USER MANUAL

DC and DCC Operation of Atlas Gold Series Diesel Locomotives

equipped with QSI Sound-Decoders (Quantum™, Quantum Titan™, or Quantum Titan™ with ET)

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Atlas User Manual Version 6.15

for the following Quantum Firmware Versions:
- Ver. 7 (Quantum or Quantum Revolution)
- Ver. 8 (Quantum Titan)
- Ver. 9 (Quantum Titan™ with ET)

Quick Start Guide: DC and DCC Operation of Atlas Gold Series Diesel Locomotives Equipped with QSI Sound-Decoders (Quantum, Quantum Titan, or Quantum Titan with ET)

Congratulations on purchasing an Atlas HO-scale or 2-rail O-scale Gold Series sound-equipped locomotive that is equipped with a QSI Sound-Decoder (Quantum™, Quantum Titan™, or Quantum Titan™ with ET). These sound decoders are among the most feature-packed and technologically-advanced such products available today.

For newer Atlas Gold Series locomotives, there is an introductory document [1] that gives locomotive-specific information as well as general material that applies to all Atlas/QSI locomotives. This document is titled:
> *Quick Start Guide: DC and DCC Operation of Atlas (specify scale and type of your locomotive) Gold Series Diesel Locomotives Equipped with QSI Quantum (Titan™) Sound-Decoders.*

To get the exact title, you must specify the *scale and type of your locomotive* (e.g., HO GP40)

To download the above document, go to the Atlas website:
> http://www.atlasrr.com/

Then go to *Support*, next go to *DCC Support*, and finally to the *Atlas Quick Start Guide* for your particular locomotive, which is found on the website under the heading *Atlas Quick Start for Locomotives with QSI Quantum Titan Sound-Decoders.*

If you cannot download a copy of the *Quick Start Guide* for your locomotive, as a substitute for the locomotive-specific *Quick Start Guide* you may instead use whichever one of the following two sections in this *User Manual* document is appropriate for your layout

- *Quick Start Guide for DC Operation,*
- *Quick Start Guide for DCC Operation,*

In addition, look at any other section or sections of this *User Manual* to which the appropriate *Quick Start Guide* refers. The two *Quick Start Glides* listed above may be found immediately after this introductory page.

Whichever *Quick Start Guide* you use, it will help you get your new Atlas HO or 2-rail O-scale Gold Series locomotive with a QSI sound-decoder running as quickly as possible, whether you are using conventional DC or DCC. Atlas recommends that you get used to running your new Atlas sound-equipped diesel locomotive by reading the section of the *Quick Start Guide* that are relevant to the type of layout power (DC or DCC) that you have and trying out all the features described in the *Quick Start Guide* before you read the rest of this *User Manual*. The remainder of the *User Manual* will let you explore the more advanced features and programming options available in QSI sound decoders.

Quick Start Guide for DC Operation

If you have a DC-powered layout, read through this section and be up and running with your new Gold Series locomotive in fewer than five minutes. Sound-equipped locomotives, such as Atlas Gold Series locos, behave differently on a DC-powered layout from the way non-sound-equipped locomotives operate. If you haven't run sound-equipped locomotives on DC before, the following bullet items explain what to expect.

- **Running the Locomotive on DC**
  - Use a variable-voltage DC power pack with a standard direction switch.
  - Set the direction switch to run your locomotive forward.
  - Turn the throttle up slowly until you hear the Quantum System™ begin to produce locomotive sounds. To hear any sounds from your Quantum-equipped locomotive, you will have to move the throttle to a higher setting (about 4.5 volts) than you would need to start a non-sound-equipped locomotive moving.   You will hear *Start Up* sounds, and the *Front and Rear Headlights* will come *on* in their *Dim* states. (The *Rear Headligh*t will be *Off* instead of *Dim* if your loco has Version 7 firmware and Q1a hardware.) Continue to turn up the throttle voltage (to about 9 volts) until the locomotive begins to move forward. The directional *Front Headlight* will turn from *Dim* to *Bright*, and locomotive sounds will continue.
  - The locomotive will start out slowly due to special Quantum inertia effects that resist rapid increases or decreases in speed[1].
  - If you slow the locomotive down by gradually reducing the throttle; squealing brake sounds will occur before the locomotive comes to a stop.

- **Reversing the Locomotive on DC**

  This simple operation is done in exactly the same manner as with standard DC locomotives.
  - Bring the locomotive to a stop, and turn the power all the way off.
  - Flip the direction switch, and reapply power to go in the opposite direction.
  - As you increase the track voltage, the *Rear Headlight* will switch from *Dim* to *Bright* (*Off* to *Bright* if your loco has Version 7 firmware and Q1a hardware), and the *Front Headlight* will become *Dim* (assuming that the locomotive was originally going forward).

- **Blowing the Horn on DC**

  Blow the authentic diesel locomotive *Horn* for short or long blasts; you control the duration.
  - **To turn on the *Horn*, while the locomotive is moving, flip the direction switch quickly[2] to its opposite** position (e.g., if the direction switch is set for the locomotive to move forward, move this switch to the reverse direction position). In this document, this action is called a ***Quick flip operation*** of the direction switch.
  - Leave the direction switch in the opposite position until the *Horn* has sounded for as long as you want it to sound. Then to shut off the *Horn*, flip the direction switch back quickly to its original position.
  - If your locomotive has *Ditch Lights*, these lights will flash alternately for as long as the Horn is blowing and will continue this alternate flashing for a short time afterwards.
  - The locomotive will NOT change direction when you blow the *Horn* or shut it off.

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[1] See *Locomotive Inertia Effects* in Section 3.1 of this document for further description of this feature. The inertial effects that occur with *Regulated Throttle Control (RTC)* can be eliminated by programming your locomotive to use *Standard Throttle Control (STC).* For information on switching between RTC and STC, see Section 0.
[2] If you flip the direction switch too slowly from one position to the other, you can momentarily lose track power while the switch is moved through its center position.

- **Ringing the Bell on DC**
  - You can turn the *Bell On* and leave it *On* while you operate other functions on the locomotive.
  - *Turn the Bell On with a **Very Quick flip-and-back operation**[3] of the direction switch. The Bell will stay On until you do another **Very Quick flip-and-back operation** of the direction switch to turn it Off.*
  - *Turn the Bell Off with a second **Very Quick flip-and-back operation** of the direction switch. The Bell will also turn Off if you interrupt track power.*

Note: Depending on the particular bell that you select[4], the bell sound can have a slow start-up effect where the pneumatic clapper gradually gains power until it starts to strike the bell.

Note: When you turn the *Bell Off*, it will continue ringing briefly with less and less volume as the pneumatic clapper slows down, just like the prototype.

*If you do a **Quick flip-and-back operation***, you will get a short Hoot of the Horn instead of the Bell. Conversely, if you try to do a very short Horn blast using a ***Very Quick flip-and-back operation***, you will activate the *Bell* instead. If you have trouble doing the **Very Quick flip-and-back operation**, try holding the power pack in place with your other hand to keep the pack from slipping.

If you have an Atlas Gold Series locomotive that has QSI's Version 9.3.1 (or later) firmware, you can select any one of 27 different bells. See Section 4.2.12 for information on how to select a bell.

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[3] A *Very Quick flip-and-back operation* is the same as a *Quick flip-and-back op*eration except that it is done more rapidly.
[4] The option of selecting among several different bells is available only in firmware Versions 8 and 9.

Quick Start Guide for DCC Operation

Read through this section and be up and running in fewer than five minutes with your new Gold Series locomotive on a layout that is powered by a DCC system that is fully compatible with the NMRA DCC specifications.

- **Running the Locomotive on DCC**
  - Select locomotive number 3 on your DCC throttle.
  - Set your DCC system to use either 128 (preferable) or 28 (acceptable) speed steps.
  - Make sure that all DCC track power is turned off. Then put your locomotive on the track and turn the DCC track power back on. When the locomotive is first powered up, the directional *Front Headlight* and *Rear Headlight* may not be turned on. If this is the case, press the *F0* (or *Headlight)* key on your DCC system one or two times to turn on the directional lighting. Both the *Front and Rear Hea*dlights will come on in their *Dim* states unless the locomotive is moving. You will also hear the *Prime Mover*[5] sounds.
  - When you turn up the DCC throttle, the locomotive will start to move forward or backward, depending on which direction (Forward or Reverse) was selected on the DCC throttle. The directional *Headlight (Front* or *Rear)* that points in the direction in which the locomotive is moving will turn from *Dim* to *Bright* (The *Rear Headlight* will change from *Off* to *Bright* if your loco has Ver.7 firmware and Q1a hardware.) and the locomotive sounds will continue.
  - If your Atlas sound-equipped locomotive has *Ditch Lights*[6], these lights will come on in the steady (non-flashing) state when the locomotive starts to move forward. When you blow the Horn **and** the locomotive is moving forward, the *Ditch Lights* will flash alternately.
  - Alternatively, if your Atlas sound-equipped locomotive has a *Mars Light*[6], this light will start pulsing when the locomotive starts to move forward. Since Canadian railroads do not use flashing ditch lights on their locomotives, the ditch lights do not flash on Atlas Canadian prototype models
  - When *Regulated Throttle Control (RTC),* which is also known as *Back EMF,* is *On* (the default setting), there will be noticeable momentum in both acceleration and deceleration.
  - As you slow the locomotive down by gradually reducing the throttle, *Squealing Brake sounds* will occur shortly before the locomotive comes to a halt.
  - When you reduce the DCC throttle setting to zero, the locomotive will automatically enter the *Neutral State* after the locomotive stops moving. You will hear a *Short Air Release* when the locomotive stops moving and a longer air release about one second later, followed by *Air Pumps* and other background sounds[7].
    - If the locomotive was moving forward, the *Front Headlight* will switch from *Bright* to *Dim* when the locomotive stops.

    - If the locomotive was moving backwards, the *Rear Headlight* will switch from *Bright* to a state that depends on the versions of firmware and hardware installed in your locomotive
      - If your locomotive has Version 7 firmware and Q1a hardware, the *Rear Headlight* will turn *Off* when the locomotive stops.

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[5] Two major parts of the operating mechanism of a prototype diesel-electric locomotive are (1) the *diesel engine* and (2) the *DC generator* (or the AC *alternator* in many modern locomotives). The generator (or alternator) is powered (mechanically) by the diesel engine and supplies (electric) power to the truck-mounted *traction motors* that drive the locomotive. The diesel engine and generator (or alternator) is mounted inside the locomotive's body, which is often called the *carbo*dy. Although the terminology *Diesel Engine* is perfectly correct technically for the (major) component of a diesel-electric locomotive that drives the generator (or alternator), some people are in the habit of calling a *diesel locomotive* a *diesel engine*. The term *Prime Mover*, as used in this document, refers to the entire Power Unit consisting of the *Diesel Engine*, the *Generator* or *Alternator*, and the *Turbocharger,* (if present). Prime Mover sounds include *Exhaust, Labored Exhaust*, and *Rod Knock*. To avoid confusion between these two entirely different meanings of *Diesel Engine*, the device that powers the generator (or alternator) is called the *Diesel Motor* in the Quantum Programmer software. However, the terminology *Diesel Motor* is not used in this document.

[6] Not all Atlas Gold Series locomotives have *Ditch Lights* or *Mars Lights.*

[7] *Neutral sounds* include *Cooling Fans* with vents opening and closing that turn on and off randomly, *Air Pumps* that come on randomly in response to air consumed, random *Spitte*r and *Air Dryer* sounds (firmware versions 8 and 9 only), and timed-out *Low Idle* sounds.

- In all other cases (Version 7 firmware and Q2 hardware, Version 8 firmware, or Version 9 firmware), the *Rear Headlight* will switch from *Bright* to *Dim* when the locomotive stops.
  - If your Atlas sound-equipped locomotive has *Ditch Lights,* the Ditch Lights will turn *Off* in the *Neutral state*.
  - If your Atlas sound-equipped locomotive has a *Mars Light* the *Mars Light* will stop pulsing and go *Dim* when the locomotive stops.

- **Reversing the Locomotive on DCC**

  This simple operation is done in exactly the same manner as it is with DCC, but not sound, equipped, locomotives.

  - The direction of motion of your locomotive will change when you press the direction button on your DCC throttle. To prevent damage to the mechanism of your locomotive, do not press the direction button until your locomotive has stopped moving.
  - The directional headlights behave as follows:
    - When the locomotive is moving forward, the *Front Headlight* will be *Bright*; when the locomotive is stopped or moving backwards the *Front Headlight* will be *Dim*.
    - When the locomotive is moving backwards, the *Rear Headlight* will be *Bright*; when the locomotive is Stopped or moving forward, the *Rear Headlight* will be *Dim (Off* if your loco has Version 7 firmware and Q1a hardware).

- **Blowing the Horn on DCC**

  Blow the diesel locomotive *Horn* for short or long blasts – you control the duration. The operation of the *Horn* depends on how your DCC system was designed and configured.

  - If your DCC system has separate *Horn* and *F2* keys,
    - Pressing the *Horn* key will blow the *Horn* only for as long as you are holding the button down. This behavior is called *momentary* operation.
    - Pressing the *F2* key and releasing it will cause the *Horn* to come on and stay on until you press *F2* again. This behavior is called *latching* operation.
  - If your DCC system has only an *F2* key, this key may be set at the factory for either *latching* or *momentary* operation, depending on the DCC system. Some DCC systems allow the user to configure a function key (such as *F2*) for either *latching* or *momentary* operation.
  - If the *Ditch Lights* are *On*, the locomotive is moving forward, and the Horn is blowing (*Horn* or *F2* key pressed), the Dit*ch Lights* will flash alternately for as long as *F2* is pressed and will continue this alternate flashing for a short time after you release the *F2* or *Horn* key.
  - If your Gold Series locomotive has QSI firmware release 9.3.1 or later, you have the option of choosing among 143 different horns. See Section 0 for additional information on this capability. .
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- **Ringing the Bell on DCC**

  - You can turn the *Bell On* and leave it *On* while you operate other functions on the locomotive;
  - Turn the *Bell On* by pressing the *Bell* or *F1* key on your DCC throttle.
  - The Bell will stay on until you do another press of the *Bell* or *F1* key on your DCC throttle (or you interrupt the track power).
  - Turn the *Bell Off* with a second press of the *Bell* or *F1* key on your DCC throttle.
  - When you turn the *Bell Off*, it will continue ringing briefly with less and less volume as the pneumatic clapper slows down, just like the prototype.
  - If your Gold Series locomotive has QSI firmware release 9.3.1 or later, you have the option of choosing among 36 different bells. See Section 4.2.12 for additional information on this capability. .
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Programming a New DCC Address for Your Locomotive

The decoder in an Atlas Gold Series locomotive comes from the factory set to use the short address "3." However, in order to control (independently) several locomotives on the same track at the same time, it is necessary that each locomotive have a unique DCC address. A convenient choice for the DCC address is the **Road Number** printed on the side of the locomotive's cab. Frequently, the number on the side of the cab is a 3- or 4-digit number, which is defined as a **Long (or 4-digit) Address** in DCC.

Most DCC systems allow you to change the DCC address of a locomotive in either of two ways:

- On a special section of track that is not connected in any way (neither mechanically nor electrically) to your layout and is called the **Program Track**. (In DCC terminology, programming locomotives on the program track is called **Service Mode Programming**.)
- Anywhere on the regular track of your layout. [In DCC terminology, programming a locomotive on the main track of your layout is called either **Programming on the Main (POM)** or **Operations Mode (Ops Mode) Programming**.]

If your DCC system allows you to program 4-digit addresses on the main line (many DCC systems do), Atlas recommends that you take advantage of this capability by programming the address of your Gold Series locomotive on the main line using *Operations Mode (Ops Mode)* programming. Table 6 in Section 4.2.3 shows, for most of the DCC systems commonly sold in North America, the DCC systems that do and do not directly support 4-digit address programming on the main line. For those DCC systems that do NOT support *Ops Mode* address programming on the main line, this table recommends that you use one of the alternate main-line address-programming procedures that are described in Sections 4.2.3.2 through 4.2.3.4. For all other DCC systems (i.e., the DCC systems that *DO* support programming of 4-digit addresses on the main line), use the *Ops Mode* programming procedure that is described in Section 4.2.3.1.

Resetting your Locomotive to Factory Default Values Using the Magnetic Wand (resets all Analog and DCC parameters)

Resetting the firmware in a QSI Sound-Decoder (Quantum™, Quantum Titan™, or Quantum Titan™ with ET) to its factory-built configuration can resolve many problems that sometimes occur with firmware-controlled electronics. In fact, we have found here at Atlas that at least 20 to 25 percent of the problems with Gold Series locomotives that we receive for repair can be resolved simply by resetting the sound-decoder. Hence, the very first step you take to resolve a problem should be to reset the sound-decoder in your locomotive. (The second step should be to clean thoroughly both the locomotive wheels and the track.)

Every Atlas locomotive equipped with a QSI sound-decoder has a magnetic reed switch located directly under the top of the plastic shell. This switch can be activated by the Magnetic Wand (the T-shaped object packed with your locomotive) without having to disassemble the locomotive.

Atlas recommends using the magnetic wand to reset the QSI sound-decoder whether your locomotive is normally operated on DC or on DCC. A magnetic wand reset can be done with either DC or DCC track power. However, the details of the procedure depend on the type of track power (DC or DCC) you are using. The DC and DCC magnetic wand reset procedures are described in Section 6.3.1 of this *User Manual*.

Table of Contents

1   Introduction

Congratulations on purchasing an Atlas HO-scale or 2-rail O-scale Gold Series (sound-equipped) locomotive that is equipped with a QSI Sound-Decoder (Quantum™, Quantum Titan™, or Quantum Titan™ with ET). These sound-decoders are among the most feature-packed and technologically-advanced such products available today.

The documentation for Atlas Gold Series HO-scale and 2-rail O-scale diesel locomotives that are equipped with QSI sound decoders is divided into three parts, with an increasing level of detail included in each successive layer of the documentation:

- **Basic-Level Information** The particular Basic-Level information available for your locomotive depends on how recently the locomotive was manufactured.
    - Older Gold Series Locomotives (HO-scale and 2-Rail O-scale)
      A generic Atlas *Quick Start Guide* was packed with your locomotive and is titled:
        Quick Start Guide: DC and DCC Operation of Atlas Gold Series Diesel Locomotives Equipped with QSI Sound-Decoders (Quantum™, Quantum Titan™, or Quantum Titan™ with ET
      explains how to run an Atlas Gold Series locomotive on your layout and operate some basic functions such as
        - o Blowing the horn
        - o Ringing the bell
        - o Turning on and off the headlights (DCC or DC with a Quantum Engineer)
        - o Turning on and off the sound (DCC or DC with a Quantum Engineer)
      Since it is essential that each DCC-equipped locomotive have a unique address, programming a new DCC address is also covered in the DCC section of this *Quick Start Guide*.

      In addition to the above generic *Quick Start Guide*, a separate 4-page pamphlet is included with each older Atlas or 2-rail Atlas O Gold Series locomotive. This pamphlet has either one or three photos of the locomotive that show where to place the magnetic wand to reset the QSI sound-decoder.

    - Newer Gold Series Locomotives (HO-scale and 2-Rail O-scale)
      The form of getting-started documentation is somewhat different for newer Gold Series locomotives. This documentation includes:
        - o Some getting-started user information is packed with each locomotive, which may be either the generic *Quick Start Guide* described above or a single-page summary of locomotive-specific information.

        - o A locomotive–specific *Quick Start Guide*, which includes:
            - An explanation of any features that are unique to that specific locomotive,
            - Three photos that show where to place the magnetic wand in order to reset the QSI sound-decoder,
            - The same general information found in the older generic *Quick Start Guide*s.
          This locomotive–specific *Quick Start* Guide may be down loaded from the Atlas website
                http://www.atlasrr.com/
          by going first to *Support*, then to *DCC Support*, and finally to the Atlas Quick Start Guide for your particular locomotive, which is listed on the website under the heading *Atlas Quick Start for Locomotives with QSI Quantum Titan Sound-Decoders*.

  In most cases, you will be up and running your new locomotive in fewer than five minutes after reading the *Quick Start Guide*

  If you cannot download the *Quick Start Guide* document, an alternative source of information is one of the two sections of this *User Manual* on pages 3 - 7 that are titled
    - *Quick Start Guide for: DC Operation*
    - *Quick Start Guide for: DCC Operation*
  The above two *Quick Start* sections are found at the very beginning of this *User Manual* (right after the cover page).

- **Intermediate-Level Information**: Once you have mastered the material in the *Quick Start Guide*, you may wish to learn more about the many features available in your Atlas Gold Series locomotive. The document that you are reading:

  > *User Manual: DC and DCC Operation of Atlas Gold Series Diesel Locomotives Equipped with QSI Sound-Decoders (Quantum™, Quantum Titan™, or Quantum Titan™ with ET)*

  explains, in considerably more detail than the *Quick Start Guide*:

  - How to operate and program the features that are available in your Atlas Gold Series diesel locomotive when it is operating on a DC-powered layout,
  - When your locomotives is operating on a DCC–powered layout, how to use the (non-programming-related) DCC functionality available in your Atlas Gold Series diesel and also how to program a number of commonly-used CVs (Configuration Variables), in addition to the basic address CV programming covered in the *Quick Start Guide*.

  Since the *User Manual* is written at a higher level than the *Quick Start Guide*, we recommend that you practice doing each of the operations described in the *Quick Start Guide* before reading the rest of the *User Manual*.

- **Advanced-Level Information**: Advanced-level information explains in detail how to use the operational and programming functionality built into your Gold Series locomotive. Advanced-level information is contained in two separate on-line documents, one for DC operation and the other for DCC:

  - For DCC: *NMRA DCC Reference Manual for QSI Quantum 3, 2, and 1 Equipped Locomotives*, Version 5.2.0, 5 August 2015 (or later).[3] The *DCC Reference Manual* contains definitions of all the CVs used in Quantum and Quantum Titan sound-decoders and includes examples of how to program various combinations of CVs to obtain particular locomotive behaviors.
  - For DC: *DC Analog Reference Manual for QSI Quantum® HO Equipped* Locomotives, Ver 4.0 (or later), 25 August 2006

  Although intended primarily for advanced users, some of the information in the above two documents will also be useful for beginners or intermediate users who want to modify the behavior of their locomotive in ways beyond the scope of this *User Manual*.

  Since Advanced-Level information about QSI Quantum and Quantum Titan sound-decoders is NOT included in this *User Manual*, if you wish to know the details of how a particular feature works or you wish to modify (typically by reprogramming CVs) the way a feature operates, you will need to download one of the above two documents. You can download either document from the QSI Solutions webpage

  <p style="text-align:center">http://www.qsisolutions.com/</p>

  by first selecting **Literature**. Then go to **Titan Decoder Documents**. Finally, under the heading **Programming Related**, double-click on either:

  - *Complete DCC Reference Manual for All QSI Decoders, v5.2.0 (or later))*[3]
  - *Complete DC Reference Manual for All QSI Decoders, v4.0 (or later)*

Roadmap to the Rest of this Document

In order to cover all the features available in your new Atlas Gold Series locomotive, this *User's Manual* is somewhat lengthy. However, there is no need to read the entire *User Manual* before you start enjoying your new locomotive.   In all cases, you should read the portion of the *Quick Start Guide* that covers your type of operation (DC or DCC). The following two paragraphs give roadmaps to the most important portions of this manual.

- **Essential Reading for DC (Analog) Operation**

  If you wish to operate your Atlas Gold Series locomotive on conventional DC power, you should read first the analog part of the *Quick Start Guide* for your locomotive. Additional useful information can be found in the following sections of this document:

  - Section 3.1, *Starting the Locomotive*,
  - Section 3.4, *Operation in Neutral*,
  - Section 3.5, *Changing the Locomotive's Direction without Turning off the Sound*,
  - Section 3.6, *Standard Throttle Control™ (STC™) and Regulated Throttle Control™ (RTC™)*.

- Section 6.3.1, *Resetting your Locomotive to Factory Default Values Using the Magnetic Wand (resets all Analog and all DCC parameters)*.contains extremely important information if the sound-decoder in your loco fails to function properly.

- **Essential Reading for DCC Operation**
  If you wish to operate your Atlas Gold Series locomotive on DCC, you should read first the DCC part of the *Quick Start Guide* for your locomotive. In addition, unless you are already quite familiar with the operation of your DCC system, you should reread (or read for the first time) your DCC system's *Owner's Manual*. Additional useful information can be found in the following sections of this document:
  - Section 4.2.3, *Programming a New DCC Address for Your Locomotive*,
  - Section 4.1.1, *Directional Lighting Operation (F0, FL, or Headlight Key),*
  - Section 4.1.2, *Bell (F1 Key)*,
  - Section 4.1.3, *Horn (F2 Key)*,
  - Section 4.1.12, *Mute (F8 Key)*,
  - Section 6.3.1 *Resetting your Locomotive to Factory Default Values Using the Magnetic Wand (resets all Analog and all DCC parameters)* contains extremely important information if the sound-decoder in your loco fails to function properly.

- **Troubleshooting**
  If you are experiencing any difficulty with your Atlas Gold Series locomotive, Section 6 (*Special Operation and Troubleshooting*) in this document should be read whether your layout uses DC or DCC power.

- **Material Applicable to both DC and DCC Operation**
  Some sections of this document apply to both DC and DCC operation. You need not read these sections before you begin using your Gold Series locomotive, but the material in these sections may be useful sometime in the future. For example, Section 2 *New Features Available with the Quantum Titan Sound-Decoder* and Section 5 *Quantum System Sounds* are optional reading for new Gold Series locomotive owners, but can be useful for both DC and DCC users.

2   New Features Available with Quantum Titan Sound-Decoders

Congratulations on purchasing an Atlas HO-scale or 2-rail O-scale Gold Series locomotive that is equipped with a QSI Quantum Titan or a Quantum Titan with ET sound-decoder. These two sound-decoders are among the most feature-packed and technologically-advanced such products available today. The Quantum Titan sound-decoder includes all the features of the original QSI Quantum system (used in previously-released Atlas Gold Series locomotives) plus many new features. As of the date of publication of this manual, there are two firmware releases for Quantum Titan sound-decoders:

- Firmware Version 8
  The following five Atlas Gold Series locomotives use QSI Quantum Titan sound-decoders with Version 8 firmware:
  - HO-scale Dash-8-40B,
  - HO-scale GP40-2,
  - HO-scale SD35,
  - HO-scale MP15DC,
  - O-scale (2-rail) F3
  All Atlas Gold Series locomotives with QSI Quantum Titan sound-decoders that were produced after the above five locos use Ver. 9 firmware rather than Ver. 8 firmware.

- Firmware Version 9
  Version 9 firmware has all Version 8 features plus:
  - An approximate 16 kHz sound sampling rate which yields higher fidelity audio,
  - A number of firmware enhancements, listed on page 2 of Reference [3] under the heading *New in DCC Reference Manual Version 5.2*.0. This remainder of this section will discuss briefly these new features. Except for features identified as Version-9-only, all features discussed below apply to both Firmware Version 8 and Firmware Version 9, but none of them apply to locomotives with QSI Version 7 firmware.

Quantum Titan Architecture

The Quantum Titan sound-decoder has a new architecture that gives it considerably more "horsepower" than earlier sound-decoders from QSI and other manufacturers. Some highlights of this new architecture are

- Over twice the audio bandwidth is used to provide very bright high fidelity locomotive sounds (only with Version 9 firmware);
- QSI's so-called "Emulator Technology™" uses physical diesel equations to model the prime mover so that the resulting sounds are as close to those of the prototype locomotive as possible (only with Version 9 firmware);;
- Higher speed processors are used;
- A 64 Mbit memory is employed; this much memory allows the Quantum Titan system to store multiple diesel Horns (or other sounds) that can be chosen by the user. Until recently, the user could select only one of two diesel horns. However, if your Atlas Gold Series locomotive has a sound-decoder that uses QSI's firmware release 9.3.1 (or later), you can choose any one of 143 different horns.
- Up to 64 mono or stereo sound channels are available;
- Ten selectable lighting outputs are available, each of which can be programmed to produce any one of eleven different lighting effects**.**

**Note**: An individual Atlas locomotive will include only a subset of the above capabilities, not all of them.

Additional DCC Functions Available both with Quantum Titan and Quantum Titan with ET

The original QSI Quantum DCC and sound system (firmware Version 7 and earlier) used DCC functions F0 and F1 to F12 to control various sounds, lights, and other features. The new Quantum Titan sound-decoders also use DCC functions F13-F28 (in addition to F0 and F1-F12). The QSI sound-decoders with Version 8 firmware (Quantum Titan) and those with Version 9 firmware (Quantum Titan with ET) both use the functions F11 to F28 to trigger the following new features:

- DCC function F11 to toggle between the primary and the secondary Horns. (After pressing F11 once, F2 will operate the secondary Horn in the normal way.) See Section 4.1.16.
- DCC function F13 to incrementally decrease System Volume in 2 dB steps.
- DCC function F14 to incrementally increase System Volume in 2 dB steps.
- DCC function F15 to play the Grade Crossing Horn sequence (long, long, short, long), but only when the locomotive is moving.
- DCC function F26 to start the Fuel Loading Scenario (dialog and sounds appropriate to fueling with diesel fuel), but only when the locomotive is stopped.
- DCC function F27 to start the Maintenance Scenario, but only when the locomotive is stopped.
- DCC function F28 to start the Water Loading Scenario, but only when the locomotive is stopped. (For example, this scenario might be used to generate dialog and sounds appropriate to adding water to the steam boiler in a diesel passenger locomotive.)

In order to use the above new features, you need a DCC system that supports 29 DCC functions (F0 plus F1 to F28). Most currently-sold DCC systems do support F0 and F1 - F28. If your DCC system does not support all of these functions, check with the manufacturer of your DCC system to see if an upgrade is available.

Other New Quantum Titan Features (both Version 8 and Version 9 firmware)

Other new features of Quantum Titan sound-decoders (for both Version 8 and Version 9 firmware) include:

- The availability of CV51.20 to set up (or turn off) automatic Horn warning signals that will be generated by the sound-decoder including:
  - Two short Horn blasts when starting in FWD,
  - Three short Horn blasts when starting in REV,
  - One short Horn blast when coming to a stop.
- The availability of CV6 to adjust the mid-range speed of a locomotive. (Using CV6 to set directly the mid-range speed is an alternative to using CV25 to select a speed curve.)
- Gradual brightening and dimming of locomotive headlights as they are turned on and off.
- Lower minimum locomotive speeds.

New Features Available only with Version 9 Firmware in a Quantum Titan Sound-Decoder

The major new feature in locomotives with Version 9 firmware is the use of sound records that have an approximate 16 kHz sampling rate, instead of the 8 kHz sampling rate used in firmware Versions 7 and 8. This higher sampling rate will almost double the highest frequency sound that can be reproduced, assuming that the frequency range of the speaker extends up to 8 kHz.

As stated earlier, in addition to a higher sampling rate, Version 9 firmware has a number of firmware enhancements that are listed on page 2 of Reference [3] under the heading *New in DCC Reference Manual Version 5.1.0*. Only one of these enhancements (*Added CV127.PI.SI Component Sound Volumes*) is covered (Section 4.2.9.2) in this *User Manual*. The QSI *DCC Reference Manual* [3] discusses in detail *all* of the Version 9 firmware enhancements listed on page 2 of the *DCC Reference Manual*.

3   DC (Analog) Operation

Most analog features can be accessed from any variable-voltage DC power pack that has a standard reversing switch[8]. However, some features can be accessed more easily from the *Quantum Engineer* or are only accessible from the *Quantum Engineer*. See Section 3.13 for a discussion of the *Quantum Engineer*.

3.1   Starting the Locomotive

Most variable-voltage DC power packs with a standard reversing switch are suitable for analog operation of Atlas sound-equipped locomotives. Generally, modern electronic type power packs will provide better performance. When operated with a standard DC power pack, your Atlas sound-equipped diesel locomotive behaves quite differently from non-sound-equipped locomotives that you may have operated. Unlike standard DC locomotives that start at very low track voltages, Atlas sound-equipped locomotives require a minimum amount of voltage (about 4.5 volts) to operate the electronics. Also, their response to the throttle is much slower and more like that of a prototype locomotive.

Turn the throttle up slowly until you hear the Quantum sound system™ start up. If the prototype locomotive was equipped with air-starting, you will also hear air-start sounds at this time. The *Number Board Lights* and *Front Headlight(s)*[9] will turn on. The *Front Headlight* will come on in the *Dim* state. If your locomotive has operating *Ditch Lights*, the *Front Headlight* will be *Dim* and the *Ditch Lights* will be *Off*. If your locomotive has a *Mars Light*, the *Mars Light* will be *Dim* and the *Front Headlight* will be *Off*. For further information, see
Table **3** and Table 4 in Section 4.1.1, which illustrate the operation of the *Front Headlight* and the *Rear Headlight*, respectively. You will hear the *Prime Mover* in your locomotive start up followed by the *Air Pumps*. If the prototype locomotive has *two* Prime Movers, you will hear both *Diesel Engines* start, one after the other.
.
Continue[10] to turn up the throttle voltage until the locomotive barely starts to move in *Forward*. This voltage is *called V-Start* and is typically 8.5 volts[11]. The *Prime Mover(s)* sounds will rev up with labored sounds proportional to the locomotive's acceleration and loading (see *Sound of Power*™, Section 3.9), and the locomotive will slowly begin to move. The *Headlight* will switch to *Bright*, and the optional *Mars Light* will begin to pulse. After 10 seconds in *Forward*, the *Cab Lights* (if installed in your locomotive) will automatically shut off

The Quantum, Quantum Titan, and Quantum Titan with ET sound decoders provide two types of locomotive inertia effects: RTC and STC. The characteristics of RTC and STC are described briefly on the next page and in more detail in Section 3.7

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[8] Some electronic power packs do not have a reverse switch. Instead they have a reverse button, which does not cause a rapid change in track polarity to the track and is not suitable for Quantum operation. See the list of suitable power packs in the *Quantum Analog Reference Manual* [2].
[9] Depending on the particular locomotive that you have, your Atlas Gold Series locomotive may not have all lights described here.
[10] It is not necessary to wait for the engine start up sounds to finish before entering *Forward*. If you turn up the throttle, the *Startup* sounds terminate, and the diesel locomotive will immediately go into normal *Forward* operation.
[11] The default value of *V-Start* is 8.5 volts, but it can be programmed to other values. See *Example 2: Setting V-Start (Analog Option #8)* in Section 3.14.4. It is important to note where *V-Start* is located on your throttle to know where you will enter and leave *Neutral* (see *Operation in Neutral*, Section 0).

Locomotive Inertia Effects

Your new locomotive is pre-programmed at the factory to use *Regulated Throttle Control (RTC)* in Analog (conventional DC powered) operation. *RTC* makes your locomotive operate as though it has the mass and inertia of a prototype locomotive. As a result, your locomotive will resist accelerating too quickly if at rest and will resist changes in speed once moving. [See Section 3.7*, Standard Throttle Control™ (STC™) and Regulated Throttle Control™ (RTC™).*] Although the *Diesel Engine* will rev up quickly when the throttle is increased, it takes a little practice to learn to wait for the locomotive to respond. If you prefer that your locomotive respond almost immediately to throttle movements on your DC power pack, it may be reprogrammed to use *Standard Throttle Control (STC).* Example 1 on page 24 in this *User's' Manual* explains how to program (using DC) your locomotive to use *STC* on a DC layout.

As you slow the locomotive down by gradually reducing the throttle to a little below *V-start*, the volumes of the *Diesel Engine(s)* rev and also the labored sounds decrease, while the *Squealing Brake* sounds occur as the locomotive comes to a slow stop.

If you feel that you need to turn your throttle up quite high to start your diesel locomotive, you can adjust *V-Start* for operation with your particular DC power pack. (See Example 2 on page 25 of this *User's' Manual.*) For a list of recommended DC power packs, consult the *Quantum Analog Reference Manual* [2].

3.2 Doppler Effect
This sound effect changes the Horn pitch and Prime Mover sounds as a QSI-sound-equipped locomotive passes by you. To trigger this effect:
- While the locomotive is moving toward you, 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 *Prime Mover* sounds shift in pitch as the locomotive passes by you.
- 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 locomotive 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.

Note: The faster the locomotive is moving, the greater will be the Doppler shift. However, there is no Doppler shift below 15 smph.

3.3 Selecting the Type of Horn
If your locomotive has QSI firmware release 9.3.1. (or later), you can select one of a large number (currently 143) of different horns. A list of the available types of horns may be found in Appendix 4: which also explains how to select a particular horn.

3.4 Special Horn Ending Sound (Optional feature, not present in all locomotives)
Prototype engineers would often "play" their *Horns* by controlling the flow of compressed air. In particular, engineers often had a signature sound associated with how they ended their *Horn* sequences. Some Quantum sound sets have special *Horn* endings that can be activated using the direction switch to produce a unique sound effect similar to playing the *Horn*.
- Flip the direction switch to blow the *Horn* for at least one second.
- The normal way to end the *Horn* is to flip the direction switch back. To do the special *Horn* ending, add an immediate **Very Quick flip-and-back operation**.

Note: If you wait too long to do the **Very Quick flip-and-back operation**, the Bell might turn on instead.
Note: Your Atlas sound-equipped locomotive may or may not have the special *Horn* ending sounds included in its feature set.

3.5   Operation in Neutral

In *Neutral*, the locomotive will continue to make prototypical sounds appropriate to its resting state. ***In DC operation, you enter Neutral by turning the throttle down below V-Start, but not off, and wait for locomotive to*** **stop** [12]. The *Front Headlight* or the *Mars Light* (if so equipped) will switch to a steady *Dim*. Alternatively, the *Rear Headlight* will be *Dim*[13] if entering *Neutral from Reverse (NFR)*. The locomotive will continue to make prototypical sounds in Neutral that are appropriate to its resting state.

You will hear a *Short Air Release* when the locomotive stops moving and enters *Neutral* and a *Long Air Release* about three seconds later. These sounds will be followed by *Air Pumps* and other background sounds. In addition to the *Air Pumps* in *Neutral*, *Cooling Fans* and *Vents* will switch on and off at random time intervals. After ten seconds, the *Cooling Fans* shut off if they were on when you entered *Neutral*. *Cab Lights* (if so equipped) come on 10 seconds after entering Neutral. If the diesel locomotive is left in *Neutral from Reverse*, a special *Low Idle State* (which is marked by subdued throbbing engine sounds) will automatically come on after 30 seconds. (See description of *Low Idle* in Section 5, *Quantum System Sounds*.) The diesel locomotive will return to generating normal diesel sounds when the throttle is turned up.

After the *Air Pumps* start, you can use the direction switch to blow the *Horn* or turn on or off the *Bell*[14].
If you cannot enter *Neutral*, or have difficulties with any of these operations, you may need to program your locomotive for optimal use with your particular power pack. (See *Analog Programming*, Section 3.14)

3.6   Changing the Direction of the Locomotive without Turning off the Sound

You can use the direction switch on the power pack to change the locomotive's direction while the loco is in *Neutral*.
- Put the locomotive in *Neutral* by bringing the throttle down below *V-start* and wait for the locomotive to stop[15].
- Flip the direction switch after you hear the *Short Air Release* but before you hear the *Long Air Release* sound and the *Air 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 *Air Pumps* start in *Neutral* and now wish to change direction, you can either:
- Turn the power all the way off, change the position of the direction switch, and turn the back power back on;
- 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 and then hoot one more time if the direction is *Forward* for a total of two Hoots. If the direction is *Reverse*, the *Horn* will hoot two more times for a total of three Hoots[16].
Note: To prevent the first horn Hoot from being too long, do not delay in turning up the throttle after you have flipped the direction switch.

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

Atlas Gold Series locomotives that are equipped with QSI sound-decoders (Quantum™, Quantum Titan™, or Quantum Titan™ with ET) 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 track voltage increases, beginning at the *V-Start* setting. *RTC* includes a motor speed control feature that prevents the locomotive from reacting quickly to changes in voltage or to minor impediments such as misaligned track joints, tight curves,

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[12] 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. When trying to stop the locomotive, do not try to reduce the throttle so far that all sounds go off.

[13] The rear headlight will be *Off* instead of *Dim* if your locomotive has Version 7 firmware.

[14] In *Neutral*, the *Bell* has a distinctive turn-on effect as the pneumatic clapper gains full motion to strike the bell.

[15] 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. With these power packs as the engine slows, you may need to reduce the throttle a little more to remain below *V-Start*.

[16] Standard prototype railroad signaling is two hoots before starting in forward and three hoots before starting in reverse.

rough switches, etc. A locomotive operating under *STC* may come to an unrealistic halt from a raised track joint or a drop in voltage; while the same locomotive under *RTC* will continue at the same speed. *RTC* operates your locomotive as though it has the mass and inertia of a prototype loco; your locomotive will resist changes in speed once it is moving and will resist starting up quickly if at rest. You will be able to operate the locomotive at very slow prototypical speeds without having to adjust the throttle continually in order to maintain speed.

While small obstacles will not affect the locomotive's speed under *RTC*, a continual force will slow your train down, just as is the case with the prototype. For instance, if your diesel locomotive encounters an upward grade under *RTC*, it will eventually slow down. Providing more throttle will slowly accelerate it back to speed. The same locomotive under *STC* would quickly slow down or stop when it encounters an upward grade.

The type of throttle control also affects how your locomotive decelerates. Under *STC*, your locomotive will respond quickly to a reduction in track voltage. Under *RTC*, your locomotive will decelerate slowly as you bring the throttle down. If you bring the throttle down below *V-Start*, the locomotive will slowly come to a stop. You can, however, force a locomotive to slow down rapidly under *RTC* by bringing the throttle down quickly; this action reduces the available power to the motor speed control circuitry 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 locomotive is running at top speed and you quickly reduce the track voltage to just below *V-Start* (where the locomotive would normally be stopped), the locomotive will at first slow down rapidly since you have reduced the available power to the motor. After this initial rapid slow down, the locomotive will decelerate at a rate determined by the *RTC* inertia and will then finally coast to a stop.

Selecting between *STC* and *RTC* is done on a DC layout by using Analog Programming (see Section 3.14). The factory-default setting is *RTC*.

3.8   Engine Load

You can set your diesel locomotive to have any of 16 different *Load Levels*, also called *inertia or momentum levels*. See *Analog Programming*, Section 3.14. As you increase track voltage, the electric motor in your locomotive is provided an increasing portion of that power which, depending on the load setting, will gradually accelerate the locomotive realistically until it reaches full speed. *Load Level 0* is the default, which is no load.

Under *STC*, the default Load Level 0 setting will allow your locomotive to accelerate or stop as quickly as its 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 diesel locomotive will take longer to change speed under either *STC* or *RTC*. With *RTC*, at Level 1, it will take approximately 15 seconds more to achieve full speed at max throttle; at Level 15, it will take over 3 ½ minutes to achieve full speed. In addition, at higher load settings, your locomotive will decelerate more slowly when you decrease the throttle.

3.9   Sound of Power™

Your QSI-equipped diesel locomotive will produce *Sound-of-Power* labored *Prime Mover* sound effects **if** you have selected any of the Load Level settings from 1 to 15. Under acceleration, the engine sounds will be more labored until the locomotive has achieved its final speed, at which point it will then produce standard sounds appropriate to its throttle setting. Under deceleration, the *Prime Mover* sounds are less labored until the locomotive achieves its final speed, where it will again produce standard *Prime Mover* sounds appropriate to its throttle setting.

3.10 Helpers

Prototype *Helpers* are locomotives that are used to provide extra power and/or braking for a heavily-loaded train. These locomotives can be part of the head end *Consist*, act as mid-train *Helpers*, or serve as *Pushers* at the end of the train. Helper locomotives behave differently from the train's *Lead Locomotive*. The Horns and Bells on Helper Locomotives 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 QSI sound-decoder (Quantum™, Quantum Titan™, or Quantum Titan™ with ET) allows you to program easily how each locomotive will behave by selecting

between a *Lead Locomotive*, *Mid Helper*, *End Helper*, or *Pusher*. Each type of Helper Locomotive has different lighting and sound characteristics. See *"Option 3, Helper"* in Table 1, of Section 3.14.

<u>Table 1 - Analog Programming Options</u>

Program Option #'s (POPs)	Option Name (default setting)	Message when Entering Option	Option Description
1	System Volume (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 15 seconds to 210 seconds in RTC and from 3 seconds to 45 seconds in STC.
3	Helper (Normal)	"<u>Helper</u> <u>equals</u>" "Normal", "Lead", "Mid", "End", "Pusher"	Selects Normal, Lead, Mid, End, or Pusher Helper in Consists. Normal Locomotive has all sounds and lights enabled. Lead Locomotive has all sounds enabled and its rear headlight disabled. Mid Helper has Horn, Bell and all lights disabled. End Helper has Horn, Bell and all lights disabled. Pusher has rear headlight on at all times to serve as a train warning light. Horn, Bell and all lights except Number Boards are disabled.
4	"Direction" (Normal)	"Direction equals X"	Selects if the features associated with the locomotive's direction are "normal" or "reversed".
5	Reserved	"Reserved"	
6	Power Pack Type (0)	"Power Pack Type equals X"	Allowable Type values: 0 or 2 0 = Universal; 2 = Modern (e.g., MRC Tech 3)
7	Notch V-Max (14 volts)	"Notch V-Max equals X"	Sets Track Voltage for highest Diesel Notch sounds
8	V-Start (8.5v)	"V-Start equals X"	Sets track voltage where locomotive will leave Neutral. (See the V-Start Example below.)
9	V-Max (12v)	"V-Max equals X"	Sets track voltage where full power is applied to motor. (See the V-Max Example below.)
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 **Very Quick** or **Quick** operation, three Bell rings followed by a spoken "Reset" to indicate locomotive returned to factory-default analog parameter values.
12	About	"Model Number"	Each Quick or Slow Operation provides progressive information about Quantum software model number, software version, and software release date

3.11 <u>Normal and Reversed Direction</u>

A QSI sound-decoder (Quantum, Quantum Titan, or Quantum Titan with ET) allows you to reverse the directional sense of your locomotive in DC operation. This is normally not an issue with DC two-rail trains since all locomotives will go in the same direction whether they are facing forwards or backwards. However, certain features like directional lighting do depend on the directional sense. For instance, if you program your locomotive to be an *End Helper*, its *Rear Headlight* operates when the locomotive is moving in *Reverse*, and the *Front Headlight* is disabled. This is ideal for providing a *Rear Headlight* for the train. Normally, if this diesel locomotive is facing backwards at the end of a Consist, its *Rear Headlight* will be facing forwards and will be lit when the Consist is moving forward; furthermore, there will be no Rear Headlight for the Consist. The *Direction* programming feature will ensure that this End Helper's backward-facing *Front Headlight* will come on *only* when the Consist is backing up, and the forward-facing *Rear Headlight* will not light at all. When making up a train with different Helper types, it is recommended that you also change the directional sense of any Helper that is intended to be operated backwards within the Consist. See "Option 4*, Direction*" in Table 1 of Section 3.14

3.12 Fuel Loading, Water Loading, and Maintenance Scenarios (firmware Versions 8 & 9 only)

HO scale and 2-rail O scale Atlas Gold Series locomotives that are equipped with a QSI sound-decoder with either Version 8 or Version 9 firmware (i.e., Quantum Titan or Quantum Titan with ET) include three different scenarios that cover the following situations:

- Loading fuel into the locomotive,
- Performing maintenance on the locomotive,
- Loading water into the locomotive.

3.12.1 Triggering the Scenarios in DC Operation

The three different scenarios are available in both conventional DC operation and DCC operation. With DC track power, these Scenarios are triggered by sequences of long and short blasts of the *Horn*. The locomotive must be in a *Neutral* state, either *NFF (Neutral from Forward)* or *NFR (Neutral from Reverse)* before you can trigger any of these scenarios.

- **Fuel Loading Scenario - Horn Code is short-short-long (· · —)**
  When the locomotive is in the *NFF (Neutral from Forward)* or the *NFR (Neutral from Reverse)* state, use either the *Horn* button on the Quantum Engineer or the direction switch on your power pack to blow a *short-short-long Horn code* to trigger the Fuel Loading Scenario. For diesel locomotives, you will hear sounds of diesel fuel being pumped into the locomotive's fuel tank.

- **Maintenance Scenario - Horn Code is short-long (· —)**
  When the locomotive is in the *NFF (Neutral from Forward)* or the *NFR (Neutral from Reverse)* state, use either the *Horn* button on the Quantum Engineer or the direction switch on your power pack to blow a *short-long Horn code* to trigger the Maintenance Scenario. For maximum realism, *after* you enter the Maintenance Scenario[17], press (once only) the *Disconnect/Standby* key on your Quantum Engineer Controller[18] to put the locomotive into the *Standby*[19] state. Then use the throttle on your DC power pack to rev the *Prime Mover* up and down without the locomotive moving. When you wish to end the Maintenance Scenario, press the *Start Up* key on your Quantum Engineer Controller to return to normal operation.

- **Water Loading Scenario - Horn Code is long-short-short-short (— · · ·)**
  When the locomotive is in the *NFF (Neutral from Forward)* or the *NFR (Neutral from Reverse)* state, use either the Horn button on the Quantum Engineer or the direction switch on your power pack to blow a *long-short-short-short Horn code* to trigger the Water Loading Scenario. For all locomotives, you will hear sounds of water being run into the locomotive's water tank. (Older diesel locomotives that supply steam heat to passenger cars need to have their water supply refreshed periodically.)

3.12.2 Timing of Horn Blasts to Trigger the Scenarios in DC Operation

It may take some practice to get the proper lengths of the *Horn* blasts so that they will trigger the three Scenarios described above. The following information should help.

- ***Minimum and Maximum Lengths (in msec) of Short Horn Blasts***
  A *short Horn blast* is one of length greater than or equal to 0.2 second but less than 1.8 seconds. This is the time you hold the Horn button down, not necessarily the length of time you hear the Horn sound play.
- **Minimum and Maximum Lengths (in msec) of Long Horn Blasts**
  A *long Horn blast* is one greater or equal to 1.8 seconds, but less than 10.0 seconds. This is the time you hold the *Horn* button down, not necessarily the length of time you hear the Horn sound play.
- **Minimum and Maximum Separations in Time (in msec) between Different Horn Blasts**
  There is no minimum time. The maximum time between the end of one *Horn blast* and the start of the next *Horn blast* in a coded Horn sequence is 2.1 seconds.

Also, there must be 2.5 seconds of *Horn* off time before the start of another coded *Horn* sequence.

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[17] These Scenarios cannot be started if the locomotive is in the *Standby* state (*Standby* is the 2nd phase of *Shut Down*). However, you can press the *Disconnect/Standby* key any time after the Maintenance Scenario has started.
[18] See Section 3.13 for information on the Quantum Engineer Controller.
[19] See Section 4.1.14 for an explanation of the *Standby* state. The three Shut Down states (*Disconnect*, *Standby*, and *Shut Down*) behave the same way in both DC and DCC.

3.13 Additional Analog Operation Features Available with Quantum Engineer Controller

Your Atlas QSI sound-equipped diesel locomotive uses QSI's QARC™ (Quantum Analog Remote Control) Technology. QARC Technology uses special remote control signals to operate different Quantum features on a conventional DC layout. With QARC Technology, you can operate features that are otherwise available only with Digital Command Control (DCC). In particular, QARC will allow you to:

- Turn on or off lights,
- Shut down and start up locomotives,
- Make up Consists easily,
- Simplify Analog programming,
- Set System Volume or Mute while train is moving or in Neutral,
- Trigger Coupler Crash sounds,
- Operate prototype-like Air Brakes,
- Turn on or off Dynamic Brakes,
- Activate verbal speedometer readout,
- Operate many other features.

The QARC System makes Analog operation more fun and more prototypical. Every button on a QARC controller does exactly what it is labeled to do. The major difference between QARC and DCC is that, with QARC, you are unable to operate multiple trains (running at different speeds) independently on the same powered section of track at the same time; whereas, you can do so with DCC.

The QARC controller, called the Quantum Engineer, can be added to your existing Analog power pack. Wiring is simple; two wires go to the variable-voltage DC output from the power pack, and two wires go to the track When a Quantum Engineer is connected, all functions on the DC power pack operate in the same way as before the Quantum Engineer was connected, including the throttle and reverse switch control. For further information on the Quantum Engineer Controller, see the *Quantum Engineer™ Add-on Control System* [4] The Quantum Engineer is **NOT** recommended for use on 2-rail O-scale layouts

3.14 Analog Programming

An Atlas Gold Series diesel locomotive with a QSI sound-decoder can be programmed on a DC layout in either of two ways:

- Use a Standard Power Pack. Most advanced analog operations can be programmed using a standard variable-voltage DC power pack. After entering programming (described below), the various features are selected and operated by using the direction switch.
- Use a Quantum Engineer controller connected between your variable-DC power pack and your layout. The Quantum Engineer considerably simplifies the programming process.

Table 1 on this page and the next shows the available analog programming options. The sections that follow (3.14.1 to 3.14.4) explain the basics of analog programming using the reversing switch on a DC power pack. Some specific examples are included in Section 3.14.4.

Table 1 - Analog Programming Options

Program Option #'s (POPs[20])	Option Name (default setting)	Message[21] when Entering Option	Option Description
1	System Volume[22] (16, Max)	"Volume equals X"[23]	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 15 seconds to 210 seconds in RTC and from 3 seconds to 45 seconds in STC.
3	Helper (Normal)	"Helper equals" "Normal", "Lead", "Mid" "End" "Pusher"	Selects Normal, Lead, Mid, End, or Pusher Helper in Consists. Normal Locomotive has all sounds and lights enabled. Lead Locomotive has all sounds enabled and its rear headlight disabled. Mid Helper has Horn, Bell and all lights disabled[24]. End Helper has Horn, Bell and all lights disabled. Pusher has rear headlight on at all times to serve as a train warning light. Horn, Bell and all lights except Number Boards are disabled.
4	"Direction" (Normal)	"Direction equals X"	Selects if the features associated with the locomotive's direction are "normal" or "reversed".
5	Reserved	"Reserved"	
6	Power Pack Type[25] (0)	"Power Pack Type equals X"	Allowable Type values: 0 or 2 0 = Universal; 2 = Modern (e.g., MRC Tech 3)
7	Notch V-Max (14 volts)	"Notch V-Max equals X"	Sets Track Voltage for highest Diesel Notch sounds
8	V-Start (8.5v)	"V-Start equals X"	Sets track voltage where locomotive will leave Neutral. (See the V-Start Example below.)
9	V-Max (12v)	"V-Max equals X"	Sets track voltage where full power is applied to motor. (See the V-Max Example below.)
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 **Very Quick** or **Quick** operation, three Bell rings followed by a spoken "Reset" to indicate locomotive returned to factory-default analog parameter values.
12	About	"Model Number"	Each Quick or Slow Operation provides progressive information about Quantum software model number, software version, and software release date

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[20] **POP** is short for "**P**rogram **Op**tion".

[21] 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.

[22] You can set volume with the manual volume control (using the Magnetic Wand, See Section 6.3.2), with programming, or with both. The manual volume control will determine the range of volume available 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.

[23] *X* is the current value of the Program Option. Default values are shown in parenthesis under the option name.

[24] Some lights that are not controlled by the Quantum System may remain on.

[25] Available only with firmware Versions 8 and 9

Table 1 (cont.) - Analog Programming Options

Program Option #'s (POPs)	Option Name (default setting)	Message when Entering Option	Option Description
13	Horn Volume	"Volume equals X"	Customizes Horn Volume (16 levels). Max is 15.
14	Bell Volume	"Volume equals X"	Customizes Bell Volume (16 levels). Max is 15.
15	Prime Mover 1 Volume	"Volume equals X"	Customizes Prime Mover 1 Volume. (16 levels). Max is 15.
16	Vents and Cooling Fan Volume	"Volume equals X"	Customizes Vents and Cooling Fans Volume (16 levels). Max is 15.
17-19	Reserved	"Reserved"	
20	Air Brakes Volume	"Volume equals X"	Customizes Air Brake Air Release Volume (16 levels). Max is 15.
21	Alternate Horn Volume		Customizes Alternate Horn Volume. (16 levels). Max is 15.
22	Prime Mover 2 Volume		Customizes Prime Mover 2 Volume. (16 levels). Max is 15 with Prime Mover 1 Volume in background for comparison
23-25	Reserved	"Reserved"	
26	Pump Volume	"Volume equals X"	Customizes Air Pump Volume (16 levels). Max is 15.
27	Air Let-off Volume	"Volume equals X"	Customizes Long Air Release Volume (16 levels). Max is 15.
28	Short Air Let-off Volume	"Volume equals X"	Customizes Short Air Let-off Volume (16 levels). Max is 15.
29	Reserved	"Reserved"	
30	Flange Volume	"Volume equals X"	Customizes Flange/Squealing Brake Volume (16 levels). Max is 15.
31	Dynamic Brake Fan Volume	"Volume equals X"	Customizes Dynamic Brake Cooling Fan Volume (16 levels). Max is 15.
32	Coupler Volume	"Volume equals X"	Customizes All Coupler Sound Volumes (16 levels). Max is 15.
33	Reserved	"Reserved"	

3.14.1 Entering Analog Programming

Use this sequence of actions to enter analog programming using the direction switch:

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

Note: **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.**

After applying power and performing the three *Bell* operations, the *Bell* will shut off automatically; you will hear "*Enter Programming*;" and the Front and Rear Headlights will flash alternately off and on.

If you have a *Quantum Engineer*, follow the instructions in the *Quantum Engineer™ Add-on Control System* manual [4] to enter analog programming, instead of the directions in the above bullet list. Also follow the instructions in the *Quantum Engineer™* manual [4] to do the operations described in Sections 3.14.2, 3.14.3, and 3.14.4.

3.14.2 Scrolling through the Program Options

After entering programming, you will hear an announcement of the first analog 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 other than the one you wanted, simply turn the power off; re-enter programming; and start programming again. Once you reach the last Program Option, the Quantum or Quantum Titan sound-decoder will continue to announce the last Option Number.

3.14.3 Entering a Program Option and Making Changes

After the verbal announcement of a Program Option, you can enter that Option by performing a **Quick** or a **Very 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 volume[26].

**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 **Quick** or **Very _Quick flip-and-back operations_** will program new settings, as described in the table above. For all level adjustments, a **Very Quick** operation will decrease one level while a **Quick** operation will increase one level.
**Note****:** Since _System Volume_ is the first Program Option, you can use **Very Quick** or **Quick** operations immediately after entering programming to change the system volume.
**Note****: It is important to flip the direction button quickly to prevent loss of power that can cause you to exit programming.**   Some power pack direction switches have a center-off position as well as plus and minus polarity positions, which can make it more difficult to switch the direction from one polarity to another without losing power. This problem can be lessened by turning the throttle all the way up after entering programming.

3.14.4 Moving on to Other Program Options or Leaving Programming

Flip the direction switch at any time to the opposite position, and leave it there. Quantum will first return to and announce the current Program Option Number and will then automatically advance on to higher-numbered Options. Exit Programming anytime you wish to do so by turning the power _Off_ and then back _On_ again.

Example 1: Setting Throttle Mode (Analog Option #10)

Analog Option #10 specifies whether your locomotive should use _Regulated Throttle Control (RTC)_ or _Standard Throttle Control (STC)_.
- Enter Programming after powering up your locomotive by turning the Bell _On_, then _Off,_ and finally _On_ again, as described above.
- After hearing "Enter Programming" followed by "Option One - System Volume" (the announcement of the first Program Option), flip the direction switch and leave it there. After flipping the switch, you will hear the announcement "Option 2, 3, 4 … etc."
- Stop immediately after you hear **Option 10** announced by moving the direction switch back. You will then hear _Throttle Mode_.
- Use a **Quick** or a **Very Quick operation** of the direction switch to enter this option. If the Throttle Mode is at its default value (_RTC_), you will hear _Mode equals Regulated_; otherwise, you will hear _Mode equals Standard_.
- Use a **Quick** or a **Very Quick operation** of the direction switch to change the throttle mode. Repeated **Quick** or **Very Quick operations** will cause the throttle mode to alternate between its two possible values
  i.e., _RTC_, _STC_, _RTC_, _STC_, ········· etc.
- Once you have selected the _Throttle Mode_ that you wish to use, turn the throttle off. When you power up again, your locomotive will be using the Throttle Mode that you have just selected.

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[26] Note that setting any volume in Analog will also apply to DCC and vice-versa.

Example 2: Setting V-Start (Analog Option #8)

This Option will set the voltage (and throttle position) at which the locomotive will leave Neutral and start moving. To change V-Start, perform the following operations.

- Enter Programming after powering up your locomotive by turning the *Bell* first on, then off, and then on again, as described in Section 3.14.1.
- After hearing the *Enter Programming* followed by the *Option One - System Volume* announcements, flip the direction switch, and leave it there. You hear the announcement *Option 2, 3, 4, … et*c. Stop when you hear the **Option 8** announced by moving the direction switch back. You will then hear *V-Start* announced.
- Use a **Quick** or **Very Quick operation** of the direction switch to enter this Option. You will hear *V-Start equals X*, where *X* is the track voltage value to leave Neutral that is currently set.
- Use a **Quick** or **Very Quick operation** of the direction switch to activate this Option. You will hear the message *Set throttle to V-Start*. When you hear this message, move the throttle knob on your DC power pack to the new voltage you wish to use for *V-Start*. The *V-Start* track voltage will be announced[27] continuously about every two seconds. If you move the throttle again, new values for the *V-Start* track voltage will be announced.
- Once the throttle is set to the voltage you wish to use for *V-Start*, use a **Quick** or **Very Quick operation** of the direction switch to begin the voltage setting procedure. The locomotive will move at a slow speed, and the *Bell* will ring continually, indicating the correct value is being calculated. If you chose a very low setting for *V-Start*, be patient. If you do not get a setting within a minute, return to the beginning of this option or else start over[28] completely; this time chose a slightly higher throttle value.
- Towards the end of the process, the locomotive will move at a slower speed and finally 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.

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

Example 3: Setting V-Max (Analog 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)[29]. Then do a **Quick** or **Slow** operation to set *V-Max*. The *Bell* will sound, indicating that *V-Max* is being set
Note**:** At end of V-Max setting, the locomotive will not move as it does under V-Start.
Note**:** When double heading two Quantum-equipped locomotives[30], 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 additional information on analog programming, consult QSI's *DC Analog Reference Manual for QSI Quantum® HO Equipped Locomotives, Ver 4.0* (*or later*) [2].

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[27] Quantum sound-decoders 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 voltmeter. However, since the Quantum voltmeter uses its own values for throttle levels, it is the correct value for the system.

[28] See beginning of Section 3.14.4: *Moving on to Other Program Options or Leaving Programming*.

[29] *V-Max* should not be set too low when using *RTC*. For most MRC™ 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.

[30] **DO NOT EVER** double-head a Quantum-equipped locomotive with a standard (non-Quantum) locomotive on a DC-powered layout and then operate the *Horn* or *Bell* while the locomotives are moving. The standard locomotive will reverse direction and then fight with the Quantum-equipped locomotive.

4 DCC Operation

4.1 Function Keys

The following table lists the QSI Quantum features that have been pre-assigned to DCC function keys. Operation of these function keys can be different in the *Neutral* state (locomotive stopped) and in the moving states (locomotive moving in *Forward* or in *Reverse*). After you have selected a locomotive on your DCC system, simply press any of the function keys listed below to produce the sound (or other effect) described in Table 2 below. Those features marked "Titan only" are available only in Atlas locomotives that are equipped with QSI Quantum Titan sound-decoders (firmware Version 8 or 9). All other features are available in Atlas locomotives with either Quantum Titan or earlier (Version 7 firmware) QSI sound-decoders.

Table 2 - DCC Function Keys for Atlas Gold Series Locomotives Equipped with QSI Sound-Decoders (Quantum, Quantum Titan, or Quantum Titan with ET)

Function Key	Forward or Reverse (FWD or REV)	Neutral (either NFF or NFR)
FL(f)[31]	Headlight, Rear Headlight, and Hazard Light (directional lighting On or Off)	Headlight, Rear Headlight, and Hazard Light (directional lighting On or Off)
FL(r)[32]	Headlight, Rear Headlight, and Hazard Light (directional lighting On or Off)	Headlight, Rear Headlight, and Hazard Light (directional lighting On or Off)
F1	Bell On/Off	Bell On/Off
F2	Horn or Horn with Doppler Effect (see Section 4.1.8)	Horn
F3	Coupler Crash/Coupler Fire	Coupler Arm (Enable) or Coupler Fire
F4	Diesel Fans and Louvers On/Off	Diesel Fans and Louvers On/Off
F5	Dynamic Brake function On/Off[33] (if loco has dynamic brakes)	Dynamic Brake function On/Off (in *Disconnect* state only)
F6	Doppler Shift (single-press F6)	Locomotive Start Up (double-press F6)[34]
F7	Squealing Brakes/Flanges and Air Brakes	Diesel: Long Air Let-off
F8	Audio Mute On/Off	Audio Mute On/Off
F9	Heavy Load On/Off (single-press F9)	Change Shut Down State: (Disconnect, Standby, Total Shut Down) (double-press F9)[34]
F10	Status Report (speed in SMPH[35])	Status Report (Loco DCC address, etc.)
F11	Alternate Horn Selection (Titan only) or Number Board or Marker Lights On/Off	Alternate Horn Selection (Titan only) or Number Board or Marker Lights On/Off
F12[i]	Automatic Cab Lights On/Off[36]	Automatic Cab Lights On/Off
F13	System Volume Decrease (Titan only)	System Volume Decrease (Titan only)
F14	System Volume Increase (Titan only)	System Volume Increase (Titan only)
F15	Grade Crossing (Titan only)	
F16-F25	Short Air Let-off	Short Air Let-off
F26		Fuel Loading Scenario (Titan only)
F27		Maintenance Scenario (Titan only)
F28		Water Loading Scenario (Titan only)

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[31] Depending on the DCC system, the *FL* Key may be labeled in various ways such as "*F0*", "*Headlights*," "*Lights*," or "*Directional Lighting*."
[32] FL(f) and FL(r) activate/deactivate the automatic behavior of the *Front Headlight*, *Rear Headlight*, and *Hazard Directional Lighting* regardless of which direction the train is moving.
[33] Dynamic brakes cannot be turned on in *Forward* or *Reverse* unless the locomotive is moving over 9 smph.
[34] May sometimes require a triple press.
[35] SMPH = Scale Miles Per Hour
[36] Automatic cab lights are not used in Atlas Gold Series locomotives that are equipped with QSI sound-decoders.

4.1.1 Directional Lighting (F0, FL, or Headlight Key)

The *FL* (or *F0*, or Headlight) DCC function key turns *On* or *Off* the directional Front and Rear Headlights and the (optional) Ditch Lights or Mars Light.[37] The defaults for the front headlight, rear headlight and the Ditch or Mars Directional Lights are *Off*. When toggled on, the Directional Lights[38] turn on according to the tables below.

Table 3 - Directional Lighting Operation in DCC and Analog w/o Ditch or Mars Light Option

Light	Forward	Neutral from Forward	Reverse	Neutral from Reverse
Front Headlight	On	Dim	Dim	Dim
Rear Headlight	Dim[39]	Dim[39]	On	Dim[39]

Table 4 - Directional Lighting Operation in DCC and Analog with Ditch or Mars Light Option

Light	Forward	Neutral from Forward	Reverse	Neutral from Reverse
Front Headlight	On	Dim	Dim	Dim
Rear Headlight	Dim[39]	Dim[39]	On	Dim[39]
Mars Light	Pulsing	Dim	Dim	Dim
Ditch Lights	On or flashing	Off	Off	Off

4.1.2 Bell (F1 Key)

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 (*F1*).

Atlas Gold Series locomotive equipped with QSI Quantum Titian sound-decoders that have QSI's firmware release 9.3.1 (or later) allow the user to choose) among 36 different bells and also gives the user the ability to customize ring period, metallurgy, and pitch shift of the (simulated) bell. See Section 4.2.12 for an explanation of how to use this Bellmaster™ feature.

4.1.3 Horn (F2 Key)

Some DCC throttles have separate *Horn* and *Bell* buttons along with the normal Function keys assigned to *Horn* (*F2*) and *Bell* (*F1*) operation. The *Horn* is usually assigned to Function *F2*. The *F2* key behaves differently from the *Horn* button.
- Pressing the *F2* key and releasing it will cause the *Horn* to come on and stay on, until you press *F2* again[40].
- Pressing the *Horn* button will blow the *Horn* only as long as you are holding this button down.

Atlas Gold Series locomotives equipped with QSI Quantum Titian sound-decoders that use QSI's firmware release 9.3.1 (or later) allow the user to choose (separately for the *Primary Horn* and the *Alternate Horn*) among numerous (currently143) different horns. See Section 0 and Appendix 4 for an explanation of how to use this Hornmaster™ feature.

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[37] Explicit lighting control features for the *Front Headlight*, *Rear Headlight*, and (optional) *Ditch Lights* or *Mars Light* can be assigned to DCC function outputs. (See the QSI DCC Reference Manual [3].)
[38] Quantum uses constant voltage lighting that is independent of track voltage.
[39] The *Rear Headlight cannot* be dimmed with Quantum Q1a hardware and Version 7 firmware; it is either *Off* or *On*. However with either Quantum Q2 hardware and Version 7 firmware or with Quantum Q3 hardware and Version 8 or 9 firmware, the rear headlight *can* be dimmed, as shown in the tables above.
[40] Since a prototype Horn uses compressed air, you may hear the air pump sounds turn on after the Horn is operated.

4.1.4 Coupler and Coupler Crash Sounds (F3 Key)

There are two ways to use the *F3* key:
- As your locomotive is about to couple up to a string of cars, press the *F3* key to trigger the crashing sound of locomotive coupling. Use the *F3* key again as the locomotive 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 sounds of the coupler knuckles opening and the air-lines parting

4.1.5 Diesel Fans and Louvers (F4 Key)

Pressing the *F4* key and releasing it will cause the sounds of the *Diesel Fans* and *Louvers* to come on and stay on until you press the *F4* key again.

4.1.6 Sound-of-Power™

Your diesel locomotive will produce *labored Prime Mover sounds* under acceleration and *lighter Prime Mover sounds* under deceleration, but only if CV3 or CV23 and CV4 or CV24 are set to non-zero positive values. The level of labored sounds is proportional to the values for these four CV's and to how much the DCC throttle is increased or decreased.

Notching and Prime Mover RPM: Quantum has all eight of the Prime Mover *Throttle Notches* that are found on prototype locomotives. As you increase the throttle, you will hear the RPM's increase for every increase in ten speed steps (at the 128 speed step setting). Idle is considered Notch 0 and occurs for speed step 0. Notch 1 includes speed steps 1 to 10; Notch 2 steps 11 to 20; Notch 3 steps 21 to 30, etc. If your DCC system has an option to increment or decrement its throttle setting by ten speed steps, the QSI sound-decoder can be reprogrammed to ten speed steps per Notch[41] to make it very easy and predicable to set your notch value.

4.1.7 Dynamic Brakes (F5 Key)

A prototype diesel locomotive usually has Dynamic Brakes that cause the train to slow down by using the traction motors in its generator mode (rather than the normal motor mode). This technique helps dissipate the energy of a moving train by converting this energy 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 locomotive *Prime Mover* sounds to idle at the lowest *Sound of Power* setting and turn on the powerful *Dynamic Brake Cooling Fans*, but only when the locomotive is traveling over 9 smph and not accelerating.
- Pressing the *F5* key in Neutral will turn on the *Dynamic Brake Fans* while the *Prime Mover* sounds remain at idle, but only if the locomotive is in the *Disconnect* stage of *Shutdown*.

The *Dynamic Brake* function automatically turns off when entering or leaving *Neutral*, the speed of the locomotive drops below 8 smph[42], or the throttle is turned up.

Note: In contrast to *Air Brakes* (*F7*), *Dynamic Brakes* do not increase the deceleration rate specified by CV4 and CV24.

Note: If *Dynamic Brakes* are on, they will remain on if you drop the throttle to decelerate or lower the throttle to zero and apply Brakes using F7. The *Dynamic Brakes*, of course, will stop automatically when the speed is reduced below 8 smph.

4.1.8 Doppler Effect (single-press F6 Key)

With DCC, you can trigger the *Doppler Effect* by quickly interrupting the *Horn* signal in the same way described in Section 3.2 under Analog Operation. Alternatively, you may use the Function key (*F6*) dedicated to the *Doppler Effect*.

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[41] Set CV129.1.0 to the value 10 to reprogram the sound-decoder to 10 speed steps per Notch.
[42] Dynamic Brakes on prototype locomotives are less effective and seldom used at low speeds.

Start the *Horn* and/or *Bell* by pressing and releasing their function keys[43]. Press F6 once to hear the *Doppler shift*. A few seconds after the *Horn* button is turned off with the F2 key, the *Prime Mover* sounds will return to normal[44].

4.1.9 Start Up (double-press F6 Key)

If your Atlas Quantum or Quantum-Titan -equipped diesel locomotive is in any stage of *Shut Down* (see Section 4.1.14), you can return your locomotive to normal operation by double-pressing the *F6 Start Up* key. *Start Up* is different for each stage of *Shut Down*, but a locomotive in any stage of *Shut Down* will start up[45] and enter normal operation.

- **Start Up from Disconnect:** If you double-press the *F6* key in *Disconnect*; the *Dynamic Brakes* will turn *Off* (if they were *On*); and the locomotive will enter normal operation.
- **Start Up from Standby:** If you double-press the *F6* key in *Standby*, the *Directional Lighting* will turn *On* (if previously *Off*); the *Prime Mover* sound will change from the special *Low Idle* to regular *Idle*, and the locomotive will enter normal operation.
- **Start Up from Total Shut Down:** If you double-press the *F6* key when the locomotive is in *Total Shut Down*, you will hear the engineer's door opening and closing; the *Cab Lights* will come on (if available); the *Number Boards* will come on (if lighted and powered separately from the headlights); and *Directional Lighting* will turn *On* (if it was previously *Off*).

   These actions are followed by sounds of the *Diesel Cooling Fan Vents* opening, the *Prime Mover* starting up, the *Air Pumps* starting up, and the locomotive entering normal operation. During the *Start Up* procedure, none of the function keys is active.

If the throttle is turned up from zero during any of the above *Start Up* scenarios, the *Start Up* procedure will abort, and the locomotive will enter normal operation.
Note: Whenever a *Start Up* command is sent, regardless of whether the locomotive is in *Shut Down* or operating normally, the Quantum System will restore all *Automatic Operations*

4.1.10 Squealing Brake and Flange Sounds (F7 Key)

Quantum provides automatic Brake Squeal as a locomotive 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 a speed less than 20 smph. Pressing the *F7* key when the locomotive 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 locomotive too quickly, the Squealing 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 the next section.

4.1.11 Air Brakes (F7 Key)

Quantum provides automatic *Brake Squeal* as a locomotive slows to a stop. If you have selected any non-zero deceleration inertia or momentum value[46] in CV4 and/or CV24, the *F7* key can be used to apply *Air Brakes* to stop the locomotive more quickly than it would normally stop from the inertia settings[47]. To use these simulated Air Brakes:

- Turn the throttle down to Speed Step 0 (zero) on a moving locomotive; this action 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 pipes continually. The longer time that "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.

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[43] If you do not turn on either the Horn or Bell, the Doppler shift will still occur but will be less dramatic.
[44] If the Bell was on, it will shut off prior to sounds returning to normal.
[45] Atlas Gold Series Quantum-equipped locos with Version 7 or 8 firmware will start up with a *Long Air Release*; locos with Version 9 firmware omit this long air release but have an extended start up sequence (which can be aborted at any time by turning up the DCC throttle).
[46] The Air Brakes feature works much better if there is at least a moderate amount of deceleration momentum (e.g., CV4 = 8.}
[47] CV4 and CV24 determine the deceleration rate. Applying the brakes increases the deceleration rate temporarily.

- 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 the brakes will be on full. You will hear no further air release sounds.

Power Braking: Prototype *Power Braking* is a method to control the slowing of a train by applying power against the brakes already set. Train Air Brakes are slow to apply and slow to release, but the throttle is fast and is a quick way to prevent a train from slowing too fast because the brakes are already set. This technique allows the engineer to stop the train at the desired location.

In order to stay within NMRA practices, QSI sound-decoders do not work against braking which would make consisting with other locomotive brands more difficult. Instead, if the throttle is increased to any value above zero and the brakes are released, the locomotive will either accelerate at a rate determined by the sum of CV3 and CV23 or deceleration at a rate determined by the sum of CV4 and CV24 depending on the throttle setting. This technique allows the operator to use the throttle to increase speed to simulate Power Braking to stop at an exact location.

Note: If the locomotive is in *Neutral* when the *F7* key is pressed, a *Long Air Release* sound simulates setting the brakes. However, no braking effect is activated[48].

Note: If the DCC system speed control is set to any speed step except 0, *Air Brakes* are not enabled; instead the *F7* key will manually activate *Squealing Brake/Flange* sounds but will not affect the locomotive's deceleration.

4.1.12 Mute (F8 Key)

The Quantum System allows you to reduce the System Volume to a lower programmable *Mute Volume* level or increase it back to its original setting using the *F8* function key. The default *Mute Volume* is 0 (no sound during *Mute*). This capability 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 running in the background of the layout and increase the volume of the closest locomotive. 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, Forward*, or *Reverse* to gradually decrease or increase the locomotive's volume.

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

Note: *Mute Volume* can be set using CV51.1. See Section 4.2.8.

4.1.13 Heavy Load (single-press F9 key in Forward or Reverse)

If *Heavy Load* is applied while the train is moving; it maintains the train at a steady speed while allowing you to have control over the sound effects of a working locomotive. Under *Heavy Load*, changing the throttle will have little effect on the locomotive's speed. Instead, you can use the throttle to control your locomotive's *Notch* and *Laboring Sound-of-Power* sound effects. When you approach a grade under *Heavy Load*, increase the throttle and hear the locomotive rev up to a higher Notch and work hard with heavy laboring sounds. When the locomotive goes down a grade, reduce the throttle to diminish the locomotive's *Notch and Laboring* sounds. You can control how hard the locomotive works by changing how much the throttle is increased or decreased from its initial position where *Heavy Load* was turned on.

To turn *Heavy Load* on and off:
- Press *F9* and hear one short Hoot when *Heavy Load* is turned on
- Press *F9* again and hear two short Hoots when *Heavy Load* is turned off
.

Note: You can apply *Heavy Load* as soon as you start moving or wait until you are up to speed.

Note: **Hint::** Return the throttle to its initial setting where *Heavy Load* was turned *On* to avoid acceleration or deceleration when *Heavy Load* is turned *Off*.

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[48] If the brakes are set in *Neutral,* turning up the throttle automatically releases the brakes.

Note: *Heavy Load* can only be turned on or off in *Forward* or *Reverse*. If turned on, it will remain on in *Neutral*. If you want it off when you start out from *Neutral*, turn *Heavy Load* Off immediately after the DCC system speed control is first turned up.
Note: *Heavy Load* is automatically turned off when track power is turned off.
Note: *Heavy Load* represents a train that would take over ten minutes to accelerate to full speed or to bring to a complete stop. It is independent of any inertia (or momentum) values set in CV3, CV4, CV23, or CV24.
Note: Under *RTC* and *Heavy Load*, grades, voltage changes, tight curves, or other real loading effects will have little effect on the speed of the train. By contrast, under *STC* and *Heavy Load*, grades, loading, etc. will affect the train speed as it moves around the layout.
Note: Applying *Air Brakes* (pressing *F7* plus keeping the throttle at speed step 0) will slow the locomotive, but it will take a much longer time to stop.

4.1.14 Three Stages of Diesel Locomotive Shut Down: (1) Disconnect, (2) Standby, (3) Total Shut Down (double-press *F9* Key in Neutral*)*

Locomotive Shut Down has three distinct stages that you can control. Each stage is entered from the preceding stage by double-pressing the *F9* key[49] when the locomotive is in *Neutral* or in one of the following three *Shut Down* stages.

Stage One: Disconnect

Quickly double-press the *F9* key in *Neutral* to enter *Disconnect*. You will hear a *Long Air Let-off*. To leave *Disconnect*, either leave *Shut Down* by double-pressing the *F6 Start Up* key (described in Section 4.1.9) 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 model's electric motor drive will act as if it were disconnected. Once you hear the *Long Air Let-off*, the DCC throttle can be moved up and down without the locomotive moving. As the throttle is moved up or down, you will hear the sound of the *Prime Mover* in the locomotive reving up and down in proportion to the throttle setting.

Note: You can also turn on the *Dynamic Brakes* in the *Disconnect* state to create *Sound–of-Power* as the throttle is moved up and down. (See description of *Dynamic Brakes* in Section 4.1.7.) Engineers on prototype diesels use the *Dynamic Brakes* to load the diesel motor-generator in order to test its output and efficiency while the locomotive is standing still.

Stage Two: Standby

While in *Disconnect*, quickly press the *F9* key twice to enter *Standby*. You will hear a *Long Air Let-off* followed by a special *Low Idle* sound. The *Directional Lighting* system and optional *Ditch Lights* or *Mars Light* will shut down. The model's electric motor will remain disconnected, while the *Air Pumps*, automatic *Cooling Fan* operation, *Number Board Lights* (only if illuminated separately from the *Headlight*), and optional *Cab Lights* will continue to operate. In *Standby*, the locomotive will not respond to the throttle or to most of the function keys[50]. The three exceptions are the *F6 Start Up* function key (Section 4.1.9), the *F8 Mute* key (Section 4.1.12), and the *F10* Status key (Section 4.1.15).

To leave *Standby*, either double-press the *F6 Start Up* key, as described in the Start Up section (4.1.9), or double-press the *F9* key again to reach the final stage of the *Shut Down* process, which is called *Total Shut Down*.
Note: *Standby* is ideal for leaving your locomotive running on a siding. Besides hearing the low idle *Prime Mover* sounds, the locomotive will not respond if you accidentally change the throttle setting or press a function key.

Stage Three: Total Shut Down

If you quickly double-press the *F9* key while the locomotive is in *Standby*, you will enter the *Total Shut Down* stage. As the locomotive goes into *Total Shut Down*, you will hear a *Long Air Let-off*. To leave *Total Shut Down*, double-press the *F6* key.

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[49] 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 sometimes has to be pressed three times, due to the command station and locomotive having different initial states for *F9*.
[50] Pressing function keys other than the three keys listed in this description of *Stage Two* will produce only a *Short Air Let-off*.

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 Pump* will turn off, followed by the *Number Boards* turning off, the sounds of the *Cooling Fans* shutting off, the *Louvers* closing, the *Prime Mover* shutting down, and, finally, the *Cab Lights* shutting off. A few seconds later, you will hear the engineer's door open and then shut. In *Total Shut Down*, the locomotive will not respond to the throttle or to the function keys. The two exceptions are the *F6 Start Up* Function key (described in Section 4.1.9) and the *F10* Status key (described below).

Persistence of Shut Down Stage

If DCC track power is turned off at any stage of *Shut Down* (*Disconnect*, *Standby* or *Total Shut Down*) or during a *Shut Down* procedure, the locomotive will remember the last *Shut Down* stage in which it was just prior to the power going off, and the locomotive will power up in the same stage of *Shut Down*. If *Start Up* is initiated during any of the above *Shut Down* procedures, *Shut Down* will be aborted, and the locomotive will return to normal operation.

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

4.1.15 Status (F10 Key)

Atlas sound-equipped locomotives that have a QSI sound-decoder can be queried for (verbal) information about the locomotive's current operating state when the locomotive is in *Neutral* or about the locomotive's current speed in scale miles per hour when the locomotive is moving in *Forward* or *Reverse*. If you press the *F10* key in *Neutral*, the locomotive will report verbally first its currently enabled *Long or Short DCC address* followed by its *Consist ID* (if it has one), followed by its Shut Down Stage (*Disconnect*, *Standby*, or *Total Shut Down*), if any. If you press the *F10* key when the locomotive is moving in *Forward* or *Reverse*; the loco will instead verbally report the locomotive's speed in scale miles per hour.

__Note__: When *Status Report* is activated, the locomotive's regular sounds will reduce to one quarter their current volume settings (Vers. 8 and 9) or to one half their current volume settings (Ver. 7) during the verbal report and then return to normal volume when the report has ended.
__Note__: Verbal Feedback volume can be adjusted using CV52.50.

4.1.16 Alternate Horn Selection (F11 Key) – firmware Versions 8 and 9 only

Some prototype diesel locomotives had two different air horns. The first horn worked best in areas where it was necessary for the sound to carry a long way, while the other horn was more useful in the city or in foggy areas where it was easier to tell the location of the locomotive by its higher pitched sound. The *Alternate Horn Selection* key allows you to choose between two different Horn sounds. To use this feature:

- Press the *Alternate Horn Selection* key (*F11*) to select between the *Alternate Horn* and the *Primary Horn*. Hear a short hoot from the selected Horn to indicate which Horn has been selected.
- Operate the *selected Horn* with the *F2* key.

Setting *F11* to "1" selects the *Primary Horn*. Setting *F11* to "0" selects the *Alternate Horn*. The feedback that uses *Horn Hoots* to identify which Horn has been selected can be disabled/enabled using CV51.2.

Atlas Gold Series locomotives equipped with QSI Quantum Titan sound-decoders that have QSI's firmware release 9.3.1 (or later) allow the user to choose (separately for the *Primary Horn* and the *Alternate Horn*) among numerous (currently143) different horns. See Section 0 and Appendix 4 for an explanation of how to use this Hornmaster™ feature.

4.1.17 System Volume Decrease (F13 Key) and Increase (F14 Key) – firmware Versions 8 and 9 only

You can decrease the *System Volume* by 2 dB by pressing the *F13* key once. You can increase the *System Volume* by 2 dB by pressing the *F14* key once. Each time you press the *F13* or *F14* key you will hear a *Horn Hoot* at the new system volume. If the system volume is already at the maximum when you press the *F14* key, the volume will not increase, and the locomotive will instead speak the word *Max.* Both *F13* and *F14* are inactive when the locomotive is in *Shut Down*. Please note that pressing the *F13/F14* key(s) also decreases/increases the value stored in CV51.0, *System Volume*.

4.1.18 Grade Crossing (F15 Key in Forward or Reverse) – firmware Versions 8 and 9 only

Prototype railroads use *Horn* or *Whistle* codes of long and short blasts for communication or warning signals. One of the most common of these horn signals is the code of *Two Longs*, a *Short*, and a *Long* blast from the horn to warn motorists that a train is approaching the grade crossing. Although you can perform this grade crossing warning signal manually by using the *Horn* button, the Quantum Titan system has made this operation more convenient. When the locomotive is in *Forward* or *Reverse*, press the *F15* key once to trigger the *Grade Crossing Horn Signal*. If you press the *Horn* key during the Grade Crossing scenario, you will terminate this feature and take control of the *Horn*. You can use CV55.154.SI to change the number of *Horn* blasts and length of each *Horn* blast in the *Grade Crossing Signal*.

4.1.19 Fuel Loading Scenario (F26 Key in Neutral) – firmware Versions 8 and 9 only

Press the *F26* key when the locomotive is in *NFF (Neutral from Forward)* or *NFR (Neutral from Reverse)* to trigger a *Fuel Loading Scenario*. For diesel locomotives, you will hear *Crew Talk* and sounds of diesel fuel being pumped into the locomotive's fuel tank.

4.1.20 Maintenance Scenario (F27 Key in Neutral) – firmware Versions 8 and 9 only

Press the *F27* key when the locomotive is in *NFF* or *NFR* to trigger a *Maintenance Scenario*. For diesel locomotives, you will hear *Crew Talk* and sounds of the *Prime Mover* being revved up and down automatically.

4.1.21 Water Loading Scenario (F28 Key in Neutral) – firmware Versions 8 and 9 only

Press the *F28* key when the locomotive is in *NFF* or *NFR* to trigger a *Water Loading Scenario*. This scenario applies to both steam and (older) diesel locomotives since diesel locomotives that supply steam to passenger cars need to have their water supply refreshed periodically. For all locomotives, you will hear *Crew Talk* and sounds of water running into the locomotive's water tank.

4.1.22 Summary of Function Key Operation in Neutral

Some function keys used in *Forward* and *Reverse* will have different effects when used in *Neutral*:

- Pressing *F6* once results in Doppler shift for a moving locomotive, but if *F6* is pressed twice when the locomotive is stationary, *Start Up* in *Neutral* will be activated. (See Section 4.1.9.)
- The *F7* key produces *Squealing Brake* sounds or applies brakes for a moving locomotive, but *F7* triggers only a *Long Air Let-off* in *Neutral*.
- Pressing *F9* once turns on/off the *Heavy Load* feature in a moving locomotive, but *F9* triggers one of the *Shut Down* states in *Neutral*. (See Section 4.1.14.)
- Pressing *F15* once triggers the *Grade Crossing signal*, but only in *Forward* or *Reverse* (Versions 8 and 9 only).
- Pressing *F26* once triggers the *Fuel Loading Scenario*, but only in *Neutral* (Versions 8 and 9 only).
- Pressing *F27* once triggers the *Maintenance Scenario*, but only in *Neutral* (Versions 8 and 9 only).
- Pressing *F28* once triggers the *Water Loading Scenario*, but only in *Neutral* (Versions 8 and 9 only).

Note: The volume of *Crew Talk* during these last three Scenarios can be independently controlled using CV52.52

4.1.23 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 or keys. Once you Take Control, the features will no longer have automatic operation, and you will control their operation and their state with function key commands. Automatic and Take Control operations are explained in the table below.

Table 5 - Diesel Locomotive Take Control Operation

Feature	Automatic Operation			Take Control Operation	
	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.
Cab Lights (if equipped)	Off after 10 seconds	Off after 10 seconds	On after 10 seconds	F12	Toggles Cab Lights on or off.
Grade Crossing Signal	Automatic Grade Crossing Horns from F15	Automatic Grade Crossing Horns from F15	Non-operating	F2 (Horn)	Sounds Horn

For example, you can take control of *Automatic Fans* by using the *F4* key to stop Automatic Operation and to control manually 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 to *Off* if the *F4* key is "0," and Automatic Operation will be disabled. Thereafter, the *Cooling Fans* will respond only to the state of the *F4* function key. 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* in Section 4.1.9.)

4.2   DCC Programming

If you wish to change the values of any of the lighting, sound, or other DCC-only parameters, you must use a DCC system. You may also change the values of certain parameters, such as sound volumes, that are shared between the analog and DCC parts of the Quantum sound decoder by using a Quantum Engineer system on a DC-powered track. (See Section 3.13.) The DCC parameters are called *Configuration Variables* (or *CVs* for short) and are stored in the memory of the sound-decoder. Note that some sort of programming (either DCC or DC-analog) is **required** in order to change the value of any sound-decoder parameters.

4.2.1   Where to Program

Most DCC systems allow you to program decoders in either of two places:
- On a special section of track that is not connected in any way (physically or electrically) to your layout and is called the *Program Track*. In DCC terminology, programming locomotives on the Program Track is called *Service Mode Programming*.
- Anywhere on your regular layout trackage. In DCC terminology, programming a locomotive on your normal layout track is called either *Programming on the Main (POM)* or *Operations Mode (Ops Mode) Programming*.

Many, but not all, DCC systems do not provide sufficient power to the Program Track to read and write the CVs of sound-equipped locomotives. (This comment applies to Atlas Gold Series Locomotives that are equipped with QSI sound-decoders.) This programming track problem can often be solved by installing a suitable *Program Track Booster* between the program track output of your DCC system and the program track[51] (See Section 6.5.) Alternatively, if you are having trouble programming on the program track, you always have the option to program CVs on the main line using *Operations Mode (Ops Mode)* programming.

4.2.2   Programming Indexed CVs

The QSI Quantum and QSI Quantum Titan sound-decoders, like sound-decoders from certain other manufacturers, use *Indexed CVs* to reduce the amount of memory needed to store Configuration Variables. In this document, an *Indexed Configuration Variable (CV)* will always be written in one of two forms:
- Singly-Indexed CV: **CVn.PI**
- Doubly-Indexed CV: **CVn.PI.SI**

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[51] Atlas recommends the SoundTraxx PTB100 program track booster.

where **n** is the number of the *Indexed CV*; **PI**, the *Primary Index*, is the value stored in the *Primary Index Register* (**CV49**), and **SI**, the *Secondary Index*, is the value stored in the *Secondary Index Register* (**CV50**). One rule that **must** be observed whenever an indexed CV is programmed is:

> The *Index Register(s)* **CV49 (**and **CV50**, if applicable) must **always** be programmed **before** the indexed configuration variable **CVn** is programmed.

For example, in order to assign the value 1 to the singly-indexed Configuration Variable **CV56.4**, the following two CV's must be programmed as specified below **and in the order listed**:

<div align="center">

CV49 = 4

CV56 = 1

</div>

Section 4.2.9.1 in this document provides an example of a singly-indexed CV that is used to set individual sound volumes; Section 4.2.9.2, provides an example of a doubly-indexed CV that is used to set volumes of the various components of the *Prime Mover* sound.   Finally, Section 5.1.1 in the QSI *DCC Reference Manual* [3] describes a "warehouse analogy" to Indexed CVs. This analogy may help you understand better the concept of Indexed CVs. Most DCC systems can program Indexed CVs without any problem. However, there are a few special cases.

- Most NCE and Digitrax DCC systems will program Indexed CVs without difficulty. However, if you do have problems with these systems, you may need a software or hardware upgrade. Check with your DCC system manufacturer.
- If you own a DCC system made by someone other than Digitrax or NCE and are having programming problems, you also need to check with the manufacturer of your DCC system.

4.2.3 Programming a New DCC Address for Your Locomotive

The most commonly programmed item in a DCC locomotive is the address. The reason for this statement is simple:

- The decoders in DCC locomotives normally come from the factory set to use the *Short Address* "3."
- However, in order to control independently multiple locomotives on the same track at the same time, it is necessary that each of these locomotives have a unique address.

Most model railroaders use the road number printed on the side of the locomotive cab for its DCC address. Quite frequently, the road number on the cab is a 3- or 4-digit number, which is treated as a *Long (or 4-digit) Address* in DCC.

Many people prefer to use Operations Mode (Ops Mode) programming to change the address of their locomotives. However, in order to use Ops Mode, your DCC system must allow you to program 4-digit addresses on the main line (Most, but not all, DCC systems do.)

Table 6 lists some DCC systems commonly sold in North America that do and do not support direct 4-digit address programming on the main line. For those (relatively few) DCC systems that do NOT support Ops Mode address programming, references are given in this table to one of three alternate programming procedures (defined later in this section). For all other DCC systems, use the programming procedure described in Section 4.2.3.1

Table 6 – Procedure Needed to Program 4-Digit Address on Main Line for Various DCC Systems

DCC System Manufacturer	Model	Support 4-Digit Address Programming in Ops Mode	Recommended 4-digit Address Programming Procedure
Bachman	EZ-Command	No	Not recommended for use with Atlas Gold Series locomotives
Bachman	Dynamis	No	Use procedure in Section 4.2.3.4 or use Program Track
CVP Products	EasyDCC	No	Use procedure in Section 4.2.3.4 or use Program Track
Digitrax	Zephyr or Zephyr Xtra **without** a DT402 or DT400 throttle	No	Use procedure in Section 4.2.3.2 or use Program Track
Digitrax	Empire Builder, Super Chief, or Zephyr/Zephyr Xtra **with** a DT402 or DT400 throttle	Yes	Use procedure in Section 4.2.3.1
Lenz	Compact or (Atlas) Commander	No	Not recommended for use with Atlas Gold Series locomotives
Lenz	All other Lenz DCC systems with Ver. 3.6 or later software	No	Use procedure in Section 4.2.3.3 or use Program Track
MRC	Prodigy Express, Prodigy Advance and Advance,[2] or Prodigy Wireless	Yes	Use procedure in Section 4.2.3.1
NCE	Power Cab or Power Pro	Yes	Use procedure in Section 4.2.3.1

4.2.3.1   Special Procedure for Long (4-Digit) Address Programming of Gold Series Locomotives on Main Line (most DCC systems)

In order to program a Long (4-digit) address in Ops Mode when your Atlas Gold Series locomotive is currently using a Short (2-digit) address or vice versa, the following special procedure must be followed with most DCC systems. In particular, you **must** use this procedure for address programming on the main line if you have a Digitrax (**except for Zephyr and Zephyr Xtra**), an MRC Prodigy [Advance, Advance[2] (i.e., Advance Squared), Wireless, or Express], or an NCE DCC system.

Proceed as follows to program a new 4-digit address on the main line:

1. Operate the locomotive on the main line using its current DCC address.
2. If you cannot determine the current DCC address of the locomotive, transfer the locomotive to a DC or DCC powered track, and reset the Quantum System decoder using the Magnetic Wand. Follow either the DC or the DCC magnetic wand reset procedure described in Section 6.3.1. After completing the reset, make sure that the locomotive can be operated using the default DCC address "3."
3. **Disable verbal announcements by using Operations Mode programming to set CV62 = 0.** Consult your DCC system manual for an explanation of how to program CVs. Since you have just disabled verbal announcements, **you will not hear any verbal confirmation** of the value "0" that you wrote into CV62.
4. Follow the procedure in your DCC system manual for programming a new Long Address using Operations Mode programming on the main line. After you have completed setting the Long Address, make sure that your DCC system has activated this Long Address, i.e., it has set CV29 to a value (such as 34 or 38) that supports 4-digit addresses (see Section 4.2.4). In particular, if you have a Digitrax DCC system that has a DT402 or DT400 walk-around throttle, be certain to press the **Y+** key IMMEDIATELY after you see **Ad4on?=y** displayed on the throttle screen.
5. Change your DCC system from its configuration for Blast Mode programming to its configuration for running a locomotive on the main line (if your DCC system doesn't perform this reconfiguration automatically).
6. Verify that the locomotive can operate on the main line using its new 4-digit address.

7. If the locomotive responds properly to the new address, re-enable verbal announcements by using Operations Mode programming again to set CV62 = 1. In this case, **you will hear verbal confirmation** of the CV62 value "1" that you just entered since you have just re-enabled verbal announcements.

4.2.3.2 Special Procedure for Long (4-Digit) Address Programming on Main Line (Digitrax Zephyr or Zephyr Xtra DCC Systems)

If you have a DT400/DT402 throttle plugged into your Zephyr or Zephyr Xtra DCC system, you do not need to use the procedure described in this section. Instead use the procedure described in the previous section (Section 4.2.3.1).

1. Put your locomotive on the main track and run it on DCC using address 3, or whatever other address you have programmed into the locomotive. If you cannot determine the current DCC address of the locomotive, transfer the locomotive to a DC or DCC powered track, and reset the Quantum System decoder using the Magnetic Wand. Follow either the DC or the DCC magnetic wand reset procedure described in Section 6.3.1. Then test run the locomotive on DCC using the main track and DCC address 3.
2. Since your locomotive has a QSI sound-decoder, keep the locomotive on the main line and use Operations Mode programming to set CV62 = 0. (Setting CV62 = 0 maximizes the probability that CV29 will be set to a valid 4-digit address value, such as CV29 = 38, in Step 8 below.) This step is not always needed, but it is impossible to tell if the step is required without going through the entire programming sequence.
3. Turn **Option Switch 7** "On" so that you can use Digitrax's *Blast Mode* programming feature. To do this,
   a. Press the **PROG** key on your Zephyr or Zephyr Xtra DCC system.
   b. Press the **SWITCH** key.
   c. Use the keyboard to enter **07**, which is the number of the *Option Switch* that you need to enable *Blast Mode* programming.
   d. Press the **c/-** key to turn **Option Switch 7** "On."
   e. Press the **EXIT** key when you are finished setting **Option Switch 7**.
4. If you took the locomotive to be programmed off the main track, put it back on the main track. If the main track DCC power is off (which it should be), turn it back on using the **POWER** key on the Zephyr or Zephyr Xtra. Make sure that the locomotive to be programmed still runs on DCC using address 3 (or whatever other address you have programmed into it).
5. Keep pressing the **PROG** key until you see *PAGE* on the Zephyr's or Zephyr Xtra's display.
6. Keep pressing the **LOCO** key until you see *AD4* on the Zephyr's or Zephyr Xtra's display.
7. Use the Zephyr keyboard to enter the 4-digit address that you wish to program (e.g., 1234 or any other address between 128 and 9983)
8. When you have finished entering the 4-digit address, write this new address into your locomotive by pressing the **CV-WR** key. Do not be surprised if the locomotive leaps forward when the programming takes place. This movement doesn't always happen, but it can.
9. To exit *Blast Mode* programming on the main line, press the **EXIT** key on your Zephyr or Zephyr Xtra.
10. To run the locomotive whose address you entered in Step 7, press the **LOCO** key; re-enter the address you entered in Step 7 by using the Zephyr or Zephyr Xtra keyboard; and press the **LOCO** key again.
11. Verify that the locomotive runs using its new address.
12. If the locomotive did not run in Step 11 when you used its new address,
    a. Turn off DCC track power and move the locomotive that you are trying to program from the main line to the program track.
    b. Using *Direct Mode* (*dir* on the Digitrax display) programming, read the values of CV29 and AD4. For 4-digit addresses, the value of CV29 should be 38 (or 34) and AD4 should be the address (between 128 and 9983) that you entered in Step 7. If you can't read the values of CV29 and AD4 on your program track, you will probably need to install a *Program Track Booster* between the program track output of your DCC system and the program track itself. (See Section 6.5.)
    c. If either or both of these values are not correct, change it (them). You may make any necessary changes in Direct Mode while the locomotive is on the program track.
13. Turn off Blast Mode programming by changing the setting of **Option Switch 7** to "Off."
    a. Press the **PROG** key.
    b. Press the **SWITCH** key.
    c. Use the keyboard to enter **07**, which is the number of the Option Switch that you need to turn off.

d. Press the **t/+** key to turn **Option Switch 7** "Off."
e. Press the **EXIT** key when you are finished setting **Option Switch 7**.
14. If your locomotive has a QSI sound-decoder and you set CV62 = 0 in Step 2, put the locomotive back on the main line, run it briefly at its new 4-digit address.   Then configure the Zephyr or Zephyr Xtra for Operations Mode programming, and change CV62 back to its default value of CV62 = 1.

4.2.3.3 Special Procedures for Short or Long Address Programming for Lenz and Certain Other DCC Systems that Do Not Normally Permit Address Programming on Main Line (CV56.129)

If you cannot program your Short or Long address in Service Mode and your Lenz (or other) DCC command station prevents you from setting either of these addresses in Ops Mode on the main line (using CV1, or CV17 and CV18), use one of the following two alternative procedures to program your locomotive's address.

- **Alternate Procedure for Programming Short Addresses in Ops Mode**
    1. Set CV49 to 129.
    2. Set CV50 to 1.
    3. Set CV56 to your short address (range 1–127 for most DCC systems). Hear the address spoken back.
    4. If necessary, set CV29 to 6 (which is the factory default) to enable your new short (2-digit) address.

- **Alternate Procedure for Programming Long Addresses in Ops Mode**
    1. Determine the values of CV17 and CV18 that correspond to your locomotive's 3- or 4-digit cab number either by using one of the CV17/CV18 calculators available on the Internet, such as
       http://ruppweb.dyndns.org/xray/comp/decoder.htm
       or else by following the instructions for calculating the values of CV17 and CV18 in the *NMRA DCC Reference Manual for QSI Quantum 3, 2, and 1 Equipped Locomotives* [3].
    2. Set CV49 to 129.
    3. Set CV50 to 17.
    4. Set CV56 to the value for CV17 that you determined in Step 1.
    5. Set CV50 to 18.
    6. Set CV56 to the value for CV18 that you determined in Step 1.
    7. Set CV64 to 17. Hear the new full Long (3 or 4 digits) Address spoken out.
    8. Set CV29 to 38[52] to allow operation with your new Long Address.
- **Address Verification**
    Verify that the address of your locomotive has been changed successfully by running it on the main line with the new address.

4.2.3.4 Special Procedures for Long Address Programming on the Main Line (Bachmann Dynamis and CVP Products EasyDCC Systems)

The Bachmann Dynamis and CVP Products EasyDCC systems allow you to program on the main line the two CVs that hold a 4-digit address (CV17 and CV18), but they do not allow you to program a 4-digit address directly.
    1. Determine the values of CV17 and CV18 that correspond to your locomotive's 3- or 4-digit ID number either by using one of the CV17/CV18 calculators available on the internet such as
       http://ruppweb.dyndns.org/xray/comp/decoder.htm
       or else by following the instructions for calculating the values of CV17 and CV18 in the *NMRA DCC Reference Manual for QSI Quantum 3, 2, and 1 Equipped Locomotives*[3].
    2. Make sure that verbal announcements (of CV values) are turned on (CV62 = 1).
    3. Using Operations Mode Programming, program CV17 to the value that you determined in Step 1. Listen to the value of CV17 that is spoken out by your locomotive. If it is correct, go to Step 4; if it is incorrect, repeat Step 3.

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[52] Entering "38" leaves the other configuration settings in CV29 at factory default values, but changes the ID to extended type.

4. Using Operations Mode Programming, program CV18 to the value that you determined in Step 1. Listen to the value of CV18 that is spoken out by your locomotive. If it is correct, go to Step 5; if it is incorrect, repeat Step 4.
5. Using Operations Mode Programming, program CV29 to the value 38. Listen to the value of CV29 that is spoken out by your locomotive. If it is correct, go to Step 6; if it is incorrect, repeat Step 5.
6. Verify that the address of your locomotive has been changed successfully by running it on the main line with the new address.

4.2.4 Selecting a Value for CV29

CV29 is probably the second (after the DCC address CVs) most often programmed CV. Moreover, CV29 is also the most important of all the Configuration Variables in DCC. Each bit in CV29 controls one basic operational setting for a DCC decoder, such as *Extended (4-digit) Addressing*, user-defined *Speed Table Enable/Disable*, *Power Source Conversion* (operate on either DC or DCC or only on DCC), *Locomotive Direction*, and others. The default value of CV29 is 6. Table 7 provides some of the more common values for CV29[53] and the features that these values support.

Table 7 - Available Features for Various Values of CV29

If You Want this Set of Features					Write this Decimal Value into CV29
2- or 4- Digit Addressing	Activate Alternate Speed Table (CV67–CV94)?	Locomotive Operates on DC?	Locomotive Uses 28 or 128 Speed Steps	Normal Direction of Locomotive	
2	No	No	Yes	Forward	2
2	No	Yes	Yes	Forward	6[54]
2	Yes	No	Yes	Forward	18
2	Yes	Yes	Yes	Forward	22
4	No	No	Yes	Forward	34
4	No	Yes	Yes	Forward	38[54]
4	Yes	No	Yes	Forward	50
4	Yes	Yes	Yes	Forward	54
2	No	No	Yes	Reversed	3
2	No	Yes	Yes	Reversed	7
2	Yes	No	Yes	Reversed	19
2	Yes	Yes	Yes	Reversed	23
4	No	No	Yes	Reversed	35
4	No	Yes	Yes	Reversed	39
4	Yes	No	Yes	Reversed	51
4	Yes	Yes	Yes	Reversed	55

4.2.5 Selecting Standard Throttle Control™ or Regulated Throttle Control™ (CV56.4)

The differences between *Standard Throttle Control (STC)* and *Regulated Throttle Control (RTC)* are explained in Section 3.7[55]. Follow the directions below to convert between *RTC* and *STC* when using DCC.

- Set CV49 to 4,
- Set CV56 to 0 for *Standard Throttle Control* or to 1 for *Regulated Throttle Control*.

Note: The default is *Regulated Throttle Control*.

Note: CV2, CV3, CV4, CV5, CV6[56] and Speed Tables apply to both *Standard* and *Regulated Throttle Control*.

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[53] For more information on CV29, see the *NMRA DCC Reference Manual for QSI Quantum 3, 2, and 1 Equipped Locomotives*[3]
[54] Two values for CV29 that allow both DCC and DC operation are CV29 = 6 (2-digit addresses) and CV29 = 38 (4-digit addresses).
[55] *STC* and *RTC* operate in a similar fashion in Analog and in DCC.
[56] CV6 (Vmid) is supported in firmware Versions 8 and 9, but not in Version 7.

4.2.6 Reset All[57] DCC CV's to their Factory Default Values (CV56.128.255)
- Set CV49 to 128,
- Set CV50 to 255.
- Set CV56 to 113[58]. In Ops Mode, you will hear **Reset** when this reset is completed.

Note*: This reset does **not** affect any Analog settings, except for volumes and certain other parameters shared between analog and DCC.*

Note: Atlas strongly recommends that you reset your locomotive using the magnetic wand (Section 6.3.1) rather than by this 3-CV method since the magnetic wand reset is more complete.

4.2.7 <u>Changing the System Volume</u> (CV51.0)
You can change the volume either manually with the magnetic wand, as described in Section 6.3.2*,* or electronically by using CV51.0 in DCC. To change the volume electronically in Service or Operations Mode, do the following:
- Set CV49 to 0[59]**.**
- Enter the desired System Volume in CV51. The System Volume can be set to any value between 0 (no sound) and 127 (maximum volume). The default System Volume is 127.

Note: In Operations Mode, when you change the *System Volume*, you will immediately hear the sound system operating at the new System Volume setting.

4.2.8 <u>Changing the Mute Volume Electronically</u> (CV51.1)
To change the *Mute Volume* in Service or Ops Mode, do the following:
- Set CV49 to 1.
- Enter the desired *Mute Volume* in CV51. The *Mute Volume* can be set to any value between 0 (no sound) and 63 (maximum volume). The default Mute Volume is 0.

Note: In Ops Mode, when the locomotive is muted and you change the *Mute Volume*, you will immediately hear the new *Mute Volume*.

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 of the *System Volume*.

4.2.9 <u>Adjusting Overall and Component Volumes of Individual Sounds</u>

With QSI version 7, 8, or 9 firmware, it is possible to set the volumes of certain individual sounds using CV52.PI, as shown in Table 8 and (and with Version 9 firmware only) the volumes of certain components of the overall Prime Mover sound using CV127.PI.SI, as shown in Table 9

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[57] Consult the *NMRA DCC Reference Manual for QSI Quantum 3, 2, and 1 Equipped Locomotives* [3] to learn how to reset different groups of CV's.
[58] "113" is QSI's Manufacturer's ID Number, as assigned by the NMRA.
[59] You will hear the value *0* you entered for CV49 spoken out (Ops Mode only).

4.2.9.1 Controlling Individual Sound Volumes

The following table shows which CVs to program to change the volume of an individual sound.

Table 8 - Using CV52.PI to Change the Volume of an Individual Sound

Name of Sound	CV49 Value	CV52.PI Value Range	Corresponding Indexed CV	Effect of Value of CV52.PI on Volume of Specified (by CV49 value) Sound
Horn	0	0-15	52.0	0 = Minimum Volume. 15 = Maximum Volume
Bell	8	0-15	52.8	0 = Minimum Volume, 15 = Maximum Volume
Overall volume[60] of PrimeMover1	10	0-15	52.10	0 = Minimum Volume, 15 = Maximum Volume
Overall volume[60] of PrimeMover2	11	0-15	52.11	0 = Minimum Volume, 15 = Maximum Volume
Turbocharger volume • Firmware Versions 7 and 8 only • Replaced by CV127.10.70 and CV127.10.72 in Version 9	14	0-15	52.14	0 = Minimum Volume, 15 = Maximum Volume
Air Pump	16	0-15	52.16	0 = Minimum Volume, 15 = Maximum Volume
Cooling Fans	19	0-15	52.19	0 = Minimum Volume, 15 = Maximum Volume
Long Air Let-off	21	0-15	52.21	0 = Minimum Volume, 15 = Maximum Volume
Short Air Let-off	22	0-15	52.22	0 = Minimum Volume, 15 = Maximum Volume
Squealing Brakes	24	0-15	52.24	0 = Minimum Volume, 15 = Maximum Volume
Generator Volume • Firmware Versions 7 and 8 only • Replaced by CV127.10.60 and CV127.10.62 in Version 9	26	0-15	52.26	0 = Minimum Volume, 15 = Maximum Volume
Dynamic Brake Fan	28	0-15	52.28	0 = Minimum Volume, 15 = Maximum Volume
Splitter Valve[61]	29	0-15	52.29	0 = Minimum Volume, 15 = Maximum Volume
Air Dryer[61]	30	0-15	52.30	0 = Minimum Volume, 15 = Maximum Volume
Coupler	34	0-15	52.34	0 = Minimum Volume, 15 = Maximum Volume
Air Brakes	37	0-15	52.37	0 = Minimum Volume, 15 = Maximum Volume
Alternate Horn[61]	40	0-15	52.40	0 = Minimum Volume, 15 = Maximum Volume
User Sound Effect1[61]	46	0-15	52.46	0 = Minimum Volume, 15 = Maximum Volume
User Sound Effect 2[61]	47	0-15	52.47	0 = Minimum Volume, 15 = Maximum Volume
Verbal feedback[62]	50	0-15	52.50	0 = Minimum Volume, 15 = Maximum Volume
Crew Talk[63]	52	0-15	52.52	0 = Minimum Volume, 15 = Maximum Volume
Water Loading[61]	53	0-15	52.53	0 = Minimum Volume, 15 = Maximum Volume
Fuel Loading[61]	55	0-15	52.55	0 = Minimum Volume, 15 = Maximum Volume
Maintenance[61]	56	0-15	52.56	0 = Minimum Volume, 15 = Maximum Volume
Prime Mover rod-knock (low RPM)[64]	62	0-15	52.62	0= Minimum Volume, 15 = Maximum Volume
Prime Mover rod-knock (high RPM)[64]	65	0-15	52.65	0 = Minimum Volume, 15 = Maximum Volume

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[60] Use CV127.10.SI to set individual component volumes.
[61]The volumes of these sounds can be adjusted in firmware Versions 8 and 9 only.
[62] Sets volume for CV-readout, programming acknowledgement, status report, and odometer readout.
[63] Crew Talk is not a stand-alone feature; it is used to set the volume of the speech segments in the three scenarios.
[64] Quantum Titan with Version 8 firmware only

Note: As of the date of publication of this *User Manual*, there are no Atlas models of prototype diesel locomotives that have two Prime Movers. Hence, CV52.11 is not currently used in any Atlas Gold Series locomotive.

To change the overall volume of one of the sounds listed in Table 8, perform the following operations:
- Set CV49 to the Primary Index (second or green column) for the individual sound whose volume you wish to change. Use the value specified in the CV49 (green) column in the table above.
- Set the desired Volume level in CV52 to one of the allowed levels listed in the third or blue column where: "0" = No sound and levels "1 – 15" are used to set the volume from the lowest level at "1" to the highest at "15."   The volume levels change in 2 dB increments.

Note: Normally, the default volume level for each type of sound is 11.

Example: To set the overall volume of PrimeMover1 to 0, do the following programming
- Set CV49 to 10 to select PrimeMover1.
- Set CV52 to 0 to set the new PrimeMover1 volume.

If you do this programming in *Ops Mode* (recommended), you will immediately hear the effect of the new volume level that you have programmed.

4.2.9.2 Changing Volumes of Prime Mover Sound Components (CV12710I.SI) – available in Firmware Version 9 only

QSI Version 9 firmware for the Quantum Titan sound decoder allows the user to change the volume of not only the prime mover, but also some of the components making up this overall sound. The sound components whose volumes may be set individually are:
- Diesel Prime Mover volume at three different RPM levels (idle, mid-RPM, max-RPM),
- Exhaust volume at three different RPM levels,
- Labored exhaust volume at three different RPM levels,
- Rod knock volume at three different RPM levels,
- Generator volume at two different RPM levels (idle and max-RPM),
- Turbocharger volume at two different RPM levels (idle and max-RPM).

This feature will probably be of most interest to intermediate to advanced users, especially to those who are also railfans. So that you can hear quickly the results of a CV value change, it is strongly recommended that you do all programing on the main line (*Operations Mode*) rather than on the program track (*Service Mode*). Furthermore, although this programming may be done with a standard DCC system, it is easier to use (an up-to-date version of) the *Quantum CV Manager* [bundled with the QSI Quantum Programmer and sold by QSI Solutions].

As shown in Table 9 below, a doubly-indexed Configuration Variable (CV127.PI.SI) is used to set the volumes of the individual sound components.

Table 9 - Using CV127.PI.SI to Change the Volume of a Prime Mover Sound Component[65]

Name of Sound Component	CV49 Value	CV50 Value	CV127 Value Range	Corresponding Indexed CV	Resulting Volume
PrimeMover1 Idle Volume	10	0	0-15	127.10.0	0 = Minimum Volume. 15 = Maximum Volume
PrimeMover1 Mid RPM Volume	10	1	0-15	127.10.1	0 = Minimum Volume, 15 = Maximum Volume
PrimeMover1 Max RPM Volume	10	2	0-15	127.10.2	0 = Minimum Volume, 15 = Maximum Volume
Exhaust1 Idle Volume	10	10	0-15	127.10.10	0 = Minimum Volume, 1 5 = Maximum Volume
Exhaust1 Mid RPM Volume	10	11	0-15	127.10.11	0 = Minimum Volume, 15 = Maximum Volume
Exhaust1 Max RPM Volume	10	12	0-15	127.10.12	0 = Minimum Volume, 15 = Maximum Volume
Labored Exhaust1 Idle Volume	10	20	0-15	127.10.20	0 = Minimum Volume, 15 = Maximum Volume
Labored Exhaust1 Mid RPM Volume	10	21	0-15	127.10.21	0 = Minimum Volume, 15 = Maximum Volume
Labored Exhaust1 Max RPM Volume	10	22	0-15	127.10.22	0 = Minimum Volume, 15 = Maximum Volume
Rod Knock1 Min RPM Volume	10	30	0-15	127.10.30	0 = Minimum Volume, 15 = Maximum Volume
Rod Knock1 Mid RPM Volume	10	31	0-15	127.10.31	0 = Minimum Volume, 15 = Maximum Volume
Rod Knock1 Max RPM Volume	10	32	0-15	127.10.32	0 = Minimum Volume, 15 = Maximum Volume
Generator1 Idle Volume	10	60	0-15	127.10.60	0 = Minimum Volume, 15 = Maximum Volume
Generator1 Max RPM Volume	10	62	0-15	127.10.62	0 = Minimum Volume, 15 = Maximum Volume
Turbo1 Idle Volume	10	70	0-15	127.10.70	0 = Minimum Volume, 15 = Maximum Volume
Turbo1 Max RPM Volume	10	72	0-15	127.10.72	0 = Minimum Volume, 15 = Maximum Volume

Changing a component volume level requires setting both a Primary Index (CV49) and Secondary Index (CV50).   If you are not familiar with QSI's indexed CV's, please refer to Section 4.2.2 in this document or pages 93-98 in the *NMRA DCC Reference Manual for QSI Quantum 3, 2, and 1 Equipped Locomotives*[3.] In particular, to change the volume level of a sound component, do the following steps:
- Set CV 49 to the Primary Index (PI) for the individual sound (see the second or green column in table above).
- Set CV 50 to the Secondary Index (SI) for the component sound (see the third or pink column in table above).
- Set volume level in CV127 to a value listed in the fourth or blue column of Table 9 as follows:
  - "0" = No sound
  - "1 – 15" = Sets volume level from the lowest level at "1" to the highest level at "15"

For most component sounds, the default volume is 11.

Example: To set the PrimeMover1 Exhaust Max RPM volume to 6, do the following programming
- Set CV49 to 10 to select PrimeMover1.
- Set CV50 to 12 to select Exhaust Max RPM.
- Set CV127 to 6 which sets the exhaust volume at max RPM to your desired value of 6.

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[65] Version 9 or later firmware only.

4.2.10 Disable/Enable Verbal Announcements (CV62)

In Ops Mode, the Quantum System will automatically announce the value of the CV that you have just programmed..
- To *Disable* these announcements, set CV62 to 0[66].
- To *Enable* these announcements, set CV62 to 1.

The Default state is *Enabled.*

4.2.11 CV Inquiry with Verbal Feedback in Ops Mode (CV64)[67]

To inquire about the current value of any non-indexed CV using Verbal Feedback in Ops Mode:
- Set CV64 to the number of the CV you wish to query.
- Hear the verbal message "*CV n equals m*" where *n* is the CV number and *m* is the value of that CV.

If the CV is indexed (e.g., CVn.PI.SI where n is the CV number, PI is the Primary Index, and SI is the secondary index, if any),
- First set CV49 to the PI;
- Next set CV50 to the SI (if there is a secondary index);
- Then set CV64 to n.
- You will hear a verbal report similar to that given in the above example.

For example, if you want to inquire about the Bell Volume, which is CV52.8 (see Table 8), set CV49 to 8 and then set CV64 to 52. You will hear, "*CV five two point eight equals Y,*" where Y is the current volume setting.

Note: If you enter either '17' or '18' into CV64, you will hear the full Long Address ID number spoken out.

4.2.12 Selecting the Type of Bell and Bell Customization (CV55.3.1) – Firmware Version 9.3.1 (or later) only

As mentioned in Section 4.1.2, it is possible (with firmware Version 9.3.1 or later) for the user to choose among 36 different bells. One of these 36 bells is the so-called *Native Bell*, which was recorded from the Prototype recording for a particular prime mover. One doubly-indexed CV (CV55.3.1) is used to pick the type of bell to be used with that prime mover. To choose the bell, use the following procedure.
- Set the value of the primary index to 3, i.e., set CV49 = 3;
- Set the value of the secondary index to 1, i.e., set CV50 = 1.
- Set CV55.3.1 to the value that corresponds to the horn you wish to use. Table 10 below is an example of a table of bell types. It gives a list of the possible values of CV55.3.1 and the type of bell corresponding to each value.

If and only if you have selected a user-defined bell (CV55.3.1 = 2 in Table 10), you can have even more control over the characteristics of your bell. To do so, you can vary three additional characteristics of the bell by changing the values of the following three doubly-indexed CVs:
- CV55.3.6 User Defined Bell Ring Period (ring rate)
  - Range: 1-255; 1 unit = 0.01; Default = 100, or one "ding" every 1.00 second;
- CV55.3.7 User Defined Bell Metallurgy
  - Range: 0-255; 0 = 100% steel, 255 = 100% bronze; Default = 128 or 50% steel/ 50% bronze.
- CV118.8.0-1 User Defined Bell Pitch Shift
  - Range: Special. This CV controls the pitch of the bell, but due to the needed resolution to allow for any selectable pitch, it is a *High Byte/Low Byte CV* (like CV17/18, which is used to store a long address). CV118.8.0-1 is very difficult to adjust using only a DCC system. However, QSI's *CV Manager* program allows you to change this CV without the need to make many complex calculations.

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[66] You will **not** hear "CV62 = 0".
[67] This option is not affected by CV62 (Disable/Enable Verbal Announcements).

Table 10 – Using CV55.3.1 to Change the Type of Bell

CV55.3.1 Value	Bell Selected
1	Native Bell (assigned by Cut & Paste)
2	User Defined Bell*
10	Bronze Bell, High Tone, Slow
11	Bronze Bell, High Tone, Medium
12	Bronze Bell, High Tone Fast
13	Bronze Bell, Mid Tone, Slow
14	Bronze Bell, Mid Tone, Medium
15	Bronze Bell, Mid Tone, Fast
16	Bronze Bell, Low Tone, Slow
17	Bronze Bell, Low Tone, Medium
18	Bronze Bell, Low Tone, Fast
19	Mixed Metal Bell, High Tone, Slow
20	Mixed Metal Bell, High Tone, Medium
21	Mixed Metal Bell, High Tone, Fast
22	Mixed Metal Bell, Mid Tone, Slow
23	Mixed Metal Bell, Mid Tone, Medium
24	Mixed Metal Bell, Mid Tone, Fast
25	Mixed Metal Bell, Low Tone, Slow
26	Mixed Metal Bell, Low Tone, Medium
27	Mixed Metal Bell, Low Tone, Fast
28	Steel Bell, High Tone, Slow
29	Steel Bell, High Tone, Medium
30	Steel Bell, High Tone, Fast
31	Steel Bell, Mid Tone, Slow
32	Steel Bell, Mid Tone, Medium
33	Steel Bell, Mid Tone, Fast
34	Steel Bell, Low Tone, Slow
35	Steel Bell, Low Tone, Medium
36	Steel Bell, Low Tone, Fast

4.2.13 Selecting the Type of Horn(s) (CV 55.1.SI) – Firmware Version 9.3.1 (or later) only

As mentioned in Section 4.1.16, it is possible for the user to choose (separately for the *Primary Horn* and the *Alternate Horn*) among numerous (currently143) different horns. Two doubly-indexed CVs are used to select the type (or types) of horn(s) to be used for the *Primary Horn* and for the *Alternate Horn*:

- CV55.1.1 is used to select the *Primary Horn*;
- CV55.1.2 is used to select the *Alternate Horn*;

To specify a particular horn
- Use the appropriate CV (CV55.1.1 for the *Primary Horn* and CV55.1.2 for the *Alternate Horn)*, To do this
    - Set the value of the primary index to 1 (Set CV49 = 1)
    - Set the value of the secondary index to
        - ○ CV50 = 1 for the *Primary Horn*,
        - ○ CV50 = 2 for the *Secondary Horn*,
- Then set CV55.1.1 or CV55.1.2 to the value that corresponds to the horn type you wish to use. A list of the possible values of CV55.PI.SI and the type horn corresponding to each value may be found in Appendix 4 of this document.

4.2.14 Enable/Disable Horn-Triggered-Doppler Shift (CV51.2)
- Set CV49 to 2.
- Set CV51 to 0 to disable Horn-Triggered-Doppler; set CV51 to 1 to enable.

See also Section 6.2.

4.2.15 Enable/Disable Automatic Horn Warning Signals (CV51.20) – Versions 8 and 9 only

You can use CV51.20 to enable (or disable) the following automatic horn warning signals that can be generated by the Quantum Titan sound-decoder. This scenario imitates the actions required of a prototype locomotive engineer when he starts and stops his locomotive**.**

- Two short Horn blasts when the locomotive first starts to move in FWD,
- Three short Horn blasts when the locomotive first starts to move in REV,
- One short Horn blast when the locomotive comes to a stop.

To enable or disable these Horn warning signals, perform the following steps:
- Set CV49 to 20.
- Set CV51 to 0 to disable all Horn Warning Signals or set CV51 to 17 to enable all three of the Horn Warning Signals listed above.

If you want to enable a different horn warning scenario from those specified above, please refer to the definition of CV51.20 in the *NMRA DCC Reference Manual for QSI Quantum 3, 2, and 1 Equipped Locomotives* [3]. If you wish to modify the timing, duration, and/or number of Horn blasts in a Horn Warning Signal scenario, please refer to the definition of CV120.PI.SI[68] in this same reference manual.

4.2.16 Speed-Matching

if you wish to consist two locomotives together, in order to avoid mechanical damage to one or both locomotives in the consist, it is important that the velocities of the two locomotives closely match each other over the entire range of speeds at which they operate.

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[68] *PI* stands for *Primary Index*; *SI* stands for *Secondary Index*. Refer to Section 4.2.2 of this document or to Sections 5.1 to 5.3 in the QSI DCC Reference Manual [3] for an explanation of the Indexed CVs used in QSI sound-decoders.

If you are speed-matching a locomotive that has a Quantum or Quantum Titan sound-decoder to another locomotive whose decoder does **not** have Regulated Throttle Control (aka, *BEMF*) you almost always need to turn off *BEMF* in the Quantum or Quantum-Titan equipped locomotive (first set CV49 = 4; then set CV56 = 0; see Section 0) before trying to speed-match. You should also eliminate any momentum that is specified in CV3, CV4, CV23, and CV24. You need to set these CVs to 0 for both locomotives in the consist.

The Quantum or Quantum Titan sound-decoder in your Atlas Gold Series locomotive provides two ways to match locomotive speeds, which will be explained in the next two subsections.

4.2.16.1 Speed-Matching with a 3-Point Speed Curve

Speed-matching with a 3-point speed curve is done in the same way as it is with any other NMRA-compliant sound-decoder that supports CV2 (Vstart), CV5 (Vhigh), and CV6 (Vmid). Put the two locos to be speed-matched on an oval[69] of DCC-powered track. However, do not apply DCC power to this track until both locomotives are on the track, and you are ready to begin speed matching. **Make sure that the two locomotives are NOT coupled together and remain uncoupled for the entire speed-matching process.** Use *Ops Mode* programming to change the values of CV2, CV5, and CV6 in the following order (assuming that both locomotives are set to 28 speed steps):

- Adjust CV2 of one or both locomotives to get the best speed match at speed step #1;
- Adjust CV5 of the faster locomotive to lower the top speed of this faster locomotive at speed step #28 so that it matches the speed of the slower locomotive at the same speed step #28;
- Adjust CV6 of the faster locomotive to lower the mid-range speed of this faster locomotive so that it matches the speed of the slower locomotive at speed step #14;
- Repeat the above three steps (in the same order: CV2, CV5, and CV6) until the match at all speeds is as good as you can get.

The 3-point speed curve speed-matching technique just described is applicable to locomotives with Quantum Titan sound decoders that use QSI firmware release 8 or 9. If you have a locomotive with an older Quantum sound-decoder (e.g., QSI firmware release 7), CV6 (Vmid) is not supported. However, you can use a very similar technique to speed-match by substituting CV25 (Quantum Speed Table Selection) for CV6. Instead of specifying a numerical speed-step value for CV6, you will program one of the following 11 values (2, 3, 4, 5, 6, 7, 67, 68, 69, 70, or 71) into CV25 to specify one of the 11 pre-defined speed curves available in QSI sound-decoders. The mid-range speed (speeds around speed-step #14) will vary depending on which QSI speed curve you choose. See Sections 3.16 and 3.5 in Reference [3].

4.2.16.2 Speed-Matching with a 28-Point Speed Curve

In most cases, using a 3-point speed curve is perfectly satisfactory for speed-matching the locomotives in a consist. If however you wish to set speeds more accurately, an NMRA standard 28-point speed curve is available in CV67 to CV94. Atlas recommends that you use one of the software decoder programming systems, such as *DecoderPro* or QSI's *Quantum CV Manager* to speed-match using 28-point speed curves. Remember that you must set Bit 4 of CV29 to a binary "1" before you can use the 28-point speed table (see Table 7).

5 Quantum System Sounds[70]

Air Brakes: When prototype train brakes are applied, air is released from the brake pipes to reduce the pressure. The more the pressure is reduced, the greater the braking. If you have a Gold Series locomotive with a Quantum Titan sound-decoder, you will hear a continual air release sound from the model locomotive as braking is continually increased. The longer the air is released, the quicker the model locomotive will slow down. Once all the pressure is released, the locomotive will continue at maximum braking, which can still result in a long stopping distance depending on your momentum/load settings (CV4 and CV24). ***DCC and QARC[71] Only***

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[69] An oval of track sized approximately 3 to 4 ft. by 6 to 8 ft. in HO scale (or the equivalent in other scales) is especially convenient to use for this speed-matching process.

[70] Not all features described here are included in every Atlas Gold Series locomotive.

[71] QARC™ or Quantum Analog Remote Control™ uses special signals under Analog control to operate different Quantum features. With QARC, you can operate features that are otherwise available only in DCC. The Quantum sound-decoder and the Quantum Engineer (Section 3.13) communicate with each other using QARC messages.

Air Pumps: Prototype *Air 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 run only occasionally to maintain the pressure. Diesel *Air Pumps* are operated directly from the locomotive's *Prime Mover* and are quite noticeable when turned on in a non-moving locomotive. In an Atlas Gold Series model locomotive that is equipped with a QSI Quantum sound decoder, you will hear the *Air Pumps* come on randomly to maintain air pressure.

Air Dryers and Spitters: *Air Dryers* are responsible for dehumidifying the air in the air lines and usually turn on after the air pump shuts down. *Spitters* were added in later locomotives to remove unwanted moisture in various airline locations around the locomotive. Each *Spitter* is independent and reacts to local moisture conditions. In Quantum Titan locomotives, you will hear the *Air Dryer* come on at the end of the *Air Pump* operation. Occasionally, you will hear the *Air Dryer* turn on randomly, independent of the *Air Pumps*. In addition, you will hear a number of *Spitters* going on randomly in all directional states although they are more obvious when the locomotive is stopped in *Neutral*. Quantum Titan *Air Dryers* and *Spitters* have separate volume controls to allow the user to customize his locomotive according to age and/or modifications of the prototype. **Firmware Versions 8 and 9 Only**

Appliance Air Release: Compressed air is used on locomotives for operating various appliances. You will hear a variety of *Short and Long Air Release* sounds emitted at various times.

Bell: Diesel and Electric locomotives, as well as larger steam locomotives, usually have pneumatically-operated mechanical *Bells*. Small steam locomotives often have hand-pulled *Bells*. During *Turn On in Neutral*, you can hear the pneumatic clapper gain greater throw with each stroke until it finally strikes the *Bell*. During *Shut Down in Neutral*, you will hear the *Bell* fade out along with the *Short Air Release* sound associated with turning this appliance off. Locomotives equipped with a Quantum Titan sound-decoder and Version 9 firmware offer a choice of four different *Bells* which include recordings for one prototype pneumatic Bell and one prototype hand-pull Bell, in addition to a programmable pneumatic Bell and a programmable hand pulled Bell. Programmable Bells have CVs to set ring rate and pitch. Additional bells are available for locomotives that have QSI version 9.3.1 (or later) firmware. For more information see Sections 4.1.2 and 4.2.12.

Brake Squeal: You can hear the brakes squeal on prototype locomotives when the locomotive is moving slowly. This noise can become particularly loud when the wheels are just about to stop turning. Listen at slow speeds for automatic *Brake Squeal* sounds in the model locomotive and the final distinctive squealing sounds as the diesel locomotive slows to a stop.

Cooling Fans: The enormous Prime Mover [consisting of the Diesel Engine and the Generator (or Alternator in modern locomotives)], which is enclosed in the diesel locomotive body, needs ventilation in order 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. The outside air is blown across large radiators. In all Atlas Gold Series model locomotives that are equipped with QSI Quantum sound, you will also hear the sounds of *Louvers* opening before the *Cooling Fans* start. When the *Cooling Fans* shut down, you will hear the *Louvers* close.

Coupler: To give you the most authentic coupler sounds, QSI has identified three distinct types of coupler activity on prototype locomotives and incorporated them into the model. 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 sound of the *Coupler Opening*, along with the hiss of the coupler air-hoses parting. The third is when the *locomotive couples up to its load of cars*, and you hear the crash as the cars bunch together from the impact. ***DCC and QARC only***

Diesel Turbo: On modern diesel locomotives, *Turbo* appliances are used to increase the horsepower of the Prime Mover by pumping air under pressure into the intake manifold. The power to operate the *Turbo* comes from the *Prime Mover's exhaust pressure*, which causes the high-pitched whine of the *Turbo* to lag the revving of the engine. Quantum systems use a separate sound record for the *Turbo* to allow it to lag behind revving up the *Prime Mover* and to "hang" for a few seconds when the *Prime Mover* is revved down.

Doppler Run-by: The locomotive sounds get louder as a prototype train approaches; then they immediately drop to a much lower pitch and lower volume as the train passes by. *Doppler Shift* is based on the speed of the locomotive; hence, the sounds change more dramatically when the locomotive is running faster. In a Quantum-equipped

locomotive, you can (with a little practice) change the pitch exactly when and where you want. After the *Doppler Shift* has occurred and the *Horn* is no longer being blown, the *Bell* shuts off automatically, and locomotive sounds return to normal.

Dual Prime-Mover Sounds: Quantum Titan diesel sound sets include two independent Prime Movers (PrimeMover1 and PrimeMover2), each with their own separate *Prime Mover* volume controls. You can choose to use either one of the Prime Mover sound sets by itself or both sound sets at the same time. However, most diesel locomotives (including all Atlas Gold Series locomotives produced to date) had only one Prime Mover. The choice of using one Prime Mover or the other can be an advantage in Consists where you might want each of the locomotives to have its own unique sounds.

Dynamic Brakes: Electric *traction 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 a Quantum-equipped diesel locomotive, the *Prime Mover* sound drops to notch 1, and the *Dynamic Brake Cooling Fan* sounds come on. Since prototype dynamic brakes are relatively ineffective at low speeds, the *Dynamic Brakes* in the Quantum-equipped model locomotive will shut off automatically below 8 smph. However, you can turn the dynamic brakes on and off in a stationary locomotive if you are in the *Disconnect* Stage of Shut Down. (See Section 4.1.14.) ***DCC and QARC Only***

Flanges: When a prototype train enters a curve, the *Flanges* on the wheels ride up on the inside of the rail and squeal. Recreate this squealing effect in a Quantum-equipped model locomotive by pressing and releasing the *Flanges* button (on the Quantum Engineer) or the F7 key (on a DCC controller) quickly and repeatedly as necessary. ***DCC and QARC only***

Horn: The Quantum System uses authentic locomotive sounds whenever possible. All Quantum *Horns* are engineered by QSI's sound experts to give you the most authentic effects. If you blow the Horn briefly, you will produce a realistic *Short Horn sound* (also called a *Hoot)*.

Low Idle: *Low Idle* is used on prototype locomotives 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.

Prime Mover Component Sounds: In addition to the Turbo, the Quantum Titan and Quantum Titan with ET sound decoders use separate sound channels for *Exhaust, Labored Exhaust*, *Rod Clank* and *Generato*r for both PrimeMover1 and PrimeMover2, where each sound has its own volume control, and each sound is in synchrony with the operation of its respective *Prime Mover*. *Rod Clank* represents motors that are aging and in need of tune-up or repair; the default for Rod Clank is zero, leaving it to the user to set this feature. It is also a feature that can further distinguish one *Prime Mover* from the other.

Prime Mover Rev: Quantum allows the *Prime Mover* to be operated with all eight notches corresponding to the throttle notches used on the prototype. As the throttle is turned up, the Prime Mover RPM will increase continuously to the value for the selected Notch; the maximum RPM occurs at notch 8.

Scenarios: Versions 8 and 9 firmware for Quantum Titan sound-decoders include three different *Scenarios* that can be activated by the user to simulate:
- *Diesel fuel filling*,
- *Maintenance* of the locomotive,
- *Water filling* of diesel steam water tanks.

The crew talk that occurs during the *Scenarios* has a separate volume adjustment if you want to turn it off completely or turn it up to hear more clearly. The default *Crew Talk* volume is intentionally difficult to hear over the background prime mover sounds, just as it is on the prototype.

6 Special Operation and Troubleshooting

For additional information on trouble-shooting, see Appendix III, *DCC Troubleshooting*, in the *NMRA DCC Reference Manual for QSI Quantum 3, 2, and 1 Equipped Locomotives*[3].

6.1 The Basics

Many problems with sound-equipped locomotives are caused by one or both of the following two conditions:
- Dirt on the track, on the wheels (particularly on the locomotive, but also on any rolling stock being pulled by the locomotive), or on electrical pickup strips in the locomotive that rub on the wheels or axles
- Scrambled firmware or parameters (CVs) in the sound-decoder.

Clean your track and wheels first. Ordinary rubbing alcohol (from the drug store or grocery) poured onto paper towels does a good job cleaning track and wheels.

The wheel cleaning process is easier and quicker to do than it is to describe. To clean locomotive wheels:
- Cut a piece of paper towel that is slightly larger than one truck of the locomotive;
- Moisten the paper towel with rubbing alcohol;
- Put the paper towel on some track that can be (but is not yet) powered;
- Put the locomotive on this track with one truck completely on the moistened pad and the other truck on the bare rails;
- Hold the locomotive while you turn up the power until you see that the locomotive wheels on the piece of paper towel are turning. If the wheels are dirty, you will see black streaks of dirt from the loco wheels rubbing against the paper towel;
- Keep running the locomotive until the wheels on the first truck are clean;
- Make a second paper towel pad and moisten it with alcohol. Put the wheels of the second truck on the clean pad. Repeat the above cleaning process on the second truck.

To clean your track, use rubbing alcohol on a paper towel. Keep cleaning each section of track until you no longer see black stripes of dirt on the paper towel.

Once you have clean track and wheels, reset your locomotive using the procedure described in Section 6.3.1. Now try running the reset locomotive. **Do NOT change any CV values (<u>INCUDING THE DCC ADDRESS</u>) until AFTER you have tested the locomotive using the default parameter values.**

6.2 Doppler Shift Problems (DCC)

With some DCC systems, using the *Horn* button to activate the **Horn** and also activating the *F6* or *Doppler* key while the *Horn* button is held down, will cause the *Horn* to shut off instead of causing a Doppler shift effect. We have experienced intermittent and independent *Horn* signal interruption with certain DCC systems, causing unexpected Doppler shifts. If this happens frequently on your layout, you may wish to disable the *Horn-Triggered-Doppler shift* using CV51.2. (See Section 4.2.14.)

6.3 Reed Switch Operation with the Magnetic Wand (Analog and DCC)

An Atlas sound-equipped diesel locomotive that is equipped with a QSI Quantum sound-decoder has a special *Reed Switch* located directly underneath the top of the plastic locomotive shell. This switch can be activated by the Magnetic Wand (included with each Atlas QSI-equipped Gold Series locomotive) without having to disassemble the loco. The reed switch can be used to reset the locomotive parameters to factory defaults, to change the overall volume of your sound system, or to turn on a locomotive that has been shut down. This last capability applies to DC (Analog) operation only.

6.3.1 Resetting your QSI-equipped Gold Series Locomotive to Factory Default Values Using the Magnetic Wand (resets all Analog and all DCC parameters)

Resetting the firmware in the sound-decoder to its factory-built configuration can resolve many problems that can sometimes occur with firmware-controlled electronics. In fact, at Atlas we have found that at least 20 to 25 percent of the problems with Gold Series locomotives that we receive for repair can be resolved simply by resetting the sound-

decoder.   Hence, the next step you take to resolve a problem (after you clean the wheels and track) should **always** be to reset the sound-decoder in your locomotive. With QSI sound decoders, there are two ways to reset the decoder parameters (1) the DCC-only reset described in Section 0 that resets only the DCC CVs and (2) the magnetic wand reset described here that resets both DCC CVs and analog parameters. Since a number of parameters (e.g., sound volumes) are shared between DC and DCC operation, the magnetic wand reset does a better job of resetting the decoder to its original factory configuration than does the DCC-only reset. Hence, Atlas recommends using the magnetic wand to reset your QSI sound-decoder whether your locomotive is normally operated on DC or on DCC.

The following items are needed in order to do a magnetic wand reset.

> **ITEMS REQIRED FOR A MAGNETIC WAND RESET**
> 1. **The Gold Series locomotive that you wish to reset,**
> 2. **The magnetic wand (packed with your locomotive),**
> 3. **The three photographs on pages 7 and 8 of the 12-page *Quick Start Guide* for your locomotive[1] that you can download from the Atlas website:**
>   *Quick Start Guide: DC and DCC Operation of Atlas Gold Series* (scale) (locomotive model) Diesel *Locomotives Equipped with a QSI Quantum Titan (with ET) Sound-Decoder*,
>   ***or* the 4 page booklet packed with your locomotive and titled:**
>   *Magnetic Wand Resetting* (or something similar).
> 4. **A DC- or DCC-powered length of track on which to do the reset,**
> 5. **Either a power pack with a *variable-voltage DC* output or a DCC system.**

The magnetic wand reset procedures given below apply to all Atlas Gold Series locomotives, both HO and Two-Rail O-scale, that have QSI Quantum Titan (with ET) sound-decoders. Resetting with the magnetic wand can be done on either a DC-powered track or a DCC-powered track. However, the procedure differs, depending on whether the track has DC or DCC power. Please note that, whether you are doing the reset on a DC-powered track or on a DCC-powered track, you will be resetting ALL parameters, both DC and DCC.

6.3.1.1   Magnetic Wand Reset Procedure on a DC-Powered Track

1. Turn off all track power to your DC-powered layout.
2. Place your Atlas Gold Series QSI sound-equipped locomotive on a section of track that can be (but is not currently) powered by conventional DC.
3. Examine the photograph(s) of the locomotive in the *Quick Start Guide* or the *Magnetic Wand Resetting* booklet (use whichever booklet is available) to determine where to place the magnetic wand on the top of your locomotive.
4. Place the Magnetic Wand over the reed switch area on the top of the locomotive at the location determined in Step 3 and ***with the metal (shiny silver) part of the wand parallel to the ties of the track and on or just above the top of the locomotive. The magnet (the shiny silver cylinder) should be horizontal with one circular end pointing towards one side (side NOT end) of the locomotive and the other end pointing towards the other side*.** Keeping the wand in the small plastic bag in which it was shipped prevents possible marring or scratching of the locomotive.
5. ***Slowly and gradually apply conventional DC power to your track until the track voltage increases from 0 to approximately 8 to 10 volts*.** If the magnetic wand is in the correct location along the length of the locomotive and the silver part of the wand is parallel to the track ties, the locomotive will not move, and there will be no sound until you hear *Reset* spoken in Step 6 (below).
6. While continuing to hold the magnetic wand on or just above the top of the locomotive, keep increasing the track voltage slowly until you hear the word *Reset* spoken from the locomotive.
7. Caution: if you don't hear the word *Reset* spoken, your locomotive has **NOT** been reset.
8. Pull the Magnetic Wand straight up (away from the locomotive) immediately after you hear *Reset* so that the manual volume adjustment procedure (Section 6.3.2 below) is not activated.

6.3.1.2 Magnetic Wand Reset Procedure on a DCC-Powered Track

1. Turn off all track power to your DCC-powered layout.
2. Set up the DCC system to run locomotive #3. (If you have to turn your DCC system *On* to select locomotive #3, turn it *Off* after completing this step.)
3. Place your Atlas Gold Series QSI sound-equipped locomotive on a currently-unpowered section of track. When the locomotive is on the track, turn DCC track power *On*.
4. Examine the photograph(s) of the locomotive in the *Quick Start Guide* or the *Magnetic Wand Resetting* booklet (use whichever booklet is available) to determine where to place the magnetic wand on the top of your locomotive.
5. Place the Magnetic Wand over the reed switch area on the top of the locomotive at the location determined in Step 4 and **with the metal (shiny silver) part of the wand parallel to the ties of the track and on or just above the top of the locomotive. The magnet (the shiny silver cylinder) should be horizontal with one circular end pointing towards one side (side NOT end) of the locomotive and the other end pointing towards the other side.** Keeping the wand in the small plastic bag in which it was shipped prevents possible marring or scratching of the locomotive.
6. While you are holding the magnetic wand on the top of the locomotive in the position described in Step 5, turn DCC power *On* for the track on which the locomotive is resting.
7. You should hear the word *Reset* spoken, either immediately after you turn DCC track power on or right after you start to advance the DCC throttle.
8. Caution: if you don't hear the word *Reset* spoken, your locomotive has **NOT** been reset.
9. Pull the Magnetic Wand straight up (away from the locomotive) immediately after you hear *Reset* so that the manual volume adjustment procedure (Section 6.2.2 below) is not activated.
10. If you have done the reset successfully, the locomotive should operate as loco #3.

The two procedures in Section 6.3.1.1 and Section 6.3.1.2 work ONLY with those QSI-equipped locomotives that have a magnetic reed switch. All Gold Series Atlas HO and Gold Series Atlas O 2-rail locomotives have a magnetic reed switch; however, some QSI-equipped locomotives from other manufacturers have a jumper wire instead of a reed switch. If your locomotive has a jumper wire to trigger reset, refer to the manual included with your locomotive for reset instructions

6.3.2 Manual Volume Adjustment using the Magnetic Wand (Analog and DCC)

- Examine the three photographs on the last page of the 4-page magnetic wand resetting booklet or the single photo at the top of page 3 of the 4-page locomotive information booklet (use whichever booklet was packed with your locomotive) to determine where to place the magnetic wand on the top of your locomotive.
- Power up the locomotive and leave it in *Neutral*.
- Place the silver part of the enclosed magnetic wand over the reed switch area on the top of the locomotive[73] (parallel to the ties and perpendicular to the rails) and wait as you hear the volume increase or decrease in incremental amounts as the *Horn* hoots about once every second. Move the wand away and again place it over the reed switch 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 Analog and DCC programming sections of this manual.

6.3.3 Turn your Locomotive On using the Magnetic Wand (Analog Only)

If it is operating in Analog (DC track power), your locomotive can be selected (turned on) using the Magnetic Wand.

To Turn On a Locomotive:
Make sure track power is applied. Place the Magnetic Wand over the reed switch area on the locomotive. The lights will come On followed by *Startup* sounds. The locomotive is now turned On and will respond to track voltage and all *Bell* and *Horn* signals.

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[73] The wand does not need to touch the body. It can be held a reasonable distance from the top of the locomotive to prevent possible marring of the painted surface.

6.4 <u>High Voltage Circuit Breaker</u> (applies only to firmware Version 7 with Q1, Q1a, or Q2 hardware)

Your locomotive is designed to operate on the normal track voltage supplied by most variable-voltage DC power packs and most DCC systems. If the track voltage exceeds 21.5 volts peak, the motor drive circuit will automatically shut down, and the locomotive will coast to a stop.   The Quantum System alerts you to the problem through a continuous series of *Horn Hoots*. This built in safety feature protects both the Quantum electronics and the motor from excessive voltage[74].

To restart your locomotive, reduce the track voltage until the hooting stops and the motor drive circuit(s) re-engaged..

6.5 <u>Program Track Operation</u> (DCC)

Atlas Gold Series locomotives conform to NMRA standards for program track operation. However, the Quantum sound system, like most other sound-decoders, requires more current to operate than standard (non-sound) decoders and may not respond to the limited program track power available from many DCC systems. If you cannot program your Atlas Gold Series locomotive on the program track, you have two choices:

- All CV's in your locomotive can be programmed on the main line in *Ops Mode*. If you don't know the loco's current address, reset the sound-decoder using the *Magnetic Wand* (Section 6.3.1) and then program it on the main line using its new address (loco #3).
- Add a *Program Track Booster* between the program track output of your DCC system and the program track. Atlas has found that the *Soundtraxx PTB100 Program Track Booster* solves most problems that occur when programming on the program track. However, if the booster doesn't help, use *Ops Mode* programming on the main track instead.

6.6 <u>Reasons Why Your Locomotive is Silent or Will Not Start</u> (Analog and DCC)

In case your locomotive remains silent after power up, and turning the power off for 15 seconds does not return it to normal operation, try the following suggestions to bring your locomotive back to normal sound operation.

- Make sure that the track and wheels are clean. ***Clean track and wheels are essential for proper operation of sound-equipped locomotives.***
- Make sure the locomotive has not been Muted with the *F8* key.
- Verify that the loco volume has not been turned all the way down manually (using Magnetic Wand) or digitally (by analog or DCC programming).
- You may have shut your locomotive down in DCC using the *F9* key; this shutdown remains in effect in Analog. Go back to DCC operation and start your locomotive by pressing quickly the *F6* key[75] twice. Once started, you can return to either DC or DCC operation. Alternatively, use the Magnetic Wand in Analog which selects and starts the locomotive if it has been shut down. (See Section 6.3.3.)
- If none of the above techniques starts your locomotive, reset the locomotive to its factory default values using the Magnetic Wand, as described in Section 6.3.1.

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[74] 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 all the way up before the engine gains speed, the track voltage will be unusually high and can trigger the high voltage circuit breaker.

[75] It may take a couple of tries to get it started.

REFERENCES

[1] *Quick Start Guide: DC and DCC Operation of Atlas (specific type of your locomotive)[76] Gold Series Diesel Locomotives Equipped with QSI Quantum (Titan™) Sound*-Decoders. Available for download from the Atlas website:

http://www.atlasrr.com/

by going first to *Support*, then to *DCC Support*, and finally to the Atlas *Quick Start Guide* for your particular locomotive, which is listed on the website under the heading *Atlas Quick Start for Locomotives with QSI Quantum Titan Sound-Decoders*.

[2] *DC Analog Reference Manual for QSI Quantum® HO Equipped Locomotives,* Ver 4.0 (or later), 25 August 2006. Available for download from the QSI Solutions website:

http://www.qsisolutions.com/

by first going to the *Literature* tab*.* Then select *Titan Decoder Documents*. Finally, under the heading *Programing Related*, double-click on *Complete DC Reference Manual for All QSI Decoders v4.0*

[3] *NMRA DCC Reference Manual for QSI Quantum 3, 2, and 1 Equipped Locomotives*, Version 5.2.0, 5 August 2015 (or later). Available for download from the QSI Solutions website:

http://www.qsisolutions.com/

by first going to the *Literature* tab. Then select *Titan Decoder Documents*. Finally, under the heading *Programing Related*, double-click on *Complete DCC Reference Manual for All QSI Decoders v5.2.0 full manual; 434 pages.*

[4] *Quantum Engineer™ Add-on Control System*, Version 2.0.1 2, 19 September 2006. Available for download from the QSI Solutions website:

http://www.qsisolutions.com/

by first selecting *Products.* Under *Products*, go to and click on the heading *HO Scale Sound and Power Decoders*. Near the bottom of the box on the right side of the *HO Scale Sound and Power* page click on *Quantum Engineer* which is under the heading *All Scale Products*. Finally, in the box labeled *Quick Links*, double click on *Quantum Engineer User Manual*.

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[76] Such as a GP-7 or a U30B.

Appendix 1.   Features Available for DC and DCC Operation with QSI Sound Decoders (Quantum, Quantum Titan, and Quantum Titan™ with ET)

Sounds & Features Common to Analog & DCC	Analog Features*[77]	DCC Features[77]

Horn and horn hoot
Bell with turn-on/turn-off effects.
High Fidelity sounds
Programmable Bell-tone & ring-rate
Two Independent Prime Movers
- Independent Exhaust
- Independent Labored Exhaust
Prime Mover Rod Knock
Generator Sounds
Diesel Turbo (optional)
Air Dryer and Spitter Sounds
Dynamic Brakes
Prime Mover Component Sounds
Automatic Cooling Fans
Doppler Shift
Brake Squeal or Flange Squeal
Neutral Sounds
Long Air Release
Short Air Release
Air Pumps
Air Brakes
Coupler Sounds
Alternate Horn
Sound of Power™
Neutral State (Idle)
Directional Lighting[78]
- Bright/Dim Front Headlight
- Bright/Dim Rear Headlight
Mars Light (optional)
Number Board lights (optional)
Cab Lights (optional)
Fuel Loading Scenario
Water Loading Scenario
Maintenance Scenario
Ready to Move Scenario
Grade Crossing Scenario
Low Idle Fuel Saver
Regulated Throttle Control
 & Standard Throttle Control
Verbal Feedback
Speedometer
Manual Volume Control
   with Magnetic Wand
Magnetic Wand reset
	Overall System Volume Control
	Individual Sound Volume Control
	Mute Volume
	Regulated Throttle Control
	  and Locomotive Inertia
	Helper Type:
	- Normal loco
	- Lead Loco,
	- Mid Helper,
	- End Helper.
	- Pusher.
	Direction:
	- Normal
	- Reversed
	Power Pack Programming
	- V-Max (12v)
	- V-Start (8.5v)
	- Notch V-max
	Power Pack Type
	Start Up with Magnetic Wand
	QSI QARC™ Operation**[79] (with QSI
	  Quantum Engineer Controller™)
	- Air Brakes
	- Flanges
	- Dynamic Brakes
	- Coupler Sounds
	- Diesel Extended
	    Shut Down
	- Extended Start Up
	- Explicit Lighting
	    Control
	- Controllable Flange
	    Squeal
	- Load on/off toggle
	- Fan on/off toggle
	- Verbal Engine Status
	- Grade Crossing
	    Signal
	- Audio Mute
		F0 or FL light control
		F1-F28 Function Keys
		28/126 speed steps (28)
		Standard NMRA CV's
		Extensive Feature Control
		Odometer
		Individual Lighting
		  Brightness Control
		Choice of 11 Pre-defined Speed Curves
		  or (Versions 8 and 9 only) CV6 = V-Mid
		
		Programming Modes Supported:
		- Address Mode
		- Register Mode
		- Service Mode
		- Direct Mode
		- Ops Mode –Long Form
		- Ops Mode –Short Form

All of the features listed in the above table are available in locomotives that have Quantum Titan™ with ET sound-decoders (Version 9 firmware), but the Quantum (Version 7 firmware) and Quantum Titan (Version 8 firmware) sound decoders do not support some of these features.

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[77] Settings in parentheses indicate factory default.
[78] Directional lighting functionality depends on versions of firmware and hardware installed in locomotive.
[79] QARC[79] Technology allows commands to be sent to locomotives under Analog control to operate different Quantum features.   With QARC technology, you can operate features that are otherwise available only in DCC plus some features that are not yet available in DCC. Quantum Engineer controllers are inexpensive accessories that employ the QARC system. A Quantum Engineer controller can be added to your existing variable-voltage DC power pack to operate additional features on your Quantum-equipped locomotive

Appendix 2. NMRA-Specified CVs Used in QSI Sound Decoders (Quantum, Quantum Titan, and Quantum Titan with ET)

CV	Name	Description	Type	Range Of Values	Atlas Default Value
CV1	Short Address	Short (2-digit) address of loco	NMRA	1 -127	3
CV2	Start Voltage	Sets minimum speed of loco	NMRA	0 – 255	32
CV3	Acceleration Rate	Value multiplied by 0.25 is time in seconds from stop to max speed	NMRA	0 – 255	0
CV4	Deceleration Rate	Value multiplied by 0.25 is time in seconds from max speed to stop	NMRA	0 – 255	0
CV5	Vmax	Speed at highest speed step If 0, use default speed of 255	NMRA	0 – 255	1
CV6	Vmid	Speed at middle speed step (step 14 for 28 steps, step 63 for 128 speed steps) – not available in Version 7	NMRA	0 –255	0
CV7	Version Number	This CV stores the version number of the decoder firmware	NMRA	-	7, 8, or 9
CV8	Manufacturer's ID	This CV contains NMRA ID # for the manufacturer' of the decoder	NMRA	-	113
CV11	Packet Time-Out Value	Maximum time decoder will maintain its current speed without receiving a valid DCC packet	NMRA	0-255	0
CV17	Extended Address	Long (4-digit) address; see Section 4.2.3 for long address programming information	NMRA	0 - 255	0[80]
CV18				0 - 255	0
CV19	Advanced Consist Address	Address for operating an Advanced Consist; see Section 5.2.3 in Ref. 1 for programming information	NMRA	1 - 127	0
CV21	Consist Mode Function Status #1	Specifies function keys (F1-F8) enabled when loco addressed by its Consist number	NMRA	0 - 255	0
CV22	Consist Mode Function Status #2	Specifies function keys (F0, F9-F12) enabled when loco addressed by Consist number	NMRA	0 - 255	0
CV23	Acceleration Adjustment	Increases or decreases acceleration from base acceleration rate in CV3	NMRA	0 - 255	0
CV24	Deceleration Adjustment	Increases or decreases deceleration from base acceleration rate in CV4	NMRA	0 - 255	0
CV25	Speed Table Selection	Use to select one of 11 pre-defined QSI speed curves; see Section 3.16 of Ref [3]	NMRA	0 - 255	2 (linear)
CV29	Configuration Register	See Section 4.2.4 for programming information	NMRA	0 - 255	6
CV66	Forward Trim	Scale factor for multiplying motor drive voltage when moving forward	NMRA	0 - 255	128
CV67 to CV94	User-defined Speed Steps 1 to 28	Specifies relative voltages applied to motor at each speed step	NMRA	0 - 255	See list of default values in Section 2.3 of Reference [3]
CV95	Reverse Trim	Scale factor for multiplying motor drive voltage when moving in reverse	NMRA	0 - 255	128

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[80] The default value for CV17 is actually 192.

Appendix 3. Some QSI-Specific CVs Used in QSI Sound-Decoders (Quantum, Quantum Titan, and Quantum Titan with ET)

CV[81]	Name	Description	Type	Range of Values	Atlas Default Value
CV49	Primary Index Register (PI)	Specifies the Primary Index for a CV that is implemented as a 1-dimentional or (with CV50) a 2-dimentional array	QSI	0-255	0
CV50	Secondary Index Register (SI)	Specifies the Secondary Index for a CV that is Implemented as a 2-dimentional array	QSI	0-255	0
CV51.PI	Overall Sound Control	Controls various parameters (e.g., overall volume) of a QSI sound-decoder (See Section 5.4 of Ref. [3].)	QSI	0-255	0
CV52.PI	Individual Sound Volume Control	Controls volumes of individual sounds; (See Section 5.5 of Ref [3].)	QSI	0 - 255	0
CV53.PI.SI	Function Output Mapping	Use to assign QSI features to the 30 decoder outputs	QSI		
CV55.PI.SI	QSI Feature Configuration	Use to configure the behavior of Quantum features	QSI		
CV56.PI.SI	QSI Configuration	Use to access Quantum Configuration settings	QSI		
CV56.128.255	Reset	Resets DCC parameters only when set CV56.128.255 to the value 113. (Analog parameters are unchanged.)	QSI		
CV56.255.SI	Version Build Information	Use this CV in Ops Mode to hear the locomotive Speak out information about its firmware	QSI		
CV62	Auto CV Verbal Feedback	Use to control Programming Verbal Acknowledgement and CV Numeric Readout	QSI		1 (enabled)
CV64	Verbal CV Inquiry	Use to hear the locomotive speak the value of any CV as a decimal number (Ops Mode programming only)	QSI	1 - 255	
CV115.PI.SI	Feature to Port Mapping	Use to map features, such as lights, to port numbers that correspond to pins on the sound-decoder board	QSI		
CV116.PI	Individual Sound Balance	Use to balance volumes of individual sounds (systems with 2 stereo speakers)	QSI	0 - 255	
CV117.PI.SI	Individual Sound Selection	Use to select sounds from onboard QSI sound libraries	QSI		
CV118.PI	Individual Sound Pitch Shift	Use to shift pitch of an individual sound from the nominal pitch	QSI	0 - 255	
CV120.PI.SI	Ready to Move Scenario	See Section 4.2.15 in this document or Section 7.5 in Reference [3].	QSI		

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[81] The notation CVn.PI means that CV #n is single-indexed with primary index PI. The notation CVm.PI.SI means that CV number m is double-indexed with primary index PI and secondary index SI. See Section 4.2.2 **for a discussion of Indexed CVs.**

Appendix 4.   Selecting the Type of Horn

As described in Section 0, it is possible for the user to choose (separately for the *Primary Horn* and for the *Alternate Horn*) among numerous (currently143) different horns. Two doubly-indexed CVs are used to select the type (or types) of horn(s) to be used for the *Primary Horn* and for the *Alternate Horn*:

- CV55.1.1 is used to select the *Primary Horn*;
- CV55.1.2 is used to select the *Alternate Horn*;

To specify a particular horn

- Set the primary index to "1" (CV49 = 1) to specify that you want to choose a particular type of horn;
- Set the secondary index (CV50)) to the value corresponding to the horn that you wish to select
  - CV50 = 1 for the *Primary Horn*,
  - CV50 = 2 for the *Secondary Horn*,
- Then set CV55 to the value that corresponds to the horn you wish to use. A list of the values of CV55 and the type horn corresponding to each value may be found in the three tables below.

Table 11a - Using CV55.1.SI to Change the Type of Horn

CV55 Values for Special Horns	Type of Horn	Number of Chimes	Notes
1	Native Horn	Assigned by Cut & Paste	Q2 Upgrade Required
2	User Defined Horn	1 to 6	CV Manager Required
CV55 Values for Buell Horns	**Type of Horn**	**Number of Chimes**	**Notes**
10	Single Chime	1	
11	Single x2	1x2	
12	3 Chime	3	
13	5 Chime	2	
CV55 Values for Leslie Horns	**Type of Horn**	**Number of Chimes**	**Notes**
19	RS-3L	3	
20	S-2A	2	20
21	S-2B	2	21
22	S-2G	2	22
23	S-2H	2	23
24	S-2M	2	24
25	S-3B	3	25
26	S-3C	3	26
27	S-3E	3	27
28	S-3J	3	28
29	S-3K	3	29
30	S-3L	3	30
31	S-3P	3	31
32	S-4T	4	32
33	S-5A	5	33
34	S-5D	5	34
35	S-5T	5	35
36	A-125-200-3G	3	36
37	A-125-200-3H	3	37
38	A-125-200-5B	5	38
39	A-125-200-5C	5	39
41	A-125-3F	3	41
43	A-125-5A	5	43
42	A-125-4A	4	42
45	A-125-75-262 x2	1x2	45
46	A-75-330	1	46
47	A-75-330 x2	1x2	47
48	A-75-440	1	48
49	A-125-200 Combo	2	49
50	A-125-206	1	50
51	A-125-206 x2	1x2	51

Table 11b -- Using CV55.1.SI to Change the Type of Horn (cont. 1)

CV55 Values for Leslie Horns (cont.)	Type of Horn	Number of Chimes	Notes
52	A-125-247	1	52
53	A-125-247 x2	1x2	53
54	A-125-277	1	
55	A-125-277 x2	1x2	
56	A-125-311	1	
57	A-125-311 x2	1x2	
58	A-125-349	1	58
59	A-125-349 x2	1x2	59
60	A-125-440	1	60
61	A-125-440 x2	1x2	61
62	A-200-156	1	62
63	A-200-156 x2	1x2	63
64	A-200-233	1	64
65	A-200-233 x2	1x2	65
CV55 Values for Nathan/Airchime Horns	**Horn**	**Number of Chimes**	**Notes**
	H5-1	5	
70	H5-2	5	
72	H5-3	5	
73	H6	6	
74	K3	3	
75	K3H	3	
76	K3Ha	3	
77	K3L	3	
78	K3LA	3	
79	K3LL	3	79
80	K5	5	80
81	K5H	5	81
82	**K5L**	**5**	**82**
83	K5LA	5	83
84	K5LA Amtrak High Pressure	5	84
85	K5LA Amtrak Low Pressure	5	85
86	K5LAM	5	86
87	K5LL	5	87
88	K5LLA	5	88
89	K5LLLA	5	89
90	K6LA	6	90
91	M3	3	91
92	M3-1	1	92
93	M3-1 x2	1x2	93
94	M3-12	2	94
95	M3H	3	95
96	M5	5	96
97	M5 (Burnett Tuning)	5	97
98	M5-124	3	98
99	M5H	5	99
100	MS1	1	100
101	MS2	1	101
102	MS3	1	102
103	P3	3	103
104	P5	5	104
105	P5A	5	105
106	P5S	5	106

Table 11c -- Using CV55.1.SI to Change the Type of Horn (cont. 2)

CV55 Values for Prime Horns	Horn	Number of Chimes	Notes
110	PM920 1st Gen	3	
111	PM920 2nd Gen	3	
112	PM920 3rd Gen	3	
113	PM990 1st Gen	3	
114	PM990 2nd Gen	3	
CV55 Values for WABCo Horns	**Horn**	**Number of Chimes**	**Notes**
120	A-1	1	
121	A-1 x2	1x2	
122	A-1#2	1	
123	A-1#2 x2	1x2	
124	A-2	1	
125	A-2 x2	1x2	
126			
127	AA-2	2	127
128	B-7-21	1	128
129	B-7-21 x2	1x2	129
130	B-7-25	1	130
131	B-7-25 x2	1x2	131
132	D-5 Long	1	132
133	D-5 Long x2	1x2	133
134	D-5 Short	1	134
135	D-5 Short x2	1x2	135
136	DD-5	2	136
137	E-2	1	137
138	E-2 x2	1x2	138
139	E-2B4	1	139
140	E-2B4 x2	1x2	140
141	E-2B-1	3	141
142	E-44	1	142
143	E-44 x2	1x2	143

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