BLUE	USB is enumerated and connected to a computer responding with proper drivers.
USB lit BLUE, winking off	USB is receiving data over USB.
TRACK STATUS is lit	Indicates there is power to the track. This indicator will be GREEN or different shades of Yellow/Orange depending on Zero Stretching.
NET indicator Solid RED on	LocoNet OK.
NET indicator Solid on RED, wink off	DCS240 detects a valid LocoNet message.
NET indicator off	DCS240 detects a low voltage on LocoNet.

DCS240 INDICATION LIGHTS

5.0 Customizing DCS240-Option Switch Setup

The Option Switch (OpSw) setup allows you to customize the operation of the unit to meet your layout and operation preferences. The DCS240's power up defaults are fine for most applications and the DCS240 will run "out of the box."

5.1 Changing DCS240 Option Switches

1. See the Option Switch Table below to decide which option switches you want to change.
2. Move the MODE toggle switch on the front of the DCS240 into the "OP" position. The LocoNet Railsync will go inactive and all other boosters plugged in to LocoNet, including the one that is built into the DCS240, will shut down. The PWR indicator will flash GREEN alternating with the PROG indicator flashing RED.
3. Disconnect LocoNet from the DCS240 you are configuring.
4. Connect your DT4xx or later throttle directly to either DCS240 LocoNet A,B,or C.
5. Press the **SWCH** key on your throttle to enter Sw (Switch) mode. Since the DCS240's MODE toggle switch is set to "OP", switch commands from your throttle will now control DCS240 internal option switch settings instead of the accessory decoders (usually turnouts) on the layout.



6. Key in the number of the OpSw. In the example above, we have keyed in 6. As you browse through the OpSws, the right side of the text area will show the current setting for each OpSw , either "c" or "t".
7. Use the **CLOC / c** key to set the OpSw to **c** (closed) or the **OPTN / t** key to set the OpSw to **t** (thrown). In the example above we have changed OpSw 6 from its factory setting of **t** to **c**.
8. Exit DCS240 Option Switch Mode by moving the MODE toggle switch on the DCS240 to "RUN." Remember to reconnect LocoNet to the DCS240. Track power will resume to the state it was in when you entered Option Switch Mode.

Note: Do not adjust any Op Switches marked "Do Not Change"

These option switches are reserved and changing them may cause problems with your system. Do not change any option switches not listed in the table below.

Special Instructions for DCS240 Op Switches 36, 37,39 and 40

For these Op Switches to work properly,

1. Set the OpSw to “**c**” by pressing the **CLOC / c** key.
2. Set the DCS240’s MODE Switch to “SLEEP” mode.
3. Set the DCS240’s MODE Switch back to “RUN” mode.
4. The operation will occur (data will be cleared) and the option switch will reset to “**t**”.
5. Your throttle display will still show “**c**” even though the reset has occurred.
6. The display will update the next time you access the OpSw.

5.2 DCS240 Option Switch Tables

The following tables provide a list of the DCS240 Option Switches and the impact of the change on the system.

DCS240 Option Switch Tables

Option Switch #	Effect on System operation	Factory Default
OpSw 01	Do Not Change	t
OpSw 02	t = Command Station Mode	t
	c = Booster only Mode (not recommended)	
OpSw 03	t = DCS240's booster normal	t
	c = DCS240's booster is auto reversing	
OpSw 04	Do Not Change	t
OpSw 05	Do Not Change	t
OpSw 06	t = check for decoder before programming	t
	c = program without checking for a decoder	
OpSw 07	Do Not Change	t
OpSw 08	Do Not Change	t
OpSw 09	Do Not Change	c
OpSw 10	Do Not Change	c
OpSw 11	Do Not Change	t
OpSw 12	Do Not Change	t
<i>DCS240 Option Switch Tables</i>		

Option Switch #	Effect on System operation	Factory Default
OpSw 13	t = Loco address purge time 200 seconds	t
	c = Loco address purge time 600 seconds	
OpSw 14	t = Loco address purging enabled	t
	c = Loco address purging disabled	
OpSw 15	t = Purging will not change loco speed	t
	c = Purging will force a loco to 0 speed	
OpSw 16	Do Not Change	t
OpSw 17	t = Automatic advanced decoder assisted [FX] consists are enabled	t
	c = Automatic advanced decoder assisted [FX] consists are disabled	
OpSw 18	t = Normal DCS240 booster short circuit shutdown time	t
	c = Extended DCS240 booster short circuit shutdown time	
OpSw 19	Do Not Change	t
OpSw 20	t = Enable address 00 or analog stretching for conventional locos	t
	c = Disable address 00 or analog stretching for conventional locos	
OpSw 21	OpSw 21-23 set the global system default type for “NEW” loco selections. SW21/22/23 set as follows: c-c-t = 128 step mode c-c-c = 128 step FX mode t-c-t = 14 step mode t-t-t = 28 step	c
OpSw 22		c
OpSw 23		t
<i>DCS240 Option Switch Tables</i>		

Option Switch #	Effect on System operation	Factory Default
OpSw 24	Do Not Change	t
OpSw 25	t = enable Route echo over LocoNet	t
	c = Disable Route echo over LocoNet	
OpSw 26	t = Disable routes	c
	c = Enable routes	
OpSw 27	t = Enable normal switch commands, a.k.a. the “Bushby bit”	t
	c = Disable normal switch commands, a.k.a. the “Bushby bit” Allows attached PC to handle switch control logic	
OpSw 28	t = Enable interrogate commands at power on	t
	c = Disable interrogate commands at power on	
OpSw 29	Do Not Change	t
OpSw 30	Do Not Change	t
OpSw 31	t = Normal route/switch output rate when not trinary	t
	c = Fast route/switch output rate when not trinary	
OpSw 32	Do Not Change	t
OpSw 33	t = Track power off at power on	c
	c = Allow track power to restore to prior state at power on	
OpSw 34	t = Disallow track to power up to run state, if set to run prior to power on	t
	c = Allow track to power up to run state, if set to run prior to power on	
<i>DCS240 Option Switch Tables</i>		

Option Switch #	Effect on System operation	Factory Default
OpSw 35	t = Enables Loco Reset Button	t
	c = Disables Loco Reset Button	
OpSw 36*	c = Clears all mobile decoder info & consists	t
OpSw 37*	c = Clears all routes	t
OpSw 38	Do Not Change	t
OpSw 39*	c = Clears all internal memory states, including OpSw 36 & 37.	t
OpSw 40*	c = Clears all internal memory states and sets Voltage Trim to default. Resets DCS240 to factory default	t
OpSw 41	t = Diagnostic click disabled	t
	c = Diagnostic click when valid LocoNet commands incoming & routes being output	
OpSw 42	t = Enable 2 short beeps when loco address purged	t
	c = Disable 2 short beeps when loco address purged	
OpSw 43	t = Enable LocoNet update of command station's track status	t
	c = Disable LocoNet update of command station's track status	
OpSw 44	t = Maximum slots to 400	t
	c = Limit slots to 120	
OpSw 45	t = Enable reply for switch state request	t
	c = Disable reply for switch state request	

DCS240 Option Switch Tables

Option Switch #	Effect on System operation	Factory Default
OpSw 46	Do Not Change	t
OpSw 47	t = Normal Program Track Setting	t
	c = Program track is brake generator when not programming. Braking is DCC set to speed 0 (not Emergency stop) for address 0, light ON, broadcast to all addresses	
<i>DCS240 Option Switch Tables</i>		

* See special instructions in *Section 5.1* for setting OpSw 36,37,39, and 40.

6.0 Fast Clock and Routes

Any DT4xx or later throttle can edit system functions like the fast clock and routes. Both of these features can be enabled or disabled by your command station. The DCS240 ships with fast clock and routes enabled.

6.1 Fast Clock Basics

Many operators use a fast clock during operating sessions to simulate prototypical operations. Traditionally, this clock is on the wall and is set up to run at a faster than normal rate. LocoNet has its own networked fast clock for all Digitrax throttles connected to your system.

The fast clock display is a 4 digit 12 or 24 Hour format clock. To display the fast clock simply press the **CLOC / c** key. The fast clock display will remain active while you are running trains until you initiate another throttle task such as loco address selection, programming, MU, Switch mode, etc. To stop displaying the fast clock and return to the default display, press the **CLOC / c** key again. This is the display you will see:



Any DT series throttle that is plugged in to your LocoNet system will update its fast clock time and rate to be synchronized to the rest of the system a couple of seconds after it is connected to LocoNet.

Each DT4xx can be set up with an alarm. When the current fast clock time matches the private alarm time set in any DT4xx, that DT4xx will beep and flash the message “Alarm” to indicate that the alarm time has elapsed.

The fast clock rate for the fast clock is user selectable from 1:1 to 100:1 in steps of 1. The most popular range of values is 4:1 to 8:1.

6.1.1 Stop the Fast Clock

Setting the clock rate to 00 will stop the fast clock for the entire system at the currently displayed time. Fast time will re-start when a new non-zero rate value is set.

The current fast clock time, fast clock rate and the DT4xx alarm time can be changed by using the Edit mode.

6.1.2 Edit Fast Clock Time, Rate and Alarm

DT4xx must be plugged in to LocoNet to edit the fast clock settings.

1. From Fn mode, press the **EDIT** key to change to Edit Mode.
2. Press the **EDIT** key to scroll through the different things you can edit.
3. The first time you press the **EDIT** key, the mode indicator in the center of the bottom row of the display will show Ec (Edit Clock Mode) and the

text area will show a 12 hour time. See your throttle manual for setting the clock for 12 or 24 hour operation.

4. Use the Throttle knobs to dial up the “current” time. Use the **L** Throttle for hours and the **R** Throttle for minutes. You can only move time forward. Press the **EDIT** key again to set the time and move on to edit the fast clock rate.
5. When you press the **EDIT** key the second time, the mode indicator will display Ef (Edit Fast Rate) and the text will show Rate=nnn where nnn is the clock rate. Use the throttle knobs to dial up a clock rate that is between 000 and 120 (the throttle will let you dial up to 255 in this case but values above 120 have no meaning to the system). Press the **EDIT** key again to set the fast clock rate and move on to edit the throttle alarm time.
6. Once the time and fast clock rate are set, the mode indicator will display EA (Edit Alarm) and the text will show a 12 or 24 hour time. Use the throttle knobs to dial up the alarm time. Press the **EDIT** key again to set the fast clock alarm. NOTE: The fast clock alarm can't be turned off.
7. Once the time, fast clock rate and alarm are set, you will automatically return to Fn Mode unless your system is enabled for other types of editing such as routes. If you are set up for command station routes, the clock editing screens will be followed by Er for editing routes as described in the system manual for command stations that support internal routes. To exit Edit mode at any time simply press the **EXIT** key.

6.2 Route Basics

You can use your DT4xx with a DCS240 to set up routes that are triggered by operating a single turnout address to make it either **c** (closed) or **t** (thrown). Setting up and operating routes is similar to consisting locomotives because you can cause more than one unit to operate based on a single command sent to the system. We call the turnout address to which other turnout addresses are “consisted”, the TOP address. To operate a route, use Sw (Switch) mode to select the TOP turnout address in the route and move it to either **c** (closed) or **t** (thrown) to initiate the route you have previously set up in your route list. The TOP turnout address does not need to be physically present on the layout, it can be a “phantom” turnout address.

The DCS240 supports up to 64 routes. Each route consists of a list that contains a TOP turnout address and its position **c** or **t** and up to 16 other turnout addresses and their positions. Routes are stored in the DCS240’s memory and can be operated by any throttle in the system that can send switch commands. Each of these 64 routes is operated by setting the TOP turnout address to the position saved in the route list. When a route is triggered, a route can include a switch that is the Top of another route and all the entries in the second route will be added to the string of turnout commands the initial route request generates. The second route called is a “nested” route.

From the initial route you can “nest” up to 3 levels deep. Note that a route that itself does not contain another Top switch (i.e., another route) will not increase the nest depth. You can combine routes as needed to issue a maximum of 120 switch commands.

When executing a route the DCS240 will check to see if it exceeds these limits or contains the same switch command more than once. If the route exceeds the 120 switch maximum the DCS240 will short beep 8 times. If the route contains the same switch command twice or “loops” on itself the DCS240 will short beep 5 times. When the DCS240 indicates these errors no switch commands will be issued. You will need to edit the route and correct the errors in the list before trying the command again.

6.2.1 DCS240 Routes OpSW

By default the DCS240 is set to enable routes. OpSw #26 enables and disables routes. To disable routes set OpSw #26 to **t** (thrown). *See section 5.1 for instructions for changing OpSws.*

You can erase all current routes in the DCS240 by setting OpSw 37 to **c** (closed) and returning to Run mode.

You can disable LocoNet Route Echo by setting OpSw #25 to **c** (closed). This will prevent the DCS240 from sending Route commands via LocoNet they will only go out over the track.

6.2.2 External Routes

The DS64 stationary decoder can also generate cascade switch message commands or routes independently of the DCS240's capability. See the appropriate manuals of these products for further details.

6.2.3 Setting up Routes using the EZ RTS button

To Set routes:

1. Press the EZ RTS button. DCS240 will issue 3 short beeps and PROG indicator will blink on once a second.
2. Using your throttle in switch mode select the turnout address to set as the Route ID. Press **c** to close the switch and set the Route ID. The DCS240 will make 1 long beep indicating it is ready to add turnout addresses to the route.
3. Select the first turnout address in your route and press as **t/c** to set the turnout position in the route. This first address will be your TOP address and the one you use to access the route when operating.
4. Continue selecting turnout addresses (including other route's TOP address) in this manner until you have reached the 16 turnout maximum or you are ready to end your route.
5. To end the route enter the same turnout address twice in sequence. The DCS240 will long beep 2 times indicating it is saved and exited Easy Routes. The DCS240 will also save and exit Easy Routes if more than 16 turnout addresses are entered. If you create a route that loops back on itself the DCS240 will short beep 5 times and exit Easy Routes saving up to your last entry.
6. To set another route start with step 1 and repeat the process.

6.2.4 Edit Routes Using a DT4xx or later throttle

To go to the Edit Routes (Er) mode you must pass through the clock editor:

1. Start in Fn mode. Press the **EDIT** key to enter Edit Mode.

Press the **EDIT** key again to enter Ec (Edit Clock) mode.

Press the **EDIT** key again to enter EF (Edit Fast Rate) mode.

Press the **EDIT** key again to enter EA (Edit Alarm) mode.

Press the **EDIT** key again to enter Er (Edit Routes) mode.

The DT4xx's display will show the following screen when you enter the Edit Routes mode.



This display shows Er (Edit Routes) in the Mode Indicator area on the bottom row to let you know you are in Edit Routes mode.

The right side of the bottom row shows which route (Route ID) you are working with. This can be any number from 01 through 64.

The left side of the bottom row of the display shows which entry within the route you are working with. The En (entry) number can be any number from 01 through 16. *With some older throttles you may only have access to 01-08.*

En01 is the TOP or controlling turnout address. The position, "t" or "c", that you set for this turnout address is the one that will operate the route.

The text area shows "Sw empty" to let you know that nothing has been entered for Entry 01, Route 01.

2. Use the **R** Throttle knob to dial up the Route number you want to work with. The bottom right display will show the route number 01-64.
3. Use the **L** Throttle knob to dial up the Entry number within the chosen route that you wish to work with. The bottom left display will show the entry number.



This display shows Entry 01, Route 11 as empty.

4. Press the **ENTER** key and "Sw" in the text area will begin to flash, use the Throttle knobs to dial up the turnout address you want to add to the route.

Use the **L** Throttle knob for 100s and the **R** Throttle knob for 10s and 1s. Once you make changes to the turnout address number or the position of that address, the entire text area will begin to flash. The key pad is not active during this throttle task even though some keys may change the display.

5. When the turnout address you want is on the screen use the **OPTN / t** key to set the turnout to **t** (thrown) or the **CLOC / c** key to set the turnout to **c** (closed).



This display shows Entry 01, Route 11 with turnout address 005 set for **c** (closed). In this case address 005 is the TOP address for this route because it is Entry 01 for the Route.

6. If you don't want to make any changes to the route and entry selected, simply press the **BACK** key or either of the Throttle knobs to exit turnout address/position editing and return to selecting a different route/entry number (step 2 above).
7. Once your selection is complete, press the **ENTER** key to save the turnout address in the position selected into the route.
8. Continue entering route entries in this manner until your route is complete. You can toggle back and forth between selecting route and entry numbers and entering turnout addresses and positions by pressing either Throttle knob or the **BACK** key.
9. Once you have finished editing routes, press the **EXIT** key to exit the Er (Edit Routes) mode and return to Fn (Normal Operating) mode.
10. To operate the routes that you have set up, simply press the **SWCH** key, key in or dial up the TOP turnout address for the route and press the **OPTN / t** key or the **CLOC / c** key to issue the appropriate **t** (thrown) or **c** (closed) command. When you select the TOP turnout address in a route and the position command (**c** or **t**) you issue matches the position that is stored in the route, the route will operate. If you select the opposite position from that stored as the route, the TOP turnout address will change to that position and the route will not operate.

Note: If there is an error with the route the DCS240 will beep 5 times.

7.0 How the DCS240 Manages Addresses

Your DCS240 has a finite number of “slots” available in its memory. The factory default is set for 400 addresses. Once the slots available in your command station are full, the system will display the “slot=max” or “FF” message to let you know that you need to release some locos if you want to select and run others. *Find details on loco dispatching in your throttle user manual or you can simply press the Loco Rest Button to clear all addresses from the DCS240 command station.*

7.1 Purging of addresses:

Purging is the process by which the DCS240 changes the status of decoders that are either not being used or are unattended to make room for other addresses to be selected and refreshed by the command station. *See Section 5.0 for setting the DCS240 OpSw 13,14, and 15 to manage how the DCS240 purges addresses.*

The DCS240's default setting for purging are:	
OpSw 13	t = Loco address purge time 200 seconds
OpSw 14	t = Loco address purging enabled
OpSw 15	t = Purging will not change loco speed

8.0 Decoder Status

The command station assigns status codes to each locomotive address in the system. Addresses are either selectable or not selectable. Decoders are not selectable if they are in-use on another throttle or if they are part of a consist. If you try to select an in-use address, you will be prompted to “Steal” the address. If you select a decoder that is part of a consist, you will be able to send function commands but you won’t be able to control its speed or direction. The text line in the DT4xx display will show “top”, “cn” or “mid” if the address is part of a consist, otherwise it will show “stat”. This display is followed by the status code for one of the following modes of operation.

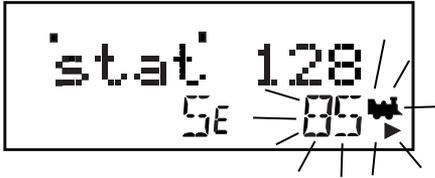
Display	Meaning
28	28 Speed Step Mode
14	14 Speed Step Mode
128	128 Speed Step Mode Digitrax Preferred Mode
28 FX	28 speed step-enable advanced consist mode
x01	Reserved, Do not use
x02	Reserved, Do not use
*128 FX	128 speed step-enable advanced consist mode

Status editing is used most often when you are running non-Digitrax decoders that do not have 128 speed step capabilities. If you can’t get a non-Digitrax decoder to work on your layout and you are sure you are using the correct address for the decoder, you probably need to status edit it to run in 14 or 28 speed step mode.

8.1 Status Editing Decoders

1. Press the **LOCO** key to enter address selection mode, the display will begin flashing the address on the active throttle and will display “Sel Loco” in the text area to prompt you to select an address. Lo will also be flashing.
2. When you use the Throttle knobs or key pad to enter the address of the locomotive you want to select, the display will show the current status of the decoder. To display the status code of the loco address that is flashing in the display when you enter selection mode, just turn the throttle knob up one address and then back to the original address and the status code will display on the Display.

- To change the status of the decoder simply press the **EDIT** key the flashing Lo will change to SE and the current status code of the address will be displayed. Use either Throttle knob to scroll through the status codes shown in the table above.



- Once the status code you want to use for the address is displayed in the text area of display, press the **ENTER** key to change the status code of the locomotive and to select it to run on the active throttle knob.
- If the loco address is in-use on another throttle or in a consist when you press the **ENTER** key to complete the status edit process and select the loco on the active throttle, the DT4xx will prompt you to Steal=Y. If you want to steal the address, press the **Y / +** key to complete the status edit. If the loco is part of a consist, it will not be selected and will remain part of the consist when the status is edited.

8.2 Note for Non-Digitrax Decoder Users

If you have a decoder that does not have advanced 28/128 speed step mode available, you must “status edit” that locomotive to standard 14 speed step mode before running it with your Digitrax system. Changing the decoder’s status will cause the system to handle this decoder as a 14 step decoder. Status editing does not reprogram anything in the decoder.

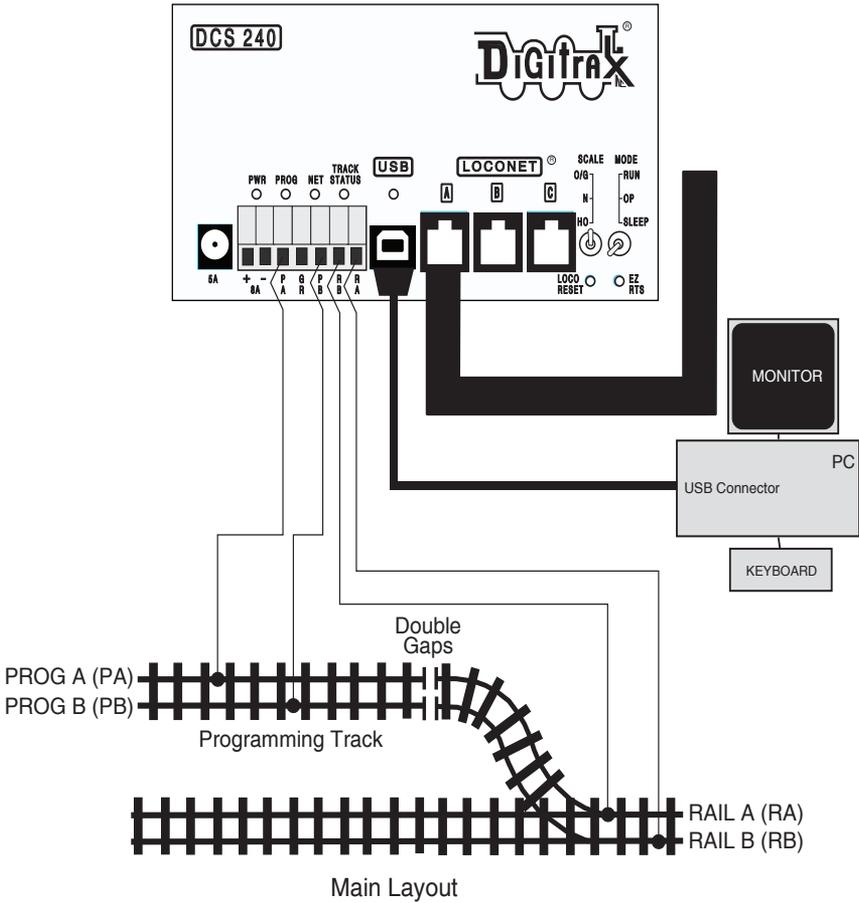
9.0 Connecting the DCS240 to a Computer

The DCS240 can be connected to a computer using the USB plug on the front. It provides all the same functionality as a PR3 giving you access to Digitrax SoundLoader II and other computer utility programs. It can also be used as an interface for other compatible layout control software.

SoundLoader II and the DCS240 have been tested to work on PC compatible computers running 550MHz and up, Windows XP, Vista, 2000, 7, and 8, 512MB of RAM.

Other combinations of hardware and software may also work, but are not supported by Digitrax, and have not been tested to operate properly.

Installation consists of three steps: (a) Driver installation, (b) Hardware Setup, (c) Software setup.



9.1 Driver Installation

Before the DCS240 USB can be used, drivers for your specific Windows version must be installed. Drivers and Windows version specific instructions are available from the Digitrax website PR3 Xtra Product page: <http://www.digitrax.com/PR3Xtra>.

The DCS240 uses the same drivers and instructions as the PR3. If you've previously installed a PR3 on the computer you are connecting to, you will not need to reinstall new drivers.

NOTE: Drivers must be installed for the DCS240 to operate over USB.

9.2 Hardware Installation

The DCS240 does not require any additional special setup to be used with a computer. Once you have installed the Drivers simply connect your DCS240

to your computer via USB cable. The DCS240 uses the DCS240's Program A(PA) and B(PB) terminals for decoder programming and communicates over LocoNet using the LocoNet A,B,or C Jacks. The USB indicator will glow Blue to indicate the USB is enumerated and connected to a computer responding with proper drivers.

9.3 Software Installation

The DCS240 uses the same Digitrax SoundLoader II program and Utilities as the PR3. It is recommend that you go to <http://www.digitrax.com/PR3Xtra> and download the latest editions of these programs to get the most out of your DCS240.

9.4 Connecting the DCS240 to a Computer Additional Troubleshooting

The DCS240 requires a driver for Windows. If the driver is not installed or not installed correctly the DCS240 will not operate with the computer.

To verify proper installation of the drivers, go to the Windows Device Manager. Under Ports (COM & LPT) there should be a Communications Port (COMx) listed, where COMx is the communications port number or com port. Right clicking on the communications port and then clicking on Properties should show Digitrax, Inc. as the Manufacturer.

The correct enumerated COMx port number must be entered into the Soundloader II or other utility programs for proper operation.

10.0 Updating the DCS240 to the latest firmware

Occasionally Digitrax makes updates and improvements to the operational code of its products. In order to update your DCS240 you will need to have the DigiPLII utility installed on a computer connected to your LocoNet and the latest firmware (.dmf) file. The DCS240 can be updated either directly using its USB connection or via LocoNet using a PR3 or other computer to LocoNet interface. When updating via USB the PWR indicator will flash GREEN alternating with the NET indicator flashing RED fast. When updating via LocoNet the PWR indicator will flash Green alternating with the NET indicator flashing RED slow, about once a second For complete instructions and the latest firmware files visit <http://www.digitrax.com/downloads/>.

11.0 Troubleshooting Problems

11.1 I'm lost!

If your DT4xx display isn't showing you what you expect based on the manual, press the **EXIT** key to return to normal operating mode Fn. Then try the throttle task again.

11.2 Runaway train or layout!

- Press the **PWR** key followed by the **N / -** key, OR
- Flip the MODE switch to "SLEEP" on the DCS240 Command Station.

Either way, the layout will stop to give you a chance to regain your composure.

To resume operations where you left off

- Press the **PWR** key followed by the **Y / +** key, OR
- Flip the MODE switch to "RUN" on the DCS240 Command Station.

11.3 Nothing is responding

Is track power turned on? Is your throttle in Idle or stopped and displaying a flashing TRACK POWER indicator and Trk=Idle in the throttle display?

Press the **PWR** key followed by the **N / -** key then **Y / +** key then **PWR** key to toggle the track power off then on. You should see the TRACK POWER indicator on the DT4xx come on solid.

11.4 Can't select a loco on my throttle

Is the loco in use by another throttle

Did the throttle ask you "STEAL=Y?".

Is the loco part of a consist?

Do you see a cn in the display when you try to select it? A loco in a consist cannot be selected and run separately. You can still control some Functions.

Have you changed the loco address?

You can read back the loco address to see if it has been changed. *See your throttle manual for instructions on reading back loco addresses.*

Does your throttle say "slot=max"?

This means that the system's capacity to handle operating locos is full. The DCS240 default setting can run up to 400 addresses at the same time. If you have the "slot=max" message, be sure that all locos that are not running are released from throttles. All locos can be cleared from the system by pressing the LOCO RESET button.

11.5 Clean Track

The majority of intermittent operation problems can be traced to bad connections and poor or noisy wheel pickups on locomotives. Check track cleanliness and quality of wheel pickups.

11.6 The Quarter Trick

If your track does not have adequate power supply to the locomotives, then the signal won't get through either. Take a quarter or screwdriver blade and go around your layout creating electrical shorts every 10 feet. Your DCS240 should beep 4 times and shutdown when the short is present. When the short is removed, the booster should beep once within 2-3 seconds and return to normal operation. If this does not happen, then you need to add more feeders. *See Section 3.3.*

11.7 The LT1 Tester

Check your LocoNet cables with the LT1 tester to be sure you don't have any cables that were made incorrectly. *See Section 2.8.*

11.8 Decoder Won't Respond Is the loco on powered track?

If the TRACK POWER indicator on the DT4xx is off or flashing, press **PWR** key and the **Y / +** key to turn on track power.

Use the "Quarter Trick" above to test for track power at several locations around the loco. If there is not track power, check your layout wiring.

Can you select the loco on your throttle?

If not, is the loco in use by another throttle or is it part of a consist (do you see a cn in the display when you try to select it)?

Do the settings in CV29, the configuration register, match the command station output?

If your decoder is a 14-step decoder running on any Digitrax system using factory defaults, status editing will be needed for that decoder. *See Section 8.1.*

Have you reset any CVs since the last time you ran the loco

If so, go back and change them to their default CV values and then try to run the loco. It is possible to set acceleration so high that it will take 10 minutes for the loco to start moving. To reset to factory default, see the Decoder Manual for a full listing of CVs.

Was the loco running just before it stopped?

If the decoder is very warm it may be in thermal shutdown. Let it cool off and see if it starts again. Also check for localized track problems. See Quarter Trick on previous page.

Are there burn marks on the decoder?

You'll need to send it in for repair!

If all else fails, reprogram the decoder address and reset CVs to default values.

11.9 "Strange" Locomotive Lights

If you can't control the operation of the lights in your locomotive with the DT4xx (in default 128, or 28 speed step mode), be sure that the decoder is programmed in advanced 28 speed step mode.

Do this by programming CV29 with a value of 06. See your Decoder Manual for more information about programming decoders.

Glossary

128 Speed Step Mode: the motor voltage/speed curve of the decoder equipped loco from stop to full speed has 128 discrete speed steps. This means that you have 128 discrete speed steps at your disposal for excellent speed control, especially at very low speeds. 128 speed step operation will give a significant improvement in speed control over 14 or 28 step operation.

2-Digit Address: decoder address between 01 and 127 which is expressed as a 2 digit number. Addresses above 99 are expressed as hexadecimal numbers. The DT4xx translates these numbers into three digit numbers 100-127. Technically a 2 digit address is a 7 bit address and is the baseline packet format for DCC addresses. It is sometimes called the short address.

4-Digit Address: decoder address between 0128 and 9983. Not all 4 digit addresses in this range are actually available for use. Your DT4xx can access 0128 through 9983. Digitrax handles addresses below 0128 as two digit addresses to avoid confusion. Technically a 4 digit address is a 14 bit address and is considered an extended packet format DCC decoder address. Sometimes this is called the long address.

+: plus or add, used to increase speed or other numbers in DT4xx display. Also used to add loco addresses to consists.

-: minus or remove, used to decrease speed or other numbers in the DT4xx display. Also used to remove loco addresses from consists.

AC or Alternating Current: An expression used to describe an electrical wave form that cycles or alternates above and below 0 volts. In the U.S., household electricity is 60 cycle, alternating 60 times a second, 110-120 volts.

Acceleration: The rate at which the decoder increases from one speed step to the next in response to a new increase speed command. Use CV03 to set this value for each decoder. This feature is used to simulate train weight and to cause your model to respond more prototypically when you increase the throttle.

Active throttle: Digitrax DT throttles are actually two throttles in one. Each hand held can control two different addresses or consists at a time one on the right side or R Throttle and the other on the left side or L Throttle. The DTs display is shared by the two sides of the throttle. The side for which information is currently in the display is called the active throttle.

Address, Decoder: an identifying number programmed into a particular mobile or stationary decoder. The system uses the decoder address to send commands to the appropriate loco or accessory decoder.

Address Range: Analog address range is 00. 2 digit address range is 01-127, 4 digit address range is 0128-9983.

Advanced (EPF) Consisting Method: consist information is stored in each decoder. Locos can be added to and deleted from the consist in any orientation. This method requires that all locomotives in the consist be equipped with decoders that support this feature (EPF decoders). This method lets you set up a consist that is “transportable” from one layout to another. The problem is that you must be sure to put the locos back on the track in the same order and orientation you programmed them for or you can get some unexpected results.

Advanced Mode (28 Speed Step Mode): the motor voltage/speed curve of the DCC loco from stop to full speed has 28 discrete speed steps. This means that speed control will be limited to 28 steps. 28 speed step mode gives fine speed control. Increasing to 128 speed step operation will give a significant improvement in speed control, especially at very slow speeds needed for prototypical switching operations. Advanced mode is offered in most command stations because there are decoders on the market that are not capable of 128 step mode operation.

Analog Loco: A locomotive operating on a DCC layout without a DCC decoder installed. Also called a Conventional Loco.

Analog Mode Conversion: When a Digitrax decoder does not see DCC packets on the layout it changes automatically to DC operation. Not all DCC systems support this feature so you may have to program non-Digitrax decoders to operate on analog layouts. Automatic analog mode conversion can be disabled by programming CV29.

Autoreversing: a feature of Digitrax boosters that allows a train to enter and exit reversing sections automatically without the need for the operator to throw a switch to match track polarities on either side of the reversing section.

Ballast Lamp: For use as a buffer between DC and DCC track sections, a ballast lamp is connected across one of the double gaps separating the two track sections. For most model railroad applications a 12 volt automobile brake lamp wired in series is used for this purpose.

Basic Consisting Method: Program all the locomotives in a consist to the same address and run them on one throttle. In this case all the locos must be running in the same direction unless you have set up normal direction of travel as reverse or have rewired the motor on locos that you want to run “backwards” in the consist.

Booster: Boosters receive the control signal from the Command Station, amplify it and put it on the track as the power that runs the locos. You can have several boosters on a system, each driving its own track section. You can have both regular or auto reversing boosters depending on your needs. Also called Power Booster, Power Station.

Browsing: scanning sequentially through locomotive or accessory decoder addresses and statuses in you throttle. Browsing is done with the DT4xx by turning the throttle knobs or using the Y+ or N- Keys.

c: closed, indicates that the turnout is in the straight through position, set for the mainline. For op switch set ups, consult your manual for the meaning of c and t.

Cab: See Throttle.

Command Station: Most systems have one Command Station that generates the commands that are sent to the decoders. The command station also produces Rail Sync so that all the devices on your LocoNet work together.

Common (Loco Status): a locomotive that is not currently “in-use” by a throttle connected to LocoNet but is still being refreshed by the command station. A loco with a status of “common” is selectable by any throttle on LocoNet.

Common Rail Wiring: A wiring system in which one side of all the track power supplies are connected. The common rail concept simplified block wiring in conventional DC systems, but is not recommended for DCC wiring. (see Direct Home Wiring).

Compatibility: the ability of equipment made by various companies to operate together on the same layout. DCC compatibility extends to decoders and boosters but not to throttles, command stations, system architecture and advanced features that are not DCC related.

Complete Train Control: the integration of many technologies including DCC for total layout control. Since DCC covers only limited aspects of layout control, the hybrid Digitrax Complete Train Control goes beyond the basics of DCC to provide you with a total layout control system.

Configuration Register (CV29): this special CV controls several different decoder characteristics including:

1. Whether the decoder uses standard 14 speed step mode or advanced 28/128 speed step mode
2. Whether or not the decoder will automatically convert to DC operation when no DCC signal is present.
3. In the case of Digitrax FX decoders, the normal direction of locomotive travel
4. Whether the decoder uses loadable speed tables and
5. Whether the decoder uses the 2 digit address or the 4 digit address.

Configuration Variables (CVs): these are special storage locations or “pigeonholes” in your decoders. By programming values into various CVs, you can control each decoder’s performance characteristics. CVs store information like the decoder’s address, start voltage, mid-point voltage, loadable speed tables and many more. Once you have programmed these characteristics, the decoders “remember” them until you change them again. The NMRA Standard and RPs define the usage of many CVs while others are defined by manufacturers.

Conformance Seal: issued by the NMRA after a product has passed the tests established and administered by NMRA volunteers to “prove” that a particular product follows exactly to the letter the Standards and RPs set up by the NMRA that pertain to that product. Conformance seals do not insure interoperability or the quality of the products, only manufacturers provide warranties on the equipment they sell.

Consisting: linking more than one locomotive together to be controlled by a single throttle and or address. Also called multiple unit operation, MU’ing, multiple unit lash ups, etc.

Constant Brightness Lighting: because DCC runs with constant track voltage, locomotive lights stay on even when the loco is not moving, just like the prototype.

Conventional Loco: A locomotive operating on a DCC layout without a DCC decoder installed. Also called an Analog Loco.

DCC: Digital Command Control.

DC or Direct Current: An expression used to describe an electrical wave form in which the voltage remains more or less at a value above or below 0 volts. DC is used by most model railroad locomotives. Sometimes referred to as Analog.

Deceleration: The rate at which the decoder decreases from one speed step to the next in response to a new decrease speed command. Use CV04 to program the deceleration value for each decoder. This feature is used to simulate train momentum so that, just like the prototype, your model won't stop immediately when the brakes are applied.

Decoders, Mobile: the electronic device installed in each locomotive that receives the signal from the command station through the track, decodes it and tells the loco what to do. Mobile decoders can also include function control, speed stabilization (back emf), transponding and other features.

Decoders, Stationary (Accessory or turnout): the electronic device for the turnouts or other accessories that receives the signal from the command station through the track, decodes it and tells the turnout/accessory what to do.

Decoder Status: the Digitrax command station assigns each decoder a status based on whether it is new to the system, in-use on a throttle, common in the system and available for selection or idle. The decoder status determines how the system treats that address.

Direct Home Wiring: A wiring system in which the DCC booster powers each rail through an individual conductor or wire. Each booster is wired to its own power district and there is no common connection between boosters. Digitrax strongly recommends direct home wiring.

Direct Programming: A type of service mode programming.

Directional Lighting: loco lights can be set up to automatically change so that the forward lamp is lit when the loco is moving forward and the reverse lamp is lit when moving in reverse.

Dispatching: use your DT throttle to set up a loco or consist you want to be run by another operator and then using a couple of keystrokes, dispatch the loco from the DT throttle and acquire it on the other throttle.

Duplex Transceiver. two way radio operation allows a duplex equipped throttle to send and receive information to the command station via a radio transceiver while not plugged in to the LocoNet.

EPF or Extended Packet Format: an extension of the baseline DCC format that allows us to use four digit addressing and other expanded decoder features.

Fn: Shorthand for Function

LocoNet: Digitrax's powerful communications network especially designed for model railroad operation.

Mid-Point Voltage: the value programmed into CV06 specifies the voltage to apply to the motor at speed step 15 in a 28/128 step system and step 7 in a 14 speed step system. This allows you to make a quick adjustment to the motor voltage/speed curve without setting up a loadable speed table.

MU: Multiple unit operations. See Consisting.

N: No, use the **N / -** key to respond to DT400/DT4xx series throttle text messages.

New (Loco Status): a locomotive that has not been addressed by the system. A new loco is selectable by throttles on LocoNet and is not refreshed.

Operating Mode: 14 or 28/128 speed steps. See also, Speed Steps, Standard Mode, Advanced Mode and 128 Speed Step Mode.

Operations (OPS) Mode Programming: lets you program CVs in DCC locos equipped with EPF decoders while they are on the mainline. A typical use for ops mode programming would be to change the acceleration rate (CV03) or the deceleration rate (CV04) of your locos to simulate the weight and braking characteristics of the train to compensate for changing the number of cars and power units in the train.

Paged Programming: Digitrax preferred method of service mode programming.

Physical Register Programming: A primitive type of service mode programming. This method is limited to programming 2 digit address, acceleration, deceleration and start voltage.

Power Booster: See Booster

Power District and Power Sub-district: A power district is the power wiring, components and equipment attached to that wiring, driven by a single properly isolated booster. A power sub-district is a sub-division of a power district.

Power Station: See Booster

Power Supply: a transformer that provides power to the layout control system.

Programming: entering values into configuration variables (CVs) available in DCC decoders or option settings for the throttle or command stations.

Programming Track: an electrically isolated track section used for decoder programming. This track ensures that broadcast programming instructions are only sent to the decoders you want to program.

Purging: the process by which Digitrax command stations automatically release locomotives from “in-use” to “common” when they are not selected on a throttle connected to LocoNet. This makes locos that have been “forgotten” by their operators available to be selected by other operators to prevent problems during an operating session.

PWM: Pulse Width Modulation.

R: Right throttle, Right reverse key, Right side of DT4xx display.

Recall stack: List of previously selected addresses stored in the DT4xx Throttle.

Refreshed (Data): Digitrax command stations re-send data to decoders many times to be sure that the signal is not lost and that you have reliable operation. All in-use and common locos in the system will continue to be refreshed until they become idle.

Route: a group of turnouts and their specified positions that will be triggered by the activation of a single “TOP” switch address to a specified position.

Scaleable Speed Stabilization (back EMF): a decoder that uses back EMF to maintain constant speed but can also buffer the speed changes to allow for optimal operation. A speed stabilized decoder that is not scaleable will cause a locomotive to maintain the speed you set no matter what grade the loco encounters. It’s like “cruise control for your loco.” If speed stabilization is not scaleable, you can have the pushy pusher problem if you run consists.

Select: To assign a decoder address to a throttle in the system so that the address can be controlled by that throttle.

Selectable: a DCC decoder is selectable when it is not currently in-use on another throttle.

Service Mode Programming: service mode programming information sent by the command station or programmer as a broadcast signal that goes out to all decoders on the track.

Slot Following: when more than one DT throttle has a single loco address selected, both DT throttles will have control of that address and both throttle displays will be updated with the same information. In other words, both operators will see what the other is doing.

Speed Steps: because DCC is a digital system, locomotive speeds are defined as discrete speed steps. This means that as motor voltage is increased, the speed of the locomotive increases in a straight line from stop to full speed with discrete speed values at each voltage.

Split field Motor: Another term for AC motor

Standard Mode (14 Speed Step Mode): the motor voltage/speed curve of the DCC loco from stop to full speed has 14 discrete speed steps. This means that speed control will be limited to just 14 steps. 14 speed step mode gives reasonably good speed control. Increasing to 28 speed step operation will give much better speed control and going to 128 speed step operation will give really excellent speed control. Standard mode is offered in many command stations because there are some decoders on the market that are not capable of 28 or 128 step mode.

Start Voltage (V-start): the voltage added to the motor drive voltage at the first speed step. This adjustment allows you to trim the loco to compensate for its motor efficiency.

Status Editing Decoders: a DCC decoder's status can be manually changed by a Digitrax command station at any time the decoder is selectable.

Stealing a Loco: overriding the in-use interlock and forcing the throttle to select an in-use loco. This can result in having two throttles logged on to and controlling one address. See also Slot Following.

t: thrown indicates that the turnout is set for the diverging route. For op switch set ups, consult your manual for the meaning of c and t.

Throttles: Throttles are input devices that tell the Command Station what you want the decoders to do. You can have many throttles on your system. The number is determined by the capabilities of the Command Station you are using. You can also use a computer to create "soft" throttles. Sometimes throttles are also called "Cabs."

TOP Locomotive: Digitrax calls the locomotive that other locomotives are consisted to, the TOP locomotive because it is not necessarily the lead loco in the consist. The TOP locomotive address controls the speed and direction of all locomotives consisted to it.

Transponding: The use of transponders installed in rolling stock and transponder detectors installed in the layout to allow the system to determine the location of a particular piece of rolling stock on the layout. Other information about the rolling stock such as speed, direction, etc. can also be determined. Transponding is useful for automation of staging yards, dispatching and for realistic sound systems.

Universal Consisting: the command station handles all consist information and lets you consist locos with any DCC decoder as well as analog locos. The locos can be added to and deleted from the consist in any orientation head to head or tail to tail.

Y: Yes use the Y / + key to answer questions in the DT402 text message display.

Zero-Stretching: incorporates a time period between packets to give you an effective DC offset between the two rails. This allows you to control a DC locomotive along with the DCC locomotives on a DCC system.

FCC Information

Radio or TV Interference: (this information is MANDATED by the FCC) This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measure

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note that any modifications to the equipment not expressly approved by Digitrax voids the user's authority to operate under and be in compliance with CFR 47 rules, as administered by the Federal Communication Commission. Digitrax believes any conscientiously installed equipment following guidelines in this manual would be unlikely to experience RFI problems.

For Canadian Users:

“This digital apparatus does not exceed the Class B limits for Radio noise emission from digital apparatus set out in the Radio Interference Regulation or the Canadian Department of Communications.”

Le present appareil numerique n emet pas de bruits radio-electriques depassant les limites applicables aux appareils numeriques de la classe B prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

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