

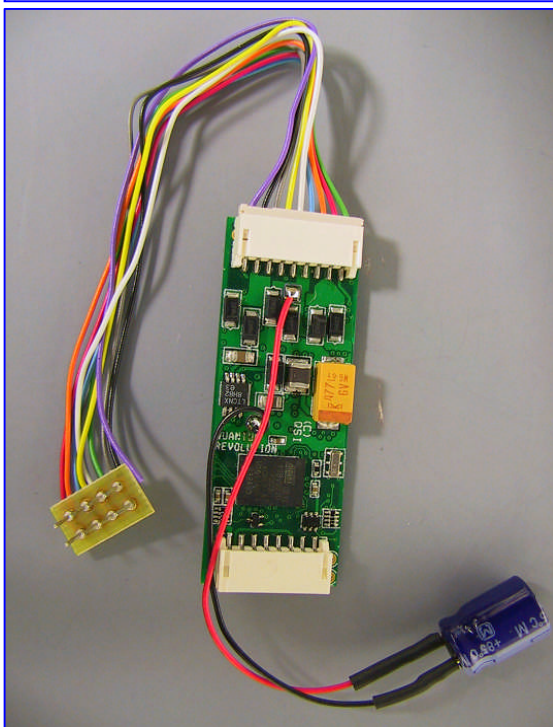


At QSI Solutions we pride ourselves in offering our unequalled Customer support. If you need help please call 800-671-0641

QUANTUM TITAN-U

Universal, PnP Format, Advanced **Stereo/Mono**
DCC Sound and Power Decoder!
User Operations Manual, Titan-U

Notes: For Athearn: #1 Speaker in Nose and #2 Speaker in Rear.	Software ID Gas Turbine Locomotives
	5100-760



Rev B 10/5/11

Manual Reset Options See Page 10

*U.S. Reissue Patent Number RE38,660



Quick Start

At QSI Solutions we pride ourselves on our unequalled Customer support. If you need help please call 800-671-0641

Note: The Quantum Titans are designed to operate in both Mono and Stereo Modes, more than one speaker is not necessary to get the complete sound spectrum of the Titans advanced technology!

1. If before you familiarize yourself with the operations manual, you want to test, explore and appreciate the great sound and performance features offered in the QSI, Titan Decoder, then please review the information listed below!
2. Observe Anti-Static Precautions!
3. Insure your test area is free of metal debris from sanding, filing, drilling etc is clean and well lighted!
4. Familiarize yourself with the decoders DC/DCC Inputs, motor outputs and lighting outputs.
5. Connecting these incorrectly will most likely let the smoke out. See: Pg-7
6. Test the decoder before installing, **DO NOT ATTEMPT TO PROGRAM NOW!**
7. Use a decoder tester if you have one, if not you can use alligator clips to make the necessary connections. This should be done with care to avoid possible inadvertent contact of the alligator clips to each other that may short the decoder. Use tape to keep the wires/connections from moving.
8. You can use a 12v-16v bulb to simulate the motor. Its intensity will vary according to your throttle speed setting. Make sure your test speaker is 8 ohm.
9. After you are sure all your connections are correct and will not short connect your test set up to either an HO, (10v-14v), DC or DCC Power Unit.
10. In DC you will need to increase the throttle to about 7v to fire up the sounds, etc
11. In DCC, select ADD=3, the factory default, and advance the throttle and the decoder will function.
12. Test all lighting functions you may have connected.
13. After you verified the decoder is operating properly then program as you wish!

Warning: If you are using the Titan's 8 Pin, NMRA plug to plug a Titan-U or- A/U into your DCC ready locomotive's socket; Please check the bottom and top of the Loco sockets first to see that the sockets are not shorted to each other due to poor soldering. Poor soldering may create a solder bridge between the sockets causing a direct short and a damaged decoder.

Special Precautions

1. Do not use too much heat when soldering. A 15 to 25 watt iron is ideal.
2. Never touch the speaker or motor wires together
3. Stereo requires two speakers. Identify the + and – terminals on your speakers before installing.
4. There are no in additional resistors required when using 12-16 v bulbs
5. If you remove and re-install the capacitor observe the correct polarity. **Red is +**

Quantum Titan-U: User Operations Manual, Table Of Contents

Bold Green Type Indicates New Feature or New Content!

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1: Welcome to the Age of the Titans!

Thank you and congratulations; you have entered the age of the Quantum Titan, the most feature-packed, and technologically advanced decoder in history. Never before has so much flexibility and so many features been combined in so small a package

1a: Titan Features and Specifications

1: 64 Stereo or 128 Mono Channels: The Most EVER in a decoder!

2: 10 CV Selectable Lighting Outputs: Easily change your lighting behavior through simple CV's. Any port can be assigned to any of the following functions:

- Headlight
- Reverse Light
- Number Board Lights (front and rear)
- Marker Lights (front and rear)
- Cab Lights (front and rear)
- Mars Light (front and rear)
- Ditch Lights (front and rear, requires two ports per set of ditch lights, horn or bell triggered strobe effect)
- Beacon Lights (front and rear)
 - Prime Beacon
 - Prime Beacon X4 (Titan Exclusive, requires four ports which blink sequentially to simulate 4 lights rotating in one 1 housing)
 - Rotary Beacon
 - Strobe Light
 - Blinking Light

3:QSI's Legendary Motor Control: RTC (Regulated Throttle Control/BEMF) – for supreme low speed

performance, smooth acceleration, braking, and incomparable power sharing between locomotives in a consist. (Have you ever dared to try and prototypically consist a helper at the rear of a train? RTC makes it possible.)

4: Load-responsive exhaust sounds: Unmatched "Sound of Power," SOP

5: Verbal Reports: CV, speed, scale MPH, and status reporting.

6: User Controlled Sound-of-Power: For even more control over the exhaust sounds.
(See 4a)

7: Dual-mode operation: Designed to run on DC or DCC.

8: Advanced Analog™: All sound features available in DCC are available in DC using the **Quantum Engineer** add-on controller, (sold separately), to your DC power pack.

9: Upgradable With Quantum Programmer: Like the Revolution Series and the Q1a chips before them, Titan is fully upgradable/customizable with the **Quantum Programmer**

(sold separately).

10: Features Configurable for Automatic or User Control: Many features happen automatically as a function

of the directional state of the locomotive however if the user desires full, hands on, control it's easily programmable.

11: Use of Lenz USP Technology: Offers improved performance on dirty track and in locos with poor pick up. (Power 1/Power 3 Module Sold Separately)

12: "Ready To Move" Scenarios: Your loco can blow the horn and turn the bell on automatically when you first leave the station or when you've just arrived again!

13: New Sounds: Load the fuel, fill with water even bring her in for maintenance all at the press of a button.

1b: Quantum Titan Specifications

Dimensions: Titan-A, 0.99" x 2.86", Titan-U, 2.13" x 0.69"

Maximum Peak Voltage: 25v

Steady State Current: 1.3 Amps

Stall Current (1 sec): 2+ Amps

Speaker Load: 8 ohms x2

Audio Amplifier: Advanced D Style Format (2 watts)

Light Outputs: 10 with 256 Intensity levels ea.

Function Current: 100ma

2: Installation Overview

As model railroaders, we understand the need for instant gratification when we get a new locomotive or decoder. We ask you to defer this for a moment or two while we go over some installation specifics. These days, most manufacturers produce DCC-ready locomotives – meaning that DCC installation is oftentimes literally a snap (which is the case with the **Titan A**)! However, before you highball into your installation, there are a few things you should do beforehand that will make things a lot easier in the long run.

1: Read this ENTIRE manual! (We know – yuk!)

2: Remember that decoders are *static-sensitive* devices. *Always* discharge any static electricity you may have built up by *touching a grounded pipe or a piece of sheet metal* **before** beginning your installation.

3: Make sure you have a clean, well lighted area consisting of a non-conductive surface on which to perform your installation.

4 Never do installation work with power applied to the decoder. This can burn up the decoder. We all love engines that smoke – but this is the wrong way to get it!

5: Never touch your speaker output leads together.

6: Never touch your motor output leads together.

7: Never exceed the designated output ratings specified in section 1B.

8: Work carefully, take your time and have fun. (What may be frustrating tonight probably won't be tomorrow.

2a: Preparing Your Locomotive; Pre-Install Precautions

This Section Not necessary for Athearn Turbines as They are Ready For Installation

We've already covered a few of the things that you don't want to do when installing your decoder. Now let's look at some things you *do* want to do to get your locomotive ready to roll.

1st: Isolate the motor. This is one of the most critical aspects of any DCC decoder installation, regardless of make or model. You **MUST** make sure your motor no longer receives ANY power directly from the track. In other words,

if you can find pick-up wires going directly from one side of your wheels/trucks to the motor terminals, you'll want to disconnect them where they connect to the motor *not from the trucks*. Disconnecting them will keep the DCC from "backfeeding" into the decoder and burning it up (see Step 5 of Section 2 regarding "smoke"!).

Note that on certain locomotives the motor draws power directly from 2 sides of a split frame, which the motor is enclosed inside. Isolating this type of motor can be more difficult and can require insulation of the inner parts of the frame. If you have any doubt about the type of motor set-up you have, please contact QSI Solutions for clarification before proceeding with the installation.

Most modern models already have the motor isolated. If the locomotive instructions say anything about it being "DCC Ready," then your model already has the motor isolated.

2nd: Trace your wires. By identifying which wire goes where, you'll make things a lot easier. We recommend you devise some method of marking the wires once you have them traced out. That way, when you want to reconnect that headlight, you won't be left sitting there, looking at a bundle of wires, thinking uhhhhhhh.....

2b: Pre-Installation loco modifications

Now that you've isolated your motor and traced your wires, it is time to figure out where to put that speaker. In steam locomotives, this is often pretty easy since most tenders are reasonably open inside. In diesels, it tends to be a bit more difficult. We'll outline a couple ideas and let you decide.

2c: Speaker Selection

Since we've talked about *where* you're going to put the speaker, let's take a step back and talk about which speaker you're going to use. QSI offers a plethora of new with varying frequency responses – which means you now have many options. We recommend you experiment, so that you can decide how much modification you're willing to do to accommodate a particular speaker. Hint: Be sure to use some type of baffle (enclosure) with your speakers. You can either use one of the available speaker enclosures, or with appropriate "sealing," the body shell itself. If you're unsure about what kind of speaker you're going to need, feel free to call QSI Solutions for recommendations.

Next, make the final decision on where you'll put your speaker(s). Some locomotives have a cover on the fuel tank that, when removed, reveals a weight that can also be removed. This is actually one of the better configurations, because it accommodates the largest speaker. Another option includes: removing weight from the top of the frame and broadcasting the sound out, prototypically, through the exhaust fan grills. The last (and possibly most common) configuration is to remove any cab detailing and locate your speaker in the remaining open space.

2d: Installing and Wiring Your Decoder

Below are color coded diagrams showing the pin outs on the connectors and their respective functions.

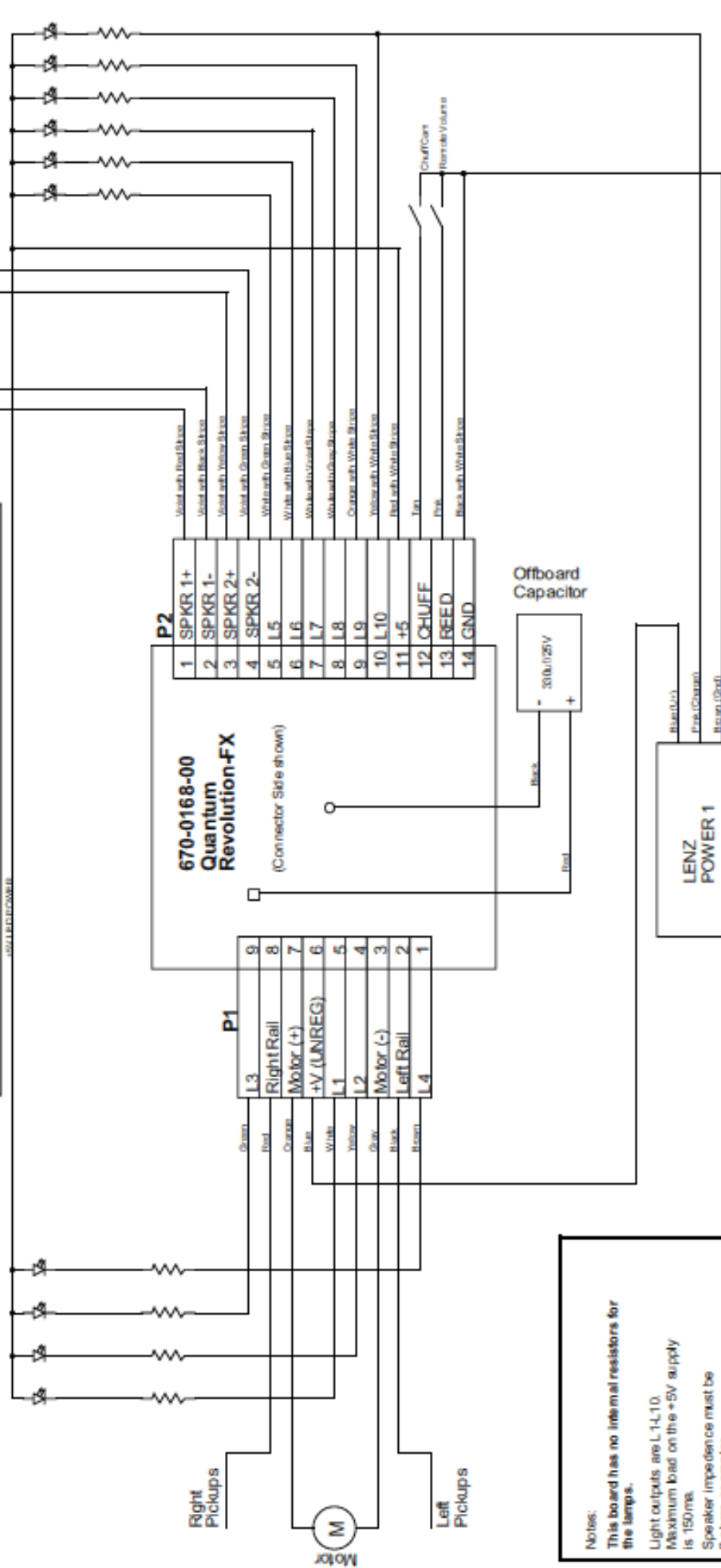
P1	Function	Color Code	Comments
9	F3	Green	L3 *Value 3 In CV 115
8	Right Rail	Red	
7	Motor +	Orange	
6	+V	Blue	(Track Voltage) - 1.5v+V
5	Front Light	White	L1 *Value 1 in CV 115
4	Rear Light	Yellow	L2 *Value 2 in CV 115
3	Motor -	Gray	
2	Left Rail	Black	
1	F4	Purple	L4 *Value 4 in CV 115
P2	Function	Color Code	Comments
1	SPKR 1+	Violet w/ Red Stripe	Must Match Polarity of Pin 3
2	SPKR 1 -	Violet w/ Black Stripe	Must Match Polarity of Pin 4
3	SPKR 2+	Violet w/ Yellow Stripe	Must Match Polarity of Pin 1
4	SPKR 2-	Violet w/ Green Stripe	Must Match Polarity of Pin 2
5	F5	White w/Green Stripe	L5 * Value 5 in CV 115
6	F6	White w/Blue Stripe	L6 *Value 6 in CV 115
7	F7	White w/ Violet Stripe	L7 *Value 7 in CV 115
8	F8	White w/ Grey Stripe	L8 *Value 8 in CV 115
9	F9	Orange w/ White Stripe	L9 *Value 9 in CV 115
10	F10	Yellow w/ White Stripe	L10 *Value 10 in CV 115
11	5v+	Red w/ White Stripe	5 volt common
12	Chuff	Tan	For cam sync steam chuff
13	Reed	Pink	to Ground for hard reset
14	Ground	Black w/ White Stripe	

*CV 115 Programming Table is on Pg.25

See Complete Diagram on Next Page

Problems: Try the Reset First!

Manually Re-set your loco to defaults by using Pins 13 & 14 of P2. Turn-off power, connect P2-13 to P2-14, Turn on power, and the decoder will say "Reset" and will be restored to prior default settings. Remove connection.



Notes:

- This board has no internal resistors for the lamps.
- Light outputs are L1-L10.
- Maximum load on the +5V supply is 150mA.
- Speaker impedance must be 8 ohms or greater.
- Continuous track current must not exceed 1.25A.
- Peak track current must not exceed 2.0A.
- QSI's standard wire colors shown, actual wire colors may differ.

When using LENZ POWER 1, L10 is not supported. Software must be configured via CV Menu per.

PG-7

Q S Industries, Inc.
 3800 SW Cedar Mill Blvd. Suite 224
 Beaverton, OR 97005 USA
 PH: 503-263-0000 FAX: 503-263-0000

This Quantum Titan -J Wiring Diagram
 Date: _____ Rev: _____
 670-0168-01 WD

If you've followed our instructions so far, you should already know what this section covers because you've already read the entire manual, right? That being the case, you should also have accomplished the following:

- 1: You've verified that your motor is isolated
- 2: You've traced your wires so you know where they all go
- 3: You've figured out a location for your speaker
- 4: You've performed any modifications necessary to fit the selected speaker into said location

The Quantum Titan U is equipped with an 8-pin NMRA plug, which will allow you to plug it in to most "DCC Ready" locomotives without much modification. If you accidentally reverse the connection of the 8-pin plug the only thing that will happen is the locomotive will run in the opposite direction of what your handheld says. It is also equipped with a 9-pin JST connector that enables it to be quickly plugged into Athearn "Ready to Roll" models and Mantua classics series using the 9 pin "quick plug" assembly. While it is possible to plug the 9-pin connector in backwards you would have to really force it. If you look closely at the side of the plug assembly you'll notice that it has locating notches that show you the correct direction to plug it in. In most cases simply plugging the decoder in is all you'll need to do to get it running. You will need to solder the speaker wires to the speaker(s) if only using 1 speaker than polarity is not important. If using full stereo output you'll want to make sure that both speakers are connected the same way to insure proper phasing.

P1 (Connector, 9 Pin JST Format)

Green: Is for the extra light function tied to F3 on this decoder it is for an optional Mars light (note: Athearn Turbines require this light to be isolated from the factory installed board)

Red: Connects to the right hand rail pick-up wires coming from the trucks

Orange: Connects to the + Motor Wire

Blue: Is the 12v common for this decoder. If using an 8 pin plug this will be the common that is connected to the plug itself. This common is good for use with 12-16v bulbs. This also serves as the power supply when using the Lenz USP connection.

NOTE* If using 1.5v bulbs or LED's we recommend that you use the +5 common from P2 as this will give you a lower voltage output and therefore require less resistance when using low voltage lights.

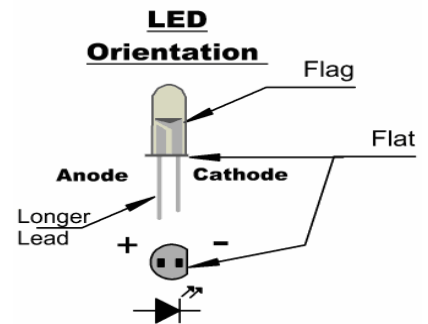
White: Connects to one wire for the headlight or the Cathode of an LED (see diagram)

Yellow: Connects to one wire for the reverse light or the Cathode of an LED (see diagram)

Gray: Connects to the - Motor Wire

Black: Connects to the left hand rail pick-up wires coming from the trucks

Purple: Is for the extra function tied to F4.



P2 (Connector 14 Pin JST Format)

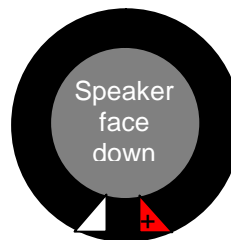
Striped Violet: Speaker wires, see below.

Red Stripe: Speaker 1 +

Black Stripe: Speaker 1 -

Yellow Stripe: Speaker 2 +

Green Stripe: Speaker 2 -



Note: All round and oval QSI Speakers with unmarked terminals are polarized as in the picture to the left.

***Note: Stereo output requires use of two speakers. It is recommended you place the speakers as far apart from each other, fore and aft, as possible.**

White/Green Striped: Is for the extra light function tied to F5.

White/Blue Striped: Is for the extra light function tied to F6

White/Violet Striped: Is for the extra light function tied to F7 In

White/Grey Striped: is for the extra light function tied to F8

Orange/White Striped: is for the extra light function tied to F9

Yellow/White Striped: is for the extra light function tied to F10 Also used in connection of Lenz U.P.S. Capacitors.

Red/White Striped: Is the 5v common for this decoder. If using LED's or low voltage (1.5v) bulbs you will use this common as less resistance will be required than with the blue 12v

Tan: This is for connecting a chuff cam sensor. This is not a required installation step but some users still like to use these kinds of sensors. If you are using this feature you will also need to set CV56.0 to a value of 16 to enable cam synchronized chuff. (Program CV49=0, then CV56 =16)

Pink: This wire forms one part of the reed switch connection. The other wire from the reed switch will go to the ground wire. **NOTE* Use of a reed switch is heavily encouraged for DC operators.**

Black/Striped: Is the ground wire. This is used to form the other end of the reed switch connection, isolated cam connection and/or Lenz USP connection.

Once your speakers are installed issuing any sort of command (be it applying DC track voltage or issuing a function command on your DCC system) you should hear your newly-equipped locomotive thunder to life. Congratulations! You've done it! That wasn't nearly as hard as you thought it was going to be was it? At this point you have our permission to have a celebratory cocktail!

3: Programming Your New Decoder

Now that you've got it installed, let's take a look at programming some of the CVs in your decoder. This section is primarily for DCC users – but you can also do it DC; it just requires some different steps. First we'll cover DCC programming, then programming with a DC power pack.

If you get into trouble you can reset the decoder by entering the following CV's in the order listed. **THIS WILL NOT AFFECT THE SOUNDS LOADED IN THE DECODER!**

CV 49 = 128

CV 50 = 255

CV 56 = 113

The decoder will speak the word "RESET" when the last CV is entered (if done on the mainline) OR when power is next applied (if done on the program track)

QSI's: Exclusive Decoder Talk Back Feature:

All QSI Decoders have a unique, exclusive "Talk Back Feature" when using OPS-Mode Programming. These decoders actually "Talk Back" to the user via the decoders Verbal Announcement feature to tell the user the values of programmed CV's.

CV62 governs the exclusive "Talk Back".

This can be extremely handy as it confirms that the decoder has not only acknowledged the information, but taken it as well. . Especially when programming indexed CV's as the decoder will speak back the entire 3 decimal value when programming is complete. (example: if you program CV 56.18.1 the decoder will say "CV Five Six point one eight point one equals xxx)

This works well with most DCC Systems .

3a: Basic Operational CVs

Programming of all CVs in this decoder is performed according to the instructions provided with your DCC system.

It should be noted that due to the relatively high in-rush current required to run this decoder, most systems require

It to be programmed on the main line (or in "Ops Mode"). If that's a problem with your particular DCC system, you can purchase a program track booster called the PowerPax from DCC Specialties that will remedy the problem.

NOTE: These CV's are grouped so that similar CV's are together.

CV#	CV NAME	DEFAULT	RANGE
1	Primary Address	3	1-127
17	Extended Address Lower Byte	192	*
18	Extended Address Upper Byte	0	*
29	Configuration Data #1	6	0-55
2	Vstart (start voltage)	8	0-255
5	Vhigh (top speed)	1	0-255
6	Vmid (mid speed)	0	0-255
3	Acceleration Rate (momentum)	0	0-255
4	Deceleration Rate (momentum)	0	0-255
51.0	Master Volume	127	0-127
52.0	Horn Volume	11	0-15
62	Verbal Announcement "Talk Back Feature"	1 (ON)	0-1 0(Off)

*= Special Range; See Below

QSI CV's

QSI Uses Several Unique CV's in their decoders, these have up to 3 parts.

Example: CV 55.70.1

1. 55 is the CV Number (think of this as a room in a house)
2. 70 is the Primary Index (think of this as a closet in the room)
3. 1 is the Secondary Index (think of this as a shelf in the closet)

CV: 1 Primary Address: If you're going to use a short address (between 1 and 127) you can simply enter that address as the value of CV1.

CV: 17/18 Extended Address: CVs 17 and 18 are known as a "paired" CV, meaning that the two CVs *together* hold one piece of information. If your DCC system does not compute the values of CV17/18 for you, here is a way to compute the values, by using a different value in each CV to "build" the address you want. To determine the values that are placed into these CVs use the following equation.

A. Start with the locomotive address; divide it by 256

$$\text{Sample } 4449 \div 256 = 17.379$$

B. Take the whole number (17) and add 192.

$$\text{Sample } 17 + 192 = 209$$

C. Program the value (209) in step B is into CV17.

D. Multiply the whole number (17) from step A by 256.

$$\text{Sample } 17 \times 256 = 4352$$

E. Subtract the loco address from the computed value in step D.

$$\text{Sample } 4449 - 4352 = 97$$

F. Program the value (97) in step E is into CV18. (Some system may require a 0 to be placed in front of numbers less than 100. That would make the 97 a 097.)

G. To activate 4 digit addressing a value of 32 (bit 5) needs to be added to CV-29.

CV: 29, Configuration Data 1: CV29 controls 4 things at one time. First, it controls which speed table is accessible in the decoder (i.e., 14, or 28/128 speed steps). Second, it determines whether or not your locomotive will still run in analog mode (analog mode conv.). Third, it tells the locomotive which direction is its “normal” travel direction. Lastly, it determines whether your loco will accept a 2 or 4 digit address. For the specific value to enter use the reference chart below.

CV29 Look-Up Table

CV Value for CV29: Hex or	Dec	Speed Step / Speed Table	Analog Mode	Normal Direction	2/4 Digit Add
X00 HEX	0	14	Off	Forward	2
X01	1	14	Off	Reverse	2
X02	2	28/128	Off	Forward	2
X03	3	28/128	Off	Reverse	2
X04	4	14	On	Forward	2
X05	5	14	On	Reverse	2
X06	6	28/128	On	Forward	2
X07	7	28/128	On	Reverse	2
X10	16	14 Speed Table	Off	Forward	2
X11	17	14 Speed Table	Off	Reverse	2
X12	18	28/128 Speed Table	Off	Forward	2
X13	19	28/128 Speed Table	Off	Reverse	2
X14	20	14 Speed Table	On	Forward	2
X15	21	14 Speed Table	On	Reverse	2
X16	22	28/128 Speed Table	On	Forward	2
X17	23	28/128 Speed Table	On	Reverse	2
X20	32	14	Off	Forward	4
X21	33	14	Off	Reverse	4
X22	34	28/128	Off	Forward	4
X23	35	28/128	Off	Reverse	4
X24	36	14	On	Forward	4
X25	37	14	On	Reverse	4
X26	38	28/128	On	Forward	4
X27	39	28/128	On	Reverse	4
X30	48	14 Speed Table	Off	Forward	4
X31	49	14 Speed Table	Off	Reverse	4
X32	50	28/128 Speed Table	Off	Forward	4
X33	51	28/128 Speed Table	Off	Reverse	4
X34	52	14 Speed Table	On	Forward	4
X35	53	14 Speed Table	On	Reverse	4
X36	54	28/128 Speed Table	On	Forward	4
X37	55	28/128 Speed Table	On	Reverse	4

CV:2, V Start: This CV dictates the amount of voltage that is applied to the motor when the throttle is first increased. The higher the value you more voltage will be applied when you first crack the throttle. If your loco stutters at low speeds increasing CV2 will often remedy the problem.

CV:5, V High: This CV dictates the top speed that the locomotive can reach. The greater the value in this CV the lower the top speed.

CV:6, V Mid: This CV dictates the midpoint between your start voltage (value CV2) and your top voltage (value CV5) Using these 3 CV's allows the user to quickly and easily build a custom speed curve.

3B Sound Control CV's Programming Indexed QSI CV's

Below are the indexed CV's for the various volume controls in the Titan as well as important system CV's. Take a moment to study the chart below and then read the information below for the explanation of how indexed CV's are programmed.

Individual Sound Vol. CV's	CV	CV50	CV49	CV52	Effect
Horn Volume	52.0	X	0	0-15	0= Minimum Volume. 15= Maximum Volume
Bell Volume	52.8	X	8	0-15	0= Minimum Volume, 15= Maximum Volume
Motor Volume	52.10	X	10	0-15	0= Minimum Volume, 15= Maximum Volume
Turbine Whoosh Volume	52.13	X	13	0-15	0= Minimum Volume, 15= Maximum Volume
Turbo Volume	52.14	X	14	0-15	0= Minimum Volume, 15 = Maximum Volume
Turbine Whine Volume	52.15	X	15	0-15	0= Minimum Volume, 15= Maximum Volume
Air Pump Volume	52.16	X	16	0-15	0= Minimum Volume, 15= Maximum Volume
Cooling Fan Volume	52.19	X	19	0-15	0= Minimum Volume, 15= Maximum Volume
Long Air Let-off Volume	52.21	X	21	0-15	0= Minimum Volume, 15= Maximum Volume
Short Air Let-off Volume	52.22	X	22	0-15	0= Minimum Volume, 15= Maximum Volume
Squealing Brakes Volume	52.24	X	24	0-15	0= Minimum Volume, 15= Maximum Volume
Dynamic Brake Fan Volume	52.28	X	28	0-15	0= Minimum Volume, 15= Maximum Volume
Coupler Volume	52.34	X	34	0-15	0= Minimum Volume, 15= Maximum Volume
Air Brakes Volume	52.37	X	37	0-15	0= Minimum Volume, 15= Maximum Volume
Alternate Horn Volume	52.40	X	40	0-15	0= Minimum Volume, 15= Maximum Volume
User Sound Effect Volume	52.46	X	46	0-15	0= Minimum Volume, 15= Maximum Volume
Crew Talk Volume	52.52	X	52	0-15	0= Minimum Volume, 15= Maximum Volume
Water Loading Volume	52.53	X	53	0-15	0= Minimum Volume, 15= Maximum Volume
Fuel Loading Volume	52.55	X	55	0-15	0= Minimum Volume, 15= Maximum Volume
Maintenance Volume	52.56	X	56	0-15	0= Minimum Volume, 15= Maximum Volume
Quantum Configuration CV's	CV	CV50	CV49	CV56	Effect
System Configuration	56.0.0	0	0	0-1	0= Sound Off at Powerup 1= Sound on at Powerup
Throttle Mode (STC and RTC)	56.4.0	0	4	0-1	0= Stand.Throttle Control 1= Regul. Throttle Control
R.T.C Minimum BEMF	56.5.0	0	5	0-31	0= NO BEMF for RTC, 31=ALL BEMF for RTC

Important QSI CV's are listed above. The programming of the values listed needs to be done in a specific order using CV's 49 and 50. When you see an indexed value like CV56.18.1 you actually need to change up to three CV's to modify the information contained within the CV. If there are 3 decimal places (like in the example above) then you must program CV50 first, then CV49 second and then whichever Master CV you're trying to change third. For simplicity this has been color coded above. You will program the **GREEN VALUE FIRST**, where applicable the **RED VALUE SECOND**, and the **BLUE VALUE LAST**

Stereo Control CV's

QSI's addition of stereo to a mobile sound decoder is an industry first! The user has very finite control over the stereo through the master system Balance CV and *individual* sound balance control CV's for every different sound the loco creates.

An example is, if your loco has a horn mounted specifically on the front of the locomotive, you can get that sound *only* from the *front* of the loco! Through mixing some sounds

between the two speakers you can create dramatic effects where motors sound like they're coming from the middle of the loco and the horn only comes from the rear of the engine.

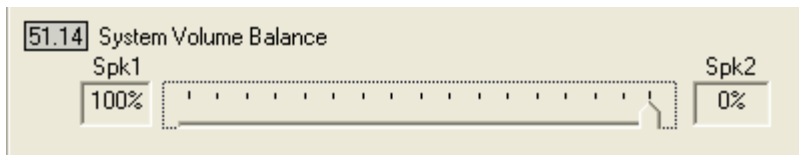
<u>Quantum Sound Control CV</u>	<u>CV</u>	<u>CV49</u>	<u>CV51</u>	<u>Effect</u>	<u>Default Value.</u>
System Volume Bal.	51.14	14	0-255*	0= Spkr 1: 100% Spkr 2: 100%. 127= Spkr 1: 100% Spkr 2: 0% 255= spkr 2: 100% Spkr 1: 0%	0
<u>Individual Sound Balance CV's</u>	<u>CV</u>	<u>CV49</u>	<u>CV116</u>	<u>Effect</u>	<u>Default Value</u>
Horn Bal.	116.0	0	0-255*	=	127
Bell Bal.	116.8	8	0-255*	=	127
Motor Bal.	116.10	10	0-255*	=	255
Turbine Whoosh Bal.	116.13	13	0-255*	=	82
Turbo Balance	116.14	14	0-255*	=	255
Turbine Whine Bal.	116.15	15	0-255*	=	82
Air Pump Bal.	116.16	16	0-255*	=	0
Cooling Fans Bal.	116.19	19	0-255*	=	0
Long Air Let-Off Bal.	116.21	21	0-255*	=	0
Short Air Let-Off Bal.	116.22	22	0-255*	=	0
Squealing Brakes Bal.	116.24	24	0-255*	=	0
Generator Bal.	116.26	26	0-255*	=	255
Dynamic Brakes Fan Bal.	116.28	28	0-255*	=	0
Coupler Bal.	116.34	34	0-255*	=	0
Air Brakes Bal.	116.37	37	0-255*	=	0
Alternate Horn Bal.	116.40	40	0-255*	=	127
User Sound Effect Bal.	116.46	46	0-255*	=	0
Crew Talk Bal.	116.52	52	0-255*	=	0
Water Loading Bal.	116.53	53	0-255*	=	0
Fuel Loading Bal.	116.55	55	0-255*	=	0
Maintenance Bal.	116.56	56	0-255*	=	0

The stereo balance CV's program in the following manner.

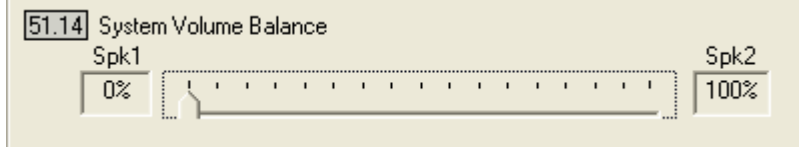
Values 1-127 Remove signal from Speaker 2 proportionally, the higher the value between 1 and 127 the lower the volume % coming from speaker 2. Values between 128-255 remove signal from Speaker 1 proportionally, the higher the value between 128 and 255 the lower the volume % coming from speaker 1. See illustrations on the next page..



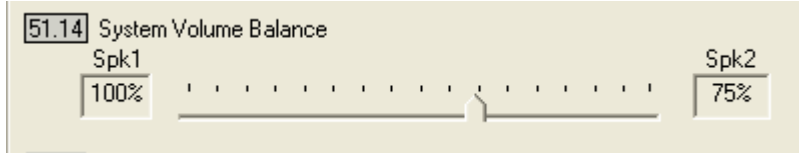
CV51.14=0 In this picture so the volume is balanced evenly between the two speakers.



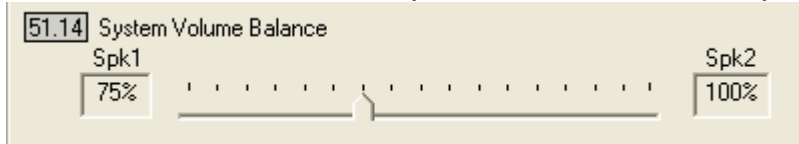
CV51.14=127 In this picture so the volume is set to 100% of Speaker 1 and 0% of Speaker 2.



CV51.14=255 In this picture so the volume is set to 0% of speaker 1 and 100% of speaker 2.



CV51.14=31 In this picture so the volume is set to 100% of speaker 1 and 75% of speaker 2.



CV51.14=159 In this picture so the volume is set to 75% of speaker 1 and 100% of speaker 2.

All individual sound balance CV's function in the same manner. So utilizing the table on the previous page you can fully customize your sound system by balancing the sounds to where you want to hear them come from!

3c: Analog Programming

PART OF THE METHOD OF RESETTING AND WORKING WITH THIS UNIT IS ANALOG MODE IS THROUGH A

MAGNETIC REED SWITCH WHICH IS AN OPTIONAL PART. IF YOU FEEL YOU NEED THIS PART PLEASE NOTIFY YOUR DEALER.

W/O Reed Switch, Manual Reset: Reset by turning the power off and contacting P2-7 to P2-8. Then turn the power on and you will hear "reset". Recycle the power and the loco will respond to add=3

Your locomotive can be programmed using a standard power pack. All advanced operations are easily programmed using your standard HO power pack. After entering programming (described below), the various features are selected and operated by using the direction switch. Where "X" is the current value of the Program Option. Defaults are shown in parenthesis along with the option name; defaults for volume levels are listed on the Diesel Model Specification sheet included with your locomotive.

Program Option #'s (POP's)	Option Name (Default Value)	Message When Entering Option	Option Description
1	System Volume (16, Max)	"Volume equals X"	Sets System volume (17 level) where level 16 is max and level 0 is off.
2	Load (0, No Load)	"Load equals X"	Selects the starting and stopping inertia 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 Reverse Light disabled. Mid Helper has Horn, Bell and all lights disabled. End Helper has Horn, Bell and all lights disabled except Reverse Light. Pusher has Reverse Light on all the time as train warning light. Horn, Bell and all other lights are disabled.
4	Directional (Normal)	"Direction Equals X"	Selects if the features associated with the locomotive's direction are "Normal" or "Reversed".
5-7	Reserved	"Reserved"	
8	V-Start (8.5v)	"V-Start Equals X"	Sets track voltage at which locomotive will leave Neutral. (See Example below)
9	V-Max (12v)	"V-Max Equals X"	Sets track voltage at which full track power is applied to motor.
10	Throttle Mode (RTC)	"Mode Equals X"	Selects between Regulated Throttle Control (RTC) and Standard Throttle Control (STC)
11	Programming Reset	"Warning-about to reset"	Selects between Regulated Throttle Control (RTC) and Standard Throttle Control (STC).
12	About	"Model Number"	Each Quick or Slow Operation provides progressive information about Quantum Model Number, Software Version, and Software Release Date.

Entering Programming

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

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

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.

Once you perform the three bell operations after applying power, the bell will shut off automatically, you will hear “Enter Programming,” and the headlight and reverse light will flash alternately off and on.

Scrolling through the Program Options

After entering Programming, you will hear an announcement of the first Program Option, “Option 1 - System Volume”.

To access other Program Options, simply flip the direction switch to the opposite position and leave it there. Listen as each option number is announced in order.

When you hear the Option Number you want, flip the direction switch back and leave it there. 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 again.

Once you reach the last Program Option, the decoder will continue to announce the last option number.

Entering a Program Option and Making Changes

After the verbal announcement of a Program Option, you can enter that option by performing a **Slow** or **Quick** Flip-and-Back operation of the direction switch. Upon entering a Program Option, you will hear the present

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 present volume setting). After a moment, you will hear the sound at its present volume.

Note: It is easy to distinguish between doing a **Quick** and **Slow** operation. When you flip the direction switch to do a **Slow** operation, wait until you hear a low level “hiss” sound from the locomotive; then immediately flip the direction switch back. To do a **Quick** operation, make sure you flip the direction switch back before you hear the “hiss” sound.

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

Note: Since “System Volume” is the first Program Option, you can use **Quick** or **Slow** operations immediately after entering Programming to change the System Volume.

Moving on to Other Program Options or Exiting Programming

Flip the direction switch at anytime to the opposite position, and leave it there. The Quantum System will first return to and announce the present Program Option, and then automatically advance on to higher options. Exit Programming anytime you want by turning the power off, and then back on again.

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

Program Option #10 determines whether your locomotive uses Regulated Throttle Control (RTC) or Standard Throttle Control (STC).

Enter Programming after powering up your locomotive by turning the Bell on, then off and then on as described above. After the “Enter Programming” and “Option One - System Volume” announcement of the first Program Option, flip the direction switch and leave it there. You will hear “Option 1, 2, 3 ... etc.” Stop when you hear “one-zero” by moving the direction switch back. You will hear “Throttle

Mode". Use a **Slow** or **Quick** flip 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 **Slow** or **Quick** flip of the direction switch to change the Throttle Mode. Repeated **Slow** or **Quick** operations will cause the throttle mode to alternate between its two possible values "Regulated" or "Standard".

Once you have selected the Throttle Mode you wish to use, turn the power off. When you power up again, your locomotive will be using the Throttle Mode that you have just selected.

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

This option determines the voltage (and throttle position) at which the locomotive will leave Neutral and begin moving.

Enter Programming after powering up your locomotive by turning the Bell on, then off and then on - as described above.

After the "Enter Programming" announcement followed by "Option One - System Volume" announcement for the first Program Option, flip the direction switch and leave it there. You will hear the announcement "Option 1, 2, 3 ... etc.". Stop when you hear the number "8" by flipping the direction switch back. You will hear "V-Start".

Use a **Slow** or **Quick** flip of the direction switch to enter this option. You will hear "V-Start equals X" in which "X" is the track voltage value presently set for leaving Neutral.

Use a **Slow** or **Quick** flip of the direction switch to activate this option. Hear the message "Set throttle to V-Start." After three seconds, the voltage will be announced. If you move the throttle, the new track voltage value is announced a few seconds later. Once throttle is set, use a **Slow** or **Quick** flip of the direction switch to begin the V-Start voltage setting procedure. The locomotive will move at a slow speed and the bell will ring continuously for about 25 seconds, indicating the correct value is being calculated. If you chose a very low voltage setting, be patient. If the locomotive does not move during this procedure, return to the beginning of this option or start over and choose a slightly higher throttle setting. At the end of the process, the locomotive will stop moving and the Horn will blow, signifying the end of the operation, and you will hear the message "V-Start = X" where "X" is the new setting.

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

Example 3: Setting V-Max (Program Option # 9)

V-Max is set in the same manner as V-Start except upon entering this Program Option, you will hear "Set throttle to V-Max" which is the throttle position at which you want full track voltage to be applied to the motor (usually about 80% of full throttle). Then do a **Quick** or **Slow** operation to start the V-Max setting procedure. Like V-Start, the bell will ring continuously until the voltage is set followed by a horn blast to indicate the procedure has been accomplished. Setting V-Max is much faster than V-Start!

4: Titan Operations:

We've covered all the particulars, now lets have some fun. Again, since this decoder is full featured in both DC and DCC we'll split this into two sections again. First the DCC:

With your locomotive on the track, call up the address on your DCC hand-held (which will be address 3 if you haven't already changed it). Upon entering the address you should hear the locomotive hiss briefly followed by the sound of the prime mover starting up. Depending on your system, you may need to issue a function command to start it up. From here when you toggle function 0 (or push the headlight button) the lights will come on.

Now, give the horn a toot and roll your throttle up. The loco will begin to accelerate according to any momentum programming you did earlier. As the locomotive accelerates listen to the notching, notice that just previous to the notch up you can hear the motor quiet down a bit before it ramps up through the notch. This will continue until you reach either top speed or (where applicable) the transition (essentially shifting gears) where you will hear another couple notches.

Now let's slow down and pull into the station or freight yard. As you slow you'll hear the brakes engage and start squealing, when you reach stop you'll hear the cylinders bleed off the last bit of pressure with a quick hiss.

With DC the process is essentially the same except in order to play the horn and the bell you'll need to throw the direction switch back and forth, not quite as much control but the fun is still there and more so than ever before).

There is another DC sound control option we haven't discussed yet. *Atlas* makes a product called the **Quantum Engineer**, which is a sound control device connects directly to the two track output wires. It provides a 28, button interface with *individual controls for all the sounds within the decoder, as well as buttons to apply and release the brakes.* (If using the Quantum Engineer you should consult the manual for proper operation procedures). Like we said: the most advanced sound control on the planet!

4a: Functions and Features Explained

First we'll go through function by function and discuss the uses of each of the basic functions. Please keep in mind that the following applies exclusively to DCC users.

F0: Toggles Light Functions in the group “

F1: Toggles Bell On or Off

F2: Toggles Horn On or Off (also toggles alternate horn after triggered using F11)

F3: Plays Coupler sounds. The first time you push the button the couplers will clank as they join together. The Second time you push the button you'll hear the pressure release and the pins bang apart.

F4: Toggles Cooling Fans On or Off

F5: Toggles Dynamic Brakes On or Off

F6: When in neutral it plays start-up sounds. When moving in forward or reverse triggers the Doppler effects causing the all locomotive sounds to “Doppler down”. This can be especially fun at the end of a grade crossing, or when used in conjunction with other sound effects.

F7: **On Turbine decoders, in neutral, single tap F7 to engage the Turbine sound.** While moving drop the throttle to ss zero and while the loco is coasting, push F7 to *actually engage the brakes!* This is far more realistic than any other decoder based braking methods because an engineer would never engage the brakes with the throttle open at main line speed.

F8: Mute.

F9: In neutral puts loco in standby/disconnect mode. When moving activates the Sound Of Power function, when sound of power is activated you'll hear the horn hoot once. As you throttle up the loco will sound as though it's under a very heavy load. Concisely, if you throttle down you'll hear the motor ramp down like it's coasting. Neither of these functions will affect speed until **F9** is pressed again when you will hear a double whistle hoot or horn blast indicating that Sound Of Power has been turned off.

F10: Status Report. In neutral the loco will read back the address and any mode that it may be in (e.g., standby/disconnect). When moving, **F10** acts as a speedometer giving a verbal read back of the scale miles per hour.

F11: Toggles between the primary and secondary horn. After pressing **F11** once **F2** will control the secondary horn normally.

F12: Toggles extra light functions in the group “Multiple Lights 3” on or off.

F13: System Volume Decrease by 2db

F14: System Volume Increase by 2db

F15: While stopped plays a short air let off, while moving plays the Grade Crossing whistle sequence

F16-25: Reserved for user assignment

F26: Fuel Loading Scenario

F27: Maintenance Scenario

F28: Water Loading Scenario

The Quantum Titan allows for changes in the “mapping” of these functions.

Mapping is the ability to change which button on your handheld controls what function.

See the complete DCC Reference manual at www.qsisolutions.com

Sound of Power

When a diesel locomotive starts to pull a heavy load, the engineer opens the throttle causing the engine to rev up before the train even starts moving. In steam engines the chuff gets louder as the engineer opens the throttle. As a train reaches its set speed, the sound level drops. When the throttle is cut back, the sound level cuts back. A diesel engine should drop to an idle. These are all possible with the **Sound of Power** feature. Sound of Power works by comparing the speed set by the DCC command to the speed of the locomotive. The greater the difference between the two, the higher the volume. Keeping that in mind, it should be noted that putting a value in the momentum CVs, (CVs 3 and 4) will make the effect more pronounced.

Checking out the Sound of Power First increase the throttle on your DCC system. When the desired speed is reached push **F9** you will hear the horn blast once and the volume increase. As you adjust the throttle you'll notice the sound of the locomotive change dependent on the direction of throttle change. I.E. If you increase the throttle you'll hear the sound get louder like the locomotive is under a load, if you decrease the throttle you'll hear the locomotive quiet down and go to idle as if it's going down a hill and no longer struggling. When finished using this feature simply press **F9** again and you'll hear a double horn blast and the locomotive will go to whatever speed step the throttle is set to when Sound Of Power was disengaged.

Braking

You can get even more control over speed by braking with **F7**. As the engine is coasting, with speed **set to zero**, **F7** will act as a brake with the added sound of the brake squeal. When you press **F7** you will also hear an air release. The longer you press, the faster the braking. This feature requires values to be set in CV3 and CV4. If you don't have momentum in the locomotive when you drop the throttle to 0 and your loco will stop immediately negating the usefulness of the brake. Set CV3 and CV4 to some value. We like CV4 set to half of CV3's value. So for starters, try about 50 in CV3 and 25 in CV4. You can program this on the main or “Ops mode”. This adds to the fun of switching. Be sure and try the braking feature you'll enjoy the challenge of running an engine more like the prototype.

The Doppler Effect

Sound waves move at the speed of sound. As a train approaches its speed vs the speed of its *sound* causes its sound wave to compress, which in turn, causes the *pitch* of its sound to seemingly increase. When the engine passes by, the opposite happens and its sound waves are stretched and the pitch of its sound drops. The greater the speed, the greater the shift in sound frequencies as the engine passes by.

Checking out the Doppler Feature

Model locomotives do not move fast enough to create such a shift in sound frequency. To achieve this, the Doppler feature needs to be triggered as the locomotive passes. There are two ways to trigger the Doppler feature. First, with the whistle blowing for *longer than a second*, quickly release the whistle/horn key and then reapply. This quick drop out of the whistle signal will trigger a drop in the sound frequency, simulating the Doppler Effect.

The second way is to use **F6** key. **F6** is used for startup when the engine is stopped, when the locomotive is moving **F6** is used to trigger the Doppler Effect. The change in sound is impressive as the engine passes - sounds like the real thing! The faster the speed, the more pronounced is the effect.

Grade Crossing

Engineers use specific signals on the horn/whistle to communicate various actions (forward, reverse all stop etc.) one of the universally recognized signals is the grade crossing, used whenever a train is approaching an active roadway. Several other decoder manufacturers have included this signal in the past. But all were fairly limited in realism because they lacked a method for changes in signal timing. QSI has remedied this by including a provision in the Quantum Upgrade software that provides very fine control of the timing. (If you do not own a Quantum Programmer see your local dealer.)

Checking out the Grade Crossing Set to **F15** Now, while moving, simply press **F15** and hear the classic *long, long, short, long*. Horn/whistle signal. For a real treat, while the last long horn blast is playing hit **F6** and listen to the way the Doppler effect really ties the grade crossing together! Now, go to your programmer and “fine tune” this fine tune!

Disconnect/Standby/Shutdown

Locomotive Shut Down has three distinct user-controllable stages. Each stage is entered by double-pressing F9 key.

Stage One: Disconnect

To enter “Disconnect,” double-press the F9 key in Neutral (neutral=speed step 0). You will hear a long air release. The motor drive will be disabled. The DCC throttle can be opened or closed without the locomotive moving as the throttle is opened or closed, you will hear the motor rev up and down in response to the throttle. Note that all Function Keys are active in Disconnect. To exit Disconnect, either double-press the F6 Start Up key as described in the Start Up section, or double-press the F9 key again to reach Standby, which is the second stage of the Shut Down mode.

Note: In Disconnect, you can also turn the Dynamic Brakes on (see Dynamic Brakes below) to create Sound-of-Power as the throttle is opened and closed. Prototype engineers use dynamic brakes to load and test the motor generator’s output efficiency while the locomotive remains stationary,.

Stage Two: Standby

To enter “Standby,” double-press the F9 key while in Disconnect, and you will hear a long air release,

followed by a distinctive “low idle” sound. The directional lighting and optional ditch lights or mars light will also shut down.

Note: In Standby, the motor will remain disconnected, while the air pumps, automatic cooling fans, number board lights and cab lights will continue to operate. Also in Standby, the locomotive will not respond to throttle or function keys with the following exceptions: The F6 Start Up Key, the F8 Mute Key (described below) and the F10 Status Key (also described below).

To exit Standby, either double-press the F6 Start Up Key (as described in the Start Up section), or double-press the F9 key again to access Total Shut Down, the final stage of Shut Down.

Note: Standby is ideal for leaving your locomotive running on a siding. In addition to hearing the sound of the diesel at low idle, the locomotive will not respond to accidental changes in throttle settings or function keys.

Stage Three: Total Shut Down

Total Shut Down allows you to take the locomotive “off line” (turn off sounds and lights, ignore throttle settings and function commands) independent of the operating session. Note that the locomotive will still be “off-line” when power is next reapplied, regardless of whether the next session is analog (conventional DC), or DCC.

Double press the F9 in Standby to enter Total Shut Down. You will hear a Long Air Let-off. The Air Pumps will turn off, followed by the Number Boards (if so equipped) and the sounds of the Cooling Fans shutting off, the louvers closing, the Diesel Motor shutting down and finally, the Cab Lights (if so equipped) turning off. A few seconds later you will hear the engineer’s door open and then shut.

Note: In Total Shut Down, the locomotive will not respond to the throttle – nor will it respond to function keys except for the F6 Start Up Key (described below) and the F10 Status Key (also described below). 17 of 28

To exit Total Shut Down, double-press the F6 key.

Note: If 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 it was at during power down, and the locomotive will power up in the same stage.

However, if Start Up is initiated during any of the above Shut Down procedures, the Shut Down is aborted, and the locomotive will return to normal operation.

Start Up

You can return your Quantum Titan-equipped diesel locomotive to normal operation during any stage of Shut Down by double-pressing the F6 key. Start Up will be different for each stage of Shut Down, but enter normal each will start up with a long air release, and will operation.

Start Up from Disconnect: Double-press the F6 key in *Disconnect*, and the diesel locomotive will produce a long air release, the dynamic brakes will shut off and the locomotive will enter normal operation.

Start Up from Standby: Double-press the F6 key in Standby, and your diesel will produce a long air release, directional lighting will turn on, the diesel motor sound will change from special low Idle to regular Idle, and the locomotive will enter normal operation.

Start Up from Total Shut Down:

Double-press the F6 key in Total Shut Down, and the locomotive will produce a long air release, you will hear the cab door opening and closing, and if so equipped, you’ll see the cab lights and number boards come on and the directional lighting turn on (if it was on previously). These actions are followed by the sounds of vents opening, the diesel motor starting up, the air pumps starting up and the locomotive’s entering normal operation.

Note: During the Start Up procedure, no DCC function keys are active. However, in the event the throttle is advanced beyond zero during any of the above Start Up procedures, the Start Up procedure will abort and the locomotive will enter normal operation.

Status Report:

Your Titan decoder is capable of verbally reporting back several different things either individually or in groups. It is capable of reporting:

- Speed in MPH or KPH
- BEMF
- PWM
- Engine Temperature (degrees Celcius)
- Odometer (Scale Miles or Kilometers)
- Analog DC Voltage

Fuel Loading Scenario: You'll hear the crew chatter about what ever type of fuel they're in need of and the sound of the fuel source filling whatever type of storage mechanism the respective loco had.

For diesels you hear the sound of the fuel filling the tank.

For steam you can select, wood, coal, or oil.

Maintenance Scenario: You'll hear the crew discuss how the loco is misbehaving. Then you'll hear either the diesel (or electric) motor go into "self test" mode where it spools all the way up to top rpm and comes back down. Or with steam engines, you'll hear the sound of the fireman lubricating and adjusting various components on the engine.

Water Loading Scenario: Again this scenario opens with crew chatter, then you'll hear the sound of the water tank banging open and the water begin to flow from the tank into the loco. This may seem like a steam engine only scenario but we've left it in the other files for the reason that many diesel locomotives also carried water to run steam generators for passenger car heating units.

***NOTE** All of these scenarios will be automatically disabled if the loco throttle is advanced.

Lighting Functions:

As we mentioned before, this decoder has more lighting functions and more CV's to customize those lights than any other decoder, even function only decoders! There are so many CV's that we strongly recommend that you look at the complete DCC users manual posted at WWW.QSISOLUTIONS.COM Some of the things you can change in the lights are:

- Initial control, QSI lights are set by default to work with LED's and to give prototypical response based on the action of the locomotive. This can be disabled and all the lights are mappable to individual function buttons.
*If not using LED's the intensity settings may need to be changed to provide proper light response.
- Intensity settings, you can adjust the intensity (brightness) of the light in any potential state so for a headlight you have control over how bright the brightest state is, and how dim the dimmest state is. With these controls you can get Mars lights that oscillate perfectly (using also the "mid intensity control") and ditchlights that wink instead of blink
- Ramp time controls, want the light to come on instantaneously? Set these controls to 0. On the flipside, is your steam engine in need of a new dynamo? Set the control to 255 for a whopping 2.55 second fade from off to on, or dim to bright.
- 4 qualifying states, when using automatic control the lights will respond to the action of the locomotive. You can have different behavior for all four of the following states

- Neutral From Forward (NFF)
- Neutral From Reverse (NFR)
- Forward (FWD)
- Reverse (REV)

All of these features and more are customizable using basic CV changes. Please consult the DCC reference manual, for the exact CV's as there are simply too many to list in this manual.

CV Selectable Lighting:

All of the light ports in the Titan can be assigned to ANY light function using simple CV programming.

<u>Light Behavior</u>	<u>CV</u>	<u>CV50</u>	<u>CV49</u>	<u>CV115</u>	<u>Effect</u>	<u>Default</u>
Front Headlight	115.70.0	0	70	L# See Page 6	Defined By Column A	1
Rear Headlight	115.73.0	0	73	L# See Page 6	Defined By Column A	2
Front Mars Light	115.76.0	0	76	L# See Page 6	Defined By Column A	3
Rear Mars Light	115.80.0	0	80	L# See Page 6	Defined By Column A	0
Front Left Ditch Light	115.84.0	0	84	L# See Page 6	Defined By Column A	4
Front Right Ditch Light	115.84.1	1	84	L# See Page 6	Defined By Column A	5
Rear Left Ditch Light	115.88.0	0	88	L# See Page 6	Defined By Column A	0
Rear Right Ditch Light	115.88.1	1	88	L# See Page 6	Defined By Column A	0
Front OHBL	115.92.0	0	92	L# See Page 6	Defined By Column A	6
Front OHBL2*	115.92.1	1	92	L# See Page 6	Defined By Column A	0
Front OHBL3*	115.92.2	2	92	L# See Page 6	Defined By Column A	0
Front OHBL4*	115.92.3	3	92	L# See Page 6	Defined By Column A	0
Rear OHBL	115.96.0	0	96	L# See Page 6	Defined By Column A	7
Rear OHBL2*	115.96.1	1	96	L# See Page 6	Defined By Column A	0
Rear OHBL3*	115.96.2	2	96	L# See Page 6	Defined By Column A	0
Rear OHBL4*	115.96.3	3	96	L# See Page 6	Defined By Column A	0
Front Number Boards	115.100.0	0	100	L# See Page 6	Defined By Column A	8
Rear Number Boards	115.102.0	0	102	L# See Page 6	Defined By Column A	0
Front Marker Lights	115.104.0	0	104	L# See Page 6	Defined By Column A	9
Rear Marker Lights	115.106.0	0	106	L# See Page 6	Defined By Column A	0
Front Cab Light	115.116.0	0	116	L# See Page 6	Defined By Column A	10
Rear Cab Light	115.118.0	0	118	L# See Page 6	Defined By Column A	0
Firebox	115.122.0	0	122	L# See Page 6	Defined By Column A	0
Firebox2	115.122.1	1	122	L# See Page 6	Defined By Column A	0

*OHBL 2, 3, 4, only active if Prime Beacon X4 is activated by CV55.92.0 = 65 or CV55.96.0 = 65

5: Fine Tuning Your Performance:

The Titan offers many ways to fine-tune your locomotive for truly astounding motor response. This is accomplished through Regulated Throttle Control, Back EMF and what are referred to in the DCC industry as PIDs. The next section explains what each of these do and how to use them to *really* tune your locomotive for prototypical operation.

Smooth Starts using QSI Decoders.

Some locos tend to jump when they start moving. This can be lessened or eliminated by one of the following.

Make sure the loco is in Regulated Throttle Control (RTC)

Increase the value in CV2 Vstart. Increase this value by a value of 10 until the loco starts moving at speed step 1 or 2. If it moves too fast then back it off by 5 until the ideal setting is reached.

If CV2 doesn't fix the problem, increase the value in CV56.5 (RTC Min. BEMF).

If the problem still persists then try increasing the values in the PID Parameters, CV56.18.0 (PGain) and CV56.18.2 (DGain)

Any setting here will also work when the loco is running on DC as well.

5a: Back EMF (Back Electro-Motive Force) Explained:

One of the better ways to explain BEMF is to compare it to the way an electric motor functions. For example, if you apply power to a motor, the shaft turns. Conversely, if you turn the motor shaft, the motor will generate power, or in our case, produce a voltage. Similarly, when a decoder applies power to a motor, it begins to rotate. However, the decoder applies power in pulses. As a result, there is a time between pulses when no voltage is applied to the motor. During this time the decoder can "read" the voltage produced by the motor. If the motor slows, the BEMF voltage drops, if speed increases, the voltage also increases. This is how a BEMF decoder can determine the speed of the motor, sense any change in motor speed, and respond accordingly to provide realistic load-related variations in speed as trains ascend and descend grades, for example.

5b: Regulated Throttle Control (RTC) Explained:

Regulated Throttle Control (RTC) adds realistic momentum to your train operations. Although it has been available in *analog* from QSI, it has not been available in DCC until now. RTC uses Back EMF to simulate the massive inertial characteristics of prototype operations. An RTC-controlled locomotive will move through such "obstacles" as tight turnouts, raised track joints, etc., with little change in speed – and will easily maintain speeds of less than 1 scale mile per hour! However, if the locomotive encounters a long uphill grade, it will slowly reduce speed just as does the prototype. Similarly, when a downhill grade is encountered, it will slowly increase in speed like the prototype. Unlike Speed Control, which is a feature used by many older decoders. RTC is a true, comprehensive throttle control system, and is controlled by the same CV's that control speed curves, including (CV2, CV3, CV4, CV5, CV23 and CV24, and all CVs related to the speed curve.

The best news: since RTC-controlled locos slowly adjust their speed based on load, locomotives in consists tend to share power equally. This makes advanced (and truly prototypical) consisting extremely easy since the locomotives can actually "talk" to each other. Put that helper in the middle of the train, or that pusher at the end – where they belong!

5c: PID (Proportional Integral Derivative) Control Explained:

The PID control process is a little like a three ring circus. Each of its three components play a part in the control process. To oversimplify, think of PID as a black box with the output as the power to the motor and the input as the BACK-EMF from the motor. We "tune" for smoothest operation by changing the CV values associated with PID parameters.

The PID control process To get a picture of how the PID process works; first consider that speed needs to be controlled. To do this, we send a speed-setting command to the decoder. This speed-setting command initiates the PID process and is called the “set point.” In response, our decoder sends power to the motor, which starts to turn. At the same time, the decoder reads the Back-EMF signal to determine how fast the motor is turning. Once the motor nears the speed of the set point, the PID process begins to function. The manner in which the individual PID components interact is briefly described below.

The Proportional component: The “P” part of the process stands for “Proportional,” which in essence, establishes a “speed band” parameter around our set point. This “proportional band” tolerates some speeds above and below the speed entered as the set point. It is somewhat akin to the way a thermostat controls furnace temperature in a house. The furnace continues to produce heat until its “set point” (thermostat setting) is reached. After this, some heat production (called overshoot) continues even after the thermostat turns the furnace off. Most thermostats then wait until the temperature drops about 2 degrees below the set point (called undershoot) before the furnace is again turned on. Its “proportional band” is between the two levels. The proportional component in PID works in a similar manner.

Integral component: The “I” part of the process stands for “Integral” action, which controls the difference between the set point and the center of the proportional band. This may not be the same due to system imbalance. The Integral action senses and tries to correct the difference between the set point and the decoder’s “center point.”

The Derivative component: The “D” part of the process is “Derivative” action, which looks for any change in motor speed. When it senses a change, this function tries to correct it. Such a change could be triggered by a locomotive starting up a grade with a string of cars, where the increased load has caused the motor to slow. The derivative component “sees” this change and applies a correction. Such a slow-down could be caused by a bind in the mechanism or a tight spot in the track. Note that some decoders use only the **P** and **I** (PI) functions and not the **D**. The Titan, on the other hand, is weighted toward utilization of the **P** and **D** components. Most of the decoders that use PID utilize a single set of values for the functions that are used over the total speed range. The Titan, on the other hand, has four sets of PID values, between which it alternates depending on speed-step settings.

PID's can be a double edged sword, you can make your loco run either beautifully or terribly. As such we do no outline PID programming in this manual. We absolutely recommend you have a Quantum Programmer and consult the full DCC reference manual for information on programming PID's.

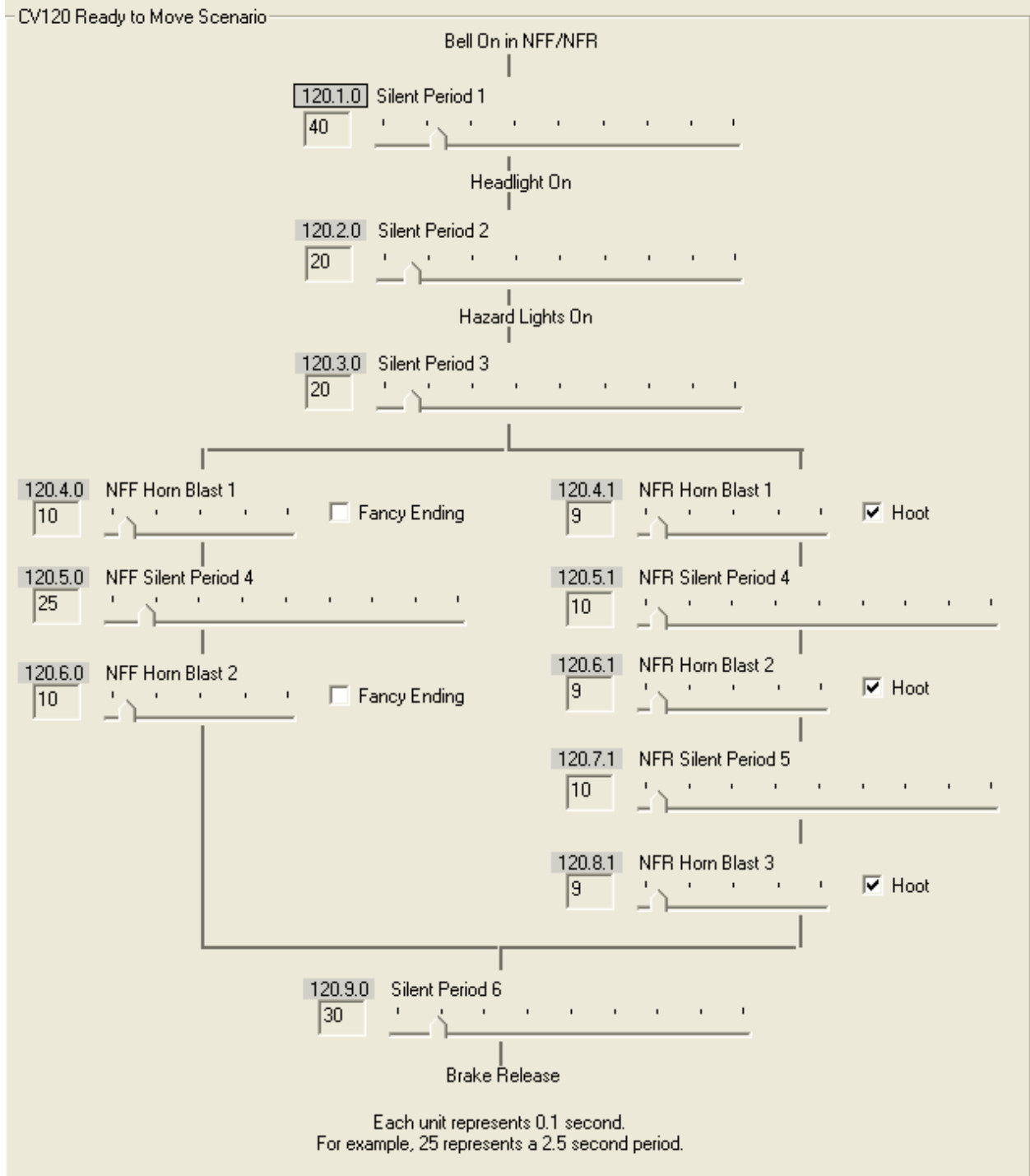
6: Ready To Move Automatic Scenarios

The Quantum Titan can provide automatic whistle, bell and lighting changes based on the state of the locomotive. There are two different types of Ready To Move Scenarios; Automatic Horn Blasts, and a Bell Triggered Scenario. Either one of these can be selected to trigger when going from neutral to moving, moving to neutral or both. The activation of these is handled by CV51.20 “Motive State Change Warning Signals”

The timing of EVERY portion of these scenarios is customizable. Using CV120 (see next page)

Automatic Horn Blasts: This scenario is fairly simplistic, the decoder measures the BEMF of the motor to determine what the loco is doing and blows the appropriate whistle signal accordingly. 2 whistles blasts for FWD, 3 whistle hoots for REV and 1 whistle blast when coming to a stop.

Bell Triggered Scenario: If you do a lot of switching the automatic horn blasts can get a little annoying so we give you a more useable method of triggering the automatic blasts. Using the bell as an indicator of what the locomotive is about to do. Below is the way this scenario will act when the bell is activated by default. (automatic horn blast skips the first 3 actions)



This table will show you the values to program in order to activate the two scenarios. These CV's are for activation in all directions but further customization is possible. For space reasons we've kept the table small. For further information please either consult the full DCC Reference manual or contact QSI Solutions.

Action	CV	CV49	CV51
None	51.20	20	0
Automatic Horn Blast	51.20	20	17
Bell Triggered Scenario	51.20	20	34

7: Special Operation and Troubleshooting

For most complete information, see the “Troubleshooting” sections (listings?) in the Quantum DCC Reference Manual (Ver. 4) and Quantum Analog Reference Manual (Ver. 4) at <http://www.qsisolutions.com>.

PART OF THE METHOD OF RESETTING AND WORKING WITH THIS UNIT IN ANALOG MODE IS THROUGH A MAGNETIC REED SWITCH WHICH IS AN OPTIONAL PART. IF YOU FEEL YOU NEED THIS PART PLEASE NOTIFY YOUR DEALER.

W/O Reed Switch, Manual Reset: Reset by turning the power off and contacting P2-7 to P2-8. Then turn the power on and you will hear “reset”. Recycle the power and the loco will respond to add=3

DCC Program Track Operation

Your locomotive conforms to NMRA standards for program track operation. However, the Quantum System requires more current to operate than standard DCC decoders and may not respond to the limited program track power from some DCC command stations. If you are unable to program in Service Mode on your program track, all CV's in your Titan-equipped locomotive can be programmed in Ops Mode. Note also that Tony's Train Exchange® offers a simple, inexpensive power booster (PowerPax™ by DCC Specialties) that will once again enable you to program on the program track with any DCC command station.

Manual Controls

There is an optional reed switch that is used to control sound volume or reset the locomotive to factory default values. If you desire this part please contact your dealer. Option w/o Reed Switch See Pg-14

To adjust the volume by hand: (Analog and DCC)

Note: Volume can also be adjusted digitally using the programming methods described in the programming sections of this manual. However, if you turn the volume down using the Manual Volume Control, you will not be able to increase the volume using programming above the level set by the reed switch.

Using Magnetic Reed Switches:

Locate the reed switch on the decoder

Power up the locomotive and leave it in Neutral.

Place the enclosed Magnetic Wand over the reed switch on the decoder and wait as you hear the volume increase or decrease in incremental amounts as the Horn hoots about every second. Move the wand away and again place it over the reed switch to change the direction (louder or softer) of the volume. Remove the wand when you reach the desired volume level

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

To Reset Your Locomotive to Factory Default Values (Analog and DCC)

In the event your locomotive's sound and control system misbehaves – and turning the power off and back on does not return it to normal operation – you can reset your locomotive to original factory values. This is done one of three ways. You can set the following CVs in the order as shown:

CV49=128,CV50=255,CV56=113

After entering the last value turn the power off and then on again and hear the word “Reset”.

If you have a reed switch installed; locate the reed switch on the decoder, and turn off the power. Place the Magnetic Wand over the reed switch area, apply power and leave the wand in place until you hear the word “Reset”. Your locomotive is now reset to original factory defaults. If you don't have a reed switch installed; locate the Pink wire (marked Reed in our diagram on pg: 7) and the Black wire with a white stripe and simply touch the ends together as you apply power as per the instructions above. The loco should speak the word “Reset” when the process is complete.

High Voltage Circuit Breaker (Analog and DCC)

Your Titan equipped locomotive is designed to operate on the normal HO track voltage supplied by most HO power packs. If track voltage gets too high, the motor drive circuit will automatically shut down and the locomotive will coast to a stop. The Quantum System will alert you to the problem through a continuous series of Horn blasts. This built-in safety feature protects Quantum Titan electronics and the electric motor from excessive voltage.

To restart your locomotive, reduce the track voltage until the horn blasts stop and the motor re-engages.

Note: Later Quantum-equipped locomotives use a different motor control design, which will operate at higher voltage.

Reasons why your locomotive is silent or will not start (Analog and DCC)

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

1. Make sure the locomotive has not been Muted with the DCC F8 key or Quantum Engineer Mute Key
2. Check to see if your Manual Volume Control or Programmed Digital Volume has been turned down.
3. You may have shut down your locomotive in DCC using the F9 key, or in Analog using the Quantum Engineer Shut Down key. Use the F6 key in DCC, or the Quantum Engineer Start Up key or Magnetic Wand in Analog, which both selects and starts the locomotive.

Important: The Magnetic Wand will not start your locomotive in DCC if it is in a “Shut Down” state. To start in DCC, you must first select the locomotive with its ID number and then double-press the F6 key. Note also that it will take a couple of seconds after you double press the F6 key before you will hear the pump sounds start.

Note: It makes no difference whether you start your locomotive in DCC or DC. Once started, you can return to either DC or DCC operation.

If the above methods do not start your locomotive, use the magnetic wand to reset your locomotive.

Addendum:

Gas Turbine Sound Files:

The Gas Turbine sounds (5100-xxx) require you to press F7 to engage and disengage the actual turbine sounds. You can only do this while the locomotive is in neutral. Without pressing F7 you will hear the diesel helper motor when you throttle up and down, after pushing F7 you will hear the flash of the Turbine igniting

and then the whoosh of the turbine. The Turbine decoder is speed limited when operating under diesel helper motor mode. The locomotive will not exceed 25smph without engaging the Turbine sound.

List of Specifications:

Feature	QSI® Titans
Operation Modes DC and DCC	DCC & True DC
Sound in Conventional DC Mode	X
Full Operation from DC Power Pack	X
Speaker Impedance	4 Mono, 8 Stereo
Included Speaker Options	X
Sound Memory Size	64-256 Mbit
Custom Advanced Sound Processor	X
Number of Simultaneous Sound Channels	64
Stereo or Dual Channel Sound	X
High Speed Bi-Directional Service Mode	X
Manual Reset	X
Asymmetric DCC	X
CPU Controlled Super Cap Hold-Up Option	X
Audio Band With	4-8K
Number of Function Outputs	10-14
LED Compensation Mode	X
Function Mapping	X
Steady State Motor Current (Only HO Listed)	1.5-2.0 A
Function Output Current	0.1A
Decoder Size (Only HO Listed)	1.75 x 0.66" X 0.26"
Additional Decoder Formats	X
JST Harness w/NMRA 8 Pin Plug Included	X

Non Sound Related, Decoder Features
Adjustable BEMF Control
RTC (Regulated Throttle Control) Exclusive
Very Slow Speed Performance < 1 SMPH
Remote Lighting Bus Support
Prototypical Breaking
User Programmable Defaults
Set Auto Stop Distance Based on Speed
Automatic Un-Coupler Operation
Firebox Flame Levels

Sound Features
Separate Dual/Triple Prime Mover/Chuff Sounds
Reverb Effects
Doppler Effects
Echo Effects
Multiple Prime Movers Selectable by CV
Horn /Whistle Sound Selectable by CV
Bell Sound Selectable by CV
Custom Horns from Individual Chimes
User Downloadable Sound Set Options
User Cut, Paste and Insertion of Custom Files
Programmable Automatic Horn/Whistle/Bell
Water Fill Scenarios
Fuel Loading Scenarios
Fireman Coal Loading
Train Maintenance
Coal Auger
Radio Cab Chatter
Separate Channels for Dual Motor/Chuff Sound
Demo Scenarios: Automate Sounds for Displays
Sound of Power
Power Loading
Power Braking

Warranty and MSRP	QSI® Titans
List Price (MSRP) (HO Versions Only)	\$119.95
Warranty	2 Yr
Printed Manual Included	Yes

Stereo Speaker Locations and Suggestions:

Take advantage of the Stereo Sound, when you hear the results you will want to incorporate the benefits and realism of stereo.

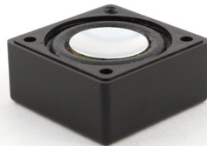
When you think about it there are many locomotives that can benefit from this new exciting technology. This is further simplified by the wide range of size and selections that we now offer. (See Table to Right)

Here are some HO locomotives that have a good possibility of installing stereo:

- 1) Many medium to large Steam Loco's can and another located aft.
- 2) Large Diesels like the EMD, E6-9's, the Alco PA's and others are ideal and simple to do. The Dual prime movers can be easily separated.
- 3) Even many smaller "F" and "FA" units can be fitted with a Mini Oval near the Cab and Horns with the Prime mover sound out back, in the rear truck area. This also applies to some narrow body diesels like the GP's, SD's and some ALCO's
- 4) Many of the larger Electrics would be the same.

Item Description
0.50" Dia Speaker (13mm)
0.62" Dia Speaker (16mm)
0.75" Dia Speaker (20mm)
1.00" Dia Speaker (26mm)
1.10" Dia Speaker (28mm)
1.20" Dia Speaker (30mm)
1.25" Dia Speaker (32mm) QSI
1.50" Dia Speaker (38mm)
2.00" Dia Speaker (50MM)
2.50" Dia Speaker
2.75" Dia Speaker
Micro Oval Speaker(14X20MM)
Mini Oval Speaker (14X24MM)
Small Oval Speaker (16X35MM)
Med Oval Speaker (35X20MM)
Large Oval Speaker(30X40MM)
HighBase20MM SQ "HSpeaker
HighBase1.06"DX0.56"HSpeaker
HighBase1.10"DX0.44"HSpeaker
HighBase1.22"DX0.62"HSpeaker
HighBase1.57"DX0.57"HSpeaker
HighBase1.77"DX0.81"HSpeaker
HighBase2.07"DX0.94"HSpeaker
High Perf 2.25"DX1.1"H Speaker
High Perf 2.50"DX1.2"H Speaker
High Perf 3.00"DX1.7"H Speaker
High Perf 3.50"DX1.7"H Speaker
High Perf 4.00" DX1.9"Hspeaker

All these speakers and enclosures are available from our Distributor, American Hobby Distributors. Have your dealer contact them: 800-671-0641, <http://www.amhobby.com/>



Mini-Oval 14X24MM	1.1" High Base w Enclosure	Small-Oval 16X35MM
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Software ID
Gas Turbine Locomotive: UP

5100-760

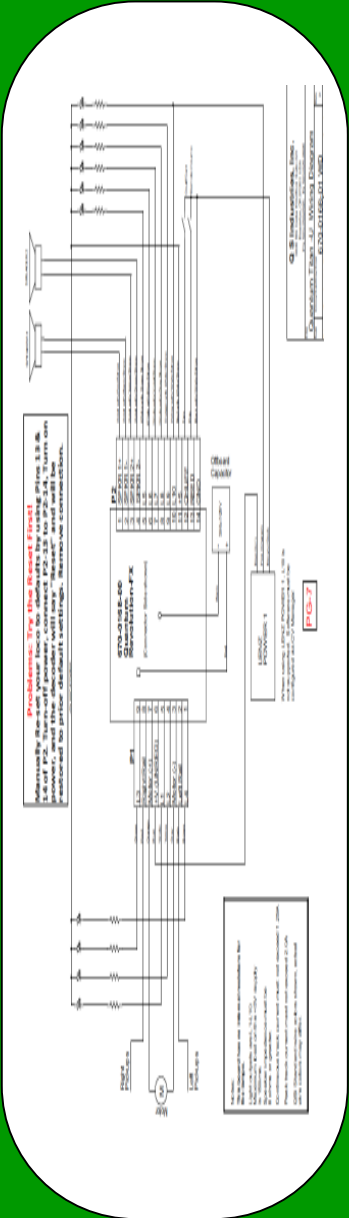
Quantum Titan-U

Advanced DC/DCC Stereo Sound and Power Decoder, Generic Format

- Advanced, Custom Sound, 48Bits, 64 Channels.
- Low Power design, allows mounting almost anywhere.
- Stereo Audio output for crisp, clear, high fidelity sounds.
- Additional memory provides for more sounds and control
- Better Motor Performance under marginal power.
- Super, Smooth low/mid speed performance under RTC.
- Steam versions of the board also support a chuff CAM.
- Lighting: 10 light outputs, all with 256 intensity levels
- User Calibration of BEMF vs. Scale MPH for Scale MPH
- User Calibration of Chuff rate for low range speeds.
- User Configurable Automatic Horns, Whistles and Bells
- Reset manually by jumper or by programming.
- Doppler Effect by key control of horn/whistle function.
- Master Volume Changes by Function Control
- "Sound of Power" by Throttle Control and loading effects.
- Programmable Grade Crossing Effect!
- Complete Sound file downloading Supports Cut & Paste or editing of sound records: Horn/Whistle, Alternate Horn/Whistle, Bell, Diesel Motor, Chuff, Dynamic Brakes, Fans, Steam Generator, Pump, Cooling Fan/Vents.
- Compatible with all DCC Systems.

The Magnetic Reed Switch is not installed on this unit.
Caution: Observe ESD Handling Practices!

Guaranty: This Decoder is Guaranteed for 2 yrs.



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info@qsisolutions.com