

Digitrax Big Boy Set & DT200 Throttle User Manual

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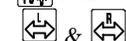
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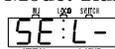
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1.0 Introduction:

Congratulations on your purchase of a Digitrax DT200 Digital Command Station and Throttle combination!

The overall design of the Digitrax Command Control system allows you to create a working layout by connecting various system components in the configuration that best meets your needs. The Digitrax system drastically reduces and simplifies layout wiring; you probably won't need to rewire your existing system.

To create a DCC system you will need a Command Station, a Booster, a Throttle and several mobile decoders for your locos. LocoNet is the communications network Digitrax products use to put it all together.

- Each system has one Command Station that generates the DCC packets that tell the decoders what to do and produces Rail Sync so that all the devices you attach to LocoNet work together. A command station can be as simple as Digitrax Challenger or as complicated as a computer.
- Boosters receive the DCC 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.
- Throttles are input devices that tell the Command Station what you want the decoders to do. You can have several throttles on your system. The number is determined by the capabilities of the Command Station you are using. When the DT200 is the command station you can run up to 20 throttles at a time.
- The Decoders in the locos or under the switches receive the signal from the track, decode it and tell the loco or switch what to do.
- There are many different combinations of Digitrax products that you can use to set up a system that is just right for your application. You can also combine Digitrax products with DCC compatible decoders, boosters and computer software made by other manufacturers.

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 DT200. We have included lots of hints and operating ideas based on our experience with the Digitrax system. If you have questions not covered by this manual please contact your dealer.

2.0 DT200 Command Station/Throttle Features and Specifications:

- The DT200 is a combination DCC Command Station and Throttle. It can operate either as the command station on a LocoNet system or as an advanced throttle on LocoNet when another device is acting as the command station.
- Compatible with the NMRA Baseline DCC standard. Also incorporates many advanced recommended practices.
- Digitrax LocoNet network forms a simple, reliable interconnect between all Digitrax Command Control System components using extremely reliable and convenient gold plated RJ12 6 pin modular telephone jacks.
- Control up to 127 locomotives (126 DCC & 1 Analog)
- Built in programmer allows you to program each individual decoder's acceleration, deceleration, start-voltage, mid-point voltage, loadable speed table, etc.
- 128 speed step operation! You can select 14, 28, or 128 speed step operation for each individual decoder so you don't have to sacrifice performance if you have some decoders that have 128 speed steps and some that don't.
- LCD display & LED indicators show throttle status at a glance & make operation easy.
- Use either knobs or buttons to control speed and select addresses.
- Encoder Knobs give incredibly fine speed control. And when you select another loco, the knob position does not change the speed of that loco. No more rushing to adjust the throttle to match the loco's speed!
- UniVersal™ Consisting lets you use any DCC decoder for consisting. You can even include an analog loco in a consist.
- Add & delete locos from MU lash-ups with a few simple keystrokes.
- Run locos within a consist in any direction you choose. Head to head or tail to tail.
- Precision speed matching is a reality with Digitrax decoders with loadable speed tables.
- Control directional lighting & 4 additional function outputs from the keypad. Sound controls for bell & whistle are on F1 & F2. F2 is a non-latching control that allows you to sound the horn for as long as the key is held down.
- Control up to 127 switch addresses from the keypad.

3.0 Big Boy QUICK INSTALLATION GUIDE

These simple instructions will get you up and running quickly. You can investigate the specifics later but, for now let's get your trains running. If you are upgrading from a Challenger system, simply use the DB100 booster that came with it and follow these instructions. A full description of all controls and technical reference information are included in this manual.

See the Hook Up Diagram: DT200 & LocoNet. These instructions are based on using a Digitrax DB100 series booster. If you wish to use a booster made by another manufacturer please contact your dealer for more information and consult the manual for the booster you are using before you proceed.

3.1 Making track & booster connections

See the Hook UP Diagram for set up instructions.

A) Start with a DB100 series booster and your conventional power pack or other suitable transformer. The DB100 accepts either 50/60 Hz AC or DC input. The power pack must be overload protected for a maximum output of 5 amps. Minimum input voltage is 12V AC or DC. Maximum input voltage is 22V AC or 28 V DC. You can use either AC or DC from a model railroad power pack or you can use a generic transformer

Transformers

There are many transformers and power packs that can supply the input power for the DB100. Most regular DC train control packs do not have enough power to supply the full power potential of the DB100 booster, since they were designed to only run 1 locomotive in a blocked system. To get the full power potential you may hook up a suitable alternative transformer.

You should be very careful in hooking up a transformer to be sure that you do not create a shock or fire hazard. Many modelers have safely hooked up line transformers when creating their own conventional DC throttles, from one of the many "do it yourself" project articles. If you are not comfortable with the 110 Volt input wiring, we strongly suggest you consult with an electrician or other competent electrical person.

The following is an example list of components for building your own low cost power supply for use with the Challenger Set, Big Boy Set, Chief Set or additional DB100 series booster.

Description	Part #	Est Cost	Supplier
16V AC 6.25 Amp Transformer	4-06-8016	\$19.95	MCI Trans
Line Cord	Q114-ND	\$ 1.31	DigiKey
1 Amp 3AG Slo-Blo Fuse	F319-ND	\$ 4.01 per 5	DigiKey
3AG In Line Fuse Holder 150145	F049-ND	\$ 2.32	DigiKey
5 Amp Fuseholder-type Circuit Breaker	PB186-ND	\$ 2.89	DigiKey
Heat Shrink Sleeving			DigiKey

The Phone Number for MCI Transformers is 1-800-MCI-TRAN (In NY dial (516)587-0510)

The Phone Number for DigiKey is 1-800-DIGIKEY (DigiKey is also an excellent source for 6 conductor phone wiring supplies needed for the LocoNet Network connections described later.)

Transformers and transformer kits are also available from you Digitrax Authorized Dealer.

- 1) Most important is to be sure the 110V input voltage is safely isolated from the low voltage secondary of the transformer. A properly installed safety ground will ensure that the layout cannot become a shock hazard if there is mis-wiring or insulation failure.
- 2) You must protect the primary and secondary windings of the transformer from overload. A typical primary (input side) protection would be a 1 amp "slow-blow" fuse (in an appropriate fuse holder) wired in the primary line circuit. For the secondary (output side) we recommend a circuit breaker rated no more the *minimum* of either the transformer secondary current rating or the DB100 output current rating.

B) Connect the two GRAY terminals of the DB100 with a piece of wire to force the DB100 to power up as a booster.

C) Set the  SCALE switch on the DB100 to the scale you are running. (N, HO, O(G)\S). For best low speed performance we recommend using the DB100 in the "N" scale setting (even if you are running HO). *When running analog locomotives (without decoders) we strongly suggest that you use the DB100 "N" scale setting to give quieter operation and generate less heat build up in the analog engines.*

D) Set the  MODE switch on the DB100 to the RUN position.

E) Plug the LA-2 LocoNet Adapter RJ12 6/6 plug into either to the DB100's LocoNet ports.

F) Connect the LA-2's Orange & Gray leads to the DB100's two terminals marked RAIL A and RAIL B. Connect the track to the same RAIL A and RAIL B terminals *Make sure no other power packs are connected to the rails used by the DB100.*

Note: We recommend that you use *stranded* 12-14awg to connect your DB100 to your track because it is easier to connect stranded wire to the DB100's push terminals.

G) Connect the two terminals marked POWER IN to the output of your transformer. Power up your booster and the DB100's "POWER ON" & "OVER TEMP"/"FAULT" LEDs will be lit.

3.2 Making A DT200 The Command Station

A) Install the battery. *Before plugging the DT200 into ANY jack*, install a 9V battery in the battery compartment at the lower rear of the unit. The positive "+" end of the 9V battery is toward the bottom of the DT200, as marked in the battery compartment. The unit is protected against incorrect battery polarity. The unit will beep and display **IdLE** in the display when the battery is correctly installed.

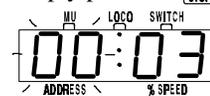
B) Before you plug in the DT200, set up your DT200 as the command station for the system, press  (Run/Stop) &  (Right Hand Reverse Arrow) simultaneously & hold for a couple of seconds until the unit beeps. (The Run/Stop must be pressed just ahead of the Right Arrow.) The "MST" LED indicator will now glow GREEN and the **IdLE** message in the display will change to **SE:L-**. Note that the small LCD indicator under the "LOCO" text above the display will be ON indicating the unit is in the LOCO mode.

C) Plug the DT200 into the "A" end of LA-2. The DB100's "TRACK STATUS" indicator light will glow ORANGE to indicate that the system is powering the track and the "OVER TEMP/FALUT" indicator will no longer be lit.

3.3 How to select the locomotive you want to run

A) Turn the Right hand knob a 1/8 turn in either direction to activate the Right hand Throttle. The display will show **SE:L-**, indicating that no Locomotive is selected on the Right Throttle and *prompting you that the  key must be pressed to activate a selection in this throttle.*

If at ANY time the center colon : in the display is flashing, it means the layout is in "STOP" and all locomotives are stopped. To return to the "RUN" mode simply press the  key for about a second, until the colon : stops flashing.



B) Press the  key to select an address. The display will show **00:03**, with the 2 digits in the "Address" side (left hand side) of the display flashing to let you know that you need to select an address.

C) Turn either throttle knob, or use the   keys, to scan through the addresses until you reach the address number of the loco you want to run. Notice, turning the knob clockwise increases the loco address number and turning the knob counterclockwise reduces the loco address number. When you have scanned to the address you want, press the  key again to SET this address *active* in the Right throttle. The display will stop flashing and

the direction indicator next to the Right throttle will flash GREEN indicating the Right throttle is the "active display" throttle and the locomotive is going forward. If you press the  (Right arrow) key to change direction, the direction indicator will flash RED indicating that the loco is in reverse.

Note: The decoder shipped with all Big Boy Sets is programmed to address 03.

The analog loco address is 00. If you are using decoders programmed with a Challenger Set, refer to the chart at the back of this manual that translates Group/Color designations into numeric addresses.

D) Turn the Right Throttle knob clockwise and the % SPEED in the left hand side of the display will increase about 1% per step or click indicating that the locomotive you have just selected is being run in 128 speed step mode. As the value in the % SPEED display increases, the locomotive on the track with the matching address will begin to move in the direction indicated.

Note: The DT200 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, please refer to section 9.8 & 9.8.1 for instructions to modify the speed step mode for this locomotive.

If you can't control the operation of the lights in your locomotive with the DT200 (in default 128, or 28 speed step mode), be sure that the decoder is programmed in advanced 28 speed step mode. Please refer to Section 14.5 "Strange Lights" for corrective measures.

Note: The display shows Address & % SPEED for throttle that is active. The active throttle is the one with the flashing direction indicator. For complete locomotive programming instructions see section 12.0.

3.4 Selecting a second locomotive to run

A) Turn the Left throttle knob about 1/8 turn to activate the left throttle. The display will change to **SE:L-** to show that the Left throttle is active but has no loco selected. Press the  key. Follow the procedure in step 3.3 B above & scan for the locomotive address you want to run with the Left throttle. When you have scanned to the address you want, press  to SET this address as active on the Left throttle. Now use the Left throttle to run the loco selected.

B) The Left throttle direction indicator flashes GREEN indicating that the Left throttle information is currently displayed & the loco's direction is forward. Since the display can only show information for one throttle at a time, the throttle direction indicator shows which throttle is on display by flashing. Notice *when we started working with the Left throttle* that the Right direction indicator stopped flashing and became a steady color indicating the direction of the Right throttle's locomotive. To display the Right throttle address & % speed all you have to do is move the throttle knob or change the loco's direction.

By now you are running two locomotives and have learned some of the key concepts of using the DT200 to run locomotives!! Please read the following

sections for more in depth information about other features and capabilities of the DT200. ENJOY!

A few simple things to look out for the first time you hook up your DT200:

If you try to access a loco address that is active on another throttle, when you press  to set the address, the display will change back to **SE:L-** and the throttle direction indicator will **not** light up. The address SET request failed because the LocoNet system doesn't allow you to select a locomotive address that is active or *in-use* on another throttle *anywhere* else on the system. This is true even if the loco address is being used by a completely different throttle or even a remote computer hooked up to the system! At this point just press  again and scan for a different loco address that is not "*in use*."

During loco address selection, the right hand side of the display shows complete status information of any locomotive address in the display. We call this feature "browsing." Sections 9.8-9.8.2 give details of locomotive status codes and what they mean. You only have to be aware of this feature if you want more complex operations. But for now just take some time and have fun running your trains!

3.5 Shutting Down the System When You Are Finished

When you are finished with your operating session shut down the Big Boy by simply pressing  (Run/Stop) &  (Left Hand Reverse Arrow) simultaneously & hold for a couple of seconds until the unit beeps and displays **idLE**. If you plan to "start from scratch" next time you operate and set up new throttle assignments and consists then simply unplug the DT200 & remove the battery. (Note: the battery can be stored in reverse polarity inside the DT200 when it is not in use with no adverse effects to the unit). If you wish to retain the DT200's information you will need to do one of the following 1. If the LocoNet is going to be OFF for a long time, we recommend changing the Command Station to Advanced Throttle mode (See section 8.1) so it can go IDLE and reduce its power consumption. If it is subsequently re-selected as a Command Station it will remember **exactly** its state prior to being IDLE, as long as the battery is not removed or the unit is not RESET (See section 8.7). See section 13.0 for how to construct a Keep Alive Power Jack.

Hook-Up Diagram: DT200 & LocoNet

4.0 Track Wiring Considerations

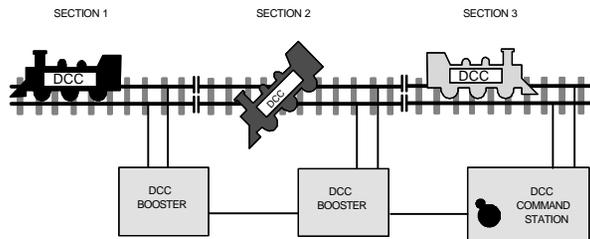
Early proponents of DCC touted the fact that you can hook up your railroad with just two wires. While this is technically correct, there are some issues that need clarification. You should have feeders to each rail every 10 feet or so from the power bus. The general rule is: if your trains will run on your track with regular DC then they will run on DCC. Unless you need to section your layout for added power, the only gaps you need are for hard shorts like reverse loops & 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 & you are ready to go. If you are using common rail wiring and need to section your layout, you will need double gaps to separate the sections.

Remember, no matter how you control your trains, you should always use safe wiring practices.

4.1 Sectioning the Layout

Even though blocking is not required for train operation with DCC, sectioning the layout may be indicated:

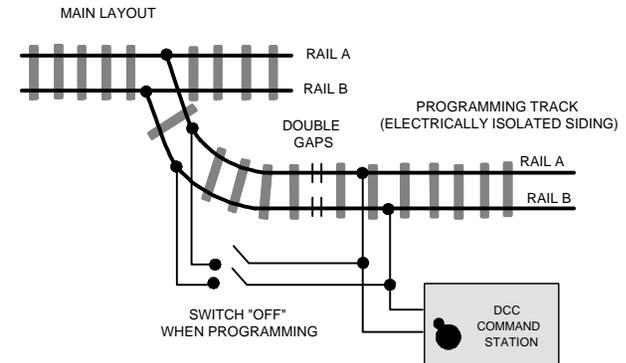
1. To provide additional power to operate more locomotives than one power supply can handle. For example a 5 amp booster and power supply will operate between 6 and 10 average N-scale locos and between 4 and 6 HO locos.



2. To prevent total layout shutdown when shorts occur in any given section. If a short occurs in one section, only that section shuts down, the rest of the layout keeps operating.

To section the layout you will connect additional boosters and power supplies. To do this, connect the DB100's two gray terminals, SYNC & GROUND, with a short length of wire and set the Mode switch to RUN to set up the DB100 as a booster when it is initially power up. Connect to other DB100's on LocoNet via either LocoNet Port A or B using regular 6 conductor RJ12 extension cables.

4.2 Separate Programming Track



Decoders are programmed when the command station sends programming information to them through the rails. This information is sent as a broadcast message to any decoder that is listening. This means that you could reprogram all the locos on the track with one keystroke. To prevent this, it is useful to add an isolated programming track to your layout and program locos as follows:

1. Run the loco you want to program onto the programming track.
2. Throw the switch to disable the rest of the layout.
3. Switch your command station to program mode and follow the manufacturer's instructions for programming the decoder.
4. Switch the layout back on and run your trains.

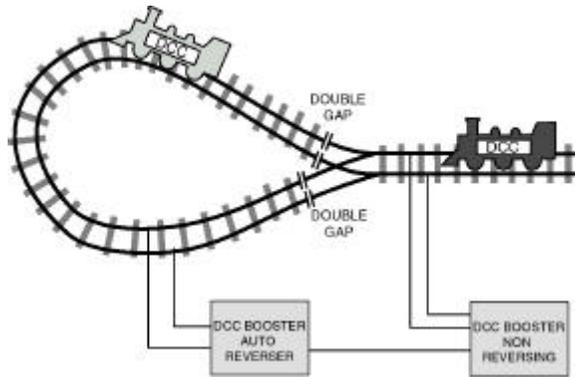
4.3 Reverse Loop Wiring

You can operate reverse loops manually or automatically with Digitrax. You must double gap (completely isolate) both ends of the reversing section.

If you choose manual operation, power the reverse section with a separate transformer and use a switch or relay to handle the polarity change as the loco enters & leaves the reversing section.

If you choose to use an additional DB100 auto reversing booster to completely automate the reversing section, power the reverse loop with a separate DB100 and transformer. Set up the reversing DB100 as follows: On the DB100, connect the two gray terminals, SYNC & GROUND, with a short length of wire and set the Mode switch to P/R to select the auto reverse mode when the unit is initially powered up. Connect to other DB100's on LocoNet via either LocoNet Port A or B using 6 conductor RJ12 extension cables.

Note that when the polarity change occurs, DCC equipped locos will continue at the speed & in the direction commanded but any analog engines running will reverse direction because they see the polarity change and respond to it.



Two DB100's are needed to perform the auto reverse function. One DB100 acts as the master system phase reference and the other handles the polarity reversal for the reversing section.

One DB100 can be used to handle more than one reverse section at a time however, the unit can only fix 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 the double gap at a time.

4.4 Bi color Track Indicators

Hooking up Bicolor LED indicators around the layout is a convenient way to see the power status of sections of the layout at a glance. The LED indicates whether a track section is powered up, if "Zero-stretching" Analog mode is being used and its local direction, and can even be used to indicate if the GAPS in a reverse section are matched or not.

You will need:

- One 2 lead bi-color LED (Radio Shack #276-012)
- One "ballast" or "current setting" resistor. We recommend a 1K 1/4 watt resistor (Radio Shack #271-1321) for reasonable brightness and current levels.
- Connect the 1K resistor in series with either one of the LED leads to make a "ballasted" LED.
- With the 2 leaded bi-color LED there is no strict polarity to observe, the emitted color will depend on the direction the LED leads are connected to the track.
- Simply connect the "ballasted" led across the track to indicate the track is powered. If you connect a "ballasted" led across one of the double gaps of a reverse section the LED will be OFF (not lit) when the gap polarity is matched.

4.5 LocoNet Wiring Components

SOURCE OF RJ12 COMPONENTS

For a convenient source of a wide range of in stock, reasonably priced LocoNet throttle network RJ12 connection products we recommend DIGIKEY. The RJ12 is the 6 pin version of the RJ11 connector with all 6 pins loaded with conductors. This is the connector Digitrax uses for LocoNet and the Challenger throttle bus.

DIGIKEY Phone # 1(800) DigiKey (1(800)344-4539).

They accept VISA/MASTERCARD, and will ship UPS/FEDEX.

Suggested parts and Digikey part #'s

Cable Couplers and Wall plates

Part Number	Description
048-0051-ND	6 Wire Adapter (1M-2F)
048-0056-ND	Fem Coupler, Crossed
048-0060-ND	Dual RJ12 Wall Plate

CABLES with RJ12 plugs already on both ends

Part Number	Description
H2662-07-ND	7' CABLE W/PLUGS, BLACK
H2662-14-ND	14' CABLE W/PLUGS, BLACK
H2662-25-ND	25' CABLE W/PLUGS, BLACK.

If you are wiring the throttle bus for Challenger use, be sure that all pins are connected in the same order when connecting to a wall plate as they are when connecting to a DB100 command station/booster. If you are only using the wiring for a LocoNet throttle network you need not worry about this, **since LocoNet was designed to work for either cable connection orientation.** Note that a Challenger throttle bus can simply be upgraded to LocoNet throttle network with no modifications. To use existing CT4's or CTX/CTY's on the full digital LocoNet you will need a CT4 LocoNet adapter, which will be available from Digitrax in Winter '96.

The Digitrax Universal Panels UP-1, UP-2 & UP-3 provide simple plug and play alternatives to wiring RJ12 phone jacks around the layout. The UP-1 is shown in the hook up diagram. This fascia mounted panel provides 2 RJ12, 1 5 pin DIN, & 1 1/4" Stereo jacks as well as "Track Status" and LocoNet Busy indicators. Instructions for changing the RJ12 plugs to the DIN or Stereo type plug on the DT200's that you use as walkaround throttles are included with the UP-1. The DT200 used as the system Command Station must remain wired with the RJ12 plug. The back of the panel provides 3 RJ12 jacks for daisy chaining from the "B" end of the LA-2 to the first UP-1 to the next UP-1, UP2, or UP3 and so on. Rather than wiring each outlet you simply use 6 conductor phone wire with male plugs on each end to make the connection from one Universal panel to the next. UP-2 provides two 1/4" stereo jacks in front and two RJ12 jacks in back. UP-3 provides two RJ12's in front and back and keep alive jack capability. Other LocoNet devices such as the DS54 can also be plugged into LocoNet via the Universal Panels. For more information, contact your local dealer.

5.0 LocoNet: The Digitrax Difference!

LocoNet is a powerful communications network specially designed for model railroad operation. It is engineered for rapid response even when many throttles & other devices are connected to the network.



To engineer LocoNet, we used all of the best features of the powerful Ethernet CSMA/CD Local Area Network, the most universal worldwide hookup standard for computer networks. We ensured that LocoNet's protocol was Peer-to-Peer, which any LAN expert will confirm, gives the most powerful and expandable software architecture.

LocoNet offers you a powerful yet SIMPLE "plug and play" connection scheme for wiring a high performance Digital Command Control railroad layout. LocoNet is cost-effective and easy to maintain, & gives excellent high speed total system performance. In particular, the system is designed to be sure that as 100 or more throttles and hundreds of sensors and other devices are added to the system, there will be no operator perceptible delays as the LocoNet **system** executes all the operators' requests. Only a Peer-to-Peer type technology on a true two-way Multiple Access network can meet these performance and expandability targets.

Your LocoNet network allows very simple, "free form" wiring and has passed the stringent Radio Interference rules of FCC Part 15 Class B, as required for home installations. This makes adding extra devices and features simple- **no complex Bus connection and terminator rules to worry about.** We have even run throttles and sensors on a LocoNet system over 2,000 feet long using "vanilla" telephone wire!

LocoNet is expandable so that as new features are added you will simply connect and "overlay" these capabilities to your existing working LocoNet system *without disruption or any changes to existing hardware and software.* Only a carefully crafted and smart Peer-to-Peer network can offer this open-ended expandability.

So, LocoNet is more than just hardware, it is a number of operating system, hardware, wiring, communications architecture and software innovations that are synthesized together to create the total LocoNet system concept. To the average user this means **Sophistication without Complexity.** You have a system that is easy to hook up, run and expand in the future. You don't need to worry about the high-tech details; Digitrax has already sweated them out for you. Just enjoy operating your layout- it's that simple and powerful!

6.0 DB100 Control Panel:

6.1 Power Input

The two power in terminals on all Digitrax boosters & command stations are the power input connections. The current capacity is designed to drop off by about 10% at maximum operating temperature. **Never share a common power source between multiple Digitrax products.** Each unit should always have its own dedicated power supply.

DB100 Power Requirements:

AC or DC	AC 50/60 Hz	DC
Max Input	22V RMS AC	28V DC
Min Input	12V AC	12V DC
Max Input Current	5 Amps	5 Amps

TECHNICAL NOTES

To ensure protection from electrical shock, fire hazard or poor unit operation, the power input must be from a National Electrical Code Class II, UL listed Safety Extra Low Voltage (SELV) supply. The user assumes all risks associated with using a power supply that is not safety and capacity rated for driving the DB100. A fuse or other positive overload safety device *must be present in the power supply leads.* In no case should the fuse rating be more than a 5 amp slow-blow fuse, and should be no greater than the current output capacity of the Class II power supply.

The power supply should not be shared with any other equipment, to prevent unexpected phasing or short circuit problems. To ensure correct RFI performance the power input must be floating in that neither lead is connected to the Safety ground of a typical 110V power cord. The AC power safety ground should be connected to the GRAY GROUND terminal on the DB100a. Minimum input voltage is 12V DC or 12V AC rms to ensure correct operation of internal logic. The power to the DB100 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.

The unit 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. This means that large input voltages when smaller output scale (e.g., N scale) voltage limits are selected will cause greater heat buildup in the unit, as the output load current is increased to the maximum. Over temperature thermal shutdown may occur in this situation. This protects the components from thermal stresses that degrade long term reliability. The ratings and "operating envelope" of power input and output are conditional on not generating over

temperature conditions. Over temperature is not directly injurious to the DB100 or its reliability, but will cause the inconvenience of automatic temporary suspension of track power. Each installation will be affected differently due to normal room temperature, cooling airflow around the DB100, scale voltage in use and load current draw. Over temperature shut down is usually not encountered except in the case where a user is pushing for maximum available power rating.

6.2 Power On Indicator

This green LED indicator glows when input power is ON. The DB100 will indicate power ON in most situations because it draws less than 1 watt when on Standby with Track Power OFF. The **○** POWER ON LED will continue to glow for several seconds after power to the unit is turned off.

6.3 Ground Terminal

The 2 terminals marked **GROUND** provide electrical safety features and an RF ground reference for minimum radiated noise. (**Either ground terminal may be used**) It should be the **ONLY** point of any DB100 installation that is connected to the AC safety ground pin provided on most 3 pin 110V AC power sockets.

TECHNICAL NOTES

If the power outlet is a 2 pin ungrounded unit, this ground terminal can be connected with a GREEN 14 AWG multi-stranded conductor to a cold metallic water pipe ground, as defined in the National Electrical Code. This is a safety precaution that should not be ignored.

6.4 RAIL A RAIL B Terminals

Connect these terminals to the track or track feed conductor bus on all Digitrax Boosters and Command Stations. Note: We recommend that you use *stranded* 12-14awg to connect your DB100 to your track because it is easier to connect stranded wire to the DB100's push terminals.

TECHNICAL NOTES

The output is a BALANCED drive to the two track lines. This means that the two track terminals both develop drive voltage with respect to the ground terminal and neither track lines or extensions of them should be shorted to ground. In addition, the two terminals are driven "out-of-phase" so that while one is at a small voltage with respect to ground, the other is at a larger voltage with respect to ground. This is a characteristic of the DCC command signal and the *balanced* line drive helps keep unintended radiated radio emissions to a minimum. The implication for you as a user is that the track sections must be isolated, and "phase" of each track, i.e., the side that is connected to the RAIL A of a Digitrax track terminal, is important. This issue will be important on large layouts where the layout is isolated into many sections with individual Boosters driving them. This is very beneficial in a DCC driven layout because it allows the rest of the layout to keep running even when an isolated track section experiences a short-circuit or problem; such as a derail or balky switches that shut it down. This is similar to "blocking" in a conventional layout. With DCC this is a recommended but, optional layout practice.

Connections to a large layout should be via a parallel conductor power bus similar to the recommended practices used in most conventional layouts, with appropriate larger copper conductors feeding taps up to the track every 10 feet or so. It is advisable to keep all conductors twisted to keep the geometry best for minimum RF radiation. Some experimentation may be needed on your layout to ensure no circulating ground loops are present. Try to wire all the power feeds away from the boosters and command stations, in a radial "star like" configuration so no large "magnetic induction" loops are created. **It is not possible to place filter or ANY capacitors across the track as these will short out the DCC signals. Be sure that no capacitors are bridging your DCC sections.**

When converting between Digitrax DCC track sections and adjacent conventional DC powered tracks, **both rails must have insulating gaps**. The DC supply *must have*

some form of current control, we recommend a 5 Watt to 10 Watt 12 Volt lamp be placed in series with one of the DC power pack supply leads. This allows the DCC booster to drive the locomotive properly onto the DC track with minimum interruption and stress to the Booster and decoders and locomotive wheels. The lamp will light as the locomotive bridges the gaps. You should try to cross these gaps quickly and not bridge the two systems for any longer than necessary.

6.5 TRACK STATUS Indicator

The **○** Track Status indicator shows that there is voltage on the track drive terminals. The color indicates the signal type. If it is orange the track is getting normal DCC signal with no analog zero stretching. See below.

TECHNICAL NOTES

The color of the TRACK STATUS led is an indication of the signal type. If it glows orange, the track sees a normal DCC signal with no "zero stretch," and a conventional locomotive on the track will hum gently and not move. If the color is green, a negative "stretched zero" signal is being boosted for operation of a conventional locomotive. A red led color indicates a "zero stretch" analog signal is being transmitted to the rails for a conventional locomotive to be operated in the reverse direction. The DCC decoder equipped locomotives are still reading their Digital commands normally and performing as commanded. If the Track Status LED is not lit there is no voltage on the track, the track power to the DB100a may be OFF. Note that during short-circuit faults, a sophisticated recovery strategy is being executed by a DB100a that will periodically attempt to restore power to the track.

6.6 OVER TEMP or FAULT Indicator

The DB100 will automatically shut down when the heat sink temperature rises to approximately 45 to 50 degrees Celsius and the **○** OVER TEMP or FAULT indicator will glow red. The DB100 automatically resumes operation when the heat sink cools down to approximately 40 degrees Celsius.

In some DB100 boosters, the over temp indicator will also be lit when there is no track status. This is normal and you should not be alarmed.

TECHNICAL NOTES

If the unit shuts down frequently try the following remedies;
move the unit so that the heat sink has an unimpeded flow of cool air
lower the track load current
reduce the input voltage
place the unit out of direct radiant heat e.g. sunshine or room heater
try direct cooling air onto the heat sink from a small fan.

Note that if the unit is being run too close to its preset current limit, it may clip or mutilate some outgoing packets to keep the track current within acceptable limits. If this happens often, the DB100a will react like there is an overload and briefly shut down and beep 5 times. In this case the track is not truly short circuited, but overloaded. Reduce the track current load, or partition the layout into more isolated DCC sections, using additional boosters.

The DB100a current limiting strategy is very safe for use with your expensive brass locomotives, and *WILL NOT* weld them to the track if derailed. The DB100a senses the short circuit very quickly and shuts down track power if the problem persists for more than a few thousandths of a second. The unit will back off and beep 5 times giving a few second delay before sensing if the fault has been cleared. The resetting strategy is sophisticated to be sure damage is not likely during a track fault. The unit automatically and conveniently powers up the track again when the fault is cleared.

6.7 SYNC Terminal

The DB100's **SYNC** terminal allows the connection of expansion boosters without repeating the actual signal on the track drive terminals. The use of this terminal is specific to each Digitrax booster and command station. It lets you choose how you will use the DB100. You decide whether the DB100 is simply a Booster, an "Intelligent Auto reversing"™ booster or a multi-featured **CHALLENGER**™ Digital Command Station.

Set Up Of DB100 Operational Mode

6.71 Challenger Command Station Mode:

Use this section only if you are running a Challenger.

If you don't connect the gray terminals (SYNC & GROUND) or if you connect them with a BC-2 Cable to run slave boosters on your system, the DB100 will select the command station mode when it initially powers up. Use the BC-2 cable when the Sync terminal is driving slave boosters on the system. An example of this is using a second DB100 running as a booster in the Intelligent Auto reversing™ mode to automate a reverse loop.

6.72 Regular Booster Mode:

Use this section when you set up your booster to run with a DT200 as a Big Boy, or as an add on booster for a Challenger, Big Boy or Chief Set. Connect the two gray terminals, SYNC & GROUND, with a short length of wire, to select the **booster** mode when DB100 is initially powered up. If you are adding boosters to a Challenger Set, connect the first additional DB100 using BC-2 cable described in the Challenger Manual. If you are adding additional boosters to a Big Boy or Chief, simply use 6 conductor male to male telco type wires for these connections. See Hook Up Diagram for details.

6.73 Intelligent Auto reversing™ booster MODE:

Use this section to configure your booster as an automatic reversing booster.

Connect the two terminals, SYNC & GROUND (either one), with a short length of wire and set the  Mode switch to P/R to select this mode on initial power up. If you are adding boosters to a Challenger Set, connect the first additional DB100 using BC-2 cable described in the Challenger Manual. If you are adding additional boosters to a Big Boy or Chief, simply use 6 conductor male to male telco type wires for these connections. See Hook Up Diagram for details.

6.8 LocoNet Ports A & B

These are the access ports for expanded Digitrax systems that allow you to daisy chain additional Digitrax products using cost-effective phone style flat cables.

You will use one of these ports for your LA2 and the other is available for booster bus expansion as detailed in the Hook Up Diagram.

TECHNICAL NOTES

The pinouts for the two RJ11 6 pin connectors are identical, and they are wired in parallel. Looking into the DB100a, pin 1 is in the Telco standard position to the RIGHT side. We use the convention of white conductor in the cable to pin 1:

PIN#	WIRE COLOR	NAME
1	White	RAIL_SYNC-
2	Black	GROUND
3	Red	LOCO_NET-
4	Green	LOCO_NET+
5	Yellow	GROUND
6	Blue	RAIL_SYNC+

The signals RAIL_SYNC+ and - are used by the booster modes of the DB100. These are high impedance differential line decoder inputs that may be used to connect a command control signal for boosting to the track. They have an input common-mode range of +/- 20V with respect to the ground terminal. The differential drive signal should be above 2 volts, as input hysteresis is built in. Common mode rejection on the input allows the unit to boost from a different system without sharing ground connections and needing "opto-isolation". Just connect RAIL_SYNC- to the ground reference of the signal source and RAIL_SYNC+ to the signal, assuming a signal of say +/- 5 V. For an input signal on RAIL_SYNC+ that swings from ground to say +5V, connect the system grounds and connect RAIL_SYNC- to ground via a 22 Kilohm 1/4 watt resistor.

6.9 Mode switch

This is the most important operational control on your booster.

- A) If the DB100 is running as a **CHALLENGER**™ Command Station it controls whether the track power is ON or if programming operations are enabled.
- B) If the DB100 is configured as a booster it controls whether track power is on. When the DB100 is a booster, (determined by SYNC terminal connection at input power on, see 6.7 above) turn the switch  OFF to turn off track power even if input power is present.
- C) Moving the switch to  P/R tells the unit to be an Auto Reversing Booster and  RUN tells it to be a regular Booster. *Switching to the P/R setting after initial power on will not change the auto reversing characteristics until the unit is turned off and powered up again.*

6.10 Scale Voltage Switch (O/G HO N)

This switch sets the maximum track Voltage limit appropriate for the selected scale. These settings allow operations of locomotives at levels close to the S9 NMRA values.

SCALE	MAX TRACK VOLTAGE
N	12V
HO	15V
O/G	20V

DT200 Control Panel

TECHNICAL NOTES

For **N scale** the limit is approximately +/- 12V peak on the track and is a couple of volts less at the motor brushes in a locomotive, accounting for rectifier diode and transistor voltage drops and booster output voltage drop due to full load current.

For **HO scale** selected the output voltage is approximately +/- 15V peak to allow full voltage at the motor brushes after decoder losses.

For **O/G scale** the output voltage is approximately +/-20V, for operation of locomotives that need a higher maximum brush voltage.

7.0 DT200 LocoNet Throttle Control Panel

7.1 General color codes

The DT200 is color coded according to how the keys are used.

The GREEN colored keys and indicators are for loco speed and direction control.

The only RED key is Run/Stop. This is so you can't miss it in case of emergency.

The BLUE keys are related to function control. When the function mode is active, the green keys in the bottom row take on the blue meanings F3, F1 , F2 , F4.

7.2 The Left & Right Throttle Knobs

The Throttle Knobs on the DT200 are actually "encoders." They give very smooth, fine speed control. In 128 speed step mode it takes several complete turns of the knob to go from stop to full speed. When you select a locomotive that is moving and set it on a Throttle Knob, the Throttle continues to run the locomotive regardless of the position of the Knob.

7.3 Direction Indicators

Red=Loco in Reverse

Green=Loco in Forward

Flashing=Throttle Active in Display

7.4 Program Mode Indicator

Indicates that the DT200 command station is in the program mode.

7.5 Master Command Station Mode Indicator

Indicates that the DT200 is acting as the Command Station or Master for the system.

7.6 LCD Display

The LCD display shows the current Operational Mode the DT200. The MU, LOCO & SWITCH mode indicators are across the top of the display. Only one of these will be lit at any time. The DT200 defaults to the LOCO mode and will return to this mode if you change to another operational mode and don't do anything within about 6 seconds. Use the  key to toggle among these operational modes



The colon : indicates whether the unit is in Run (: not flashing) or Stop(: flashing).

The numbers & letters have different meanings depending on the mode the DT200 is in and the functions you are executing. They may be flashing or not. A flashing display is usually a prompt for the user to do something.

7.7 Run/Stop

Press to toggle between RUN & STOP. See section 8.0 for other special uses for Run/Stop.

7.8 Select/Set

Used for selecting and setting loco addresses on the throttles. When you are in Select Address mode the Left hand side of the display (the address side) will be flash and the LOCO mode indicator will be ON.

7.9 Mode/Dispatch

Press  to move from one operational mode to another. LOCO is the DT200's default mode since most of the time you are running locos. Press  to change to SWITCH then to MU then back to LOCO.

To Dispatch or offer a locomotive you have set up on a DT200 to a BT-2 limited throttle, press this key while in Select Address mode.

7.10 Function/F0/Light Control

Press once to enter Function Mode. The display shows **Fn:oo**.

Press again to toggle the directional lights on or off. Or, press the key above F1, F2, F3 or F4 to change any of those functions that are available in your loco.

7.11 & Left & Right Throttle Direction Change Arrows

Changes the direction of the loco on the Throttles.

7.12 Up/Add & Down/Delete Arrows

Use to browse addresses and increase/decrease speed. Use to MU-Link and MU-Unlink locos from consists.

7.13 F3, F1, F2, F4 Keys

Active when in function mode. Use the keys above these designations to access the various decoder functions.

8.0 DT200: MAJOR SYSTEM MODES

The DT200's MAJOR mode changes are controlled by using the  key in conjunction with other keys as described below.

8.1 Advanced Throttle Mode

This is the mode the unit is in when the battery is first loaded and is the state most DT200's use when operating on LocoNet. To change a DT200 acting as the command station to advanced throttle mode, press the  and left/arrow keys simultaneously. The unit becomes an advanced LocoNet throttle with no command station functionality.

8.1.1 Walkaround Operation On LocoNet

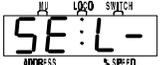
When a DT200 is in advanced throttle mode & detects that it is NOT connected to a powered-up LocoNet it will enter the power saving IDLE mode, and will display **IdLE**. This occurs when you unplug a throttle to walk around the layout. When you reconnect a DT200 to a powered LocoNet, it automatically logs back on to the network and verifies that the command station has an *exactly* matching state for any of its throttles that were active when the DT200 was disconnected. If there is any discrepancy, the associated throttle will not be reactivated automatically. Reactivated throttles will have the direction indicator lit and the display will show the state of the last "active display" throttle.

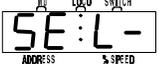
If a DT200 with selected *in-use* locomotives is disconnected from LocoNet for more than the system purge time (about 200 seconds), the Command Station will purge these *in-use* locomotives to the *common* state so that other throttles can access these locomotives. If the original DT200 is reconnected after a purge of its last *in-use* locomotives, it will recognize this and not reactivate its throttles. If the previously *in-use* locos that are now *common* locomotives have

not been selected by other LocoNet throttles, the original DT200 can simply reselect the matching locomotives by pressing the  key for the appropriate throttle, i.e., the DT200 throttles still remember the locomotive that was last selected. The SET operation will reactivate the throttle and make the locomotive *in-use* in exactly the state the system remembers it. The designation of locomotives as *in-use* or *common* ensures orderly sharing of locomotives on the layout and increases the system's ability to run more locos at a time. See section 9.8 for a discussion of locomotive status, *in-use*, *common*, etc.

8.1.2 Time Out! "Lost" Loco Problems

Sometimes when I plug my DT200 back in it doesn't log back on to the engine (or engines) I was running before I unplugged. What should I do? The DT200 will release engines that are not being controlled by a connected throttle after about 200 seconds to allow other throttles to gain control of engines that may have been left running unattended by an engineer.

If you are not able to log back on to the address or addresses you were previously controlling you have probably been unplugged for more than 200 seconds. If this is the case your throttle will show  when you

plug in your DT200. Just Press  and the address you were last controlling will appear in the left hand side of the LCD and will be flashing. Unplug the throttle while the address is flashing and plug it back in and the DT200 will log on to that address, the direction indicator light for the throttle you are controlling will light up and you will have the locomotive under control again. If you were controlling 2 addresses before you "lost control" you will need to re-log on to the other address as well by touching the non active throttle (the one without the direction indicator lit). When you touch the inactive throttle the LCD will display  Next, press  and the address for the second throttle will be displayed flashing in the LCD. Unplug the DT200 again and plug it back in to log on to the second throttle again.

Of course, you can avoid this problem by keeping your DT200 plugged in at all times and only unplugging while walking from one plug in location to the next.

8.2 Command Station Mode

1. To enter Command Station Mode the DT200 must be disconnected from any LocoNet connections.
2. Press the  and right/arrow keys simultaneously for about 2 seconds until the unit beeps and the GREEN master mode "MST" LED is lit.
3. Then you can plug the DT200 into the DB100 or LA-2 adapter to run the system.

LocoNet requires that only one command station be present on the system at a time. Therefore only one DT200 in a system will be the Command Station and ONLY when no other device is already acting as a Command Station on the LocoNet. When the DT200 is operating as the command station this means the DT200 has a special connection to LocoNet & is not a workaround throttle when operating in this mode!

8.3 Track Power On Mode

Press the  and  keys simultaneously to have the DT200 command station turn on the track power & go through power up sequencing. LocoNet will generally supply most of the power requirements of the DT200 acting as either a Command Station or an Advanced Throttles when they are plugged in.

Note: A DT200 without battery installed can be connected to a powered LocoNet. The unit will log-on if there is sufficient LocoNet power available and can be run as an advanced throttle. If a unit being run without a battery is disconnected it will not be able to automatically reconnect and log-on its previously active throttles and the locomotives that were selected and *in-use* prior to disconnection will remain *in-use* until purged by the system (or the Command Station performs an unlimited status edit to change the loco to *common*).

8.4 Track Power Off Mode

Press the  and  keys simultaneously to have the Command Station turn OFF track power and stop generating DCC packets. Note that in some LocoNet configurations this can unpower LocoNet itself. If this is the case the throttles will display **Idle** and only the Command Station will be able to restore track power.

A Note About Batteries:

When the DT200 is connected to a powered LocoNet, all of its power requirements come from LocoNet and the battery is not used. When LocoNet is powered down, the DT200 Command Station draws its power requirements from its internal battery. In this state the battery life will be about 30 hours. If the LocoNet is going to be OFF for a long time, we recommend changing the Command Station to Advanced Throttle mode (See section 8.1) so it can go IDLE and reduce its power consumption. In this case the battery life will be more than 300 hours. If it is subsequently re-selected as a Command Station it will remember **exactly** its state prior to being IDLE, as long as the battery is not removed or the unit is not RESET (See section 8.7). See section 13.0 for information about LA-2's keep alive function and how to build your own keep alive jack. We do not recommend the use of NiCad rechargeable batteries since their full charge voltage of 7.2 volts is about the end of life voltage of a regular

alkaline cell battery. You won't get very many hours of operation with rechargeable batteries.

8.5 Stop Mode

If the  key is held down longer than about a second the DT200 will enter STOP Mode and the center colon : in the display will flash. In this state there is power to the track but all locomotives are stopped. To return to regular operation simply press the  key again until the colon : stops flashing.

8.6 Programming Mode

Only a DT200 operating as the Command Station can program locomotive decoders. To enter Programming Mode, press the  &  keys simultaneously. Section 12.0 Decoder Programming and Configuration gives complete programming instructions.

8.7 DT200 Unit Reset

Press ,  &  keys simultaneously. This three key-stroke input will force the DT200 to reset and clear itself and its internal locomotive status and refresh stacks. Removing and replacing the battery also causes the DT200 to reset. Use this to clear a Command Station or Advanced Throttle.

9.0 LOCO Mode: Running Trains

LOCO mode is the default mode for the DT200 because it is the mode you use to run the trains. If you change to SWITCH or MU mode and don't do anything, the unit will default back to LOCO mode in about 6 seconds.

If a throttle has a locomotive selected and under its control, its associated  direction indicator will be GREEN if the loco's direction is forward & RED if its direction is reverse. In addition, if the direction indicator is flashing it means the associated throttle's locomotive information is currently showing in the display, *meaning the Address and Speed in the display are related to this throttle*. For example: if the  on the right side of the DT200 is flashing RED, this means that the ADDRESS and % SPEED in the display are for the loco that is currently being run by the Right Throttle Knob and that locomotive's direction is reverse.

To display the information for the throttle not currently in the display, turn the Throttle Knob not currently in the display or change the direction of the loco not currently displayed and the display will change to that Throttle Knob.

9.1 The Select Message

If a Throttle Knob does NOT have a locomotive selected when you try to make it display its information with its knob or direction change arrow, the display will show SE:L-. This means that there is no active loco on the Throttle you

tried to display and that you need to press  to select a locomotive and set it to that Throttle before you can use it.

9.2 Loco Address & % Speed Display

The numbers to the left of the colon : and above the word "ADDRESS," are the address of the locomotive and the numbers to the right of the : and above the words "% SPEED" are the % speed for the Throttle currently displayed. The speed is shown as a % of full speed and is NOT actual speed step codes sent to the decoders in the locomotives. Note: For addresses above 99 please refer to Table I below to translate the mixed mode hexadecimal value that shows in the display for addresses above 99.

Table I: Translation Table for Decimal to Mixed Mode Hexadecimal Numbers for Loco and Switch Addresses Above 99.

DEC	MM	DEC	MM	DEC	MM
0-99	0-99				
100	A0	110	b0	120	c0
101	A1	111	b1	121	c1
102	A2	112	b2	122	c2
103	A3	113	b3	123	c3
104	A4	114	b4	124	c4
105	A5	115	b5	125	c5
106	A6	116	b6	126	c6
107	A7	117	b7	127	c7
108	A8	118	b8		
109	A9	119	b9		

Note: The DT200 Command Station is designed to address all DCC decoders by using their 2 digit short address (CV01). Many Big Boy users use the convention that the last two digits of each locomotive's road number are programmed as the locomotive decoder's address. If you are using extended packet format (EPF) decoders (Digitrax FX or other EPF decoders) with your Big Boy, you will be able to address them by their 2 digit short addresses CV01. Since these decoders have both 2 digit short addresses and 4 digit long addresses, you will also be able to run them on systems that handle 4 digit long addresses. See your Decoder Manual CV section for more information about this feature.

9.3 Locomotive Speed Control

To control the speed of a locomotive, just turn the Throttle Knob that is set to the locomotive whose speed you want to change. If the throttle was not already active in the display it will now become "display active" and the display will show its address and current speed commanded. Alternately, speed can be increased and decreased by using the   keys.

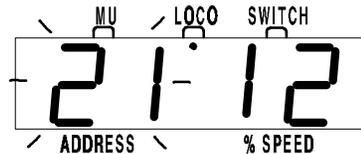
9.4 Locomotive Direction Control

To change the direction of a locomotive, just press the Direction arrow  or  associated with the throttle that is running the locomotive. The direction indicator of the throttle will change color to show the new direction commanded. If the throttle was not "display active" its information will appear in the display. Really, it is more prototypical to close the throttle to 0 speed and stop the loco first, before commanding a direction change but, it's up to you.

If the decoder has a non-zero deceleration rate that matches the scale effect of braking the train, then you can simply command an instant reverse of direction, and the system and decoder will make the locomotive slow down at the programmed deceleration rate, stop and accelerate again at the programmed acceleration rate.

9.5 Selecting A Loco & Setting It To A Throttle

1. To select a new locomotive address to run in the "display active" throttle, press the  key to enter "address select" mode. The left hand side of the display that shows the address digits will flash to indicate that you need to choose an address.



This display shows locomotive address 21 selected but not set. Notice the status "12" indicate this address is *common*, 14 speed step.

2. Turn either throttle knob or use the

  keys to scan through to the address you want.

3. Press the  key again to SET that loco address. If the address request is successful, the display will now show the locomotive information at *the speed and direction* the system has remembered it.

When you request "address select" on a "display active" throttle, the current displayed locomotive will be made *common* or released to the system for anyone to select. Once you have entered "address select," you can browse for another locomotive that is *common*, *idle* or *new* and SET this locomotive on the throttle with another press of the  key. Obviously, you can simply re-select the locomotive you just released when you started "browsing," subject to someone else not selecting it in the meantime.

When you press the  key the second time to SET a locomotive address the system makes the locomotive *in-use* and only your throttle has control of it.

A *new* locomotive address once set on the throttle becomes *in-use* at speed, forward direction and all functions off.

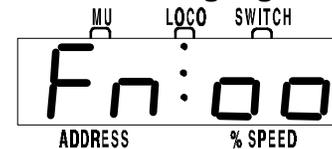
The only way to modify the Speed and Direction of consisted or MU'd locomotives is to select the address of the TOP of the consist. We call the "key" locomotive that other locomotives are consisted TO, the **TOP** locomotive because it does not *need to be in any particular physical order in the consist*. The TOP locomotive address controls the speed and direction of all locomotives consisted to it by the MU function. See section 11.0.

If during "address select" mode there is no input for the 6 second time-out time, the DT200 will abort the selection process and default back to LOCO mode with the throttle now inactive. The effect of this is to clear the locomotive that was in the throttle and make it *common* or accessible to the rest of the system.

Note that the right-hand side of the display shows various status codes as you "browse" locomotive addresses. The meanings of these codes are detailed in the Status Edit section (Section 9.8.2). Generally you don't need to worry about these codes since the system automatically uses them transparently to most users. They give you a convenient and valuable insight as to how locomotives are operating on the layout.

Note: If the right hand side of the status display shows "FF" during address selection, this means that the Command Station has reached the limit of *in-use* and *common* locomotives that it can refresh at one time. To free up refresh slots, (space for loco Addresses) make sure any locomotives you are not using are unselected to *common* at speed 0. The DT200 can handle approximately 20 active locos with any available address.

9.6 Controlling Lights & Functions



1. Press the  key once to enter the Light/Function control mode for the "display active" locomotive. The display will show **Fn:00** with the "n" flashing to indicate that the function number of the function you wish to change needs to be selected.

2. Once you are in the "Fn00" mode, use one of the 5 blue keys to choose which function you want to change.  key will now select and change the Light or "F0" function. Each time the  key is pressed while in the "Fn00" mode, the Light/F0 will change from OFF to ON or vice-versa. The display will show **F0:0n** for light ON and show **F0:0F** for light OFF. This is the same for the other functions F1, F2, F3, F4.

You can "mix & match" and change any of the 5 functions while you are in the "Fn00" mode until you are satisfied with the settings and return to LOCO mode.

To make it easier to control sound features, F2 is a non-latching function. This means that if F2 is used to control a whistle or horn sound from the decoder, it will only sound when F2 is held down in the "Fn00" mode.

To exit back to LOCO mode just adjust either throttle, press the  or  key, or wait for the 6 second no-input time-out to elapse and the DT200 will return to LOCO mode by itself.

Note that for proper light operation, you must be sure that the decoder's speed steps match the speed steps sent by the Command Station. If you are using a Digitrax or other Advanced capability decoder, we recommend it be programmed to Advanced mode, and the DT200 run in the 128 speed step (default) mode or 28 step mode. **For other DCC Baseline-only decoders you will need to edit the status of the locomotive to 14 speed step mode to have correct motor & light operation. See also Status Edit in section 9.8.**

9.6.1 Controlling Functions On Consisted Locos

Even though a locomotive is part of a consist, you can still access its function outputs independently. SELECT & SET the address of a locomotive that is a part of consist. In this case the display will show **XX:cn** to show that locomotive address XX is part of a consist and can't have its speed or direction changed. The throttle knob and direction arrow will NOT operate. However, the functions on this locomotive address can be modified with the regular Fn00 action described in Section 9.6!

9.7 Dispatching Locomotives

Dispatching is a special feature incorporated into the LocoNet "language" to meet the needs of clubs and serious operators that wish to enforce a strict discipline in how engineers access locomotives.

To dispatch a locomotive using a the DT200, press  to enter "address select" on the active throttle, select an address and press  to dispatch it, that's all there is to it! The dispatched train can be a single locomotive or a consist that was set up by the DT200.

Any LocoNet throttle with dispatch capability can take a locomotive setup in a throttle and release it to the system as *common* and also specially marked as the dispatch locomotive.

This specially marked Dispatch locomotive can be requested and acquired by any BT2 "Buddy Throttle." BT2's have no address selection capability of their

own. This is similar to how real Engineers are "given" trains in the prototype world, by dispatchers or controllers issuing waybills and work orders.

The BT2 that acquires the dispatched locomotive/consist will pick-up the train *in exactly the state it was in* when it was initially dispatched, i.e., if the unit was moving with lights on, it will be acquired with no speed change and continue with lights on until the acquiring BT2 commands a new setting.

The TOP locomotive in a consist or MU lashup can be Dispatched to pass control of the entire consist to a BT2 "Buddy Throttle."

Dispatching a locomotive is also a fast and convenient way to clear a throttle for another address selection, without having to wait for the unit time-out back to LOCO mode. This happens when you want to swap locomotive addresses for convenience, from one throttle side of a DT200 to the other.

There is only one Dispatch marked locomotive in the system at a time. Any DT200 throttle can reselect this dispatch address since it is also *common*.

9.8 Editing the Status of a Locomotive

During "address selection" the right hand side of the display shows the Status of the locomotive address that appears in the left hand side of the display. Table II lists most of the status codes you will see and their meanings. Note that you interpret each of the 2 Status digits *separately*. For example a *new* loco address will always be Status "03"; the first digit "0" indicates that this is the FIRST time this address has been called up (is *new* to the system), and the second digit "3" indicates the system will run this loco in the default 128 speed step mode.

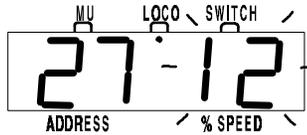
If you wish to edit the status of a locomotive that is selected but not yet set to a throttle (flashing in the left hand side of the display), press the  key. The right hand side of the display will flash to show that you are editing the locomotive's status.

Use either knob or the   keys to change the status value. This value is displayed in the right hand side of the display. After changing the 2 Status digits (right hand side of display) to the value you want, press  to make the change and SET the locomotive into the display active throttle. If the loco was originally *in-use*, the throttle will become inactive with **SE:L-** in the display. A DT200 throttle will not be able to edit the status of an *in-use* locomotive, it can only edit the status of a loco that is available for it to select. If the loco was *common*, *idle* or *new* at the start of editing, the new status value will be loaded and the throttle will be activated on this locomotive when the  key is pressed.

A consisted loco address cannot have its status edited. To edit the status for a consisted locomotive, the unit must be MU un-linked from the consist.

9.8.1 Note for LENZ, MARKLIN, ARNOLD decoder users

If you have a decoder that does not understand 128 speed step or 28 speed step operations, you will need to edit the status of that locomotive before running it with the DT200. You will need to change the status code to a value of "x2", for example "12", so that the DT200 will operate those decoders in 14 speed step mode.



This display shows locomotive Address #27 that is *common* and in 14 speed step mode, being Status Edited.

9.8.2 Unlimited Status Editing With the Command Station

Note that the DT200 operating as the Command Station has a special capability to edit the status of an *in-use* locomotive. The Command Station operator can use this capability to change the Status of a locomotive under the control of *another* throttle. Use this feature with care! In contrast, DT200's operating as throttles can only edit the status of locos that are available for them to select, i.e., *common*, *idle* or *new*.

Table II: Loco STATUS Codes

Left Status Digit Value	State	Selectable?	Refreshed?
0x	<i>New</i>	selectable (default)	
1x	<i>Common</i>	selectable	refreshed
2x	<i>Idle</i>	selectable	not refreshed
3x	<i>In-use</i>	not selectable	refreshed
5x	<i>Common</i>	not selectable	consisted
7x	<i>In-use</i>	not selectable	consisted

Right Status Digit Value	Meaning
x0	Normal 28
x1	Special 28
x2	Baseline 14
x3	128
xb	128 Consist TOP

Examples: If a loco's status code is 03, it is *new*, selectable, refreshed and 128 speed step operation. If a loco's status code is 52, it is part of a consist,

common, not selectable because it is not the TOP of the consist and operating in baseline 14 speed step mode.

10.0 SWITCH Mode Changing switches

To change the position of a switch, press **MODE/DISP** until the SWITCH mode indicator is on. The display shows the switch address in the left hand side of the display. The right 2 digits display the switch position, and will be a "-t" to indicate the switch is "thrown," or "-c" to indicate the switch is "closed" (not turning out). If this -t or -c indicator is flashing it means that the LocoNet Command Station does not know the current switch direction. This display example shows Switch #2 is in an unknown direction.



Use either Throttle Knob or the **▲** **▼** keys to scan to the address of the switch you want to change.

Once you have the desired address in the left side of the display, press either **↔** key and the switch selected will change position from closed to thrown or vice-versa.

After commanding the switch "closed" or "thrown" the switch position display will stop flashing, since the Command Station now knows the current switch position. The DT200 Command Station cannot read back these positions now, but with the addition of future Command Stations or computer control you will be able to access this feature. In this case, when you scan through the switches, the switch position display will not flash, since the system will know the current switch position.

Note that the switches in the system are accessible to all throttles or control devices with switch control capabilities and are not reserved *in-use* to a single throttle as locomotives are.

When you have finished your switch operations you can return to LOCO mode by pressing the **MODE/DISP** key twice (skipping past MU mode), pressing the **FUNC/FBY** key or waiting for the 6 second *no-input time-out* to return the DT200 to the LOCO default mode. The next time you select SWITCH mode the display will remember and start at the last switch address and position you selected.

11.0 MU: Setting up and maintaining consists

From the default LOCO mode, press the **MODE/DISP** key twice to cycle through SWITCH mode to MU mode. The left-hand side of the display shows the loco address active on the Left Throttle Knob and the right-hand side of the display shows the loco address active on the Right Throttle Knob. MU'ing or consisting with the DT200 allows you to lashup *any* DCC Baseline compatible decoders

with different addresses. You can add a MU'ed locomotive in either direction and in any physical location in the lashup. Note that we always add or MU LINK a loco to the "TOP" loco of a consist. The "TOP" loco is special, in that it has the speed and overall direction of the consist, and all other loco's added or linked into the consist will be controlled by running the "TOP" loco on a single throttle knob. The TOP loco is always defined as the loco on the **Right Throttle Knob** when the MU-Link is performed.

Consists are controlled through the TOP locomotive and all loco's in the consist will be *common*, *in-use* or *idle* based on the state of the TOP loco. Each loco within a consist will maintain it's original 14, 28, or 128 speed step setting. To run a loco in a consist with loadable speed tables, set the locomotive status for 28 speed step mode and program the decoder in that locomotive to operate with the loadable speed table enabled. See section 12.5. A consist can be made *common* and run by any other throttle, and can also be Dispatched.

11.1 MU-Link: Adding a Loco to a Consist

1. You will add the active loco on the **Left Throttle Knob** to the "TOP" loco active on the **Right Throttle Knob**. Run the Left loco so it is in the location you where you want it to be in the lashup.
2. When it is in position (typically coupled physically in the lashup) be sure that it is traveling in the SAME PHYSICAL DIRECTION ON THE TRACK as the TOP or Right hand throttle loco. (The direction indicators DO NOT matter at this time since the relative loco directions at the time of MU-Linking determine the new loco direction in the final consist.) So, you can actually bring in a helper or extra B unit in either direction and add it head-to-head, tail to tail, or head to tail, as you wish. If you get this step wrong the MU linked locos will not travel in the same directions when the consist moves!
3. Press the  key until you get to MU mode (the MU mode indicator will be lit).
4. Press the  key to MU LINK the locos. That's all!
5. The Left Throttle's direction indicator will go inactive but the display will show the address of the Left throttle loco with "cn" in the % SPEED part of the display. This indicates the loco that was in the Left throttle is now consisted to the Right throttle (TOP) loco. The Right throttle will now control the speed and direction of the loco that was in the Left throttle.

You can consist loco's that are moving and/or are coupled, and the TOP loco can be a "phantom" or non-existent locomotive address. You can access the functions of the TOP loco as normal. You can select a consisted loco and change its functions BUT will not be able to change its speed or direction while it is consisted.

Once a consist is set up and linked to the TOP locomotive, this TOP loco can be run from either throttle.

11.2 MU UNLINK: Breaking A Loco Out Of A Consist

1. Select the address of the loco that you want to release from a consist on the **Left** throttle. The display will show "cn" for the loco speed, confirming this loco is part of a consist.

The display example shows loco #36 consisted and selected.



2. Press the  key until you are in MU mode.
3. Press the  key to unlink the locomotive. The unlink is complete. The Left throttle becomes active with the loco you just unlinked! *The unlinked loco will be broken out of the consist at the current speed and direction that it was going in the consist.* You can uncouple and run the unlinked loco as an independent loco again! If a DT200 is acting as a Command Station, it can link many loco's to a single TOP loco as a consist. It can also create and maintain numerous independent consists. Any of these consists cannot *then* be added to another active consist, or be "nested." This limitation on the nesting of consists is peculiar only to the DT200 Command station, and **not the LocoNet "language"!** When using any of the more powerful LocoNet command stations such as the DCS100 or DCS200, a DT200 throttle can "nest" consists-of-consists many deep!! The LocoNet language has provisions for full control of very complex consisting operations, still using "language" that a DT200 can understand and use as a throttle.

11.3 MU of Mismatched Locomotives

If all the locomotives in the consist have performance characteristics that are closely matched, it is reasonable to run all units in 128 step mode for excellent control. If the units are completely mismatched, then we recommend programming the decoders using the User Loadable Speed Table (See section 12.5) and running the DT200 in the 28 step mode to use this feature. This allows you to closely speed match the 28 step operation of each locomotive to a given reference locomotive, so when they are consisted they will run well together. If you want to consist with a conventional analog locomotive, use the analog locomotive as the reference locomotive and match the DCC locos to it using the User Loadable Speed Table.

12.0 DT200 Programming Mode

The DT200 running as the Command Station has a built in programmer that allows you to change the **Configuration Variables (or CV's for short)** and customize the personality of each decoder. Your DCC Decoders have many

different configuration variables (CV's for short) that allow you to set up a different operating characteristics for each decoder installed in each locomotive.

Each of these configuration variables controls a characteristic of the decoder. These CV's allow you to customize each locomotive's performance characteristics to give you prototypical operation. You can pick and choose from among the variables and set each one independently or you can use the default values that are preprogrammed. Each of these CV's can be set up when your command station is in the programming mode or by using the Digitrax PR-1 Computer Programmer & your PC. The CV's are remembered in the decoder until it is reprogrammed to a new value.

It is a good idea to run your decoders with the default values that come preprogrammed in your decoders until you get used to the system and what it can do for you before you begin customizing. Initially, you should keep deceleration numeric values as small as practical. This allows you to adapt to the delays in deceleration you have programmed without crashing your valuable locomotives!

12.1 Programming Track

We recommend that you use an electrically isolated section of track for programming decoders because, the programming information sent by the DT200 is a broadcast signal that will be seen by all locos on powered track sections. In a broadcast programming scenario this saves great aggravation because a user could accidentally re-program all mobile decoders in one fell swoop! An electrically isolated siding works very well as a programming track. See Section 4.2 for wiring instructions for a separate programming track. The following is an outline of how to program CV's with your DT200 command station followed by explanations of the most often used CV's.

12.2 Using Your DT200 To Program Decoders

Programming your Digitrax Decoder with

- Once you have your system up and running switch the *master* DT200 to Programming Mode by pressing  &  together until the DT200 programming indicator  glows red & the  indicator glows green. When the red indicator is on, the DT200 is in programming mode. Check the LCD display on the DT200 and be sure that the colon  in the center is on steady. If it is flashing press  briefly until it is steady. Be sure that only the loco or locos that you want to program are on the live track section attached to the command station. *Note that if the display shows a flashing , the track is in STOP mode and you will have to press  to re-start the layout. The Programmer will not run when the layout is in STOP mode.*

- Turn the left knob on the DT200 clockwise until the CV number you want to change is showing in the left hand side of the LCD display.
Note that CV 01 is the loco address and displays as Ad on the left side of the display. See section 12.3 & 12.4 below for more information about programming addresses and other CV's.
- Turn the right knob on the DT200 clockwise until the value you want to program for the CV selected is showing in the right hand side of the LCD display.
- Press the  key to program the CV you selected on the left side of the display to the value you selected on the right side of the display.
- You can continue selecting CV's & assigning values to them until you are finished. Just be sure that the colon in the center of the display remains on steady while you are in the programming mode. When you are finished with your programming session, return the the "RUN" mode by pressing  &  together until the DT200 programming indicator  no longer glows red.

12.3 Loco Address Programming

The initial program display will show **Ad:01** that is showing the Locomotive Address (CV #1) is the starting default to be programmed.

Programming Mode Display

The left side of the display is the decimal number of the Configuration Variable that will be programmed. The display shows "Ad:01." The "Ad" is an alias for the Loco address CV that is defined as CV #1.



The rest of the CV's display as numbers. The DT200 can write a loco address from 0 to 127 using the *mixed-mode decimal numbers* shown in

Table I. All other CV's can be programmed in hexadecimal, the full data range of 0-FF hex. See Table VI for Hexadecimal numbers.

The right side of the display is the data to be stored in the CV number displayed on the left side of the display.

To program a loco address:

- Once you are in Program Mode, select Loco Address programming by turning the Left Throttle Knob counter-clockwise until the Left side of the display is showing flashing "Ad".
- Then use the Right Throttle Knob to change the Right side of the display to the loco address you want to program into the decoder on the programming track. The display will scroll through address numbers and flash indicating you are scanning to a new value for the loco address to store in the "Ad" CV.

3. When you have the new loco address you want in the Right hand flashing display, press the  key to "SET" or program this value into the decoder. The display will flash "- - -" and the loco will pulse briefly as it is programmed to its new address.

It is that easy to reprogram a loco address! When you are finished programming and want to return to LOCO mode, simply press  and  simultaneously again to return to LOCO mode.

12.4 Programming Configuration Variables (CV's)

To program a CV:

1. To program any other CV simply select it by turning the **Left** knob until the CV number you want to program appears in the Left hand side of the display.
2. Then turn the Right knob until the data value you want to write to the CV you selected appears in the right side of the display.
3. When the values you want are in the display, press the  key to set the values.

In order to give you the most power possible in a programmer in a unit as compact as the DT200, it was necessary to use hexadecimal numbers for the data to be stored in all *but* the Address CV (CV #1). Table VI shows how the hexadecimal numbers correspond to regular decimal numbers you are probably used to. The CV's that you will use most are listed in the following table. Please refer to your decoder manual for more CV's and their meaning as it relates to your specific decoder.

Table III: Most Commonly Used CV's

CV #	Used For	Value range
Ad(1)	Loco Address	0-99 decimal, "A0 -C7" mixed mode
02	Start Voltage (Vstart)	0- FF hexadecimal
03	Acceleration rate	0-1F hex
04	Deceleration	0-1F hex
06	Mid-point Voltage (Vmid)	0-FF hex
29	Configuration Register	See Table IV

CV's 65 to 95 are allocated to the 28 step "Loadable Speed Table" function and table V lists the actual usages.

Table IV: Configuration Register Values:

These are some of the common hexadecimal (hex) values used in the **Configuration register** (CV #29) and their meaning.

Value in CV29 (in hex)	Meaning to Decoder	
	Speed Steps (Std of Adv)	Analog Conversion
00	14 (Standard Mode)	No
02	28/128 (Advanced Mode)	No
04	14 (Standard Mode)	Yes
06	28/128 (Advanced Mode)	Yes
16	Enable Loadable Speed Table	Yes

Note that with Digitrax decoders if 128 speed steps are sent by the command station then the 14/28 speed step and Loadable speed table selections are not used.

12.5 User Loadable Speed Tables

To Set Up a Loadable Speed Table:

1. Set up your command station for programming mode (or use a computer programmer like the PR-1)
2. Place the loco you wish to program on the programming track.
3. With the DT200, Program CV's 65 through 96 with the values listed in Table V. To do this dial in the CV # on the left knob and the value to be entered on the right knob and press  Select/Set to program the CV and data value. To program the full table you will need to repeat this for each CV from #65 through #96.
4. After programming the table values, program CV29 to the value of 16 to enable the loadable speed table. If you want to disable the loadable speed table later, just program CV29 to 06 and you will return to 128 speed step operation with the DT200 (the speed table is still remembered and can be re activated by programming CV29 to 16 again later).
5. If you are using the PR-1 programmer, it is a simple matter of drawing the throttle response curve you want on the screen and pressing the "Send" or Program button.
6. Once the table is loaded, return your system to "LOCO" mode and run the locomotive.
7. If you are speed matching locos, you should get the first loco running the way you want and then match subsequent locos to it.
8. If you are programming with a DT200, keep a running list of the settings you have entered so that you will know "where you have been" and can work out "where to go next."

The following Table V is an example of a loadable speed table that you might choose to try.

Table V: Example Loadable Speed Table

Usage	CV #	DT200 HEX Data See Note 1	Lenz Register	Suggested Setting DECIMAL
			Page 17=PL	
Kick Start	CV65	01	1	1
Forward Trim	CV66	80	2	128
Step 4 value	CV67	0A	3	10
Step 5 value	CV68	0E	4	14
			Page 18=PL6	
Step 6 value	CV69	12	1	18
Step 7 value	CV70	16	2	22
Step 8 value	CV71	18	3	24
Step 9 value	CV72	1c	4	28
			Page 19=PL6	
Step 10 value	CV73	20	1	32
Step 11 value	CV74	24	2	36
Step 12 value	CV75	28	3	40
Step 13 value	CV76	2c	4	44
			Page 20=PL6	
Step 14 value	CV77	32	1	50
Step 15 value	CV78	36	2	54
Step 16 value,	CV79	3c	3	60
Step 17 value	CV80	40	4	64
			Page 21=PL6	
Step 18 value	CV81	46	1	70
Step 19 value	CV82	4c	2	76
Step 20 value	CV83	52	3	82
Step 21 value	CV84	5A	4	90
			Page 22=PL6	
Step 22 value	CV85	60	1	96
Step 23 value	CV86	6A	2	106
Step 24 value	CV87	72	3	114
Step 25 value	CV88	7E	4	126
			Page 23=PL6	
Step 26 value	CV89	88	1	136
Step 27 value	CV90	94	2	148
Step 28 value	CV91	A2	3	162
Step 29 value	CV92	b2	4	178
			Page 24=PL6	
Step 30 value	CV93	c6	1	198
Step 31 value,	CV94	dA	2	218
Reverse Trim	CV95	80	3	128
Configuration Register	CV29	16	5	22
Page Register	None	None	PL6=Page register	1

Notes for Table V:

1. In order to give you the most programming power possible in a unit as compact as the DT200, it was necessary to use hexadecimal numbers for the data to be stored in all CV's except the address CV (CV#1). Table VI shows how hexadecimal numbers correspond to regular decimal numbers that you are used to.
2. The Kick Start table entry allows a short voltage kick to happen when you start the Locomotive decoder from 0 speed or stopped to a moving speed. A value of 0 turns this OFF. Experiment with values for a particular installation to find the best compromise.
3. Forward Trim (CV66) & Reverse Trim (CV95) values of 128 (80 Hex) will yield a scaling of 100%. The same effect will occur if the value 0 or 1 is loaded for Forward or Reverse Trim, i.e., Multiply by exactly 1. A Trim value of 255 (FF Hex) will give 200% scaling of the table entry value.
4. A *final scaled table value* of 255 (FF Hex) represents 100% applied motor voltage or Full speed. A value of 128 (80 Hex) represents 50% applied motor voltage, i.e., the actual table step entry is multiplied by the appropriate Trim value to yield the final scaled table value that defines the voltage to apply to the motor.
5. The Steps defined in the table are for the NMRA 28 step mode. Step 4 is the first motion step in the 28 Speed step code system. Step 31 is the "full throttle" speed step. When configuring the decoder to run 14 step mode, only every second entry is used, the decoder automatically uses the correct data value.
6. The suggested data values given in the table will give a throttle response curve that most US users are comfortable with. The data values can be further modified to suit individual preferences.

For the demanding user who wishes to fully customize the throttle response of individual decoders and locomotives, Digitrax has incorporated Loadable Speed Tables compatible with proposed NMRA Advanced Configuration Recommended Practices. The table has 28 speed step data entries that allow the User to "draw" an arbitrary "power curve" with a resolution of 1/2%, from the Stop to Full-speed codes. The shape of this curve defines the "feel" of the decoder throttle response. Once the curve is drawn, the user can scale the actual speed the curve sets by using a Forward and Reverse Trim value that acts like a "volume control." In this way, you don't have to reload the entire 28 step table if you want to change, for example, the maximum forward speed from 45 scale mph to 80 scale mph. Changing the Forward or Reverse Trim values will scale or multiply all the values used in the table, in the corresponding direction, by the amount desired. Using different Forward and Reverse Trim values allows different Forward and Reverse speeds, The Trim value can multiply up the table values from 100% to 200% with 1% resolution, or down from 100% to 2% with 1% resolution. All the table values are non-volatile and are remembered when the power is off.

Note that if the Configuration Register is set up with the User Loadable Speed Table flag SET to *enable* the Speed Table, the VSTART and VMID values are *not used* to by the decoder when calculating Loadable Speed Table values.

Many Digitrax customers have asked us why we can't formulate tables like this one for the specific locomotives that they are running. The reason for this is that each and every locomotive is different. If we bought 5 identical brand new locos today and put them on the test track, we would probably find that they do not all run exactly the same way. And as time goes on and we run these locos for different amounts of time under different sets of circumstances they will probably change even more. It's really best to start with the default table shown and work with your own equipment to customize it for your own preferences. If you are planning to do a lot of customizing, the PR-1 is probably an easier solution for setting up loadable speed tables.

12.6 The Simplest Way to Program Your Digitrax Decoders Yet: Digitrax PR1 Decoder Programmer and your PC!

The PR1 is a low cost IBM PC- Windows based Advanced Programmer developed by Digitrax to give you a more convenient (and less cryptic) method of programming decoders. The programmer software was developed in close co-operation with Tannersoft, who also developed the excellent LocoNet® Certified "Winlok 2.0" Windows layout monitoring and control program.

To program decoders using the Digitrax PR1 you will need

- Digitrax PR1 programmer and software
- Windows computer with an available COM port
- 15Volt DC power supply
- Programming track wired to the PR1 with the cable provided with the PR-1.

With this set up, you can read and write all the decoder CV's without worrying where they are and what they mean. Several features of the PR-1 are of particular value:

- With the PR-1 software's graphical capabilities you can "draw" the Loadable Speed step curve you want and send it directly to the decoder via the PR1's programming track. You can also read back a decoder's Speed table via the PR1 to the same graphical display, and optionally save all the decoder information to and from named files on a computer disk. This makes it simple to load the same speed table into several different decoders.
- FX options can be selected by pointing to choices that let you program the rich variety of possible lighting effects without having to look up numbers in

a table and program individual CV's on your DT200. The software loads the appropriate CV #'s with the correct data automatically.

- The PR-1's DS54 option allows full programming of the powerful features of the DS54 Stationary Animation decoder **Error! Bookmark not defined.** This makes setting up complex DS54 configurations a breeze, since you can simply click on the options desired. Best of all, on top of being able to read back and write a new configuration to a DS54 it is also possible to read and write that particular setup to a named computer disk file and copy it to another DS54 if desired.
- General access to all RP-9.2.2 CV's and support for decoders without such sophisticated capabilities is also provided.

For users wanting the most convenient and sophisticated Programming capabilities the PR1 is an excellent choice.

13.0 LA-2, Keep Alive Jacks, & Shutting Down the System

When the layout is powered down we recommend that you change the DT200 that is running as the Master command station to Advanced Throttle mode so it can power down and conserve its battery. Do this by following the instructions below. When you turn off track power, the DT200 acting as the master will stop making DCC packets and all other Advanced Throttles on LocoNet will power down and show "idLE" (when the LocoNet wires (pins 3 and 4 of the RJ12 plug) fall below +5Volts for more than 1/4 of a second). If the Railsync lines on LocoNet (pins 1 and 6 of the RJ12 plug) remain above +12Volts, the minimal keep alive power needed by the DT200's will be drawn from LocoNet and **not the internal battery**. If you do not wish to leave LocoNet powered you can use your LA-2 as a keep alive jack for the master or build your own with the following instructions.

13.1 LA-2 LocoNet Adapter with DC Power Jack For Master & Throttle Keep Alive

The 2mm DC power jack on the LA-2 allows you to "keep alive" your DT200 master & other throttles when the system is powered down by powering them from LocoNet rather than from their internal batteries. You will need a +12V to +15V DC supply such as the Mouser 412-1104 (12v 500ma) connected to the LA-2. See Diagram for connections needed. When this jack is powered it will "keep alive" LocoNet even when the command station is off and all throttles plugged in will run off LocoNet Power and will conserve battery power. You can leave this jack unconnected if you choose not to use it as a keep alive jack.

Follow these simple instructions in place of previous instructions for the LA-1.

- A) Plug the LA-2 LocoNet Adapter RJ12 6/6 plug into either to the DB100's **LOCONE**™ ports.

- B) Connect the LA-2's Orange & Gray leads to the DB100's two terminals marked RAIL A and RAIL B. Connect the track to the same RAIL A and RAIL B terminals *Make sure no other power packs are connected to the rails used by the DB100.*
- C) If you wish to use the master keep alive feature, plug in a +12V DC to +15V DC power supply such as the Mouser 412-1104 (12V DC, 500ma) to the 2mm DC power jack on the LA-2.

13.2 Shutting Down the System

With LA-2 Master & Throttle Keep Alive

If the Railsync lines on LocoNet (pins 1 and 6 of the RJ12 plug) remain above +12Volts, the minimal keep alive power needed by the throttles will be drawn from LocoNet and not the internal batteries. If you do not wish to leave LocoNet powered you can build a keep alive jack for the throttles or you can use the LA-2's Master & Throttle Keep Alive Feature as follows:

1. Wire a "Sleep Switch" according to the diagram below. This switch will be open during regular system operation and closed when shutting down the system.
2. When you want to shut down the system and maintain throttles in power conservation mode, first close the Sleep Switch. This will cause all regular throttles connected to LocoNet to go "Idle."
3. Next Power down your DB100 by pressing  Run/Stop &  keys together. Leave the DT200 master plugged in to the A end of the LA-2. The DT200 master will still have the master light on and will be kept alive by the LA-2 until you are ready to run your system again.
4. You can leave the DB100 power on or switch it off. Note: the track power indicator will be off in either case.
5. When you are ready to run again, on the DT200 master, press  Run/Stop &  keys together and open the "Sleep Switch." You will then be able to resume operations where you left off.

Sleep Switch/Sleep Plug Diagram

Without LA-2 Master & Throttle Keep Alive:

When the layout is powered down we recommend that you change the DT200 that is running as the Master command station to Advanced Throttle mode so it can power down and conserve its battery. Do this by pressing  Run/Stop

&  Left Arrow keys together. When you do this you are turning off track power, the DT200 acting as the master will stop making DCC packets and all other throttles on LocoNet will power down and show "idLE." (when the LocoNet wires (pins 3 and 4 of the RJ12 plug) fall below +5Volts for more than 1/4 of a second).

To build a "Keep-Alive" power jack:

1. Wire pins 2,3,4 and 5 of an RJ12 socket to the negative lead of a 12 volt power supply.
2. Connect the positive (+) lead of the 12 volt supply through a 1k 1/4Watt resistor to pins 1 and 6. This will keep a DT200 Throttle from using the internal battery when it is hooked into this socket, thus extending battery life.

14.0 Troubleshooting

14.1 Clean Track

The majority of intermittent operation faults can be traced to bad connections and poor or noisy wheel pickups on locomotives. Check track cleanliness and quality of wheel pickups. The DCC digital packet communication strategy performs exceptionally well in a less than perfect environment, and will often mask bad connections until they are really impossible to work with!

14.2 Decoder Won't Respond

If you cannot figure out what a locomotive is doing or "who" it is by address, do not panic! Just reprogram the locomotive. If the decoder is damaged, all is not lost, it can be repaired. See the Warranty section for details.

14.3 Emergency Stop

If the layout starts to "get away" on you, either PRESS  or, turn the track power  OFF on the DB100. Either way will give you a chance to regain your composure, and you will be able to rejoin the contest against many locomotives at once!

14.4 Mechanical Drive Train Problems

Pay attention to the mechanical drive train and free movement of the locomotive wheel sets. This is especially important with inexpensive locomotives. Using Digitrax decoders with appropriate programming settings,

you can achieve surprisingly good quality motion, if you carefully audit the mechanisms for smooth running.

14.5 Strange Lights (not the ones in the sky)

If you can't control the operation of the lights in your locomotive with the DT200 (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 Configuration Variable 29 with a value of "06" (the code for advanced mode per Table IV.) Refer to section 12.0 on for complete programming instructions.

Your Digitrax decoder may have been shipped programmed to standard 14 speed step mode (the minimum industry standard). Or you may have changed your decoder's programming when performing the decoder test procedure. In any case, if you are not able to turn the locomotives lights on and off, you will need to change CV 29 to "06" to have proper light operation when using the DT200 in its optimum 128 speed step mode.

14.6 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 measures:

- 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.

15.0 Adding Chief Components To Your Big Boy Set

With your Big Boy Set, the DT200 acts as both Command Station & Throttle for your system. The DB100 series booster is a stand alone booster. With the Chief Set the DCS100 acts as the Command Station & Booster & the DT100 is your Throttle.

You can add either or both the DCS100 &/or the DT100 to a system that is already running with a DT200 command station (Big Boy Starter Set).

Adding a DCS100 to your existing Big Boy will give you

1. The ability to run more engines at a time.
2. Complete walk around capability for all DT200 throttles.
3. Nested Consisting (using consists as part of other consists).
4. The ability to run Motorola Trinary Format Decoders on your LocoNet system.
5. No LA-1 or LA-2 needed.
6. Throttle keep alive is built in so batteries are no longer an issue.
7. Customizable system features.
8. DT200's will show actual switch position.

Adding one or more DT100's to your Big Boy will give you

1. Less expensive full featured throttles.
2. Fast Clock Display in all DT100's on your system.
3. DT100's will show actual switch position.
4. Customizable throttle options like ballistic tracking.

If you are an experienced Digitrax, Big Boy or LocoNet user & are adding a DCS100 to a working Big Boy LocoNet system, enter at any installation step you feel comfortable with. Refer to the system diagrams 1 & 2 in this manual and to the hook up diagram in your Big Boy manual for typical connections. Be sure to review the display differences between the DT100 & the DT200 if you are using a DT100 for the first time.

15.1 Adding a DCS100 To Your Big Boy Layout

Please note: You will NOT use the DT200 as a command station when you add the DCS100. You will NOT use an LA1 or LA2 when you use the DCS100.

1. Unplug your DT200 master (command station unit) from the system & remove its battery to clear it from master mode.
2. Disconnect the LA-1 or LA-2 from your DB100 booster & existing LocoNet wiring. Put it away, you won't need it as long as you are running with the DCS100 as your command station.
3. Connect the LocoNet cable that was connected to the "B" end of your LA1 or LA2 to the LocoNet "B" port of the DCS100. Use a male to male 6 conductor jumper from the LocoNet Port on the DB100 booster where the

- LA-1 or LA-2 was plugged into back to the DCS100 LocoNet port "A."
Note that the DCS100 and DB100 LocoNet A & B ports are interchangeable.
4. Reinsert the battery in your DT200 after a minute or so & the DT200 will display "idLE." DO NOT make the DT200 a command station, the DCS100 is handling that part of your system now. Plug in your DT200 anywhere on LocoNet & run trains as you did with your Big Boy. The DT100, DT200's & any other devices can be connected anywhere along the LocoNet wiring.
 5. The expanded Chief set diagram 2 shows one way you might choose to set up your wiring for this conversion. The main point to note is that you do not have the LA1/LA2 wiring adapter anymore, & you can hookup all LocoNet ports in the most convenient & sensible manner.

15.2 Using A DT200 Throttle With Your Chief Set

To use your DT200's with your Chief Set, insert the battery in your DT200 & the throttle will display "idLE." DO NOT make the DT200 a master (command station), the DCS100 is handling that part of your system now. DO NOT plug in an LA-1 or LA-2. Plug in your DT200 anywhere on LocoNet & run trains as you did with your Big Boy.

A DT200 that is running as a throttle on a DCS100 command station **will work just like it always has on a Big Boy**. As an added bonus, there are several additional features a DT200 can access when it is running with a DCS100 as the system command station. For example, the DT200 can now work with "nested" consists, set up "advanced" consists, display the actual position of all turnouts and can select & run locos with Motorola Trinary Format decoders on the layout.

15.3 Using A DT100 Throttle With Your Big Boy Set

Simply insert the battery in your DT100, setup any Throttle options you wish to change & plug it in to any LocoNet Jack. It is ready to run. Complete operating instructions for the DT100 are included in the Chief Manual. Also, see Chief Manual section 22.0 for information about the specifics of running and Editing the Fast Clock feature.

15.4 Differences Between "Chief" and "Big Boy" Operations

Differences between the DT100 & DT200: The following are differences that users of DT200's will notice when they use DT100's.

- A) Steady ORANGE in DIR indicators show that Track power is OFF.
- B) Flashing ORANGE in DIR indicators show that the track is "idLE"/Paused/Stopped (In the DT200 this was indicated by a flashing colon ⌚ in the LCD).
- C) Flashing Colon ⌚ (with no other mode flags) means that the fast clock time is being displayed on the LCD. All DT100's have a synchronized networked

fast clock with an integral 24 hr Alarm. The fast clock will synchronize between DT100's even when they are operated on a Big Boy system with a DT200 as the command station.

- D) The Switch commands are explicit "Thrown" & "Closed" commands rather than simply toggle commands as in DT200.
- E) The DT100 can control F5-F8 when the  key is pressed and held down while pressing the bottom row key corresponding to the function you want to control.
- F) The DT100 can access the DCS100's separate service mode programming output. This means that you can program decoders without shutting down operations on the main track. See Chief Manual section 21.1 for full details on this programming track. Programming to loco's on the mainline [operation Mode programming] is also available. See Chief Manual section 21.7.
- G) The Expanded Address Mode Indicator  will blink RED when the address being displayed is an aliased four digit address & will be steady RED when the address is a four digit long address. The  indicator will be off when using two digit short addresses.
- H) The DT100 can automatically recover *common* purged loco's when logged back on to LocoNet.
- I) The DT100 has a feature called "slot following" to allow for future products that will allow speed supervision by a computer or other device (for example, signal approach speed limiting). Today you can use this feature for training new operators or supervising inexperienced operators. You can do this by concurrently logging on to (or "stealing") the loco that is currently "in-use" by another throttle. If a DT100 detects changes to its locomotive it will track the changes, & if the loco is active in the display, the speed/direction will update in the display & the unit clicks. See Chief Manual section 13.2 for a full discussion of this feature.
- J) The DT100 has provisions for programming components of the future Digitrax Signaling System. Compatible with data format supported by Tannersoft/Winlok, etc.
- K) The DT100 has a throttle option mode that is accessible when you first power up each throttle. This mode allows you to configure your throttle for Ballistic or Straight Line tracking, Audible Feedback On or Off, Fast Clock On/Off & much more. See Chief Manual section 20.0 for DT100 Option setups & values.
- L) The DT100 has selectable Ballistic knob tracking & auto-repeat +/- keys.

If a DT200 has been used on a Chief set & **is going to be used as the Master Command Station for a Big Boy set**, this throttle must be 'reset' to erase the Chief setup information it may still carry. To do this, simply remove the battery to power down the throttle and then replace the battery to reset the throttle. OR

do a throttle reset by pressing ,  &  simultaneously. If the DT200 is just being used as a throttle on a Big Boy, this step is not needed.

15.5 Converting Your DT200 to a DT100

Your DT200 can be *converted* into a DT100 with capability of accessing **all** the expanded Chief features. Once this conversion is made please remember that your DT100 is only a throttle & does not have command station capabilities. Therefore, a DT100 cannot act as a command station in a Big Boy Set. So, changing your DT200's into DT100's is really a conversion & not an "upgrade" because some features are lost while others are gained. This conversion can be done by the factory or by most local dealers. Please contact either Digitrax or your dealer before sending in your throttle for conversion so that we can schedule a good time for the work to be done so that you are not inconvenienced by a long wait.

16.0 Warranty and Repair Information: DT200, DB100, LA-2

One year guarantee on DT200, DB100 & LA-2. These units are not user serviceable (opening the case voids your warranty). If a defect occurs, return the unit to us for service. We will repair or replace these units at our discretion at no charge to you for one year from purchase date. This warranty excludes damage due to abuse, such as failure to properly protect against input over current with a fuse or circuit breaker or applying excessive input voltage to the unit. We will make any repair needed because of physical damage or electrical abuse at fair and reasonable rates.

Decoders

Digitrax carefully tests every decoder we ship to be sure that you receive reliable products. Because we want you to be comfortable installing your own decoders, we outline a decoder test procedure that you can perform so that you can be sure your decoder works before you begin installing it in your locomotive. If, within 60 days of purchase, your decoder fails to pass the decoder test procedure outlined in the instructions, we will replace it free of charge to you. Because we can't control the actual decoder installation we can't cover your decoder once you have tested it and started the installation. In the event that you somehow manage to "blow-up" one of these little guys, we will repair or replace it for a nominal fee (call for the current amount) if you return the decoder to us.

Do not remove the shrink-wrap protective sleeves from Digitrax decoders or open the Command Stations or other products. None of the units have user serviceable parts, and opening them will void ALL warranty protection. If you are returning a decoder that failed the **test procedure**, all wires must be their original lengths. Do not cut any wires or install any units until you are sure they have passed the Decoder Test Procedure detailed in the

Decoder Manual. Please don't return *anything* to Digitrax without calling and getting return instructions.

In order to make sure we give you the best service possible, please call (770)441-7992 to let us know before you send anything to us for service or as a return.

All warranties on Digitrax products are limited to refund of purchase price or repair or replacement of Digitrax products at the sole discretion of Digitrax. In the event that Digitrax products are not installed or used in accordance with the manufacturer's specifications, any and all warranties either expressed or implied are void. Except to the extent expressly stated in this section, there are no warranties, express or implied, including but not limited to any warranties of merchantability or fitness for a particular purpose.

Table VI: Decimal to Hexadecimal Conversion Chart

DEC	HEX												
00	00	39	27	78	4E	117	75	156	9c	195	c3	234	EA
01	01	40	28	79	4F	118	76	157	9d	196	c4	235	Eb
02	02	41	29	80	50	119	77	158	9E	197	c5	236	Ec
03	03	42	2A	81	51	120	78	159	9F	198	c6	237	Ed
04	04	43	2b	82	52	121	79	160	A0	199	c7	238	EE
05	05	44	2c	83	53	122	7A	161	A1	200	c8	239	EF
06	06	45	2d	84	54	123	7b	162	A2	201	c9	240	F0
07	07	46	2E	85	55	124	7c	163	A3	202	cA	241	F1
08	08	47	2F	86	56	125	7d	164	A4	203	cb	242	F2
09	09	48	30	87	57	126	7E	165	A5	204	cc	243	F3
10	0A	49	31	88	58	127	7F	166	A6	205	cd	244	F4
11	0b	50	32	89	59	128	80	167	A7	206	cE	245	F5
12	0c	51	33	90	5A	129	81	168	A8	207	cF	246	F6
13	0d	52	34	91	5b	130	82	169	A9	208	d0	247	F7
14	0E	53	35	92	5c	131	83	170	AA	209	d1	248	F8
15	0F	54	36	93	5d	132	84	171	Ab	210	d2	249	F9
16	10	55	37	94	5E	133	85	172	Ac	211	d3	250	FA
17	11	56	38	95	5F	134	86	173	Ad	212	d4	251	Fb
18	12	57	39	96	60	135	87	174	AE	213	d5	252	Fc
19	13	58	3A	97	61	136	88	175	AF	214	d6	253	Fd
20	14	59	3b	98	62	137	89	176	b0	215	d7	254	FE
21	15	60	3c	99	63	138	8A	177	b1	216	d8	255	FF
22	16	61	3d	100	64	139	8b	178	b2	217	d9		
23	17	62	3E	101	65	140	8c	179	b3	218	dA		
24	18	63	3F	102	66	141	8d	180	b4	219	db		
25	19	64	40	103	67	142	8E	181	b5	220	dc		
26	1A	65	41	104	68	143	8F	182	b6	221	dd		
27	1b	66	42	105	69	144	90	183	b7	222	dE		
28	1c	67	43	106	6A	145	91	184	b8	223	dF		
29	1d	68	44	107	6b	146	92	185	b9	224	E0		
30	1E	69	45	108	6c	147	93	186	bA	225	E1		
31	1F	70	46	109	6d	148	94	187	bb	226	E2		
32	20	71	47	110	6E	149	95	188	bc	227	E3		
33	21	72	48	111	6F	150	96	189	bd	228	E4		
34	22	73	49	112	70	151	97	190	bE	229	E5		
35	23	74	4A	113	71	152	98	191	bF	230	E6		
36	24	75	4b	114	72	153	99	192	c0	231	E7		
37	25	76	4c	115	73	154	9A	193	c1	232	E8		
38	26	77	4c	116	74	155	9b	194	c2	233	E9		

NMRA ADDRESSES AS THEY CORRESPOND TO CHALLENGER COLOR CODES

	RED 	GREEN 	BLUE 	BLACK 
GRP A	CONV	01	02	03
GRP B	04	05	06	07
GRP C	08	09	10	11
GRP D	12	13	14	15

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DT200 Cheat Sheet

Make Command Station Press & Hold  &  Together

Reset  &  &  Together

Idle  &  Together

Note: Press Run/Stop a little ahead of other keys when used in combinations.

DB100 Power ON  &  Together

DB100 Power OFF  &  Together

Loco Status Change

 Select Address, 

Left Side of Display=Address,
Right Side of Display=Status

 ,  , 

Status: 10=28 Speed Steps 12=14 Speed Steps 13=128 Speed Steps

MU Set UP  ,  , 

Left Loco will consist with right loco

NOTE: Locos must all be heading in the same relative direction when consisted.

MU Break UP  ,  , 

Left Loco will break off from consist

Program Mode  

Left Display=Configuration Variable
Right Display=Value

Refer to Table III for most commonly used CV's & value ranges.

 to Set the CV & Value