M.T.H. HO SUBWAY
(PS3)
Engineer's Guide

Congratulations! You've just purchased the most feature-rich and technically advanced HO subway set ever produced! This highly detailed model includes a broader range of features than you'll find on any other HO powered car, including smooth performance from a three-scale-mile-per-hour crawl to full throttle; "cruise control" for steady speeds regardless of curves, switches and grades; built-in decoders for DCC and the M.T.H. Digital Command System (DCS); and a full range of prototypical sounds. If you're looking for motive power that's accurately detailed, smooth running, and a great deal of fun to operate, it doesn't get any better than this.

Operates on 18" radius curves with Code 70, Code 83 or Code 100 rails.

Transit Announcements

PLEASE READ THE MANUAL
BEFORE USE AND SAVE
WWW.MTHHOTRAINS.COM

TABLE OF CONTENTS

QUICK START GUIDE

Of course, you should read your manual over before running your powered car. But if you just can't wait, choose which control method that you use from the list below. Follow the steps outlined in your section, run your powered car and enjoy! Now, after a few minutes, shut down the powered car and read through your engineer's guide.

I USE A REGULAR DC SUPPLY...

Step 1: Unpack your subway set.
Step 2: Set the powered car on the track
Step 3: Apply 6-8VDC voltage until she starts up and then increase to
        pull out.

I'M A DCC OPERATOR...

Step 1: Unpack your subway set.
Step 2: Set the powered car on the track …
Step 3: Power up your DCC system…
Step 4: Select engine address 3 and press "F3" to start her up…
Step 5: Turn the throttle and head on down the pike…

I RUN DCS...

Step 1: Unpack your subway set.
Step 2: Set the powered car on the track …
Step 3: Power up your DCS system…
Step 4: Add the powered car to your system and start her up…
Step 5: Turn the throttle and move out…

CAUTION: M.T.H. HO powered cars **DO NOT OPERATE ON AC VOLTAGE**. Applying AC power to your locomotive could cause permanent damage and will void your warranty.

Please note, when making setting changes in DCS or DCC, such as address, please wait a minimum of 5 seconds after removing power to ensure the settings are stored in the engines memory. Reapplying power in less than 5 seconds may result in losing the setting changes.

UNPACKING YOUR SUBWAY SET

Removing and Unwrapping Your Subway Set
Carefully remove and unwrap the model on a soft surface. By nature, models with high levels of detail have some small fragile parts.

Carefully remove any foam packing pieces that may be surrounding the model.

PRODUCT OVERVIEW

Getting to Know Your M.T.H. HO Subway Set

Key Features
Your new HO Subway Set is equipped with the exclusive M.T.H. Proto-Sound® 3.0 digital sound and control system. In plain English, this means your locomotive contains state-of-the-art electronics providing realistic digital sounds, precisely controlled speed in increments of 1 scale mile per hour, and much, much, more.

Compatibility
The Proto-Sound 3.0 system is universally compatible with track power and/or signal combinations including analog DC (regular DC power pack), DCC (NMRA Digital Command Control), or DCS (MTH Digital Command System). Simply set your powered car on the rails, apply any one of these power/signal sources, and move out! The Proto-Sound 3.0 system automatically senses the track environment and adapts accordingly. No hidden jumpers, switches, magic wands, or programming required! A vast array of realistic operation is automatic when the powered car is run on analog DC. You can expand access to features in a DCC environment. Experience the most your new locomotive has to offer in the simple to use yet powerful world of DCS. **To be clear, DCS is NOT a proprietary version of DCC, as some other manufacturers offer. DCS is a comprehensive layout control system designed with one primary goal: make model trains do amazingly realistic things using a simple and intuitive controller. We put the complexity on the inside, and the fun in your hands!**

Digital Sound

Your Proto-Sound 3.0 (PS3) equipped powered car contains over 100 individual recordings. These recordings are played back dynamically at appropriate times to create a symphony of realism for your ears. Hear the sound automatically intensify or lighten when speeding up or slowing down, listen to the sounds of brakes squeaking and squealing as you come to a stop, or enjoy the random conversations of railmen working as your model sits at idle. It's all there and it's incredible.

Your HO powered car includes built-in realistic horn sound effects, including forward (two blasts) and reverse (three blasts) signaling and crossing signal sounds, all available with one-touch control from a DCS controller or through any DCC controller capable of accessing up to F28.

Digital Control

In standard analog DC mode, your model still operates under digital control. The PS3 advance speed control system converts track voltage into digital speed commands. Your model will run smoothly and consistently at any speed regardless of load, hills, or curves. If you are a DCC user, you'll quickly learn to appreciate the precision of our speed control and linear speed curve. DCS users will enjoy the added benefits of controlling speeds in increments of 1 scale mile per hour displayed on DCS controllers or easily changing acceleration and deceleration rates independently without any discussion of bits or bytes. **To be clear, DCS is NOT DCC.**

Lights

As you read on, you'll notice there are no instructions for replacing light bulbs in your powered car. That's because there aren't any. We use specially designed and controlled LEDs to create realistic lighting effects that occur automatically. Again, NO PROGRAMMING!

More...

In analog DC operation, just flip the track polarity or direction switch at any speed and watch your powered car gradually come to stop, turn on the appropriate directional lighting, and smoothly accelerate back up to speed. No other HO powered car has features like these. There are so many more things to learn and enjoy about M.T.H. powered cars, we could write a book. But, that's no fun. So, if you haven't already done so, flip to the Quick Start Guide and let's run your new powered car!

SET-UP

Lubrication

Use light machine, household, or the oil in the MTH maintenance Kit (Item #30-50051). Apply a very small amount to all axle points as shown.

Lubricate Axles (L)   Lubricate Axles (L)

Your gearbox is properly greased at the factory and probably never needs service, however, if you run excessive hours pulling heavy loads, it's a good idea to remove the gearbox cover and re-grease using M.T.H. gear grease or equivalent.

Gently lift both sides to remove the Gear Box Cover

Lubricate Gears

Gear Box Cover
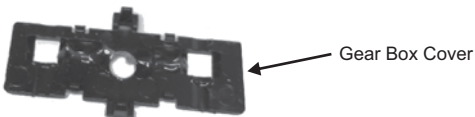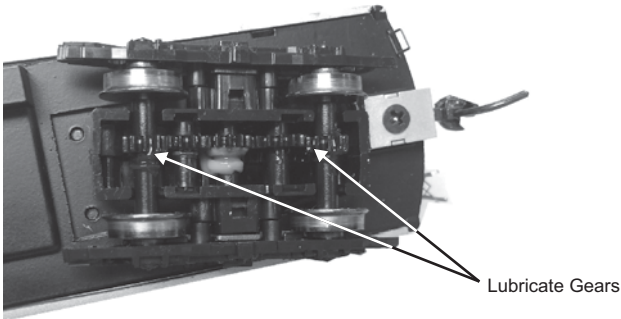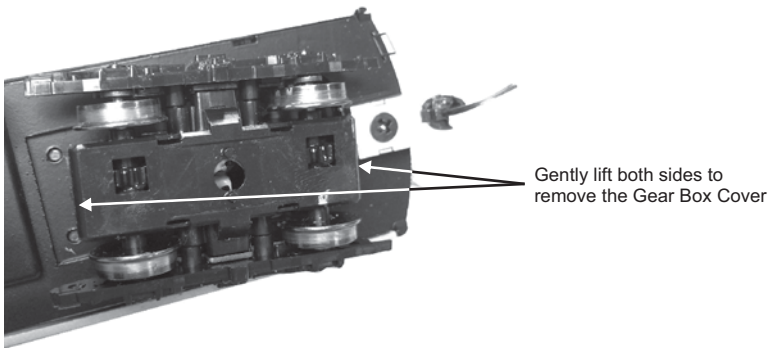
Non-Powered Car

If you need to access the interior of the non-powered car for any reason, such as adding figures, simply pull outward slightly on the body near a truck as you pull up on the truck. After you free one side repeat this step on the other end of the car. Then gently pull the chassis from the body to access the interior.

Pull Body Outward

Modes of Operation

There are 3 modes of operation with different levels of features accessible in each. We refer to them as Analog DC, DCS and DCC. Here's a brief explanation before we get into the features of each mode.

Analog DC

This is when there is nothing connected to the rails except a conventional DC power pack. These power packs generally have at least one variable output controlled by a throttle of some sort and a means of reversing DC polarity on the track to change the direction of your powered car.

DCS or Digital Control System

While the acronyms are close, this is about where the similarities between DCS and DCC end. Yes, they are both digital control systems, however, M.T.H. DCS is NOT DCC. There are several proprietary versions of DCC on the market, but this is NOT one of them. M.T.H.'s DCS system is proven technology in the O and One gauge markets and now, we've brought its power and simplicity it to you.

First, the power signal in DCS is NOT the command signal. Next, DCS employs a fully functional bi-directional communication scheme opening a vast range of advanced features and yet, is so simple and intuitive, you can enjoy them! No programming tracks, bits and bytes, or conversion of binary to hexadecimal numbers here! To add a powered car in DCS, just press "ADD ENGINE." After that, If you want to start your powered car, just press "START UP" or, to turn the sound on or off, just press "SOUND." No combinations of letters or numbers to remember! We think you're really going to like this!

Please note, when making setting changes in DCS or DCC, such as address, please wait a minimum of 5 Seconds after removing power to ensure the settings are stored in the engines memory. Reapplying power in less than 5 seconds may result in losing the setting changes.

DCC or Digital Command Control

DCC is a popular digital command control scheme wherein the track power is also a digital control signal. That is, using a DCC controller, you can communicate with multiple engines and have them all moving at different speeds or moving in opposite directions on the same track at the same time. The power/command signal remains constant and engines are "commanded" to perform as desired. M.T.H. is new to DCC but, we recognize it's importance to many HO operators. So, we loaded our powered car with more DCC features easily accessible to the operator than any HO powered car ever built previously. You DCC guys are in for a real treat!

FEATURES AND OPERATION

Now, for the fun stuff! Your new M.T.H. HO powered car has more features and operating capabilities than any HO powered car ever built by any manufacturer. We're going to walk you through everything she does in general, but you'll probably find a few we forgot to mention on your own.

Analog DC

Not much explanation is required here, and that's exactly why you run your trains this way! Here's the good news, even if you like to keep it simple, your MTH HO Subway Set is packed with cool sounds, lights, and operating features, that you're going to love.

Running the Subway Set

Set the powered car on the rails, and apply DC power. Refer to the Set-Up section of this guide for instructions on how to lubricate the chassis.

As you increase power, at about 6 volts, the lights and sounds will come on. Keep going on up to about 8 and she'll move out! About 16 volts DC is adequate for prototypical speeds however, your powered car can handle up to 24 volts DC if you feel the need for speed!

Changing Direction

If you flip the direction (polarity) switch on your power pack while the powered car is moving, it will gradually slow to a stop, and slowly accelerate back up to speed in the opposite direction. This is an exclusive feature of MTH engines that we're sure you'll enjoy. You can also change direction the old fashioned way by reducing throttle until the powered car stops, flip the direction switch, and then increase throttle again. Either way is OK, we just thought a graceful transition from any speed would be cool.

If you switch track polarity too slowly, the powered car may stop abruptly and not move in the reverse direction. This is normal. There is a feature we call "anti-jack rabbit" that prevents the powered car from taking off at high speeds when high voltage is applied to the track instantly. Some direction switches have a "dead" spot where the power is completely off during polarity changes. This can invoke the anti-jack rabbit feature. The solution is to flip the direction switch more quickly or disable the feature in DCC. Don't worry you won't hurt the powered car.

Speed Control

Your powered car is equipped with speed control. This feature is always active, even in analog DC mode. Basically, your powered car constantly measures track voltage and converts this to a digital speed command. You should notice the speed remains constant up and down grades, around curves, and with varying loads. This is no accident. You've got the most precise speed control system available today.

Sounds

In this mode, sounds are pretty much automatic. If you're moving, you'll hear the sounds of the subway car's motor.

When your sitting at idle, there may be some station sounds. You may also hear voices from the conductor or from passengers.

When you're moving at a pretty good clip and you reduce the throttle quickly, you may hear the brakes squeak and squeal as the engineer applies them. Of course, they'll stop when the powered car does.

If things get too noisy, just locate the sound volume pot underneath the powered car, adjust the volume from maximum down to off, whatever suits you. Turn it counterclockwise to reduce the volume or clockwise to increase it.

Volume Pot
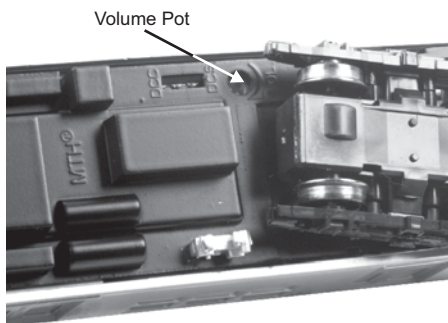
Lighting

Now, this is an illuminating section (we couldn't resist). Your powered car is equipped with headlights, taillights, end & side destination boards, route signs and local/express lights. Your non-powered cars are equipped with interior lighting and side destination boards.

The first thing to know about the lighting is there aren't any bulbs. It's all LEDs, so you should never have to replace them. As with sounds, in analog DC mode, lighting operation is fully automatic. They're always on and behave appropriately.

DCS Digital Command System

As you may have gathered by now, DCS is an M.T.H. exclusive Digital Command System that provides easy access to dozens and dozens of features in our models. We developed DCS to provide a powerful and advanced model train control system that was simple and enjoyable to use. We've accomplished that goal. DCS further expands the features available far beyond that of DCC. After all, in DCC, we only had a limited number of "F" commands to fill.

As with DCC, we'll leave the detailed "how-to" system explanations to the DCS system manuals. What you should know are all the cool features your powered car has built-in, waiting for you to experience.

Running the Powered Car
Once the DCS system is connected to your track and powered up by a DC Power Supply (even though DCS can be controlled by AC and DC power supplies, your M.T.H. HO powered car will ONLY run on DC power), you simply place your powered car on the rails, press "ADD ENG" and the system will scan the track and automatically upload your powered car into the controller. At this point, you can press "START UP", roll the throttle and pull out! That's it!

Speed Control
DCS powered cars are controlled in scale miles per hour (smph) and increments of one. So, that means if you dial up 10, your powered car will smoothly accelerate to 10 smph. There is no need to select a speed step setting, there's only one precise linear control at scale speeds. See, powerful yet simple.

Sounds
Independent Volume Settings
Using DCS, you independently adjust the bell, horn, powered car, and accent sounds volume. This is like a mixer so you can set up the powered car to fit your specific tastes and sense of realism. They all move relatively up or down with the master volume settings.

Doppler Loop
You can either press the Doppler button on the remote to activate what we refer to as "one-shot" Doppler, or, using DCS, you can program a Doppler loop that will peak at the same point on your layout, over and over.

Custom Sounds

You can fire any of 10 individual sound bites pre-loaded into your powered car. These are typically, diesel idling sounds. Each one at the press of a single button. You can also make voice or other audio recordings and play them back on command with ease.

Proto-Dispatch

Press the "MIC" (microphone) button on your DCS remote and speak. Your voice will be digitized and played out of the model in real-time. Talk about station announcements!

Proto-Cast

Another MTH exclusive, you can connect any audio source with a line output to the DCS TIU and send music, train sounds, or anything you like down the rails to be played through the powered car as it moves along the track. Your holidays may never be the same!

Lighting

As with everything in DCS, this becomes a little more than obvious. Pressing the "HEADLIGHT" button turns off the directional headlight and reverse light. The local/express lights can be toggled using the beacon light softkey (LBE) on your DCS remote.

DCC - Digital Command Control

DCC is a popular digital command scheme wherein the track power is also a digital control signal. That is, using a DCC controller, you can communicate with multiple engines and have all of them moving at different speeds and in varying directions on the same track at the same time. The power/command signal remains constant and engines are commanded to perform as desired. Your MTH PS3-equipped powered car has the ability to decode and respond to these DCC commands. This allows you to mix and match MTH PS3-equipped engines as well as operate them with any other manufacturer's DCC-decoder equipped engine. The best part about your MTH PS3.0-equipped powered car is that the decoder is built right in. No need to remove the body and install speakers or boards. It's all done for you at the factory. Each PS3-equipped powered car has a full complement of lights and sounds. Just set the model on the rails, apply DCC power and hit F3 on your DCC handheld controller and you're off and running.

Basic DCC Operation

Your MTH PS3.0-equipped subway set takes full advantage of DCC's capabilities. Below are the basic commands you'll want to know to get started running quickly. Please refer to the Advanced DCC Operation section of the manual if you want to dig into the full capability of DCC.

A note about enabling/disabling F Functions in DCC - Depending upon the DCC system you have you may need to toggle a particular F Function on then off to actually get it to enable. Some DCC systems do this for you automatically and others allow you to set particular F Function buttons to either be set for momentary or toggle. Please refer to your DCC control station manufacturer's manual for more information on how they handle F Function buttons.

Your MTH PS3.0-equipped powered car's default short address is 3. So all you have to do is power up your DCC system and call up Locomotive 3 to begin.

Start-Up/Shut-Down
F3 – Start-Up/Shut-Down
Pressing this twice (toggle on then off) will start up your engine. When you apply DCC power your MTH PS3.0-equipped engine will remain dark and quiet. Since you likely don't want to run the engine this way, simply press F3 twice to start your engine. The lights, sound and smoke (if equipped) will come on.

Note: You are actually able to move the engine in DCC without starting it up. Just increasing the throttle will cause the engine to move. In order for F3 to function correctly the engine must NOT be moving.

To shut your engine down, press the F3 button twice. This will play the shut down sounds and then turn the lights and smoke and sounds off. As long as there is DCC power still on the track the engine can be started up again by pressing the F3 button twice.

Bell/Whistle (Horn)
F1 – Bell
To activate the Bell press F1. To deactivate it, hit F1 again.

F2 – Whistle (Horn)
To activate the Whistle/Horn, press F2. To shut it off either let off the F2 button or press and release it.

Lights
F0 – Headlight/Taillight
This toggles your headlight/taillight on and off.

F5 – Lights
This toggles your lights (except headlights) on and off.

Master Volume
F6 – Master Volume
When you activate F6, the Master Volume will begin increasing. If you are at 0 (no volume), the first time you turn on F6 it will take approximately 3 seconds to get to 100% volume. When you get to your desired volume level, turn F6 off.

The next time you toggle F6 on it will drive the Master Volume to 0. If you are at 100% it will take approximately 3 seconds to get to 0. When you arrive at your desired level turn F6 off.

It works like a volume slider – the first time you enable F6 it goes up and stops at 100%. Toggle F6 off and then back on and it will go down to 0 and stop.

Forward/Reverse Signal

Just like a real engine, you can announce the direction of intended movement using your DCC handheld and F9 and F10.

F9 – Forward Signal

Pressing F9 twice (toggling on then off) will sound the Forward Signal. This is two whistle/horn blasts.

F10 – Reverse Signal

Pressing F10 twice (toggling on then off) will sound the Reverse Signal. This is three whistle/horn blasts.

Engine Sounds
F25 – Engine Sounds

You can turn the Engine Sounds On/Off by pressing the F25 button. Pressing it once (enabling F25) will cause the Engine Sounds to shut off. The Whistle/Horn and Bell sounds will still be active, however. To turn the engine sounds back on press the F25 button again (disable F25).

Additional F Functions
F4 – Station Announcement

Note: F4 has two functions with trolley/subways:
1. It scrolls through the station announcements to allow you to pick a specific station to stop at in Manual Mode.
2. It scrolls though the station announcements to allow you to pick the station stop you want to program while the engine is in Learn Mode.
Depending upon how you have F4 set to function (toggle or momentary) you will want to turn F4 On then Off to get the station announcement to play.

Manual Mode Operation using F4:

1. While the engine is moving press F4 so it goes On then Off. You will hear a station announcement (for example, "Next Stop, Times Square.").
2. Manually drive the engine to where you'd like it to stop and bring the speed to zero.
3. The engine will begin playing its random station sounds. These are sounds of a station that include all the ambient noises one might hear.
4. Once you are ready to depart the station simply roll the throttle up to your desired speed and the engine will wrap up its station sounds and play a departing announcement. Shortly after it will start moving.
5. You can repeat this process as often as you like. You can also scroll through the list of stations to get to one in particular you'd like it to stop at. The last station announcement the engine makes is the one it will stop at. If you happen to go past the one you want you can continue toggling F4 until you hear it again. The station announcements loop around in the list.

F7 – Auto Mode

Auto Mode is a mode of operation that allows the engine to run along a pre-programmed route that you have taught it. When F7 is On the engine will announce "Auto Mode". Toggling F7 Off will shut off Auto Mode and put the engine back into Manual Mode. The engine will not announce that it's in Manual Mode, however.

F8 – Learn Mode

Learn Mode is a mode of operation that allows you to teach the engine when and where to stop. By using the F4 and F8 function buttons you can program stops along a route. Here's how this works:

1. Ensure the engine is stopped at the first station as close as possible to exactly where you want it to stop (and start). It is important that you get this as close as possible because any errors you have in programming will become cumulative along the entire route.

2. Press F8 so it is On (ensure it is left On the entire time you are programming the engine's route). The engine will announce "Learn Mode".

3. Assuming your engine is exactly where you want your first stop press the F4 button On then Off (again, this depends upon how you have the functionality of some F-Function Buttons). The first station in the list will be announced. If this is the station you want to program press F2 On then Off. The engine will announce, "Saved". It's a good idea to write down the stations in the order in which you save them. This is especially important for the final step of saving the final stop.

4. Continue on programming station by advancing the throttle and stopping at the next station. Repeat step 3 and 4 for as many stations you want to program.

PLEASE READ THE FOLLOWING STEP AS IT'S EXTREMELY IMPORTANT

5. This step shows you how to save the final station. The method in which you save the final station determines whether your route is an out-and-back or loop:

    a. To save as a Loop:

        I. Ensure the engine is back at the EXACT same spot you started.

        ii. Using F4 cycle through the station list until you hear the first station you programmed in step 3.

        iii. Press F2 On/Off to save the station. The engine will announce "Saved. Save Complete" and the engine will go back to the normal engine sounds.

b. To save as an Out-and-Back:

> i. Ensure the engine is sitting at the final station you
> programmed in step 4.
> ii. Press F2 On/Off again and the engine will announce, "Save
> Complete" and the engine will go back to the normal engine
> sounds.
> iii. Advance the throttle and drive the engine to the first station
> you saved.

You are now ready to run the engine in Auto Mode (F7).

To run in Auto Mode:
1. Drive or set the engine at the first station you programmed earlier. It's important that you be as exact as possible where you start the engine to minimize any drift the engine might have from the physical station stop.
2. Press F7 so it's On. The engine will announce, "Auto Mode".
3. Advance the throttle and the engine will automatically stop at the pre=-programmed stops.
To make it stop at All or Random stations see the section on All/Random Stops.

F11 – Custom Sound 2
Custom Sound 2 is a pre-programmed sound that you can call up at will by pressing F11 On then Off. It could anything from an ambient station sound to a conductor's voice. It will be the same sound each time you trigger it.

F12 – All/Random Stops
You can control whether the engine stops at all the pre-programmed stops taught to it in Learn Mode or at Random stops along the route. To do this:
1. While the engine is running or while it's stopped, doesn't matter; press the F12 button so it's On. Once F12 is active you are now telling the engine to stop at Random stops along the route. To make it stop at ALL stops along the route turn off F12

F13-F16 – Idle Sequence
Pressing F13, F14, F15, or F16 twice (toggling on then off) will trigger an Idle Sequence if the engine is not moving. These vary from engine to engine and may include things like checking the coal load, checking the water level, using the Alemite grease gun on the drivers, etc. When triggered, these will run through the sequence that varies in duration.
NOTE: The engine must be sitting still in order to trigger these

F17 – Extended Start-Up

If your engine is shut down or you've just applied DCC power pressing F17 twice (toggling it on then off) will start the Extended Start-Up sounds. This is very similar to F3 except you will hear the crew talking back and forth about getting the engine ready to run.

F18 – Extended Shut-Down

If your engine is already up and running you can play the Extended Shut Down sounds by pressing F18 twice (toggling on then off). The Extended Shut Down is very similar to F3 in that the engine will ultimately shut down, but in the case of Extended Shut Down you will hear the crew talking back and forth about how the engine ran, time schedules, etc.

F19 – Train Marker Train Marker is used on certain engines that carry marker or End Of Train lighting. This is controlled by F19. When F19 is On the Marker light will be On. If F19 is Off, the marker will be Off.

F20 – Local/Express or Alternate Mode Lighting

The Local/Express control is for engines that carry a local/express light (R-17 subway, for example). Some engines do not carry this light or this feature. Alternatively, some engines do carry a light that can be toggled by F20. Often times this will be a Beacon light or a variable indicator light of some kind. Again, not all engines carry a light controllable by F20.

F21 – One Shot Doppler

You can set your MTH PS3.0-equipped engine to simulate the actual Doppler Effect sound a real engine makes as it passes you. To do this, press the F21 button once (enable F21) and then listen as the engine makes that pitch shift that mimics the Doppler Effect perfectly. Press the F21 button again (disable F21) to shut off the Doppler Effect. With a little practice in timing and speed you can make this happen right in front of you.

F22 – Coupler Slack

When an engine hooks up and pulls a train it has to take up the coupler slack. You can play this sound by pressing F22 twice (toggling on then off). This feature works two ways – While the engine is sitting still, press F22 twice to enable it. Then, when you move the engine, it will play the Coupler Slack sound.

The second way is to simply force the sound while the engine is moving. To do this, simply press F22 twice (toggling it on then off). The sound will play.

F23 – Coupler Close
To play the Coupler Close sound press the F23 button twice (toggling it on then off). You can play this sound as you're coupling cars together to add realism.

F24 – Custom Sound 1
Functions exactly like Custom Sound 2 except Custom Sound 1 will play a different pre-programed sound each time F24 is toggled On/Off.

F26 – Brake Sounds
Pressing the F26 button (enable F26) will disable the Brake Sounds for your engine. The Brake Sounds occur when you reduce the speed of your engine rapidly. To enable the Brake Sounds press the F26 button (disable F26). Brake Sounds are On by default.

F27 – Cab Chatter
Cab Chatter occurs when the engine is sitting at idle. There are various times when the crew will talk to each other when the engine is sitting at idle. Pressing the F27 button (enable F27) will disable the Cab Chatter. Pressing the F27 button again (disable F27) will enable Cab Chatter. Cab Chatter is On by default.

F28 – Feature Reset
Resets Features to defaults.

FUNCTION CHART

F Key	**Description**
F0	Head/Tail light
F1	Bell
F2	Horn
F3	Start-Up/Shut Down
F4	Station Announcement
F5	Lights (except headlights)
F6	Master Volume
F7	Auto Mode
F8	Learn Mode
F9	Forward Signal
F10	Reverse Signal
F11	Custom Sound 2
F12	All/Random Stops
F13	Idle Sequence 4
F14	Idle Sequence 3
F15	Idle Sequence 2
F16	Idle Sequence 1
F17	Extended Start-Up
F18	Extended Shut-Down
F19	Train Marker
F20	Local/Express
F21	One Shot Doppler
F22	Coupler Slack*
F23	Coupler Close*
F24	Custom Sound 1
F25	Engine Sounds
F26	Brake Sounds (On/Off)
F27	Cab Chatter (On/Off)
F28	Feature Reset

*Many Subway and Trolley models do not have operating couplers.

CV29

Cv29 is the basic decoder setup CV that is used by all DCC decoder manufactures.

So, if you are familiar with CV29 from other manufacturer's decoders M.T.H.'s is no different. The most important part of CV29 is the ability to switch between long and short addressing. By default, CV29 on your M.T.H. PS3.0-equipped engine is set to 2.

Long and Short Addressing

Like most DCC Decoders, your M.T.H. PS3.0-equipped engine can be programmed with both Long and Short Address. Short addresses are those from 1-127 and Long addresses are those from 128-9999. You can program the engine address either with Programming on the Main (PoM) or using a Programming Track. Since it's easiest, in most cases, to PoM the instructions will show you how to do it this way. By default, your M.T.H. PS3.0-equipped engine comes programmed with both a long and short DCC address. The default Short address is always 3. The default Long address will be 3333.

To change your engine's Short Address using PoM:

1. Call up the engine's current address on your DCC handheld
2. Enter Programming on the Main on your DCC handheld
3. Enter the new address you want. Remember, you can only use address 1-127 for Short Addressing
4. Once you hit Enter the engine will give you a two whistle/horn blast response
5. Call up the engine on its new address and away you go.
NOTE: If you have elected to use PoM and did not start-up the sounds of your locomotive, you will not hear the two-whistle/horn blast response.

Alternatively, depending upon the type of DCC system you have, you can enter PoM and then write the new address in the Address Menu. This only works for short addressing. For example, on an MRC Prodigy Advance2 system, you would:

1. Call up the engine's current address on your DCC handheld
2. Hit the PROG button twice to enter PoM mode
3. Hit Enter twice so the LCD displays "Adr"
4. Type in the new Short Address (1-127) that you want and hit Enter
5. The engine will give you a two whistle/horn blast response
NOTE: If you have elected to use PoM and did not start-up the sounds of your locomotive, you will not hear the two-whistle/horn blast response.

To change your engine's Long Address using PoM:
   1. Call up the current engine's address on your DCC handheld
   2. Enter Programming on the Main on your DCC handheld
   3. In the following steps you will need to write values to CV17 and CV18 to tell the engine what the long address should be

   In order to determine your required values for CV17 and CV18 you will need to go to **https://mthtrains.com/sites/default/files/CV17-CV18%20Spreadsheet.pdf**

   Enter in the long address you want then click anywhere else in the spreadsheet and it will return the values for CV17 and CV18 (it will also return the hex conversion of the CV17 and CV18 values if your DCC system requires this).

   Below is an example for extended address 2011:

CV 17 and CV 18 Conversion Tool

Desired 4-Digit Engine Address	Hex Conversion	C17 Value to Enter	C18 Value to Enter
2011	07DB	199	219

   4. Call up CV17 and enter the value required for CV17. You will get a two whistle/horn blast response
   5. Call up CV18 and enter the value required for CV18. You will get a two whistle/horn blast response
   6. In this step you have to tell the M.T.H. engine that you want it to start looking at long addresses. You do this in CV29:
      a. Bring up the CV menu on your DCC handheld
      b. Enter "29" to edit CV29
      c. Enter "38" to change the value of CV29 and hit Enter
      d. The engine will give you a two-whistle/horn blast response.
   NOTE: If you have elected to use PoM and did not start-up the sounds of your locomotive, you will not hear the two-whistle/horn blast response.

Feature/Factory Resetting
Please note, when making setting changes in DCS or DCC, such as address, please wait a minimum of 5 seconds after removing power to ensure the settings are stored in the engines memory. Reapplying power in less than 5 seconds may result in losing the setting changes. If all else fails and you aren't sure of something, never fear. You can always get your engine back to a known state by either performing a Feature or Factory Reset.

There are a couple of ways to reset your M.T.H. PS3.0-equipped engine:

Factory Resets: Clears everything (makes engine just like it was when you bought it new)
- Send a decimal 08 to CV8 to reset everything entirely back to factory default
- Send a decimal 192 to reset everything except user speed tables

Feature Resets: There are a couple of Feature Resets that you can use
- Press F28 twice (toggling on then off). This resets the smoke, volume and
lights back to their defaults
- Send a decimal 64 for a Feature Reset. This resets volumes, smoke and light settings.
- Send a decimal 128 to reset only address values back to factory default
  - This is the same as writing 55 to CV55 to engine address 55
  NOTE: The engine address has to be something other than address 55

Lost or Unknown Engine Address and the 55-55-55 Address Reset

In some cases you may not remember or have somehow lost the engine address. Following the above Feature or Factory Resets will allow you to recover an engine. The limitation to this is that for most resets you must know the engine address. If you are unsure of the engine address you can apply the 55-55-55 reset (send a value of 55 to CV55 to engine address 55). In order for this to work correctly the engine's address must NOT be 55. The engine will need to be sitting at some address other than 55.

Below is the method (55-55-55 Reset) you can employ to return an engine to its factory default short address of 3 (it will also set the engine's long address back to its default – usually 3333 or the cab number on some models) if you're unsure of the engine's current address:

- Check first to see if the engine happens to be sitting at address 55. Call up engine 55 on your DCC handheld and hit F3 to start the engine up. If it starts up then you can change the address to whatever you want using CV1 (short address) or CV17 and CV18 (long address)
- If the engine doesn't start up at address 55 then you can use the 55-55-55 reset. To perform this follow the instructions below:
  - Ensure the DCC system is powered up and power is on the rails
  - Call up engine address 55. NOTE – you are NOT changing the engine's address to 55 you are just telling the DCC system to start talking to engine address 55. You will want to make sure that no other MTH engines are on the rails or any other manufacturer's engines with an address of 55 are on the rails. MTH engines will listen for commands coming to engine address 55 when the 55-55-55 reset is enabled even though they are not programmed

• Enter PoM mode on your DCC handheld and write a value of 55 to CV55. Again, even though your MTH engine is NOT on address 55 it will still listen for this reset command
• Call up address 3 on your DCC handheld and hit F3. The engine should now start-up

If you have performed the 55-55-55 reset and the engine still doesn't respond then place the engine on the programming track output of your DCC system and program a value of 3 to CV1. This will set the engine's short address to 3. However, as long as the engine is NOT programmed as address 55 then the 55-55-55 reset will always set the engine's long and short addresses back to their factory defaults. It will also set the engine's addressing back to short (if you happened to have CV29 set to long addressing)

The 55-55-55 Reset can be confusing at first but the main point to note is that you are NOT setting the engine's address to 55 to perform the reset, you are just calling up engine address 55 on your DCC handheld and sending a value of 55 to CV55. Again, MTH engine's will listen to the 55-55-55 reset command even though the engine's address isn't actually 55 (and it can't be for the 55-55-55 reset to work).

MTH PS3.0 Expanded DCC Functionality

Advanced DCC Operation

This section of the manual provides more in-depth detail on how to set up and configure your MTH PS3.0-equipped engine using the NMRA-standard CV's as well as the manufacturer-specific CV's. It also explains some of the other F Functions not covered in the Basic DCC Operation section.

Configuration Variables (CV)

Configuration Variables used on MTH PS3.0-equipped engines.

CV1	Short Address: 1-127 are the valid addresses
CV2	Start Voltage [1]
CV3	Acceleration Rate [1]
CV4	Deceleration Rate [1]
CV5	Max Voltage [1]
CV8	MFG ID. MTH =27 (Also used for various resets)
CV11	Packet Timeout
CV17	High Byte of Extended Address
CV18	Low Byte of Extended Address
CV19	Consist Address (bit 7=1 on an engine will tell the engine it's reversed in a consist)
CV21	Defines active Function F1-F8 for the active consist
CV22	Defines active functions for FL and F9-F12 for the active consist (bit 0=1 will tell an engine that you want it's FL control to operate under the consist address – bit1-0/bit2=1 will configure the FL control for a reversed engine in a consist)
CV23	Consist Acceleration Rate
CV24	Consist Deceleration Adjustment
CV25	Speed Table Select
CV29	Decoder Configuration
CV49	Short Address (controllers that prohibit PoM)
CV50	Extended Addr High Byte (controllers that prohibit PoM)
CV51	Extended Addr Low Byte (controllers that prohibit PoM)
CV52	MTH/PWM Mode Configuration
CV53	MTH Acceleration (1/8 *sMPH/s) (For example - a Value of 8 written would give you 1sMPH/s acceleration)
CV54	MTH Deceleration Rate (1/8*sMPH/s)
Cv55	Factory Address Reset Alternate method. Send a value of 55 to CV55 on address 55 and the model will go back to the Factory Default Address. Note: The engine address has to be something other than address 55
CV56	Marklin Configuration
CV57	Anti-Jackrabbit Toggle. A value of 7 disables the feature, a value of 0 enables the feature.
CV63	MTH Consist Acceleration Rate (1/8*sMPH/s)
CV64	MTH Consist Deceleration Rate (1/8*sMPH/s)
CV66	Forward Trim [1]
CV67-CV94	Speed Table Selection (CV29 bit 4 must be set to 1 then CV25 must be set to 0 or 1)
CV95	Reverse Trim [1]
CV105	User ID #1 – General Purpose use for customer
CV106	User ID #2 – General Purpose use for customer
CV115-CV170	MTH Function Assignments – See table of supported CV's and manual section on how to re-arrange them for further information

1. CV52, bit0 must = 1. This will enable PWM Mode.

Factory Default Values for MTH PS3.0 DCC Configuration Variables (CV's)

Default Value	Range	Description	CV	F-Key	Description	CV
3	0-127	Short Address	1	1	Function - Bell High Byte	115
16	0-255	Start Voltage (Cv52 bit 0 must =1)	2	1	Function - Bell Low Byte	116
0	0-255	Accel Adjustment	3	2	Horn High Byte	117
0	0-255	Decel Adjustment	4	2	Horn Low Byte	118
0	0-255	Max Voltage (Cv52 bit 0 must =1)	5	3	Start-Up/Shut Down High Byte	119
0	-	NMRA Mfg Version	7	3	Start-Up/Shut Down Low Byte	120
27	-	NMRA Mfg ID	8	4	PFA High Byte	121
0	0-255	Packet Timeout	11	4	PFA Low Byte	122
205	192-231	Extended Address High Byte	17	5	Lights High Byte	123
5	0-255	Extended Address Low Byte	18	5	Lights Low Byte	124
0	0-255	Consist Address	19	6	Master Volume High Byte	125
0	0-255	Consist Functions F1-F8	21	6	Master Volume Low Byte	126
0	0-255	Consist Functions F9-F12	22	7	Front Coupler High Byte	127
0	0-255	Consist Acceleration Adjustment	23	7	Front Coupler Low Byte	128
0	0-255	Consist Deceleration Adjustment	24	8	Rear Coupler High Byte	129
0	0-127	Speed Table Select	25	8	Rear Coupler Low Byte	130
2	0-255	Decoder Configuration	29	9	Forward Signal High Byte	131
-	0-127	Short Address (controllers that prohibit PoM)	49	9	Forward Signal Low Byte	132
-	192-231	Extended Addr High Byte (controllers that prohibit PoM)	50	10	Reverse Signal High Byte	133
-	0-255	Extended Addr Low Byte (controllers that prohibit PoM)	51	10	Reverse Signal Low Byte	134
0	0-255	MTH PWM Motor Configuration	52	11	Grade Crossing High Byte	135
128	0-255	MTH Acceleration Rate	53	11	Grade Crossing Low Byte	136
64	0-255	MTH Deceleration Rate	54	12	Smoke On/Off High Byte	137
0	0-255	Marklin Configuration	56	12	Smoke On/Off Low Byte	138
0	0-255	Anti-Jackrabbit	57	13	Smoke Volume High Byte	139
0	0-255	MTH Consist Acceleration Rate	63	13	Smoke Volume Low Byte	140
0	0-255	MTH Consist Deceleration Rate	64	14	Idle Sequence 3 High Byte	141
0	0-255	Forward Trim	66	14	Idle Sequence 3 Low Byte	142
0	0-255	Alternate Speed Curve Step 1	67	15	Idle Sequence 2 High Byte	143
9	0-255	Alternate Speed Curve Step 2	68	15	Idle Sequence 2 Low Byte	144
19	0-255	Alternate Speed Curve Step 3	69	16	Idle Sequence 1 High Byte	145
28	0-255?	Alternate Speed Curve Step 4	70	16	Idle Sequence 1 Low Byte	146
38	0-255	Alternate Speed Curve Step 5	71	17	Extended Start-Up High Byte	147
47	0-255	Alternate Speed Curve Step 6	72	17	Extended Start-Up Low Byte	148
57	0-255	Alternate Speed Curve Step 7	73	18	Extended Shut Down High Byte	149
66	0-255	Alternate Speed Curve Step 8	74	18	Extended Shut Down Low Byte	150
76	0-255	Alternate Speed Curve Step 9	75	19	Rev Up High Byte	151
85	0-255	Alternate Speed Curve Step 10	76	19	Rev Up Low Byte	152
94	0-255	Alternate Speed Curve Step 11	77	20	Rev Down High Byte	153
104	0-255	Alternate Speed Curve Step 12	78	20	Rev Down Low Byte	154
113	0-255	Alternate Speed Curve Step 13	79	21	One Shot Doppler High Byte	155
123	0-255?	Alternate Speed Curve Step 14	80	21	One Shot Doppler Low Byte	156
132	0-255	Alternate Speed Curve Step 15	81	22	Coupler Slack High Byte	157
142	0-255	Alternate Speed Curve Step 16	82	22	Coupler Slack Low Byte	158
151	0-255	Alternate Speed Curve Step 17	83	23	Coupler Close High Byte	159
161	0-255	Alternate Speed Curve Step 18	84	23	Coupler Close Low Byte	160
170	0-255	Alternate Speed Curve Step 19	85	24	Single Horn Blast High Byte	161
179	0-255	Alternate Speed Curve Step 20	86	24	Single Horn Blast Low Byte	162
189	0-255	Alternate Speed Curve Step 21	87	25	Engine Sounds High Byte	163
198	0-255	Alternate Speed Curve Step 22	88	25	Engine Sounds Low Byte	164
208	0-255?	Alternate Speed Curve Step 23	89	26	Brake Sounds On/Off High Byte	165
217	0-255	Alternate Speed Curve Step 24	90	26	Brake Sounds On/Off Low Byte	166
227	0-255	Alternate Speed Curve Step 25	91	27	Cab Chatter On/Off High Byte	167
236	0-255	Alternate Speed Curve Step 26	92	27	Cab Chatter On/Off Low Byte	168
246	0-255	Alternate Speed Curve Step 27	93	28	Feature Reset High Byte	169
255	0-255	Alternate Speed Curve Step 28	94	28	Feature Reset Low Byte	170
0	0-255	Reverse Trim	95			
0	0-255	User ID #1	105			
0	0-255	User ID #2	106			

User-Settable F-Function List

This feature allows you to take the 28 F-Functions that currently reside in each MTH Protosound 3.0-equipped HO Engine and change the location of that function. For example: F18 is currently Extended Shut Down and you'd like that placed down to F28 which is Feature Reset. The below instructions explain how you can do this.

Note: When you set a particular F-Function to a numeric location you are overwriting that existing number's function. Further, you are leaving the location where the previous function was moved from empty, which means that F-Function no longer has any function associated with it.

In order to move the F-Functions around you will need to refer to the below table. **Note**: The Function Identification number IS NOT the F Function number you'd use on your DCC handheld. It is used internally in the engine:

Function Identification Chart

SOUNDS	FUNCTION IDENTIFICATION	OTHER FUNCTIONS	FUNCTION IDENTIFICATION
Bell	1	Feature Reset	29
Brake Sounds	2	Front Coupler	30
Cab Chatter	3	Front Pantograph Up/Down	31
Clickety Clack	4	Pantograph Auto/Manual	32
Coupler Close	5	Rear Coupler	33
Coupler Slack	6	Rear Pantograph Up/Down	34
Drift Chuff	7	Rev Down	35
Engine Sounds	8	Rev Up	36
Forward Signal	9	Smoke On/Off	37
Grade Crossing Signal	10	Smoke Volume	38
Horn	11		
Idle Sequence 1	12	**MOTOROLA MODE**	
Idle Sequence 2	13	Disable Momentum (Motorola)	40
Idle Sequence 3	14	Half-Speed (Motorola)	41
Idle Sequence 4	15	Switch—Half-Speed/ Momentum Disable (Motorola)	42
Labor Chuff	16		
Master Volume	17	**LIGHTS**	
Short Horn	18	Lights	39
One Shot Doppler	19	Marker (Train/No Train)	43
Reverse Signal	20	Beacon (Alt Lighting/Country)	44
SCRIPTS		**ELECTRIC SMOKE**	
Extended Shut Down	21	Electric Boiler Start-Up	45
Extended Start Up	22	Electric Pressure Release	46
PFA	23		
Start Up/Shut Down	24		
Train Wreck	25		
Trolley Manual Mode	26		
Trolley Learn Mode	27		
Trolley Auto Mode	28		

The above list includes ALL F functions that an MTH PS3 powered car could have. You are free to change any of the above listed items to any F function position, 1-28. For example, if your powered car came from the factory without a smoke unit but you added one at a later date you could swap out any of the F functions, 1-28, for the Smoke On/Off and the Smoke Volume.

So, using the example of moving F18 (Extended Shut Down) to F28 (Feature Reset) here are the steps:

1. Refer the MTH Supported CV table to see what CV the destination Function is assigned to. In doing so, you are looking only for the Low Byte CV location. In this case it's CV170
2. Using your DCC system, bring up CV programming for CV170
3. Now tell the powered car which F-Function you want to write at CV170. So, looking at the Function ID table above you can see that Extended Shut Down is a value of 21
4. Using your DCC system, enter a value of 21 for CV170 and hit Enter. You have just re-assigned the Extended Shut Down sound to F28 on your DCC controller. The powered car will give you a two horn blast indication. Note – You've also left an empty location where Extended Shut Down used to be (F13)
5. Now you can fill that location with whichever CV you'd like. For this example we are just going to move the Feature reset up to F18 (we're just swapping F18 and F28)
6. Since F18's Low Byte is CV150 then bring up CV programming for CV150
7. Now tell the powered car which F-Function you want to write at CV150. So, looking at the Function ID table above you can see that Cab Chatter is a value of 29
8. Using your DCC system, enter a value of 29 for CV150 and hit Enter. Your powered car will give you a two horn blast indication

Custom Speed tables

Below is a table that shows the value to write to CV25 to achieve the desired speed curve. For example, if you would like to use speed curve 18 then:

1. Write a value of 1 to CV52 to enable PWM Mode
2. Write a value of 1 to bit 4 of CV29
3. Write a value of 18 to CV25. Your powered car will now use the speed curve #18 below
4. If you want to create your own speed table using CV's 67-94 then write a value of 0 or 1 to Cv25

CV25 Speed Tables
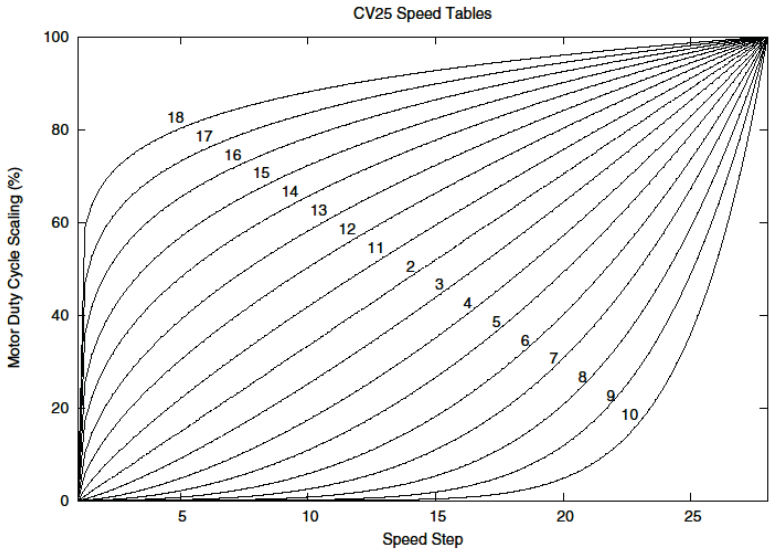
Advanced Consisting

Advanced Consisting follows the NMRA standards. Any values assigned to CV's 21-24 are ignored once the consist is removed (CV19 set to 0).

• Setting the MSB (Bit 7) of CV19 tells the powered car that it is facing reverse in the consist.
• Setting CV21 and CV22 determine which F Functions the consist responds to.

See diagram below for example

F	R	F	R	R	F
Engine 1 - Front		Engine 2 - Middle		Engine 3 - Rear	

Normal Forward Direction of Travel
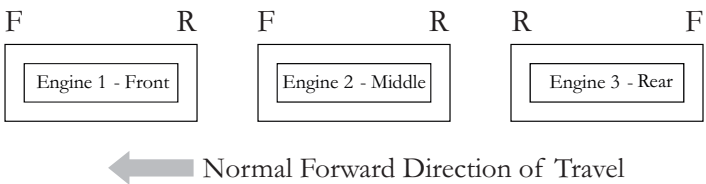
To set this consists up so that:
- The Headlight is ON in the Front powered car when going Forward, OFF when the consist is in Reverse
- The Reverse light and headlight is OFF in the Rear powered car when the consist is going Forward, headlight is ON, reverse light is OFF when the consist is in Reverse
- The Middle non-powered car has no lights in either direction

Perform the following:
1. Build the consist using your DCC system per the DCC system's manufacturer's instructions. In many newer systems you have the ability to tell the system which subway car is reversed. Remember the consist address you told the DCC system to be built at as you'll need to come back to that address to actually run the consist. The instructions assume only CV19 gets the consists address and nothing more
2. Call up the Front powered car on your DCC handheld; address 1 in this example
3. Select CV22 and write a value of 1. This tells the powered car that it's a forward facing powered car and that you want F0 to control the FL function at the consist address. The powered car will give you two horn blasts to announce that it received the CV change
4. Ensure F0 is deactivated at the Front powered car's address. Most systems have a light bulb icon to indicate whether F0 is active or not. Ensure that it is OFF
5. Call up the Rear powered car on your DCC handheld; address 3 in this example
6. Set CV19 to 128 + the value of your consist address
   a. So, if your consist address is 4 you would add 128+4=132. You would write 132 to CV19. This tells the Rear powered car that it's reversed in the consist. You will get two horn blasts to announce that it received the CV change. Some DCC systems may already do this for you but the instructions assume your system does not. If you are in doubt then go ahead and follow step 5 as it will do no harm

7. Set CV22 to a value of 2 to the Rear powered car's address to tell the Rear powered car that you want to control its FL control with the F0 button at the consist address. The powered car will give you two horn blasts to announce that it received the CV change
8. Ensure F0 is deactivated at the Rear powered car's address. Most systems have a light bulb icon to indicate whether F0 is active or not. Ensure that it is OFF
9. Call up the Middle non-powered car on your DCC handheld; address 2 in this example
10. Ensure F5 and F0 are toggled OFF. You may have to toggle F5 on/off a couple times to get the lights in sync with the DCC command station. This will depend upon your DCC system
11. Call up the consist address (address 4 in this example)
12. Press the F0 button to ensure the FL is toggled on. Most systems have a light bulb icon to indicate whether F0 is active or not. Ensure that it is ON

Note: The convenient thing about setting up the consist as described above is that it allows you flexibility in the orientation of an engine in a consist; particularly the head and tail engines where the FL control is integral. For example, if you wanted to flip the Rear powered car around and make it face forward in the consist all you'd have to do is go into the Rear powered car's address (address 3 in the example) and clear bit 7 of CV19. In other words, just write the consist's address to CV19. The FL control will automatically understand what you've done so there is no need to go in and change CV22.

Below is a table that outlines which bits correspond to what F Functions F0, F9-F12 are used in a consist:

Bit (Decimal Value)	7 (128) Not Used	6 (64) Not Used	5 (32)	4 (16)	3 (8)	2 (4)	1 (2)	0 (1)
F Function	Not Used	Not Used	F12	F11	F10	F9	F0 (Engine Facing Rev)	F0 (Engine Facing Fwd)

Setting Up CV21 for a Consist

Cv21 allows you to set which F Functions you want the consist address to control. For example, you will likely want all of your MTH consist engines to respond to Start-Up/Shut Down (F3). Also, you'll likely want at your Front engine to respond to the Bell and Horn commands (F1 and F2, respectively) and the Front Coupler (F7 on most MTH models). Likewise, you'll want your Rear engine to respond to the Rear Coupler command (F8 on most MTH models). Please refer to the table below to see which bits have what decimal value and which F Function they correspond to.

To do this:
1. Call up the Front engine on your DCC system

2. To set the Front engine to respond to the Bell (F1), Horn (F2), Start-Up/Shut Down (F3) and Front Coupler (F7) you will want to write a value of 71 to CV21. This is setting bits 0, 1, 2, and 6 ON.

   a. CV21's bits are shown in the table below – the decimal value is shown in parenthesis:

Bit (Decimal Value)	7 (128)	6 (64)	5 (32)	4 (16)	3 (8)	2 (4)	1 (2)	0 (1)
F Function	F8	F7	F6	F5	F4	F3	F2	F1

NOTE: CV21 is ONLY used when you have some value other than 0 written to CV19. If CV19 = 0 then the values of CV21, CV22, CV23, and CV24 are not used

3. Call up your Middle engine (address 2 in the example)

4. Since you want to have the Middle engine respond to F3 only then write a value of 4 (CV21, bit 2 = ON)

5. Call up your Rear engine (address 3 in the example)

6. Since you want to have the Rear engine respond to the Start-Up/Shut Down (F3) and Rear Coupler (F8) functions you want to write a value of 132 to CV21

Your engines are now set up according to the example above.

You will note that there is no F0 in CV21. This is because that function (FL) is controlled by CV22. Please refer to the Advanced Consisting section for more information regarding CV22.

Programming Track

Your MTH Proto-Sound 3.0-equipped HO powered car does not program well on Programming tracks due to the inclusion of super capacitors utilized in the locomotive's electronic package. The super capacitors provide backup power to the electronics, allowing the locomotive to better negotiate track sections suffering from poor electrical conductivity. This ensures that sounds continue to play, the locomotive continues to move forward and lighting remains lit. During power shutdowns, the super capacitors provide power to allow the locomotive shutdown sounds to continue playing through their conclusion. Unfortunately, the super capacitors require that operators ONLY program engine CV's using Programming on the Main (PoM).

DCC Bit Value Decoder

Example Value (bit 7 -> bit 0) 11011001							
Bit (Decimal Value)	7 (128)	6 (64)	5 (32)	4 (16)	3 (8)	2 (4)	1 (2)	0 (1)
Binary Example	1 (on)	1 (on)	0 (off)	1 (on)	1 (on)	0 (off)	0 (off)	1 (on)
Decimal Value	128	64	0	16	8	0	0	1

So, in the above example you simply add up the values in the "Decimal Value" row – 128+64+0+16+8 +0+0+1 = 217. You would write 217 to the CV you were altering.

The above applies to any CV. Also, if you have a CV that already has a value assigned that you do not want to alter but need to make additions to it, for example CV29, you would simply add the additional bits you enabled to the existing value to obtain the new CV value.

For example, if you had a consist address (CV19) set to 5 and you wanted to alter this to show an engine reversed in the consist you would need to set bit 7 (decimal value = 128) for the engine you want to reverse. To do this - take 128 (the new bit you want to set) + 5 (the existing bit that you do not want to alter) = 133. You would then write a value of 133 to CV19.

SPECIFICATIONS

Electrical	Input Voltage	0-24 VDC
	Current Draw (lights, sounds)	~230 - 650mA
	Lighting	LED - Rule 17
Operating Modes	Analog DC	Yes
	DCC - Digital Command Control	Yes
	DCS - Digital Control System	Yes
Default Addresses	DCS	1
	DCC short	3
	DCC extended	3333

US PATENTS

US 6,457,681	Oct. 2, 2002
US 6,619,594	Sept. 16, 2003
US 6,655,640	Dec. 2, 2003

CARE AND MAINTENANCE
HO Troubleshooting Guide
The following Guide will help you trouble shoot your M.T.H. HO powered car. This guide is broken up into the three operating modes of the powered car Analog DC, DCC, and DCS

Analog DC

Start-Up	Solution
When I apply power to the track my powered car doesn't do anything. No lights, no sound, nothing.	Check to see if that section of track has power. Use a voltmeter or a lit passenger car.
	Slide the powered car a couple of feet in either direction, you may have a bad track section.
	Have you got that section electrically isolated with a toggle switch or other device?

Sound	Solution
I have no sound from my powered car, but my lights are on and it moves just fine.	Check the volume pot on your powered car. Full CW = Max Volume
There's a crackling sound from my powered car	Check to see if a screw or some other material hasn't lodged itself in the underside of the powered car body.

Lights	Solution
One of my lights is out.	Most likely you had been running the powered car in DCC or DCS mode and toggled that light off. Put it back into one of those modes and turn that light back on. The powered car will remember that when you run it again in Conventional DC.
None of my lights are on.	Could be the same reason as "One of my lights is out."
	Is the powered car getting power? Check to see if there is voltage on the track or move the powered car a few feet in either direction.

Motion	Solution
When I apply power to the track my powered car starts up (lights and sound) but it won't move	Lower the track voltage then raise it again. The powered car should start moving. If you apply greater than 9VDC quickly the engine will just sit there. Lowering it below 9VDC then raising it will get the engine moving.
My powered car hesitates at slow speeds.	A powered car may do this right out of the box if it has not been lubricated. Follow the lubrication instructions. Now try to run it.
	New powered cars may take a little bit to get everything running, even after they are lubricated. Be patient and let it run for a bit. It should clear up shortly after lubricating and running.

DCC

Start-up	Solution
When I apply power to the track my powered car doesn't do anything. No lights, no sound, no nothing.	Did you press F3 yet? F3 on your DCC hand-held will start your powered car up.
	Check to see if that section of track has power. Use a voltmeter or a lit passenger car, not your tongue.
	Slide the powered car a couple of feet in either direction, you may have a bad track section.
	Have you got that section electrically isolated with a toggle switch or other device?
Sound	**Solution**
I have no sound on my powered car, but my lights are on and it moves just fine.	You may have it turned off. Repeatedly press F6 to cycle through the volume levels (there are 9 levels, 0-max).
When I run Doppler I can hear the Doppler shift but then the powered car sounds fade out and I can't get them back.	This is normal. You will need to press the F21 button again to turn Doppler off. Your powered car sounds will now return to normal.

DCC

Lights	Solution
One of my lights is out.	Check your F keys. F0 is the headlight (also controls the Back-up light) and F5 will toggle the Cab light and firebox light.
None of my lights are on.	Could be the same reason as "One of my lights is out"
	Is the powered car getting power? Check to see if there is voltage on the track or move the powered car a few feet in either direction.
Motion	**Solution**
When I apply power and hit F3, my powered car powers up but it won't move.	This is normal, dial up the speed on your DCC controller to make your powered car move.
My powered car hesitates at slow speeds.	An powered car may do this right out of the box if it has not been lubricated. Follow the lubrication instructions. Now go ahead and run it.
	New engines even after they are lubricated may take a little bit to get everything run in. Be a little patient and let it run for a bit. It should clear up shortly after lubricating and running.
Shut Down	**Solution**
Okay, I give up. What do I have to do to shut it down?	Well, you can either remove power from the track or press F3 again.
Lost or Unknown Address	**Solution**
I can't call up my powered car on the address I believe it to be set at	Perform the 55-55-55 Reset instructions
	If you are trying to talk to an powered car on its short address you may have set CV29 to activate long addressing. Try to get a hold of the powered car on its last known long address
	Place the powered car on the Programming Track output on your DCC system and write a value of 3 to CV1

DCS (Remember, it's NOT DCC)

Start-up	Solution
When I apply power to the track my powered car doesn't do anything. No lights, no sound, no nothing.	This is normal. You have to hit the Start-Up button.
	Check to see if that section of track has power. Use a voltmeter or a lit passenger car, not your tongue.
	Slide the powered car a couple of feet in either direction, you may have a bad track section.
	Have you got that section electrically isolated with a toggle switch or other device?
I get an error when I hit Start-Up.	Have you recently changed the engine address?
	Check if there is power on that section of track the powered car is sitting on (there has to be power for the signal to get to the powered car and for the powered car to be able to hear it).
	If you have two engines on the track they both may have the same address. Take one of them off the rails and try it again.
DCS is polarity sensitive when powered by a DC power supply.	Check the polarity of the DC power supply connected to the Fixed 1 or Fixed 2 Inputs. Shut down power, reverse the inputs and repower DCS. Hitting the start-up button the DCS remote should start up the locomotive.
Sound	**Solution**
I have no sound on my powered car, but my lights are on and it moves just fine.	You may have it turned off. Repeatedly press VOL + to bring the Master Volume up.
	Did you turn off the ENG Sounds? Press the ENG SND button on your DCS controller.
	Check that you haven't lowered any of the independent powered car volumes (Eng Sounds, Bell, Whistle, or Accent).
When I run Doppler I can hear the Doppler shift but then the powered car sounds fade out and I can't get them back.	This is normal. You will need to press the Doppler button again to turn Doppler off. Your powered car sounds will now return to normal.

DCS (Remember, it's NOT DCC)

Lights	Solution
One of my lights is out.	Check that you haven't turned it off with the DCS controller. You have independent control over lights on your powered car
None of my lights are on.	Could be the same reason as "One of my lights is out"
	Is the powered car getting power? Check to see if there is voltage on the track or move the powered car a few feet in either direction.

Motion	Solution
When I apply power and hit Start-up, my powered car powers up but it won't move.	This is normal, dial up the speed on your DCS Remote to make your powered car move.
My powered car hesitates at slow speeds.	An powered car may do this right out of the box if it has not been lubricated. Follow the lubrication instructions. Now go ahead and run it.
	New engines even after they are lubricated may take a little bit to get everything run in. Be a little patient and let it run for a bit. It should clear up shortly after lubricating and running.

TAS	Solution
When I enter TAS all that happens is the bell rings. What do I do?	Press the DIR button. Your powered car will stop and begins the arrival sequence. Pressing the DIR button will cycle you through the next 3 TAS sequences
Why does my powered car run away all by itself after the TAS is over?	This is normal. The powered car will leave the station at the same speed it entered (when hit the TAS button). The speed setting can be changed after the bell stops ringing.

Shut Down	Solution
Okay, I give up. What do I have to do to shut it down?	Well, you can either remove power from the track or press or press Shut-Down. Button on the DCS Remote

Lost or Unknown Address	Solution
I can't call up my powered car on the address I believe it to be set at	Delete the powered car from your DCS remote, and attempt to re-add it.
	On the DCS Remote, hit Menu > System > Engine Setup > Recover Engine

HOW TO ORDER PARTS:

Replacement parts are available directly
from the M.T.H. Parts Department
Order online: www.mthtrains.com
E-mail: parts@mth-railking.com
Fax: 410-423-0009
Phone: 410-381-2580
Mail: 7020 Columbia Gateway Drive
Columbia MD 21046-1532

Service & Warranty Information

How to Get Service Under the Terms of the Limited One-Year Warranty

When you suspect an item is defective, please check the operator's manual for standard operation and trouble-shooting techniques that may correct the problem. Additional information may be found on the M.T.H. Website. Should you still require service, follow the instructions below to obtain warranty service. First, e-mail, write, call or fax a M.T.H. Authorized Service Center (ASC) in your area to obtain Repair Authorization. You can find the list of ASCs on the M.T.H. Website, www.mthtrains.com. Authorized Service Centers are required to make warranty repairs on items sold only from that store; all other repairs may-- or may not be done at the store's own discretion. If you did not purchase the item directly from the ASC, you will need to select a National Authorized Service Center (NASC). These centers are compensated by M.T.H. to perform warranty service for any customer whose repair qualifies for warranty service. A list of NASC retailers can be located on the M.T.H. Website or by calling 410-381-2580. Should the warranty no longer apply, you may choose either an ASC or NASC retailer to service your M.T.H. Product. A reasonable service fee will be charged.

CAUTION: Make sure the product is packed in its original factory packaging including its foam and plastic wrapping material to prevent damage to the merchandise. There is no need to return the entire set if only one of the components is in need of repair unless otherwise instructed by the Service Center. The shipment must be prepaid and we recommend that it be insured. A cover letter including your name, address, daytime phone number, e-mail address (if available), Return Authorization number (if required by the service center, a copy of your sales receipt and a full description of the problem must be included to facilitate the repairs. Please include the description regardless of whether you discussed the problem with a service technician when contacting the Service Center for your Return Authorization.

Please make sure you have followed the instructions carefully before returning any merchandise for service. Authorized M.T.H. Service Centers are independently owned and operated and are not agents or representatives of M.T.H. Electric Trains. M.T.H. assumes no responsibility, financial or otherwise, for material left in their possession, or work done, by privately owned M.T.H. Authorized Service Centers.

If you need assistance at any time email MTH Service at service@mth-railking.com, or call 410 381-2580.

Limited One-Year Warranty

All M.T.H. products purchased from an M.T.H. Authorized Retailer are covered by this warranty provided the product was manufactured within five years of the date of purchase. This warranty is for the original purchaser and is non-transferable.

See our website **www.mthtrains.com** to identify an M.T.H. Authorized Retailer near you.

M.T.H. products may be registered online in advance of warranty work at **www.mthtrains.com/warranty**. The original sales receipt and the conditions below must be met regardless of whether the product is registered on the M.T.H. website in order to obtain warranty service.

M.T.H. products manufactured within five years from the date of purchase are warrantied for one year against defects in material or workmanship, excluding wear items such as light bulbs, pick-up rollers, batteries, smoke unit wicks, and traction tires. We will repair, replace, or credit (at our option) the defective part without charge for the parts or labor if the following conditions are met: (1) the item is returned to an M.T.H. Authorized Service Center* (ASC) or M.T.H. National Authorized Service Center (NASC) or M.T.H. Electric Trains Service Department, (2) was manufactured within the previous five years and (3) was purchased within one year of the original date of purchase from an M.T.H. Authorized Retailer. Products manufactured after the five year cutoff from the date of purchase are not covered under any warranty by M.T.H. Electric Trains. The manufacture date of an item can be verified on the item's detail page "shipping date field" on the M.T.H. website (www.mthtrains.com). This warranty does not cover damages caused by improper care, handling, or use. Transportation costs incurred by the customer are not covered under this warranty.

Items sent for repair must be accompanied by a return authorization number, a description of the problem, and a **copy of the original sales receipt from an M.T.H. Authorized Retailer**, which gives the date of purchase. If you are sending this product to an Authorized Service Center, contact that Center for their return authorization.

This warranty gives you specific legal rights, and you may have other rights that vary from state to state. Specific questions regarding the warranty may be forwarded to M.T.H. Directly.

* Authorized Service Centers (ASC) are only obligated to provide warranty service for any consumer who has purchased the specific M.T.H. item from them that requires service work.

Service Department:
M.T.H. Electric Trains
7020 Columbia Gateway Drive
Columbia MD 21046-1532