CHEAT SHEET FOR ATLAS GOLD SERIES DIESEL LOCOMOTIVES EQUIPPED WITH ESU LOKSOUND® SELECT SOUND-DECODERS

1   Introduction

The purpose of this document is to give a fairly concise description of the principle ways in which the DCC operation of Atlas Gold Series diesel locomotives equipped with ESU LokSound® Select sound-decoders differs from the operation of:

- Locomotives equipped with sound-decoders made by companies other than ESU (e.g., QSI Quantum or Quantum Titan, SoundTraxx Tsunami)
- Locomotives made by companies other than Atlas (e.g., Bowser or Intermountain) that are equipped with ESU LokSound® Select sound-decoders

Since it is possible that there may be additional changes for future Atlas Gold Series locomotives, it is strongly recommended that you check with Atlas for possible updates to this *Cheat Sheet.*

To download the above document, first go to the Atlas Model website:
>   http://www.atlasrr.com/
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4.1   DCC Function Keys

Table 1 lists the features that are typically pre-assigned to DCC function keys in an Atlas Gold Series locomotive equipped with a LokSound Select sound-decoder. After you have selected the DCC address of the locomotive on your DCC system, simply press the corresponding DCC function key to produce the desired effect

Table 1 – DCC Function Key Operation for Atlas Gold Series Locomotives with ESU LokSound Select Sound-Decoders

Function Key	Locomotive Behavior when Press Function Key	Volume CV (if applicable)
F0	Front headlight and rear headlight are directional. See Table 2 and Table 3.	
F1	Bell (1st push *On*; 2nd push *Off*)	283
F2	Playable Airhorn	275
F3	Coupler Clank	291
F4	Dynamic Brake	299
F5	Aux 3 for optional lighting.	
F6	Aux 1 & Aux 2 (Front Ditch lights if equipped)	
F7	Switching Mode (1st push *On*; 2nd push *Off*)	
F8	Audio Mute and Start Up or Shut Down (Push twice if *F8* is currently *On*)	259
F9	Drive Hold	
F10	Locomotive Independent Brake.	
F11	Radiator Fan Sound	315
F12	Headlight Dimmer (1st push *Dim*; 2nd push *Bright*)	
F13	AUX4 Func Output (Rear Ditch Lights if equipped)	
F14		
F15	Fast Spitter Valve	371
F16	Spitters on shutdown	
F17	Brake Set/Release	
F18	Sanding Valve sounds (1st push *On*; 2nd push *Off*)	355
F19	Short Air Let-Off sounds	363
F20	Air Compressor sounds (1st push *On* ; 2nd push *Off*)	307
F21	Slow Spitter Valve	387
F22	Air Dryer	427
Note:	**Before changing volume CVs first set CV31 to 16 and CV32 to 1**	

4.1.1 Directional Headlight Operation - (F0 or Headlight button)

The *F0* or *Headlight* DCC function key turns *On* or *Off* the directional front headlight and rear headlight.
The defaults for the front headlight and rear headlight are *Off*. When switched On, the Directional Headlights operate as shown in Table 2 for *yard or local switching locomotives* (such as the S-2) and in Table 3 for *road locomotives* (such as the C424/C435 and RS-1). These two different types of headlight behavior (one for yard or local switching locomotives and the other for road locomotives) mimic, to the extent possible, the way prototype locomotives operate.

Table 2 - Directional Headlight Operation in DCC and DC for Yard or Local Switching Locomotives

Light	Forward	Stopped after Forward	Reverse	Stopped after Reverse
Front Headlight	Bright	Dim	Dim	Dim
Rear Headlight	Dim	Dim	Bright	Dim

Table 3 - Directional Headlight Operation in DC and DCC for Road Locomotives

Light	Forward	Stopped after Forward	Reverse	Stopped after Reverse
Front Headlight	Bright	Dim	Off	Off
Rear Headlight	Off	Off	Bright	Dim

4.1.9   Mute/Unmute and Shutdown/Start Up - (F8), DCC only

The *F8* function key is used for two purposes:
- Muting and unmuting the diesel engine (*Prime Mover*) sounds
- Triggering the *Shut Down* and *Start Up* sound sequences

The above two operations take place simultaneously as will be explained below.

Muting and Unmuting Diesel Engine (Prime Mover) Sounds

The LokSound Select sound-decoder allows you to turn on or off the *Prime Mover* (diesel engine) sounds using the *F8* function key. This capability is very useful whenever you need to reduce the sound level to engage in a conversation or to answer the phone. If you have many trains operating at once, you can turn off the *Prime Mover* sounds on the locomotives that are running in the rear of the layout and increase the volume of the closest locomotive. Press the *F8* key in the *Stopped* or *Forward/Reverse* states to gradually decrease or increase the locomotive's volume between no sound and full volume.

> *Note*: Depending on the current state of DCC function *F8*, you may need to press this function key twice to mute the sound.

> *Note*: For the first two Atlas locomotives with LokSound Select decoders (RS-3 and S2), the mute/un-mute state **IS** maintained if power is turned off and back on again; hence if the locomotive sound was muted when track power is turned off, it will still be muted when power is turned back on. However, for the C424/C425 and future Atlas Gold Series locomotives, the mute state is **NOT** maintained if track power is turned off and back on; the *Prime Mover* sounds will return to their full volume setting upon power up.

Triggering Shut-Down and Start-Up Sounds

- **Shut-Down:** When diesel engine sounds are *On **AND*** the locomotive is stopped, pressing the *F8* function key initiates a *Shut-Down* sound sequence. At the conclusion of this sequence, the diesel engine sounds will be turned off. (If the locomotive is moving when you press the *F8* function key, the *Shut-Down* sound sequence will not play, and the locomotive sounds will be muted rapidly.)

  > *Note:* After the diesel sounds have been turned off, you can still operate (silently) the locomotive with your DCC speed control and direction switch. Although there will be no diesel engine (*Prime Mover*) sounds, you can still trigger and hear the *Bell* (*F1*), *Horn* (*F2*), *Cab Radio Communication* (*F15*), and other sounds by pressing the appropriate function keys

- **Start-Up:** When diesel engine sounds are *Off **AND*** the locomotive is stopped, pressing the *F8* function key initiates a *Start-Up* sound sequence. For the entire duration of this *Start-Up* sound sequence (up to 25 seconds), the locomotive will not move even if the DCC throttle is advanced. If you prefer not to have this

behavior, you can eliminate the delay in movement by setting CV124 to either 0 or 16, depending on whether you wish to use either a *Variable* or a *Constant BEMF Regulation Frequency*, respectively. (For further information on reducing BEMF noise, please see Section 4.2.7.)

4.2.0 Drive Hold

This feature allows the modeler to easily simulate a loaded or empty train by adding a single "Drive Hold" function button. When the button is pressed, the motor will remain at a constant speed, while the sound can be controlled independently from the motion with the throttle knob! This exciting, new feature gives the operator the ability to have his or her train crawl in notch 8 or coast at 50mph. Then, by releasing the Drive Hold function button you simply go back to throttle-controlled speed and motion. No more switching between manual notching and programming on the main to go back and forth. All of this can be done on the fly with hardly even thinking about it.

4.2.4 Selecting a Value for CV29

CV29 is a mandatory *Configuration Variable (CV)* in the NMRA DCC standard. Moreover, CV29 is perhaps the most important of all the CVs in DCC since 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*, among others.

The LokSound Select sound-decoder follows the conventions for CV29 with one exception; the default value of CV29 is 14 instead of the typical default value of 6. CV29 has the default value 14 to specify that RailCom (or RailCom Plus) is (if available in the DCC system) active by default.[1]

RailCom, originally developed by Lenz, provides a method for two-way communication between a DCC decoder and a DCC command station. RailCom Plus is an enhancement to RailCom that was developed by ESU. All LokSound Select sound-decoders support both RailCom and RailCom Plus. However, no DCC systems from North American DCC manufacturers support RailCom (or RailCom Plus). To Atlas's knowledge, the only DCC systems that do support RailCom are from European DCC companies. As a result, most customers (unless they have a European DCC system that supports RailCom and/or RailCom Plus) can use the customary values for CV29 that are given in Table 7 of Reference **Error! Reference source not found.**. Customers with a DCC system that does support RailCom and RailCom Plus will need to add "8" to each of the values for CV29 that are given in Table 7.

4.2.6 Reset all CVs to their Factory-Default Values

Reset all CVs in your Atlas Classic Gold Series locomotive to their factory default values as follows:

> **Reset all CVs to their Factory-Default Values**:
> - Place the locomotive on your program track.
> - Program the number 8 into CV8.
> - Cycle power to the decoder first off and then on again by doing the following steps:
>   - Tip the locomotive to one side so that all the wheels on the opposite side are off the rail.
>   - Hold the locomotive in this tipped position for 5 or 10 seconds.
>   - Slowly lower the locomotive back down until all wheels are once again on the rails.

The second bullet item above (power cycling) is extremely important. **DO NOT OMIT IT**. It may take up to 8 seconds for all CVs to return to their default values. For more details, see Section 5.1.7 in Ref [1].

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[1] Since the default value of CV29 is 14, if you program a long address, many DCC systems will simply add 32 to this default value, resulting in CV29 = 14 + 32 = 46 rather than the customary value CV29 = 38 for long addresses.

4.2.7 Reducing Noise from BEMF Circuitry

ESU has determined that the background noise generated by the BEMF circuitry can be reduced by using CV124 to specify that the BEMF circuitry use an *Adaptive Regulation Frequency* instead of a *Constant Regulation Frequency*. This change is made by setting bit number 4 of CV124 (when bits are numbered in the North American way from 0 to 7) to the binary value "1," which is equivalent to adding "16" to the current decimal value of CV124. This modification to the behavior of the LokSound Select decoder was first implemented in Atlas HO-scale Gold Series RS-1 locomotives and is planned to be used in all future Atlas HO-scale locomotives that use LokSound Direct decoders. With this change, the new default value of CV124 is 20. If you wish to convert an older Atlas Gold Series locomotive equipped with a LokSound Direct decoder to use a *Constant Regulation Frequency*, make one of the following changes to the value of CV124:

- Set CV124 = 16 if you want no *Prime Mover Startup Delay*[2];
- Set CV124 = 20 if you want to retain the *Prime Mover Startup Delay*.

5. Selection of Alternate Sounds (CV48)[3]

The LokSound Select sound-decoder installed in your Atlas Gold Series diesel locomotive allows you to change the sounds produced by the decoder to suit your preferences. In particular, this sound-decoder permits you to select from up to:

- Up to sixteen different air horns,[4]

- Two different bells,

- Two different brake squeals.

If the sounds that you would like to use are stored in the flash memory of the LokSound Select decoder that is installed in your locomotive, there is no need to download a new sound set from the Internet. You can simply pick the prime mover, air horn, bell, and brake-squeal sounds that you desire to use, program these selections into CV48, and you will have a locomotive with the sounds that you wish it to have. To compute the value for CV 48, follow the instructions in subsections 5.2.7.1, 5.2.7.3, and 5.2.7.4 of the *LokSound Select User Manual for Diesel and Steam Decoders*[1]. **With Ops Mode programming on certain DCC systems, it is necessary to cycle track power first Off and then On again for the changed value of CV48 to take effect.**

Appendix 2. NMRA-Specified CVs Used in LokSound Select Sound- Decoders that Have Non-Typical Default Values

CV	Name	Description	Type	Range Of Values	Atlas Default Value
CV2	Start Voltage	Sets minimum speed of loco	NMRA	0 – 255	3
CV3	Acceleration Rate	Value multiplied by 0.25 is time in seconds from stop to max speed	NMRA	0 – 255	60[5]
CV4	Deceleration Rate	Value multiplied by 0.25 is time in seconds from max speed to stop	NMRA	0 – 255	40[5]
CV6	Vmid	Speed at middle speed step (step 14 for 28 steps, step 63 for 128 speed steps)	NMRA	0 – 255	128[5]
CV7	Version Number	This CV stores the version number	NMRA	-	255

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[2] See Example 1 on page 9 of this document for further information on *Prime Mover Startup Delay*.
[3] Not all features described here are included in every Atlas Gold Series locomotive.
[4] Starting with the HO- and N-scale S-2 locomotives, the *Quick Start Guide* packed with your Atlas locomotive lists the available horns.
[5] Typical CV value; actual value varies among Atlas Gold Series locomotives equipped with LokSound Select decoders.

		of the decoder (currently always 255)			
CV8	Manufacturers ID	This CV contains the Manufacturer's ID of the decoder In addition, setting CV8 = 8 **and** cycling power first *Off*, then *On* again, resets the sound-decoder	NMRA	-	151
CV29	Configuration Register	See Section 4.2.4 of Reference [1] for programming information.	NMRA	0 - 255	14^6

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[6] See Section 4.2.4 for an explanation of why "14," rather than "6," is the default value.

Appendix 3. Some ESU-Specific CVs Used in LokSound Select Decoders[7]

CV	Name	Description	Source	Values 0f CV Bits		Range of Values	Atlas Default Value
CV31	Index Register High	Index Register used for access to CV257 to CV511 **To program the CVs discussed in this manual, you MUST ALWAYS have CV31 = 16.**	ESU			Currently Only 16	16
CV32	Index Register Low	Index Register *required* for access to CV257 to CV511	ESU			0, 1, 2, 3	0
CV48	Master Sound Select	Selects sound sets for diesel engine horn, bell, and brake squeal	ESU			0 - 255	Depends on Locomotive
CV49	Extended Configuration #1	Additional Settings #1 for LokSound Select Decoders	ESU			0 - 255	19 = 16+2+1
		Purpose of Each Bit:		Bit #	Decimal Value		
		Enable back EMF (0=disable, 1=enable)		0	1		
		Motor PWM frequency (0 = 20 kHz, 2 = 40 kHz)		1	2		
		Automatic DCC speed step detection. 16 = Enable automatic speed step detection		4	16		
		LGB® func. button mode 32= Enable LGB® function button mode		5	32		
CV63	Master Volume	Master volume control for all sound Effects. Don't set too high or audio clipping will occur	ESU			0 - 192	192
CV122	Status Storage	Remember or forget current states	ESU			0 -3	3: RS-3 & S-2 0: C424/C425 & RS-1
CV124	Extended Configuration #2	Additional Settings #2 for LokSound Select Decoders	ESU			0 - 255	20[8]
		Purpose of Each Bit:		Bit #	Decimal Value		
		Bit #0 ignored		0	1		
		Decoder lock using CV15 and CV16 (0 = disable, 2 = enable) :		1	2		
		Prime mover startup delay (0 = disable, 4 = enable)		2	4		
		Serial protocol for Marklin C Sinus (0 = disable, 8 = enable)		**3**	8		
		Regulation frequency (0 = adaptive, 16 = constant)		4	16		
CV255 to CV511	Indexed CVs	The values of these CVs depend on the value of Index registers CV31 and CV32. Indexed CVs are used for physical output settings, volume control, and function mapping. A detailed description of these CVs can be found in Ref. [1]	ESU			0-255	

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[7] Please see the *LokSound Select User Manual for Diesel and Steam Decoders*[1] for the definitions of the CVs that are *not* listed in this table.
[8] CV124 has a default value of *4* for the first four Atlas Gold Series locomotives with LokSound Select decoders (HO-scale RS-3, HO-scale S-2, N scale S-2, HO-scale C424/C425) and has a value of *20* for locomotives from the RS-1 onwards.

Appendix 4. Some Examples of LokSound® Select Sound-Decoder Programming

This appendix contains some examples of programming the CVs of an ESU LokSound® Select sound-decoder to change the behavior of an Atlas Gold Series diesel locomotive.

Example 1. Eliminate Prime Mover Startup Delay (DC and DCC)

This simple CV change eliminates the delay that prevents the locomotive from moving while the *Start-Up* sounds are playing. (Although the locomotive will now move as soon as the DC or DCC throttle is advanced, such motion is not prototypical since a real locomotive cannot move until after it has been started up.) The value to which CV124 must be set for this change depends on whether you wish the BEMF circuitry to use a *Variable Regulation Frequency* or a *Constant Regulation Frequency*. See Section 4.2.7 for more information on reducing BEMF noise.

For BEMF circuitry that uses a *Variable Regulation Frequency*, make the following CV value change:

Functionality to be Changed	Original Default CV Value (for Atlas locos)	Purpose of Original CV Value	New CV Value for Desired Functionality	Reason for Each CV Change
Disable *Prime Mover Start-Up* delay	CV124 = 4	Keeps locomotive from moving until *Start-Up* sounds complete	CV124 = 0	Allows locomotive to move even when the *Start-Up* sounds are playing

For BEMF circuitry that uses a *Constant Regulation Frequency*, make the following CV value change:

Functionality to be Changed	Original Default CV Value (for Atlas locos)	Purpose of Original CV Value	New CV Value for Desired Functionality	Reason for Each CV Change
Disable *Prime Mover Start-Up* delay	CV124 = 20	Keeps locomotive from moving until Start-Up sounds complete	CV124 = 16	Allows locomotive to move even when the *Start-Up* sounds are playing

Appendix 5. Considerations for Programming CVs Numbered over 255

Certain Digitrax and NCE DCC systems do not allow programming of CVs numbered above 255. In particular, the following DCC systems are currently NOT capable of programming of CV256 through CV511:
- The Digitrax Zephyr or Zephyr xtra with DT400 throttle,
- Digitrax Super Chief or Empire Builder with DT400 throttle,
- NCE Power Pro in Service Mode (programming on the program track).

The following Digitrax and NCE DCC systems DO allow programming of CV256 through CV511:
- Digitrax Zephyr or Zephyr xtra with DT402 throttle,
- Digitrax Super Chief or Empire Builder with DT402 throttle,
- NCE Power Cab in either Service Mode or Ops Mode,
- NCE Power Pro in Ops Mode (programming on the main track).

In order to make full programming of LokSound Select decoders possible, ESU has implemented an assistance tool. Since the higher-numbered CVs cannot be reached, this tool asks you to write the number of the desired CV temporarily into two assisting CVs (called the *Address Offset* and *Address* registers). After programming these first two CVs, the user programs the desired value for the CV numbered above 255 into a third assisting CV (called the

Value register). After the Value register has been written, the LokSound Select decoder automatically copies the contents of the Value register to the actual desired CV that is numbered above 255 and sets the values of the three assisting CVs back to 0. To summarize, three CVs have to be programmed to write the value of one CV numbered above 255.

These three CVs are described in the following table:

CV	Name	Description	Value Range
96	Address Offset	Saves the hundreds digit of the CV number that you wish to program	0 – 9
97	Address	Saves the units and tens digits of the CV number that you wish to program	0-99
99	Value	Saves the value of the CV that you wish to program	0-255

Example: You wish to program CV 317 with the value 120. Proceed as follows:
- Program the value of the CV number in hundreds in CV 96.
  - In this example, CV 96 = 3.
- Program the value of the CV number in units and tens in CV 97
  - In our example, CV 97 = 17.
- Program the desired value into CV 99.
  - In our example, CV 99 = 120.

As soon as you have programmed CV 99, the value of CV 99 will be transferred by the LokSound Select decoder into CV 317. When the programming finished, CVs 96, 97 and 99 will be set back to 0 automatically.

This procedure is ONLY needed when programming CVs numbered above 255 on a DCC system that does not allow programming of CVs numbered above 255.

REFERENCES

[1]. *LokSound Select User Manual for Diesel and Steam Decoders,* Third Edition (or later), May 2012. You can download the ESU *LokSound Select User Manual* document from the ESU website:
http://www.esu.eu/en/start/
by first selecting *DOWNLOADS.* Then click on *Instruction manuals.* Then, click on *Digital decoders.*

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