

Locomotive Owner's Manual



Atlas Master™ Gold Series FM Train Master Diesel Locomotive

QSI Quantum System™ Sound and Train Control with Electronic Dual-Mode® Decoder (e-DMD)



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INTRODUCTION

Congratulations on your purchase of the Atlas Master™ Gold Series FM Train Master HO locomotive. With this locomotive, you get museum-quality features and details, such as separately-applied detail parts, accurate painting and printing, along with the performance and reliability you expect and deserve from an Atlas engine. Your Gold Series locomotive is factory equipped with QSI's Quantum System™ that gives you state-of-the-art sound technology with the added benefit of an electronic Dual-Mode® Decoder (e-DMD) that allows your locomotive to run on either conventional DC or on NMRA Digital Command Control (DCC). Sound adds realism and authenticity to your model railroad empire in a way you may have never experienced before. Let the fun of operating sessions begin.

Getting Started

Atlas recommends that you get used to operating and having fun with your locomotive before exploring its programming options. If you intend to operate your locomotive with conventional DC power, go to the Analog Operation section that starts on page 6. If you intend to operate your locomotive with Digital Command Control, go to the DCC Operation section that starts on page 17. In either case, the information provided in these sections will have you up and running your locomotive in approximately five minutes.

Power Supplies

Most HO DC power packs with a standard reversing switch are suitable for analog operation of your FM Train Master locomotive. Generally, modern electronic type power packs will provide better performance. All functions needed to operate your locomotive on an analog layout can be easily done from a standard HO power pack that is equipped with a direction switch.

Most currently available DCC command stations are suitable for DCC operation and programming of your FM Train Master locomotive. However, the Quantum System requires more current to operate than standard decoders and may not respond to the limited program track power available in Service Mode from some DCC command stations. If your FM Train Master locomotive will not respond properly on the program track, all of its Configuration Variables (CV's) can be programmed on the main line in Operations Mode. Also, check with the command station manufacturer; some companies will give you a free upgrade or have another suggestion that allows use of the programming track.

The Quantum System uses all thirteen functions available in the new NMRA 0-12 function key standard, and the FM Train Master uses twelve of these thirteen functions. If you have a DCC command station that supports the older NMRA 0-8 function key standard, Atlas recommends that you consider upgrading or replacing your command station so that you have access to all thirteen functions. As an interim measure, however, the DCC Operation section in this manual gives a function key remapping that allows you to control most FM Train Master features from an older command station that supports only DCC functions 0 to 8.

Programming

The Analog Programming and DCC Programming sections in this manual give programming instructions that cover briefly programming of the specific Quantum System features included in your FM Train Master locomotive. More complete analog programming instructions may be found in the Quantum Analog Reference Manual (Version 2), which may be downloaded from the QSI website at <http://www.qsindustries.com/>. Similarly, more complete DCC programming instructions are found in the *Quantum DCC Reference Manual (Version 2)* which may also be downloaded from the QSI website at <http://www.qsindustries.com/>.

ANALOG OPERATION

Starting the Locomotive

Use an HO power pack with a standard direction switch. Set the switch to run your engine forward.

- Turn the throttle up slowly until you hear the Quantum System™ come on with air let-off sounds. The front Number Board Lights will turn on. The front Headlight will turn on at its "dim" setting¹. You will hear the diesel engine in the FM Train Master start up followed by the air pumps.
- Continue² to turn up the throttle voltage until the locomotive starts to move in Forward (this voltage is called V-Start³). The FM Train Master diesel engine sounds will rev up with labored sounds proportional to the engine's acceleration and loading (see Sound of Power™ on page 10). The Headlight will switch to its bright setting.⁴
- As you slow the engine down by gradually reducing the throttle, the diesel motor rev and labored sounds volume decreases, while squealing brake sounds occur as the FM Train Master comes to a stop⁵.

If you need to turn your throttle up quite high to start your FM Train Master locomotive, V-Start can be adjusted for operation with your particular DC power pack (see Analog Programming on pages 12-16).

Reversing the Locomotive

This simple operation is exactly the same as with standard locomotives.

- Bring the locomotive to a stop and turn the power off.
- Flip the direction switch and reapply power to go in the opposite direction.

The FM Train Master Rear Headlight turns on and the Front Headlight comes on dim. For a complete description of directional lighting operation in locomotives with and without Mars lights, please see the tables on page 18.

Horn

Blow the single chime authentic FM Train Master horn for short or long blasts — you control the duration.

¹ Mars lights are also included on SP 4802 and 4805 FM models. On these models the front Mars light will come on in neutral at its dim setting and the front Headlight will be off.

² It is not necessary to wait for the engine start up to finish before entering forward. If you turn up the throttle, the start up sounds terminate and the FM Train Master will immediately go into normal forward operation.

³ V-Start is set at 8.5 volts. It is important to note where V-Start is located on your throttle control to know where you will enter and leave neutral (see Neutral on Page 7).

⁴ If your FM has a Mars light, it will come on dim and the front Headlight will be off in Neutral and Reverse. In Forward, the front Headlight will turn on, and the Mars Light will turn on fully with its distinctive pulsing motion.

⁵ Squealing brakes occur if the engine exceeds 40 scale miles per hour (smph) and then slows down to below 20 smph.

- While the locomotive is moving, flip the direction switch to turn on the horn.
- Flip the direction switch back to shut off the horn.

The engine will not change direction when you blow the horn. If you flip the direction switch too slowly from one position to the other, you can momentarily lose track power as the switch is being moved through its center position.

Bell

You can turn the bell on and leave it on while you operate other functions on the locomotive.

- Turn the bell on with a Quick flip-and-back operation of the direction switch.
- Turn the bell off with a second Quick flip-and-back operation of the direction switch.

The bell will stay on until you do another Quick flip-and-back operation of the direction switch to turn it off, or you interrupt the track power. If you do a Slow flip-and-back operation, you will get a short horn hoot instead of the bell. If you try to do a very short horn blast using a Quick operation, you will activate the bell instead. If you have trouble doing the Quick flip-and-back operation, try holding the power pack in place with your other hand to keep the unit from slipping.

Note: When you toggle the bell off, it will continue ringing briefly with less volume as the pneumatic clapper shuts down, just like the prototype.

Doppler Effect

This effect changes the horn pitch and engine sounds as the locomotive passes.

- While the engine is moving toward the observer, flip the direction switch to turn on the horn.
- Wait at least one second while the horn is blowing.
- Flip the direction switch back and forth quickly so the horn does not shut off. You will hear the horn and other FM Train Master engine sounds shift in pitch as the locomotive passes by.
- Either flip the direction switch back to shut off the horn, or continue with long or short horn operations. When you are finished blowing the horn, the engine sounds will automatically return to normal after a few seconds. If the bell was on, it will shut off just before the sounds return to normal.

Neutral

In Neutral, the locomotive will continue to make prototypical sounds appropriate to its resting state.

- Enter neutral by turning the throttle down below V-Start, but not so low that the sounds

turn off, and wait for locomotive to stop⁶. The Front Headlight switches to a steady dim, and the Rear Headlight will turn off entering in Neutral from Reverse (NFR).

- You will hear a short air release when the engine stops moving and enters neutral, and a longer air release about three seconds later followed by air pumps and other background sounds. In addition to the pumps, cooling fans and vents will come on at random time intervals in neutral. After ten seconds, the cooling fans shut off if they were on when you entered neutral.
- If the diesel locomotive is left in Neutral from Reverse, a special Low Idle state marked by subdued throbbing motor sounds will automatically come on after 30 seconds (see description of Low Idle in the section on Quantum System Sounds on page 30). The FM Train Master will return to normal diesel motor sounds when the throttle is turned up.
- After the pumps start, you can also use the direction switch to blow the horn or turn on or off the bell⁷.

If you cannot enter neutral, or have difficulties with any of the operations, you may need to program your locomotive for optimal use with your particular power pack (see Analog Programming on pages 12-16).

Changing the Locomotive's Direction without Turning off the Sound

You can use the power pack's direction switch while the locomotive is in neutral to change the engine's direction.

- Put the locomotive in neutral by bringing the throttle down below V-start (but not so low that the sounds turn off) and wait for the locomotive to stop⁸.
- Flip the direction switch after you hear the short air release but before you hear the longer air release and the pump sounds turn on. During this short time (3 seconds), the horn will not blow when you flip the direction switch.
- Turn up the throttle anytime thereafter to operate the locomotive in the opposite direction.

If you have waited until the pumps start in neutral and now wish to change direction, you can either:

- Turn the power off, change the direction switch and turn the power back on, or,
- Flip the direction switch (the horn will come on) and then turn up the throttle. When the locomotive starts to move in the opposite direction, the horn will stop automatically.

⁶ If Regulated Throttle Control is enabled (see below) it is important to wait until the locomotive stops on its own. The engine's electronic inertia will keep it moving even though you have reduced the throttle far enough below V-Start to stop the locomotive. In your attempt to stop the locomotive, do not try to reduce the throttle so far that all sounds go off.

⁷ In neutral, the bell has a distinctive turn on effect as the pneumatic clapper gains full motion to strike the bell.

⁸ On some power packs that have high internal resistance, the track voltage may rise slightly as the locomotive slows down and requires less power to operate. As the engine slows, you may need to reduce the throttle a little more to remain below V-Start.

Standard Throttle Control™ (STC™) and Regulated Throttle Control™ (RTC™)

Quantum locomotives have two types of throttle control available, standard and regulated. Both Standard Throttle Control (STC) and Regulated Throttle Control (RTC) will apply more power to the motor as a function of increasing track voltage beginning at the V-Start setting. RTC differs from STC by including a motor speed control feature that prevents the locomotive from reacting quickly to changes in voltage or minor impediments such as misaligned track joints, tight curves, rough switches, etc. An engine under STC may come to an unrealistic halt from a raised track joint or a drop in voltage, while the same engine under RTC will continue at the same speed. RTC operates your engine as though it has the mass and inertia of a prototype locomotive; your engine will resist changes in speed once it is moving and will resist starting up quickly if at rest. You will be able to operate your locomotive at very slow prototypical speeds without having to adjust your throttle continually to maintain speed.

While small obstacles will not affect the engines speed under RTC, a continual force will slow your train down, just like the prototype. For instance, if your FM Train Master encounters a grade under RTC, it will eventually slow down. Providing more throttle will slowly accelerate it back to speed. The same engine under STC would quickly slow down or stop if it encountered a grade.

The type of throttle control also affects how your engine decelerates. Under STC, your engine will respond quickly to a reduction in track voltage. Under RTC, your locomotive will slow down slowly as you bring the throttle down. If you bring the throttle down below V-Start, the engine will slowly come to a stop. You can, however, force an engine to slow down rapidly under RTC by bringing the throttle down quickly; this reduces the available power to the motor speed control circuit and forces the speed to decrease faster than RTC would normally allow. Once the locomotive slows down and regains normal RTC operation, it will continue to decelerate slowly according to its built-in inertia. For instance, if your engine was running at top speed and you quickly reduced the track voltage to just below V-Start, where the locomotive would normally be stopped, the engine's speed would at first slow down rapidly as you reduced the available power to the motor, and then would start decelerating at a rate determined by the RTC inertia and finally coast to a stop.

STC and RTC are selected under Analog Programming (see pages 12-16). The default is RTC.

Engine Load

You can set your FM Train Master to have any of 16 different loads (also called inertia or momentum levels; see Analog Programming on pages 12-16). As you increase track voltage,

the motor is provided an increasing portion of that power which, depending on the load setting, will gradually accelerate the locomotive more realistically until it reaches full speed. Level 0 is the default, which is no load.

Under STC, the level 0 load setting will allow your engine to accelerate or stop as quickly as the internal flywheels will allow. Under RTC, level 0 will add no additional load to the built-in inertia already provided by RTC. For any load setting from 1-15, your FM Train Master locomotive will take longer to change speed under either STC or RTC. At level 1, it will take approximately 15 seconds more to achieve full speed at max throttle⁹; at level 15, it will take over 3.5 minutes to achieve full speed. In addition, at higher load settings, your engine will decelerate more slowly as you decrease your throttle.

Sound-of-Power™

The FM Train Master locomotive will produce Sound-of-Power labored diesel motor sound effects if you have selected any of the load settings from level 1 to 15. Under acceleration, the motor sounds will be more labored until the FM Train Master has achieved its final speed where it will then produce standard sounds appropriate to the throttle setting. Under deceleration, the engine sounds are less labored until it achieves its final speed where it will again produce standard diesel sounds appropriate to its throttle setting.

Helpers

Helpers are locomotives that are used to provide extra power and/or braking for a heavily loaded train. These engines can be part of the head end consist or as mid-train helpers or as pushers at the end of the train. Helper engines behave differently from the train's lead locomotive. Their horns and bells are usually not operated, and their lighting options are different or not used at all.

When you make up your train using more than one locomotive, the Quantum System allows you to easily program how each engine will behave by selecting between a Lead engine, Mid Helper, End Helper, or Pusher. Each type of helper engine has different lighting and sound characteristics as described in the table in the next section on Analog Programming.

Normal and Reversed Direction

The Quantum System also allows you to reverse the directional sense of your locomotive. This is normally not an issue with DC two-rail trains since all engines will go in the same direction

⁹ Some unloaded power packs produce excessive voltage at max throttle and will activate the Quantum high voltage circuit breaker. When this happens, your engine will stop and emit a series of hoots until the power is reduced to a lower voltage (see High Voltage Circuit Breaker, page 33).

whether they are facing forwards or backwards. However, certain features like directional lighting or diesel low idle do depend on the directional sense. For instance, if you program your engine to be an End Helper for your consist, its Rear Headlight operates when the engine is moving in reverse and the Front Headlight is disabled. This is ideal for providing a directional headlight at the rear of the consist. However, if this engine is facing backwards at the rear end of a consist, the Rear Headlight will be facing forwards and will be lit when the consist is moving forward. Moreover, there will be no directional Headlight at the rear of the consist. The reversal program feature will ensure that this End Helper's backward-facing Headlight will come on only when the consist is backing up, and the forward-facing Headlight will not light at all. When making up a train with different helper types, it is recommended that you also change its directional sense if the helper is intended to be operated backwards within the consist. See "Option 4 Direction", Analog Programming, next section.

ANALOG PROGRAMMING

The FM Train Master Loco can be Programmed Using a Standard Power Pack.

All advanced operations are easily programmed via your standard HO power pack. As described below, after entering programming, features are selected and operated by using the direction switch.

Program Option #'s (POP's ¹⁰)	Option Name	Message ¹¹ when Entering Option	Option Description
1	System Volume ¹² (16, Max)	"Volume equals X"	Sets System volume (17 levels) where level 16 is maximum volume and level 0 is off.
2	Load (0, No Load)	"Load equals X"	Selects the starting and stopping momentum for both Regulated Throttle Control (RTC) and Standard Throttle Control (STC). Level 0 (no load), Level 1-15, increasing load with acceleration to full speed from 5 seconds to 200 seconds.
3	Helper (Normal)	"Helper equals" "Normal" "Pusher" "End" "Mid" "Lead"	Selects Normal, Pusher, End, Mid, End, or Lead Helper in consists. Normal Engine has all sounds and lights enabled. Pusher has rear Headlight on all the time as train warning light; horn, bell, and all other lights except rear Number Boards are disabled. End Helper has rear headlight and rear Number Boards on only when loco is moving backwards; horn, bell and all other lights are disabled. Mid Helper has horn, bell and all lights disabled. Lead engine has all sounds, front Headlight, & front Number Boards enabled; rear Headlight is disabled.
4	"Direction" (Normal)	"Direction equals X"	Selects if the features associated with the locomotive's direction are "normal" or "reversed".
5-7	Reserved	"Reserved"	
8	V-Start (8.5v)	"V-Start equals X"	Sets track voltage where engine will leave neutral. (See Example below)
9	V-Max (12v)	"V-Max equals X"	Sets track voltage where full power is applied to motor.
10	Throttle Mode (RTC)	"Throttle Mode equals X"	Selects between Standard Throttle Control (STC) and Regulated Throttle Control (RTC).
11	Programming Reset	"Warning – about to reset"	After next Quick or Slow Operation, bell rings followed by a hoot to indicate locomotive returned to factory default.
12	About	Model number	Each Quick or Slow Operation provides progressive information about Quantum model number, software version, and software release date.
13	Horn Volume (11)	"Volume equals X"	Customizes Horn Volume (16 levels). Max is 15.
14	Bell Volume (10)	"Volume equals X"	Customizes Bell Volume (16 levels). Max is 15.
15	Motor Volume (8)	"Volume equals X"	Customizes Diesel Motor Volume. (16 levels). Max is 15.
16	Vents and Cooling Fan Volume (8)	"Volume equals X"	Customizes Vents and Cooling Fans Volume (16 levels). Max is 15.
17	Reserved	"Reserved"	
18-19	Reserved	"Reserved"	
20	Air Brakes Volume (11)	"Volume equals X"	Customizes Air Brake Air Release Volume (16 levels). Max is 15.
21-25	Reserved	"Reserved"	
26	Pump Volume (9)	"Volume equals X"	Customizes Air Pump Volume (16 levels). Max is 15.
27	Air Let-off Volume (11)	"Volume equals X"	Customizes Long Air Release Volume (16 levels). Max is 15.
28	Short Air Let-off Volume (11)	"Volume equals X"	Customizes Short Air Let-off Volume (16 levels). Max is 15.

Program Option #'s (POP's)	Option Name	Message when Entering Option	Option Description
29	Reserved	"Reserved"	
30	Flange Volume (11)	"Volume equals X"	Customizes Flange/Squealing Brake Volume (16 levels). Max is 15.
31	Dynamic Brakes Volume (8)	"Volume equals X"	Customizes Dynamic Brake Cooling Fan Volume (16 levels). Max is 15.
32	Coupler Volume (11)	"Volume equals X"	Customizes All Coupler Sound Volumes (16 levels). Max is 15.
33	Reserved	"Reserved"	

Where "X" is the current value of the Program Option. Defaults are shown in parenthesis next to the option name.

¹⁰ POP is short for "Program Option".

¹¹ The verbal programming responses (such as "Enter Programming" etc.) have a minimum volume setting to provide programming information even when the system volume is turned all the way off.

¹² You can set volume with the manual volume control or with programming or both. The manual volume control will determine the range of volume control under programming; that is, if you turn the manual volume control down to say, 50%, you will not be able to increase the volume above the 50% value using programming.

Entering Programming

Use this simple sequence to enter programming using the direction switch.

1. Apply power and turn up the throttle to hear the sound system come on.
2. Within five seconds of powering up, turn on the bell with a Quick flip-and-back operation.
3. Within three seconds of the bell turning on, turn the bell off with a second Quick flip-and back operation.
4. Within three seconds, turn the bell back on again with a third Quick flip-and-back operation.

If you delay too long after power has been first applied, the opportunity to enter programming will time out and you will need to start again by shutting off and reapplying track power.

Once you perform the three bell operations after applying power, the bell will shut off automatically and you will hear "Enter Programming;" also, the front Headlight and Rear Headlight will flash alternately off and on.

Scrolling through the Program Options

- After entering programming, you will hear an announcement of the first Program Option, "Option 1 - System Volume".
- To access other Program Options, simply flip the direction switch to the opposite position and leave it there. Listen as each option number is announced in order.
- Flip the switch back and leave it there when you wish to stop at a particular option. After you stop at an option you will hear the option number and name announced. When you are scrolling through and stopping at Program Options, you are not making any changes. To make changes you must actually enter the Program Option.

Note: If you accidentally go to a higher option number than the one you wanted, simply turn the power off, re-enter programming, and start again. Once you reach the last Program Option, it will continue to announce the last Option number.

Entering a Program Option and Making Changes

After the verbal announcement of a Program Option, you can enter that option by performing a Slow or Quick flip-and-back operation of the direction switch. Upon entering a Program Option, you will hear the current setting for that option. For unused Program Options, you will hear "Reserved". For any volume option, you will hear "Volume equals X" (where "X" is its current volume level setting). After a moment, you will hear the sound playing at its current volume¹³.

Note: Entering a Program Option does not change the settings for that option; it only provides information about its current value. After entering the Program Option, additional Slow or Quick flip-and-back operations will program new settings as described in the above table. For all level adjustments, a Quick operation will decrease one level while a Slow operation will increase one level.

Note: Since "System Volume" is the first Program Option, you can use Quick or Slow operations immediately after entering programming to change the system volume.

Moving on to Other Program Options or Leaving Programming

- Flip the direction switch at anytime to the opposite position, and leave it there. Quantum will first return to and announce the current program option number and then automatically advance on to higher options.
- Exit Programming anytime you want by turning the power off and back on again.

Example: Setting Throttle Mode (Program Option # 10)

This will determine whether your locomotive uses Regulated Throttle Control (RTC) or Standard Throttle Control (STC).

- Enter Programming after powering up your engine by turning the bell on, then off and then on as described above.
- After the "Enter Programming" followed by "Option One - System Volume" announcement of the first Program Option, flip the direction switch and leave it there. After you hear the announcement "Option 1, 2, 3 ... etc." stop when you hear "ten" by moving the direction switch back. You will hear "Throttle Mode".
- Use a Slow or Quick operation of the direction switch to enter this option. If the throttle mode is at its default value (RTC), you will hear "Throttle Mode equals RTC;" otherwise, you will hear "Throttle Mode equals STC."

- Use a Slow or Quick operation of the direction switch to change the throttle mode. Repeated Slow or Quick operations will cause the throttle mode to alternate between its two possible values (RTC, STC, RTC, STC ... etc.)
- Once you have selected the throttle mode you wish to use, turn the throttle off. When you then power up again, your locomotive will be using the throttle mode you have just selected.

Example: Setting V-Start (Program Option # 8)

This will determine the voltage (and throttle position) where your engine will leave neutral and move out. **Lowering V-Start will increase the range of your throttle that is usable for controlling locomotive speed. However, if V-Start is set too low, your locomotive cannot enter neutral, and you will lose all features available in the neutral state.**

- Enter Programming after powering up your engine by turning the bell on, then off and then on as described above.
- After the "Enter Programming" followed by "Option One - System Volume" announcement of the first Program Option, flip the direction switch and leave it there. After you hear the announcement "Option 1, 2, 3 ... etc." stop when you hear "eight" by moving the direction switch back. You will hear "V-Start".
- Use a **Slow** or **Quick** operation of the direction switch to enter this option. You will hear "V-Start equals X" where "X" is the track voltage value currently set to leave neutral".
- Use a **Slow** or **Quick** operation of the direction switch to activate this option. Hear the message "Set throttle to V-Start" and after three seconds the voltage will be announced¹⁴. If you move the throttle, the new track voltage value is announced a few seconds later.
- Once the throttle is set, use a **Slow** or **Quick** operation of the direction switch to start the procedure. The bell will ring continually, indicating the correct value is being calculated. If you chose a very low setting, be patient. If you do not get a setting within a minute, return to the beginning of this option or start over¹⁵ and then chose a slightly higher throttle value.
- At the end of the process, the engine will move slightly and stop. The horn will hoot, signifying the end of the operation and you will hear the message "V-Start = X" where "X" is the new setting.

Note: The final value of V-Start will decrease from the original voltage reading because resistance in the power pack or pickups will drop the voltage slightly during this calibration procedure.

Note: Sometimes it is difficult to see the engine move unless you are watching carefully.

- To leave programming, turn the throttle off, and then power up for normal engine operation.
- Or continue to V-Max by moving the direction switch and waiting for the next programming option to be announced.

Example: Setting V-Max (Program Option # 9)

V-Max is set in the same manner as V-Start except after entering this Program Option, you will hear "Set throttle to V-Max" which is the position where you want the full track voltage to be applied to the motor (usually about 80% of full throttle)¹⁶. Then do a Quick or Slow operation to set V-Max.

Note: When double heading your Quantum equipped locomotives¹⁷, make sure that both locomotives have similar speed/throttle characteristics by adjusting V-Start and V-Max to prevent them from fighting each other.

For more information, download the Quantum Analog Reference Manual (Version 2) from <http://www.qsindustries.com/>

¹³ Setting any volume in Analog will also apply to DCC and vice-versa.

¹⁴ Quantum systems have a built-in voltmeter that measures the track voltage and announces its value verbally. Depending on the power pack, this voltage may be slightly different from the value measured by an external meter. However, since the Quantum voltmeter uses its own values for throttle levels, it is the correct value for the system.

¹⁵ See section above: *Moving on to Other Program Options or Leaving Programming.*

¹⁶ V-Max should not be set too low when using RTC. For most power packs, the best choice for V-Max is about 1.5 volts below the highest throttle setting as determined by the Quantum internal voltmeter.

¹⁷ Do not double-head Quantum engines with standard engines and then operate the horn or bell while engines are moving. The standard engine will reverse direction and fight with the Quantum engine.

DCC OPERATION

These steps will allow you to start operating your FM Train Master immediately using any qualified NMRA command station.

1. Select engine number 3.
2. Set your controller to 128 (preferable) or 28 (acceptable) speed step range.
3. Start your locomotive immediately by pressing the F6 function key to hear the engine start up sounds. The directional Front Headlight, Rear Headlight, and Mars¹⁸ Light will be off. Use the FL or FO key to turn on the directional lighting.

When you reduce the throttle to zero, the engine will automatically enter neutral when the engine stops. You will hear a short air release when the engine stops moving and a longer air release about one second later followed by air pumps and other background sounds¹⁹. The directional Front Headlight will go dim or, if your model FM Train Master has a Mars Light, the Mars light will stop pulsing and go dim.

The direction of your locomotive will change when you press the direction key.

Function Keys

The following table lists features that have been pre-assigned to your DCC function keys. Operation of these keys can be different in the neutral state (locomotive stopped) and the motive states (locomotive moving in forward or reverse). After you have selected your locomotive, simply press any of the function keys listed below to produce the described effects.

Function Key*	Forward and Reverse	Neutral
FO or FL or Headlight	Directional Lighting on or off	Directional Lighting on or off
F1	Bell on or off	Bell on or off
F2	Horn or horn with Doppler Effect (see below)	Horn on or off
F3	Coupler Crash/Coupler Fire	Coupler Arm or Coupler Fire
F4	Diesel Motor Cooling Fans on or off	Diesel Motor Cooling Fans on or off
F5	Dynamic Brake function on or off	Dynamic Brake function on or off
F6	Doppler	Start Up
F7	Brake Squeal/Flanges and Air Brakes	Brake Set - Long Air Let-off
F8	Audio Mute on or off	Audio Mute on or off
F9	Short Air Let-off ²⁰	Shut Down
F10	Locomotive's Verbal Speed Readout in SMPH	Locomotive's Verbal Status Readout
F11	Front Number Board Lights on or off	Front Number Board Lights on or off
F12	Short Air Let-off	Short Air Let-off

* Quantum supports the new NMRA 0-12 function key standard as proposed; the older 0-8 standard is not supported.

¹⁸ Only SP 4802 and 4805 FM Train Master models have Mars Lights. The Mars light is operational at the front (short hood) end only.

¹⁹ Neutral sounds also include cooling fans with vents opening and closing that turn on and off randomly.

²⁰ A "Short Air Let Off" is the sound we use to indicate a "no-op" (no operation of a feature).

If you have a DCC command station that supports only the older 0 to 8 function key standard, you will have no way to initiate Shut Down in Neutral with these pre-assigned feature to function key mappings. There is an interim solution to this problem; by changing CV38 from its default value of 4 to decimal 128, you can control Shut Down in Neutral from function F4 (instead of function F9) on your DCC command station. However, by doing this remapping, you will lose the ability to "Take Control" of the vents and cooling fans with a DCC function. (See Automatic Features with "Take Control" Operation on page 21.)

Directional Lighting Operation (FO or FL or Headlight)

The FL (or FO, or Headlight) key toggles the directional Front Headlight/Rear Headlight/Mars Light system²¹ on or off.

The defaults for the Front Headlight, Rear Headlight, and Mars directional lights are off. When toggled on, the Directional Lights²² come on according to the tables below.

Directional Lighting Operation in DCC and Analog without Mars Light Option (Long hood forward)

	Forward	Neutral from Forward	Reverse	Neutral from Reverse
Front Headlight	On	Dim	Dim	Dim
Rear Headlight	Off	Off	On	Off

Directional Lighting Operation in DCC and Analog with Mars Light Option (Short hood forward)

	Forward	Neutral from Forward	Reverse	Neutral from Reverse
Front Headlight	On	Off	Off	Off
Rear Headlight	Off	Off	On	Off
Mars Light	Pulsing	Dim	Dim	Dim

Coupler and Coupler Crash Sounds (F3)

There are two ways to use the F3 key.

- As your engine is about to couple up to a string of cars, press the F3 key to trigger the crashing sound of engine coupling. Use the F3 key again as the engine moves out to trigger the same sound as the slack is taken up in the cars.
- Use the F3 key in neutral to produce uncoupling sounds as you disconnect cars over uncoupling magnets. Press the F3 key once to produce the sound of the lift bar and coupling pin being raised. This also arms the uncoupling sound effect. Press the F3 key again while moving or in neutral to trigger the sound of the coupler knuckle opening and air-lines parting.

²¹ Explicit lighting control features for headlight, reverse light and Mars Light can be assigned to DCC function outputs. (See Quantum DCC Reference Manual, Version 2)

²² Quantum uses constant voltage lighting that is independent of track voltage.

²³ Since the prototype horn uses compressed air, you may hear the air pump sounds turn on after the horn is operated.

²⁴ If you do not turn on either horn or bell, the Doppler shift will still occur but will be less dramatic.

²⁵ If the bell was on, it will shut off prior to sounds returning to normal.

Sound-of-Power

Your FM Train Master locomotive will produce labored diesel motor sounds under acceleration and lighter diesel motor sounds under deceleration but only if CV 3 or CV 23 and CV 4 or CV 24 are set to non-zero positive values. The level of labored sounds is proportional to the values for these four CV's, and how much the throttle is increased or decreased.

Diesel Motor RPM: Quantum has all eight diesel motor throttle "notches" found on most prototype locomotives. As you increase the throttle, you will hear the RPMs increase for every increase in ten speed steps (at 128 speed step setting). Idle is considered Notch 1 and occurs for speed step 0. Notch 2 ranges from 1 to 10, Notch 3 from 11 to 20, Notch 4 from 21 to 30, etc. If your controller has an option to increment or decrement your throttle setting by ten speed steps, it is very easy and predicable to set your notch value.

Horn and Bell Buttons (F2, F1)

Some DCC controllers have separate horn and bell buttons along with Function Keys assigned to Horn and Bell operation. The horn is usually assigned to F2. The F2 key and the horn button behave differently.

- Pressing the F2 key and releasing it will cause the horn to come on and stay on, until you press F2 again²³.
- Pressing the horn button will blow the horn only as long as you are holding it down.

Pressing the F1 key and releasing it will cause the bell to come on and stay on, until you press F1 again. There is no difference in operation between the bell button and its corresponding Function Key.

Doppler Operation (F6)

With DCC, you can trigger the Doppler effect by quickly interrupting the horn signal in the same way it is described under Analog control. Or you can use the Function Key dedicated to the Doppler effect.

- Start the horn and/or bell by pressing and releasing their function keys²⁴.
- Press F6 to hear the Doppler shift. A few seconds after the horn button is turned off with the F2 key the engine sounds return to normal²⁵.

Squealing Brake and Flange Sounds (F7)

Quantum provides automatic brake squeal as an engine slows to a stop. The operator can also control squealing sounds for continuous and variable brake sounds for protracted stops or to simulate the sounds of squealing wheel flanges on curved track.

- Squealing brakes come on automatically when the speed is reduced from high-speed travel (over 40 smph) to less than 20 smph.
- Pressing the F7 key when the engine is moving at any speed will manually activate squealing brake sounds, and repeated pressings while the Squealing Brake sounds are occurring will continue the sounds uninterrupted.

Note: If you slow the engine too quickly, the brake sounds will terminate abruptly when the locomotive stops and enters neutral.

Note: If you lower your throttle to speed step 0 on a moving locomotive, the F7 key will apply Air Brakes as long as the locomotive continues moving. See next section.

Air Brakes (F7)

If you have selected any non-zero deceleration inertia or momentum value in CV 4 and/or CV 24, the F7 key can be used to apply brakes to stop the engine more quickly than it would normally stop from the inertia settings²⁶. To use Air Brakes:

- Turn the throttle down to speed step 0 on a moving engine; this enables the F7 key to act as a brake.
- Press the F7 key. Hear a brief brake squeal sound and air being released from the brake lines continually. The longer the air is released, the greater the braking action.
- Press the F7 key again to stop the air release. The train will continue to slow at the last braking value.
- If you want to apply more braking, press the F7 key again to release more air. When you reach the desired amount of braking, press F7 again to stop the air release.

Note: If you continue to release air (for over 24 seconds total), all the pressure will be released and brakes are on full; you will hear no future air release sounds.

- Turn up the throttle to any value above 0 to release the brakes; this returns the engine's deceleration to a value determined by the sum of CV 4 and CV 24.
- If the engine is in Neutral when the F7 key is pressed, a long air release sound simulates setting the brakes. However, no braking effect is activated²⁷.

If the throttle is set to any speed step except 0, air brakes are not enabled; instead the F7 key will now manually activate squealing brake/flange sounds but will not affect the engine's deceleration.

²⁶ CV 4 and CV 24 determine the deceleration rate. Applying the brakes increases the deceleration rate temporarily.
²⁷ If the brakes are set in neutral, turning up the throttle automatically releases the brakes.

Automatic Features with "Take Control" Operation

The Quantum System allows the operator to take control of certain automatic features by using their associated function key. Once you "Take Control", the features will no longer have automatic operation and you will control their operation and their state with their function key commands. Automatic and Take Control operations are described in the table right.

	Automatic Operation			Take Control	
	Forward	Reverse	Neutral	Function Key	Operation
Vents & Cooling Fans	Non-operating	Non-operating	On and off at random times	F4	Toggles Vents/Fans operation between on or off.

- Take Control of Automatic Fans with the F4 key to stop automatic operation and control whether the Cooling Fans are on or off.

Regardless of the state of the automatic fans (on or off), if you press the F4 key, the cooling fans will be set to on if the F4 key is "1" and off if the F4 key is "0," and automatic operation will be disabled. Thereafter, the fans will respond only to the state of the F4 function. Automatic operation will be restored if the power is shut down and reapplied or if the F6 Start Up key is double pressed in neutral (see the description of Start Up on page 23).

Three Stages of Shut Down: 1. Disconnect, 2. Standby, 3. Total Shut Down (F9)

Engine Shut Down has three distinct stages that you can control. Each stage is entered by double pressing the F9 key²⁸.

Stage One: Disconnect

- Double press the F9 key in neutral to enter Disconnect. You will hear a long air let-off.
- To leave Disconnect, either double press the F6 Start Up key described in the Start Up section or double press the F9 key again to reach the next stage of Shut Down, Standby.

If you double press the F9 key in neutral, the motor drive will be disconnected. Once you hear the long air let-off, the throttle can be moved up and down without the FM Train Master moving. As the throttle is moved up or down, you will hear the diesel motor rev up and down in proportion to the throttle setting.

Note: You can also turn on the Dynamic Brakes (see description of Dynamic Brakes on page 23) to create Sound-of-Power as the throttle is moved up and down. Engineers on prototype diesels use the Dynamic Brakes to load the diesel motor-generator to test its output and efficiency while the locomotive remains stationary.

²⁸ Double pressing ensures that Shut Down stages are not entered or exited accidentally. Double pressing is defined as two F9 commands sent within two seconds. Note that the F9 key may have to be pressed three times, due to the command station and locomotive having different initial states for F9.

Stage Two: Standby

- Double press the F9 key while in Disconnect to enter Standby. You will hear a long air let-off followed by a special "Low Idle" sound. The Directional Headlights and Mars Light will then shut down. The motor will remain disconnected, while the Air Pumps, automatic Cooling Fan, and Front Number Board Lights will continue to operate. In Standby, the engine will not respond to throttle or function keys²⁹. The one exception is the F6 Start Up Function Key (described on the next page).
- To leave Standby, either double press the F6 Start Up key described in the Start Up section or double press the F9 key again to reach the final stage of Shut Down, Total Shut Down.

Note: Standby is ideal for leaving your engines running on a siding. Besides the low idle motor sounds, the engine will not respond to accidentally turning up the throttle or pressing the function keys.

Stage Three: Total Shut Down

- Double press the F9 in Standby to enter Total Shut Down. You will hear a long air let-off.
- To leave Total Shut Down, double press the F6 key.

If you double press the F9 key while in Standby, you will hear a long air let-off after which the locomotive will advance to Total Shut Down. The air pumps will turn off, followed by the sounds of the cooling fans shutting off, the louvers closing, the diesel motor shutting down and finally, the FM Train Master Engineer's door opening and shutting. In Total Shut Down, the engine will not respond to throttle or function keys. The one exception is the F6 Start Up Function Key (described on the next page).

If power is turned off at any stage of Shut Down (Disconnect, Standby or Total Shut Down) or during a Shut Down procedure, the engine will remember the last Shut Down stage it was at during power down, and will power up in the same stage. If Start Up is initiated during any of the above Shut Down procedures, Shut Down is aborted and the engine returns to normal operation.

Note: Total Shut Down allows the operator to take the engine "off line" (turn off sounds, lights, ignore throttle settings and function commands) independent of the operating session; that is, the engine will still be "off line" when power is reapplied for the next operating session.

Dynamic Brakes (F5)

The prototype FM Train Master has Dynamic Brakes that cause the train to slow down by using the traction motors in generator mode. This helps dissipate the energy of a moving train by converting it to electrical power, which is then applied to a large air-cooled resistor load in the locomotive.

- Pressing the F5 key in Forward or Reverse will set the FM Train Master diesel motor sound to idle at the lowest Sound-of-Power setting and turn on the powerful Dynamic Brake Cooling Fans.
- Pressing the F5 key in neutral will turn on the Dynamic Brake Fans while diesel motor sounds remain at idle.

The Dynamic Brake function automatically turns off when entering or leaving neutral, or the speed of the locomotive drops below 7 smph³⁰, or if the throttle is turned up. The Dynamic Brakes cannot be turned on in Forward or Reverse unless the engine is traveling over 8 smph.

Note: In contrast to Air Brakes (F7), Dynamic Brakes do not increase the deceleration rate specified by CV 4 and CV 24.

Start Up (F6)

If your FM Train Master is in any stage of Shut Down, you can return your locomotive to normal operation by double pressing the F6 Key. Start Up will be different for each stage of Shut Down, but all will start up with a long air release and will enter normal operation.

Start Up from Disconnect: If you double press the F6 key in Disconnect, the FM Train Master will produce a long air let-off, dynamic brakes will shut off (if on), and the locomotive will enter normal operation.

Start Up from Standby: If you double press the F6 key in Standby, the FM Train Master will produce a long air let-off, the diesel motor sound will change from the special Low Idle to regular Idle, and the engine will enter normal operation.

Start Up from Total Shut Down: If you double press the F6 key in Total Shut Down, the FM Train Master will produce a long air let-off, you will hear the engineer's door opening and closing, followed by the vents opening, the diesel motor starting up, the pumps starting up, and the locomotive entering normal operation. During the Start Up procedure, none of the function keys are active.

²⁹ Function keys will only produce a short air let-off.

³⁰ Dynamic Brakes on prototype locomotives are less effective at low speeds and are seldom used.

If the throttle is turned up from zero during any of the above Start Up procedures, the Start Up procedure will abort, and the engine will enter normal operation.

Note: Whenever a Start Up command is sent, regardless of whether the engine is in Shut Down or operating normally, the Quantum System will automatically restore all Automatic Operations.

Mute (F8)

The Quantum System allows you to reduce the System Volume to a lower level or increase it back to its original setting using the F8 function key. This is useful when you need to reduce the sound to engage in a conversation or to answer the phone. If you have many trains operating at once, you can reduce the volume on all those that are in the back of the layout and increase the volume of the closest engine. The Mute feature changes the sound gradually over a second or two, which allows the sound to increase or decrease realistically as the locomotive approaches or recedes from the observer.

- Press the F8 key in Neutral or Forward/Reverse to gradually decrease or increase the locomotive's volume.

Note: Mute state is not maintained if power is turned off and back on; the locomotive will return to full volume setting.

Note: Mute volume can be programmed in CV 51.1.

Status or Scale Speed (F10)

Quantum provides verbal information about the engine's current operating state when the locomotive is in neutral or the engine's current speed in scale miles per hour when the locomotive is moving.

- Press the F10 key in Neutral; the locomotive will verbally report first its currently enabled long or short Loco ID followed by its Consist ID if it has one, followed by its shut down state (Disconnect, Standby or Shut Down).

Note: F10 Status will also operate on a selected locomotive in Total Shut Down.

- Press the F10 key in Forward or Reverse; the locomotive will verbally report the locomotive's speed in smph.

Note: When Status Report is activated, the locomotive's sounds will reduce to one half their current volume settings during the verbal report and then return to normal volume when the report has ended.

Function Key Operation in Neutral

Some Function Keys used in Forward and Reverse will have different effects in Neutral:

- The F7 key produces Brake Squeal for a moving locomotive but produces a long air let-off in neutral.
- Pressing F6 results in Doppler shift for a moving locomotive but activates Start Up in neutral.
- Pressing F9 produces a short Air Let-off in a moving locomotive but activates Shut Down in neutral.
- Pressing F10 produces a verbal readout of locomotive speed in smph for a moving locomotive but produces a verbal report of engine status in neutral.

Note: Horn, Bell, Doppler Shift, Squealing Brake and Neutral sounds are described in detail on pages 30-31, in the Quantum System Sounds section of this manual.

DCC PROGRAMMING

Most command stations currently available will program Quantum equipped locomotives in Service or Operations (Ops) Mode. If your command station will not program in Service Mode, check with the command station manufacturer; some companies will give you a free upgrade or have another suggestion that allows use of the programming track. Also, see Program Track Operation on page 33 of the Special Operation and Troubleshooting section.

Changing the System Volume Electronically in CV 51.0

You can change the volume either manually as described in the Special Operation and Troubleshooting section or electronically using QSI CV 51.0 in DCC³¹. To change volume in Service or Ops Mode, do the following:

- Enter 0 in CV 49.³²
- Enter the System Volume in CV 51. The System Volume can be set to any value between 0 (no sound) and 127 (100%). The default System Volume is 127.

Note: When you change the System Volume, you will immediately notice the change in volume in Ops Mode.

Changing the Mute Volume Electronically in CV 51.1

To change the Mute Volume in Service or Ops Mode, do the following:

- Set CV 49 to 1.
- Enter the Mute Volume in CV 51. The Mute Volume can be set to any value between 0 (no sound) and 63 (100%). The default Mute Volume is 0.

Note: When you change the Mute Volume, and the locomotive is muted, you will immediately notice the change in Mute Volume in Ops Mode.

Note: The Mute Volume level will be the smaller of either the Mute Volume setting or one half the current System Volume. In other words, the Mute Volume will never be more than one half the system volume.

Enable/Disable Horn Triggered Doppler Shift (CV 51.2)

- Set CV 49 to 2.
- Set CV 51 to 0 to disable Horn Triggered Doppler; set to 1 to enable Horn Triggered Doppler.

³¹ System Volume changes in DCC also apply to Analog and vice-versa.

³² You will hear the value spoken out (Ops Mode Only).

³³ 'X' refers to the value in column 1 of the table, the Primary Index number that will be entered into CV 49.

³⁴ Setting any Individual Feature Volume in DCC will also apply to Analog and vice-versa.

Changing Individual Sound Volumes (CV 52.X)³³

To change the volume of individual sounds listed in the table below do the following³⁴:

- Set CV 49 to the Primary Index for the individual sound from the table below.
- Enter Volume level in CV 52 as follows: "0" = No sound, "1 – 15" sets volume from the lowest level at "1" to the highest at "15", with volume levels at 2db increments.

Primary Index entered into CV 49	Sound	Default
0	Horn	11
8	Bell	10
10	Diesel Motor	8
16	Air Pump	9
19	Vents and Cooling Fans	8
21	Long Air Let-off	11
22	Short Air Let-off	11
24	Flanges/Squealing Brakes	11
28	Dynamic Brakes	8
34	Coupler Sounds	11
37	Air Brake Sounds	11

Reset all³⁵ CV's to Factory Default Values (CV 56.128.255)

Note: This does not affect Analog settings, except volumes.

- Set CV 49 to 128.
- Set CV 50 to 255.
- Set CV 56 to 113³⁶. In Ops mode, you will hear 3 hoots when reset is completed.

Special ID Programming (CV 56.129)

If you cannot program your ID number in Service Mode and your command station prevents you from changing your ID in Ops Mode using CV 1, or CV 17 and CV 18, use the following alternative procedures to program your engine ID's.

Procedure for Entering Short (Primary) Address in CV 56.129 in Ops Mode

- Set CV 49 to 129.
- Set CV 50 to 1.
- Set CV 56 to your short address (1 or 2 digits). Hear the address spoken back.
- If necessary, set CV 29, bit 5 to '0' (or set CV 29 to 6 which is factory default) to enable your new primary address.

³⁵ Consult the Quantum DCC Reference Manual (Version 2) to learn how to reset different groups of CV's.

³⁶ "113" is QSI's Manufacturer's ID Number assigned by the NMRA.

Procedure for Entering Long (Extended) Address in CV 56.129 in Ops Mode.

- Determine the value of CV 17 and CV 18 for your Extended Address from table below or follow instructions for CV 17 and CV 18 in the Quantum DCC Reference Manual (Version 2) to calculate a different ID number.
- Set CV 49 to 129.
- Set CV 50 to 17.
- Set CV 56 to the value of CV 17 from the table or your calculations. There will be no verbal response.
- Set CV 50 to 18.
- Set CV 56 to the value of CV 18 from the table or your calculations. Hear the new full Extended Address spoken out.
- Change CV 29, bit 5 to '1' (or set CV 29 to 38³⁷) to allow operation with your new Extended Address.

FM Train Master ID's

Engine	CV 17	CV 18	CV 17	CV 18	CV 17	CV 18
ID #	Dec	Dec	Hex	Hex	Binary	Binary
51	192	51	C0	33	11000000	00110011
55	192	55	C0	37	11000000	00110111
850	195	82	C3	52	11000011	01010010
859	195	91	C3	5B	11000011	01011011
2408	201	104	C9	68	11001001	01101000
2410	201	106	C9	6A	11001001	01101010
4802	210	194	D2	C2	11010010	11000010
4805	210	197	D2	C5	11010010	11000101
8703	225	255	E1	FF	11100001	11111111
8706	226	2	E2	2	11100010	00000010
8905	226	201	E2	C9	11100010	11001001
8917	226	213	E2	D5	11100010	11010101

Disable/Enable Verbal Announcements (CV 62)

In Ops mode, Quantum will automatically speak out the value of the CV you enter.

- To disable, set CV 62 to 0³⁸; to enable, set CV 62 to 1. Default is Enabled.

CV Inquiry with Verbal Feedback in Ops Mode (CV 64)³⁹

To inquire about the current value of any CV through Verbal Feedback in Ops Mode:

- Enter the CV number in CV 64. Hear the verbal message "CV 'X' equals 'Y'", where 'X' is the CV number and 'Y' is the value.

³⁷ Entering "38" leaves the other configuration settings in CV 29 at factory default, but changes the ID to extended type.

³⁸ You will not hear "CV 62 = 0".

³⁹ This option is not affected by CV 62 (Disable/Enable Verbal Announcements).

Note: If the CV has a Primary Index such as QSI CV nn.mm (where nn is the CV number and mm is the Primary Index), mm must be entered in CV 49 before you enter the CV number, nn, in CV 64. For example, if you want to inquire about the contents of CV 56.4, enter 4 into CV 49 and enter 56 into CV 64. You will hear, "CV five six point four equals 'Y' ('Y' is the current value).

Note: If you enter either '17' or '18' in CV 64, you will hear the full Extended Address ID number spoken out.

Common NMRA Configuration Values (CV 29)

Each bit in CV 29 controls some basic operational settings for DCC decoders, including Extended Addressing, Speed Table Enable, Power Source Conversion, Lighting Operation, Locomotive Direction, and others. The default value of CV 29 is 6.

The following table provides some of the more common values for CV 29 for the features indicated.

Extended Addressing	Speed Tables	Power Conversion	28/128 Speed Steps	Reversal Direction	Decimal Value	Binary Value	Hex Value
			X		2	00000010	2
		X	X		6	00000110	6
	X		X		18	00010010	12
	X	X	X		22	00010110	16
X			X		34	00100010	22
X		X	X		38	00100110	26
X	X		X		50	00110010	32
X	X	X	X		54	00110110	36
			X	X	3	00000011	3
		X	X	X	7	00000111	7
	X		X	X	19	00010011	13
	X	X	X	X	23	00010111	17
X			X	X	35	00100011	23
X		X	X	X	39	00100111	27
X	X		X	X	51	00110011	33
X	X	X	X	X	55	00110111	37

For more information, download the Quantum DCC Reference Manual (Version 2) from <http://www.qsindustries.com>

QUANTUM SYSTEM™ SOUNDS

Diesel Motor Rev: Quantum allows the opposed-piston FM Train Master diesel engine to be operated with eight throttle notches. As the throttle is turned up, the diesel engine RPM will increase in fixed increments until the maximum RPM occurs at notch 8.

Low Idle: Low Idle is used on prototype diesel engines to maintain a warm and ready locomotive with a minimum of fuel consumption. The special Low Idle sound has a lower base throb and is less harsh than the normal idle.

Cooling Fans: The enormous diesel engine and generator need ventilation to stay cool. All diesel locomotives have powerful cooling fans on the roof to draw outside air through louvers on the sides of the locomotive. This air is blown across large radiators. You will also hear the sounds of louvers opening before the fans start. When cooling fans shut down, you will hear the louvers close.

Air Pumps: When a locomotive is sitting still, the pumps come on in a steady beat to replace the air lost from the brake air release or any other air operated appliances. Once the pressure is up, the pumps only turn on occasionally to maintain the pressure. Diesel Air Pumps are operated directly from the diesel engine and are quite noticeable when turned on in a non-moving locomotive. In forward, you will hear the air pumps come on soon after the horn is operated to maintain the air pressure.

Appliance Air Release: Compressed air is used on locomotives for operating various appliances. You will hear either a short air release or long air release at various times.

Air Brakes: When prototype train brakes are applied, air is released from the brake lines to reduce the pressure. The more the pressure is reduced, the greater the braking. You will hear a continual air release sound from the FM Train Master model as braking is continually increased. The longer the air is released, the quicker the model FM Train Master will slow down. Once all the pressure is released, the locomotive will continue at maximum braking (which can still require a long stopping distance that depends on the deceleration momentum set in CV4 and CV24). **DCC only.**

Brakes Squeal: You can hear the brakes squeal on prototype locomotives when the locomotive is moving slowly. This squeal can become particularly loud when the wheels are just about to stop turning. Listen at slow speeds for automatic brake squeal sounds and the final distinctive squealing sounds as the FM Train Master slows to a stop.

Dynamic Brakes: Electric motors can act as motors or generators depending on whether they are using power or generating power. When used as generators, the traction motors are disconnected from taking power from the locomotive's prime mover, and instead are connected to large resistor grids in the roof. By increasing the resistive load on the traction motors, the traction motors become harder to turn and act as brakes for the locomotive. The electric power generated by turning the traction motors is dissipated as heat by the resistor grid. These resistor arrays get quite hot and require cooling. When dynamic brakes are turned on in the Quantum equipped FM Train Master, the diesel engine sound drops to notch 1, and the dynamic brake cooling fan sounds come on. Since Dynamic Brakes are relatively ineffective at low speeds, the Dynamic brakes will shut off automatically below 8 smph. **DCC only.**

FM Train Master Horn: The Quantum System uses authentic locomotive sounds whenever possible. The Quantum horn has been recorded from a prototype single chime horn. All Quantum horns and whistles are engineered by our sound experts to give you the most authentic effects. If you blow the horn briefly, you will produce a realistic short horn sound or "hoot".

FM Train Master Bell: Diesel and Electric locomotives, as well as larger steam engines, usually have pneumatically operated mechanical bells. Small steam engines often have hand-pulled bells. With the Quantum FM Train Master bell, you will hear the bell fade out along with the short air release sound associated with turning this appliance off.

Doppler Run-by: The engine sounds get louder as the train approaches, then immediately drop to a much lower pitch and lower volume as the train passes by. With a little practice you can change the pitch exactly when and where you want. Doppler shift is based on the speed of the locomotive, so the sounds change more dramatically when the locomotive is running faster. After the Doppler shift has occurred and the horn is no longer being blown, the bell shuts off, and locomotive sounds return to normal.

Coupler: To give you the most authentic coupler sounds, QSI has identified three distinct types of coupler activity. The first is when the coupler is armed where you will hear the clanking sound of the coupler lift bar and coupler pin raising. The next is the coupler opening, with the hiss of the air-lines parting. The third is when the locomotive couples up to its load of cars, and you hear the crash as all the cars bunch together from the impact. **DCC only.**

Flanges: When a train enters a curve, the flanges on the wheels ride up on the inside of the rail and squeal. Recreate this squealing effect by pressing and releasing the F7 key quickly and repeatedly as necessary. **DCC only.**

SPECIAL OPERATION AND TROUBLESHOOTING

For a full description, see the Troubleshooting section in the Quantum DCC Reference Manual (Version 2) at www.qsindustries.com

With some Command Stations, using the Horn button to activate the horn, and, while this button is held down, activating the F6 Doppler key, will cause the horn to shut off instead of causing a Doppler shift effect.

We have experienced intermittent and independent horn signal interruption with some DCC command stations, causing unexpected Doppler shifts. If this happens frequently, you may want to disable the Horn triggered Doppler (CV 51.2).

Reed Switch Operation with Magnetic Wand

The FM Train Master is equipped with a special reed switch located directly under the plastic roof that can be activated by a magnetic wand (enclosed) without having to disassemble the locomotive. The reed switch can be used to change the volume of your sound system or to reset the engine to factory defaults.

Manual Volume Adjustment

- Locate the reed relay area on the locomotive as shown in the FM Train Master diagram on page 33.
- Power up engine and leave in neutral.
- Place the enclosed magnetic wand over this reed switch area on the roof of the locomotive⁴⁰ perpendicular to the track and wait as you hear the volume increase or decrease in incremental amounts as the horn hoots about every second. Move the wand away and again place it over the reed area to change the direction (louder or softer) of the volume change. Remove the wand when you reach the desired volume level.

Note: Volume can also be adjusted digitally using the programming methods described in the programming sections of this manual.

Resetting your Engine to Factory Default Values with Magnetic Wand

In case your engine's sound and control system misbehaves and turning the power off for 15 seconds does not return it to normal operation, you can reset your locomotive to original factory values.

- Locate the reed relay area on the locomotive as shown in the FM Train Master diagram on page 33.

- Turn off the power.
- Place the magnetic wand over the reed switch area, apply power, and leave the wand there until you hear the word "reset". Your engine is now reset. Remove the wand before the manual volume adjustment is activated.
- The locomotive has now been returned to original factory defaults including all DCC and Analog values.



High Voltage Circuit Breaker

Your FM Train Master locomotive is designed to operate on the normal track voltage supplied by most HO power packs. If track voltage exceeds 21.5 volts peak, the motor drive circuit will automatically shut down and the engine will coast to a stop, while the Quantum System alerts you to the problem through a continuous series of hoots. This built in safety feature protects the Quantum System and motor from excessive voltage⁴¹.

- To restart your engine, reduce the track voltage until the hooting stops and the motors re-engage.

Program Track Operation

The FM Train Master conforms to NMRA standards for program track operation. However, the Quantum System requires more current to operate than standard decoders and may not respond to the limited program track power from some command stations. If your FM Train Master will not respond properly on the program track, all CV's can be programmed on the mainline in Operations Mode.

Reasons why Your Locomotive is Silent or will not Start

In case your engine remains silent after power up and turning the power off for 15 seconds does not return it to normal operation, you will need to check the following points to bring your engine back to normal sound operation.

⁴⁰ The wand does not need to touch the plastic body. It can be held a reasonable distance from the roof area to prevent possibly marring the painted surface.

⁴¹ The high voltage circuit breaker will sometimes activate if the load (inertia or momentum) feature is used. Most power packs have substantial series resistance, which lowers the track voltage when the engine is drawing power. However, with a load setting, the engine does not require much power when it first starts moving. If the throttle is turned up all the way before the engine gains speed, the track voltage will be unusually high and can trigger the high voltage circuit breaker.

- Make sure the engine has not been Muted with the F8 Key.
- Check to see if your sound system volume has been turned all the way down, either manually with the magnetic wand or digitally by analog or DCC programming.
- You may have shut your engine down in DCC using the F9 key, which remains in effect in Analog. Go back to DCC operation, and start your engine with the F6 key. Once started, you can return to DC or DCC operation. As an alternative, you may use the Magnetic Wand, which selects and starts the engine if it is shutdown.
- If the above methods do not start your engine, reset your FM Train Master to factory default values as described above.

Summary of Analog and DCC Features

Sounds & Features Common to Analog & DCC	Analog Features*	DCC Features*
Horn or hoot Bell with shut down and turn on effects Diesel Motor Automatic Cooling Fans Doppler Shift Brake or Flange Squeal Neutral Sounds <ul style="list-style-type: none"> • Long Air Release • Short Air Release • Air Pumps Sound-of-Power™ Neutral State (Idle) Directional Lighting <ul style="list-style-type: none"> • Front Headlight • Rear Headlight • Mars Light Air Brakes Manual Volume Control with Magnetic Wand Reset to Factory Defaults with Magnetic Wand	System Volume Programming Individual Sound Volume Control Regulated Throttle Control and Locomotive Inertia (0) Helper Type: (Normal) Normal loco, Lead loco, Mid Helper, End Helper, Pusher Direction: (Normal) Normal/Reversed Power Pack Programming <ul style="list-style-type: none"> • V-Max (12v) • V-Start (8.5v) 	F0 or FL light control F1-F12 Function Keys 14/28/126 speed steps (28) Coupler Sounds Dynamic Brakes Programming Modes Supported: Address Mode, Register Mode, Service Mode, Direct Mode, Ops Mode Long Form & Ops Mode Short Form NMRA™ CV's supported: 1 Primary Address (3) 2 V-Start (32) 5 V-High (0) 8 QSI MFG's ID Number (113) 3-4,7,17-25,29,33-46,66-95 QSI CV's supported: 49 Primary Index 50 Secondary Index 51 Sound Control <ul style="list-style-type: none"> • 51.0 System Volume (127) • 51.1 Mute Volume (0) • 51.2 Doppler (Enabled) 52 Individual Sound Volume Control 53 Function Output Mapping 56 QSI Configuration <ul style="list-style-type: none"> • 56.128.n Reset • 56.253 Version Build Information (HO105 f00 Mars Light Version) (HO106 f00 Standard Lighting Version) 62 Auto CV Verbal Feedback (enabled) 64 CV Inquiry Verbal Readout

*Settings in parentheses indicate factory default

ATLAS WARRANTY

Limited Warranty

Atlas Model Railroad Co. Inc. warrants that this locomotive will be free from defects in material and workmanship for a period of ninety (90) days from the date of purchase. If this locomotive fails during the warranty period, carefully pack the assembled item in the original carton, together with the dated sales receipt, and return to: Atlas Model Railroad Co. Inc., 378 Florence Avenue, Hillside, NJ 07205. Defects due to dropping, misuse, improper maintenance and/or abuse are not covered by the warranty. Items that have been disassembled by the modeler or anyone other than an Atlas repair person are not covered by the warranty. This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

NOTE: • Maximum operational voltage: 21.5V DC • Additional lubrication at time of purchase is not recommended.

Atlas Locomotive Repair Policy

Any locomotive needing repair should be carefully packed in its original display box (if available), placed in an outer box surrounded by supportive material, insured and returned via UPS or US mail to:

**Atlas Model Railroad Co. Inc. • 378 Florence Avenue • Hillside, NJ 07205
Attn: Repairs Dept.**

- Please include a brief explanation of the problem along with your name, return address, daytime telephone number and email address.
- All locomotives will be logged in by the date received. Warranty* repairs must include a copy of the hobby store receipt and will be processed in the order they are received.
- Non-warranty repairs will be processed upon customer's approval of repair cost. If Atlas cannot obtain approval within 30 days of the locomotive's receipt, the un-repaired locomotive will be automatically returned to the customer.
- Atlas is not responsible for damage caused to, or by, any external or internal customized locomotive, including, but not limited to add on parts, speakers, wiring and DCC decoders. Locomotives that have been custom painted should only have the mechanism returned.
- Customers should allow 4-6 weeks for repair.

*90 days from original purchase date on manufacturer's mechanical and/or paint and print defects

QSI WARRANTY

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July 2004, Issue 1.0