

The Atlas #500099 DCC decoder is installed in the following DCC-equipped Atlas N scale VO-1000 locomotives (all from the first run of these locomotives): Atlas Item numbers 50701, 50702, 50703, 50704, 50705, 50706, 50707, 50708, 50709, 50710, 50711, 50712, 50713, 50714, 51701, 51702, 51703, 51704, 51705, 51706, 51707, 51708, 51709, 51710, 51711, 51712, 51713, 51714, 51715, 51716, 51717, 51718, 51719, and 51720.

The principle features of this decoder are:

- * Extended (4-digit) addressing
- * Advanced consist control (lashing up locomotives that have different DCC addresses)
- * Will operate on conventional DC layouts; this feature may be disabled by setting a CV.
- * Supports the forms of DCC programming described in NMRA RP-9.2.3.
- * Both short form instructions and long form instructions supported in Operations Mode programming (programming on the mainline)
- * Settable for operation with 14/27 speed-steps, 28/55 speed-steps, or 128 speed-steps with direct drive
- * Directional headlights

Atlas #500099 DCC Decoder For N Scale Locomotives

Item Number 500099
Revised 03/09/2005



The Atlas #500099 DCC decoder is in conformance with NMRA DCC Standards and Recommended Practices. It has been augmented to work well with all major DCC systems on the market.

The Atlas #500099 DCC decoder provides the following features

- Extended (4-digit) addressing
- Advanced consist control (lashing up locomotives that have different short or long DCC addresses)
- Settable for operation with 14/27 speed-steps, 28/55 speed-steps, or 128 speed-steps with direct drive
- The forms of programming described in NMRA RP-9.2.3 supported
- Both short form instructions and long form instructions in Operations Mode programming (programming on the mainline) supported
- Operates on conventional DC layouts; this feature may be disabled by setting a CV.
- Directional headlights

The characteristics of these decoders can be programmed to customize the decoder to the locomotive in which it is installed. For details on the configuration variables supported by these Atlas N scale decoders, please read the *Configuration Variables and their Definitions* section of this manual. The VO-1000 DCC decoder supports all NMRA-specified programming modes.

Preparing to Install the #500099 Decoder

Before installing the Atlas #500099 decoder in your N scale locomotive, it is necessary to test (and adjust, if necessary) the locomotive for proper operation on conventional DC power. Replace any worn out parts, such as brushes. Also clean any dirt or oxidation from the wheels and pickups to in order to insure that electrical contact is good. Now is also a good time to lubricate your locomotive. A locomotive that runs well under conventional DC will also run exceptionally well under DCC.

The #500099 DCC decoder is quite small and will fit into an Atlas N scale VO-1000 locomotive in place of the existing printed wiring board that controls the headlights in the conventional DC (analog) version of the locomotive.

Precautions to Take When Installing the Decoder:

Although the #500099 DCC decoder has many internal safeguards to prevent damage, you must not allow any metal part of the locomotive to touch surface components of the decoder other than the pickup pads on the decoder that connect to the wheel-sets, the headlights, and the motor brushes. **Any contact to other parts of the decoder can cause a direct internal short circuit and destroy the DCC decoder.**

The Atlas #500099 DCC decoder is not completely protected against static electricity and has sensitive electronic parts. When installing this decoder in your N scale locomotive, it is recommended that you wear a grounded anti-static wrist strap. Also be careful in handling the decoder, especially in the area around the top rear part of the decoder (the area where the microprocessor is located).

All Atlas #500099 Decoders come with two LED headlights already installed. The light outputs of these decoders are designed only to drive these LED headlights. The Atlas warranty is void if the LEDs are removed from the decoder PC board.

Step by Step Installation

In the following steps, please refer to the instructions provided with your Atlas locomotive.

- 1) Remove the locomotive's body shell. Use care so as not to damage any of the fragile parts.
- 2) Loosen the two screws that hold the frame together; these screws are located at the front and rear of the frame.
- 3) Carefully remove the lighting control circuit board, which is located at the top of the frame.
- 4) Place the decoder between the two halves of the frame so that the decoder label is at the top of the board and the two motor pads are at the bottom of the decoder. These motor pads will connect with the two copper motor contacts when the decoder installation has been completed.
- 5) Carefully press the two frame halves together, with the sides of the decoder inserted into the notches in the two halves of the frame. Some pressure is needed to press the two frame halves together. This pressure fit insures good electrical contact between the frame and the decoder.
- 6) Tighten the two screws that hold the locomotive frame together.
- 7) Carefully check to make sure that the motor contacts are not touching either half of the frame. It is necessary to look down from the top through the frame cutouts in order to check for such unwanted shorts,

There must be NO electrical contact between the motor contacts and any part of the frame

Place the locomotive (without its plastic body) on your DCC programming track and read back the locomotive's address from the decoder. If the decoder is properly installed, you will be able to read

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back the factory pre-set address 03. If your system does not support reading decoder properties, observe carefully the decoder's behavior while on the low current programming track. Each time you try to program the decoder you can see the acknowledgement that is sent by the decoder in the form of a brief and minor jerk of the locomotive. A successful acknowledgement means that you have installed the decoder correctly.

Remove the locomotive from the track and, if necessary, correct any installation errors. Once you have successfully programmed the decoder, reinstall the plastic body and retest the locomotive on the programming track. If this test is successful, the locomotive is ready to use.

Programming Atlas #500099 DCC Decoders

Atlas #500099 DCC decoders support service mode and also operations mode programming. Using these programming methods, many features (such as the locomotive's address, acceleration, and configuration) can be customized to the individual locomotive in which the decoder is installed. The properties will be saved in non-volatile memory locations on the locomotive decoder so that they will retain their values even after the power has been removed. The values are set electronically, which means that the locomotive does not need to be opened again after the decoder has been installed in order to read or modify the values of these so-called Configuration Variables (CVs). DCC decoders have a total of 128 CVs. Not all of these CVs are used at this time since many have been reserved for future use.

All NMRA-compliant DCC Command Stations can be used to program Atlas #500099 DCC decoders. With several entry-level systems, only CV #1 (the locomotive address) can be set unless you use a separate DCC programmer. More advanced DCC systems support the ability to set many more CVs.

This decoder is most readily programmed in either Direct Mode on the programming track or in Operations Mode on the main track.

The specific details for reading and writing Configuration Variables with your DCC system are specified in the user manual of the particular system that are using. Note: In order for newly programmed CV values to take effect after service mode programming, the decoder must go through a power reset. If your DCC command station does not support automatic power reset, simply rock the locomotive off the track after programming.

Configuration Variables

Atlas #500099 DCC decoders support a range of features, which are activated by setting configuration variables. All the configuration variables are numbered. These numbers are used during programming and are identical for all decoders that conform to the NMRA standards, independent of the decoder manufacturer. The following table lists the CVs supported in Atlas VO-1000 DCC decoders. Both CV numbers and Register numbers are provided for cross-reference.

Some CVs (such as CV29) have specific meanings for each bit. In order to conform to the NMRA convention for bit numbering, the bit assignments shown in this table use the bit-numbering scheme of 0 to 7.

Table 1: Configuration Variables (CVs) for Atlas #500099 DCC Decoders

CV	Reg.	Description	Range	Default Value**
1	1	Short locomotive address: This is the (2-digit) number used to specify to the DCC system the locomotive that you wish to run.	1-127	3
2	2	Start voltage: This is the voltage applied to the motor in speed-step 1. Set this value so that the locomotive just starts moving in speed-step 1.	1-15	10
3	3	Acceleration Momentum: Determines the rate of change of speed upon acceleration. A higher value leads to a slower acceleration.	1-31	1
4	4	Brake Momentum: Determines the rate of change of speed upon braking. A higher value leads to longer braking distances.	1-31	1
5	5	Contains CV29 (see definition of CV29 below)	0-39	6

CV	Reg.	Description	Range	Default Value ¹
7	7	Version Number: This location stores the version number of the decoder. This CV is read-only.	-	46
8	8	Manufacturers Identification:¹ This value is the manufacturer ID of the decoder, (Atlas=127). This location is read only. Writing decimal "33" to this CV while the locomotive is on the programming track and then briefly removing the locomotive from the programming track will reset all CVs to their default values.	-	127
17	-	Extended Address High Byte	192-231	0
18	-	Extended Address Low Byte The two-byte (4 decimal digit) address, if used, is contained in CV17 and CV18.	0-255	0
19	-	Consist Address The advanced consist address, if used, is stored in CV19. (In Atlas Commanders, allowable range is 1-99.)	0-255	0
29		Decoder Configuration, Byte 1: Several decoder properties are set with CV29. Changes are easiest if done in binary mode, but can also be done by adding together the decimal values (shown in parenthesis) for all the desired features and writing the total into CV29. (For an example, see the section of this manual that is entitled <i>Converting Values of Individual Bits within a CV into an Equivalent Decimal Value for the Entire CV.</i>) The definitions for the individual bits of CV29 are given below.	0-55	6
	Bit 0	Locomotive direction: This bit sets the direction that the locomotive will move when told to move forward in digital mode. 0 = locomotive's direction is normal 1 = locomotive's direction is inverted	0,1	0 (1)

¹ This DCC decoder was designed for Atlas Model Railroad Company by Lenz GmbH.

CV	Description		Range	Default Value**
29	Bit 1	Headlight mode: 0 = Operation with 14 or 27 speed-step systems. This setting is selected when the locomotive decoder is used with any DCC system that does not support the 28 speed-step mode. If the headlights turn on and off as the speed is increased, the command station is configured for 28 speed-steps, and the decoder is set for 14 speed-steps. 1 = Operation with 28, 55 or 128 speed steps. If you use this setting, the Command Station must also be configured to use either the 28 speed-step mode or the 128 speed-step mode; otherwise, the headlights cannot be controlled.	0,1	1 (2)
	Bit 2	Usage on conventional DC layouts: 0 = locomotive operates in digital (DCC) mode only 1 = locomotive can operate on either conventional DC or on DCC	0,1	1 (4)
	Bit 3 Bit 4	Both bits always 0	0	0
	Bit 5	Extended Addressing: 0= Normal (single byte) addressing 1=Two byte extended addressing	0-1	0 (32)
	Bit 6 Bit 7	Both bits always 0	0	0
50	Decoder Configuration, Byte 2: CV50 is similar to CV29, but CV50 is used to set other properties. The definitions for the individual bits of CV50 are given below.		0 or 4	0
	Bit 0 Bit 1	Both bits always 0	0	0
	Bit 2	Brake momentum on DC operation. Used to achieve prototypical braking at red signal indications if conventional DC control is disabled. (CV29.2 = 0*) 0 = locomotive proceeds with track-voltage-dependent speed inside the conventional DC section. 1 = locomotive brakes in the conventional DC section with pre set brake momentum.	0,1	0 (4)
	Bits 3-7	Not used, always 0	0	0

* The notation CVx.y = z means that bit y of CVx has the value z. For example, CV29.2 = 0 means that bit 2 of CV29 has the value "0."

** In the Default Value field, the numbers shown in parenthesis () are the decimal values that must be written into a CV for the specified bit of that CV to have the value "1."

Converting the Binary Values of Individual Bits within a Configuration Variable into an Equivalent Decimal Value for the Entire CV

Reasons for Setting and Clearing the Individual Bits of a Configuration Variable

In order to make a DCC decoder perform in the manner that you wish it to perform, one must sometimes set or clear individual bits of a CV. To program a DCC decoder using a DCC system that allows only the writing of decimal values into CVs (such as the Atlas Master Commander), it is first necessary to convert the values of all the individual bits of that CV that are to be set to the binary value 1 into their equivalent decimal values. It is then necessary to add together all of these equivalent decimal values.

Procedure for Converting Individual CV Bit Values into a Decimal Equivalent Value for the CV

The following table illustrates how to calculate the decimal value that must be written into a CV in order to set and/or clear a specified set of individual bits within that CV.

Each bit of a CV that is to be set to the binary value "1" can be represented by the equivalent decimal number shown in the second column of this table. To determine the equivalent decimal value to be written into the CV, first write down in column 3 of this table the decimal equivalent values of all the bits of the CV that are to be set to a binary 1. Write nothing in column 3 for each bit of the CV that is to be cleared, i.e., set to a binary 0. Then add up all the numbers that you have written down in column 3. The sum that you get is the equivalent decimal value that you need to write into the CV.	Bit Number	Decimal Equivalent	Decimal Values for CV Calculation
	0	1	
	1	2	
	2	4	
	3	8	
	4	16	
	5	32	
	6	64	
	7	128	
		SUM:	

Example: Calculating the Default Value for CV29

	Bit Number	Decimal Equivalent	Decimal Values for CV Calculation
From the definition of CV29 given in Table 1, we see that the default values of bits 1 and 2 are binary 1s; whereas, all other bits in CV29 have a default value of binary 0.	0	1	
In order to compute the decimal equivalent default value of CV29, simply write in the rightmost column of this table the number "2" for bit 2 and the number "4" for bit 3.	1	2	2
Then add up all the non-zero numbers that you have entered into this rightmost column. Since the sum of these numbers is 6, the decimal number to be programmed into CV29 is 6.	2	4	4
	3	8	
	4	16	
	5	32	
	6	64	
	7	128	
		SUM:	6

Troubleshooting Decoder Programming Problems

Fault	Cause and Solution
Locomotive does not move when you address it on DCC system.	Check to see if you have selected the correct address for that locomotive.
Locomotive does not move when DCC system is set to the address in CV1, even though this address can be read from CV1.	You have used the single-byte address (CV1), but the decoder is still set to the extended (two-byte) locomotive address, i.e., bit 5 of CV29 has been set. Use the extended address or else clear bit 5 of CV 29.
Locomotive does not move when DCC system is set to the address in CV1, even though this address can be read from CV1 and DCC functions can be activated when DCC system is set to the address in CV1.	Check whether to see if a consist address has been programmed into CV19, i.e. check to see whether or not CV19 has a value greater than 0. If CV19 has a non-zero value, you must either use this consist address to operate the locomotive or else program the value 0 into CV19.
Function 0 (lighting) cannot be switched on and off.	Matching of speed steps is incorrect: The decoder has been set to 28/128 speed steps, but the DCC system has been set to 14/27 speed steps. Either set the DCC system to 28 or 128 speed steps or else change the decoder speed step setting to 14/27 speed steps. (CV29.1 = 0).
Locomotive headlights are only illuminated when the locomotive speed is increased or decreased; the locomotive headlights go on and off as the locomotive speed changes.	Matching of speed steps is incorrect: The decoder has been set to 14/27 speed steps, but the DCC system has been set to 28 or 128 speed steps. Either set the DCC system to 14/27 speed steps or else change the decoder speed step setting to 28/128 speed steps. (CV29. 1 = 1).

Atlas Limited One-Year DCC Decoder Warranty

Please fill out and mail the Warranty card on the reverse side, within 30 days of purchase. Atlas Model Railroad Company, Inc. warrants that this decoder will be free from defects in material and workmanship for a period of one year from the date of purchase. If this decoder fails during the warranty period, uninstall and carefully pack the item in the original carton, together with the dated sales receipt, and return to

Atlas Model Railroad Company
Attention DCC Repair
378 Florence Avenue
Hillside, NJ 07205.

Defects due to misuse, improper maintenance and/or abuse are not covered by the warranty. This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.



For Technical Assistance

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FC This equipment complies with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Please save this manual for future reference.

Lenz GmbH designed these DCC decoders for Atlas Model Railroad Co., Inc.

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