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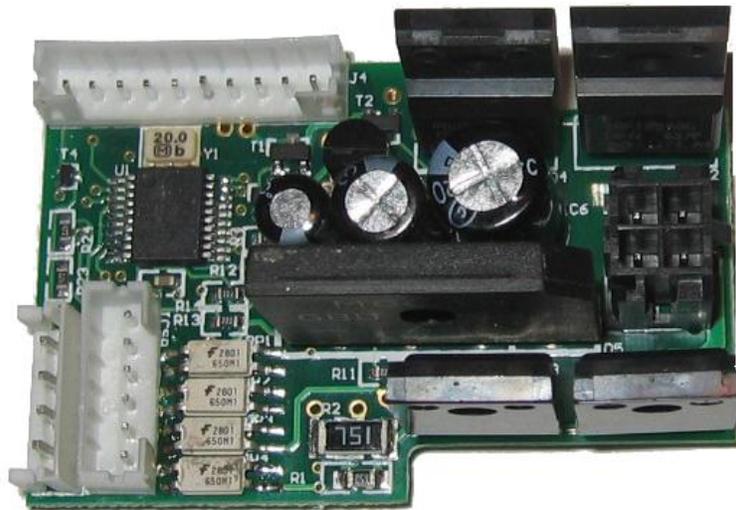
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Cruise Commander MTM

Instruction Manual



Cruise Commander MTM

TMCC Compatible DC Cruise Command Upgrade Board

Overview

The Cruise Commander MTM (modular) is an upgrade replacement for the Odyssey cruise DCDC used in the Lionel & K-Line engines with early TMCC. Those had 32 steps whereas this version offers 100 step speed control. The patented Cruise Commander with SMS* TechnologyTM is a breakthrough in cruise control technology for 3-rail. The Cruise Commander product line uses motor commutation and back-EMF to monitor the speed of the motor(s) attached instead of an external tachometer sensor. This method of motor control is easier to install than attaching an optical tachometer and timing tapes, and does not require flywheels on the motor. With the Cruise Commander MTM installed, the performance of the engine will be greatly enhanced.

Revised February 2020

All Cruise Commanders have a lash-up feature, with “nudge mode” to support minor variations in motor power. The mode allows a person to match the engines in a lash-up. Once the speeds are matched, they dynamically adjust with throttle position. The “nudge” settings are saved for future operating sessions; however they may be easily reset.

All Cruise Commanders are capable of operating in 32 speed step mode for speed profile compatibility with older TMCC equipped engines. The default setting for the Cruise Commander MTM is 100-speed steps. The Cruise Commander uses the sound system to indicate configuration changes by blowing the whistle/horn for acknowledgement.

SMS* - Speed Management System

Enhanced Features

- Simple “Tach-Less” operation
- Same footprint and wiring as Lionel modular command board
- Lashup Operation with Nudge adjustment
- Operates in command (TMCC & Legacy) and conventional modes
- Single or Dual DC motor capability (8 amps peak)
- CAB-1TM selectable 32 or 100 (default) speed steps
- Ditch Lamp and Marker Lamp outputs provided
- Uses existing mounting brackets in engine

Small Footprint

1.98” L x 1.28” W x 1.00” H footprint

Included with Board

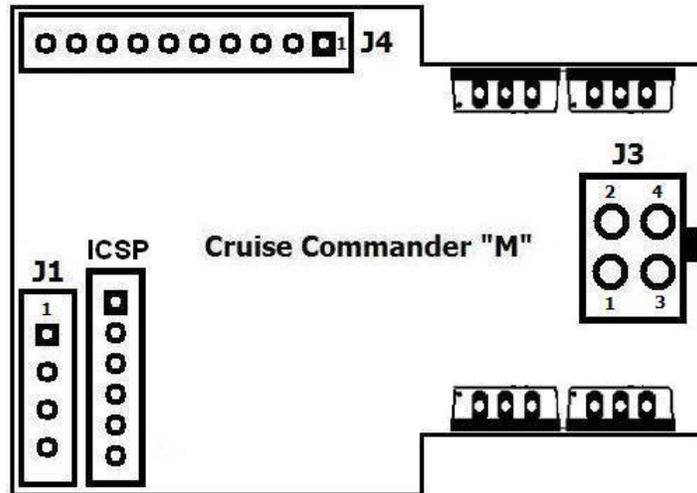
Hook-up wires, heat shrink, wire ties

Generic Installation Information

The Cruise Commander MTM (CCM) system is designed for operation in engines with modular factory TMCC with minimal modification to the engine wiring. The CCM will also be a great choice for engines that have K-Line cruise, or OdysseyTM cruise systems. This includes steam, electric and diesel engines. An existing R2LC is required and not supplied.

The next page shows all the connection pin/connector details and provides a reference for the remainder of this document. Details of the required connections during upgrade are provided in the next section. This is followed by a section for detailed commands and engine setup. Specific installation examples are found in the following section. The information in the **Installation** section should be used to determine what you need and the Examples used only for added reference to aid during the upgrade. The examples will guide you through the install, however many common elements exist in the install during the upgrade per the next section.

Cruise Commander M™ Connector Pin Designations



J1 Connector	Function – Power for Motor Drive Control
Pin 1, 3	Power input, 5.6v, supplied from the R2LC
Pin 2, 4	Motor Direction & phase control, from the R2LC

ICSP Connector	Function – Cruise Control (not required)
Pin 1	Option select, not currently used
Pin 2, 3, 4	Test only, do not connect
Pin 5	Cruise Enable switch
Pin 6	Cruise Enable switch, short 5 to 6 to disable

J3 Connector	Function – AC Power & Motor outputs
Pin 1	AC input, Track Common
Pin 2	AC input, Track Hot
Pin 3	Motor positive terminal
Pin 4	Motor negative terminal

J4 Connector	Function – Serial data & Lighting outputs
Pin 1	Serial Data IN from R2LC-C08
Pin 2	Serial Data OUT to sound system
Pin 3, 4	Marker output #1, pin 3 is positive
Pin 5, 6	Marker output #2, pin 5 is positive
Pin 7, 8	Ditch Lamp #1 output, pin 7 is positive
Pin 9, 10	Ditch Lamp #2 output, pin 9 is positive

Installation

A minimum of three electrical connectors are required during the installation of the Cruise Commander M™ (CCM). Additional connections/modifications may be required for ditch lights, marker lights, cruise switch and/or cab lighting.

Power & Motor Connections (J3 Connector)

The four pin black connector has the power input and the motor outputs. Depending on the engine chosen you may have either a 4 or 6 pin black connector. Most 4 pin connectors use the same pin connection as shown for J3 on the previous page. Those with the 6 pin connector will replace it with the provided 4 pin connector. The four pins include track power (center rail-usually red & outer rail-usually black) and the two wires to the motors. The motor wires may have to be reversed if the engine starts in reverse.

Motor Drive Control (J1 Connector)

The J1 connector provides for DC voltage, and motor direction/phase control from the R2LC. In some installations, you will be able to move the connector from the former command unit to the CCM. Other upgrades will use the included 4 pin cable with three (some have 4) wires to connect to an existing connector on the motherboard as shown to the right. A 4-pin cable is included in the CCM kit for engines that do not have this wire harness (e.g., K-Line).



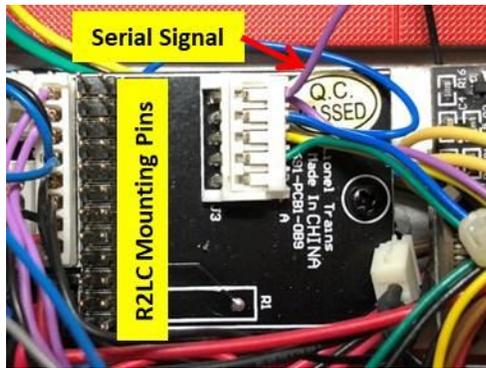
Serial Signal and ancillary connections (J4 Connector-10 pin)

The R2LC communicates commands via a serial connection to the CCM. There are multiple methods to originally connect to the command board; however there is only one method to connect to the new board. Pin 1 of J4 (previous page) is the serial input from the R2LC. Pin 2 of this connector is the output that may be used to drive the tether connection on steam engines. If the serial data is not connected properly, the CCM will enter conventional operating mode and the throttle will be unresponsive.

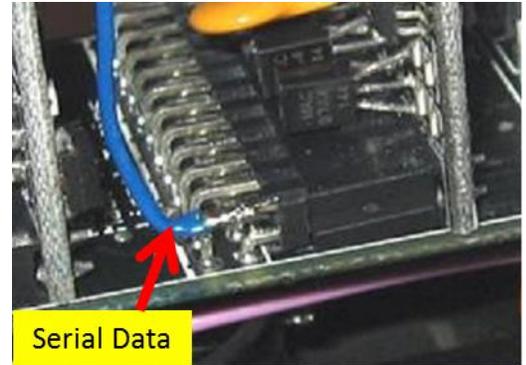
Some engines will have the same 10 pin connector to facilitate an easy install. Ensure the extra wires correspond to the pin designations on Page 3. Correct any problems prior to making the connection! On other engines the serial data signal may be found at some point on the existing motherboard or directly from the R2LC board.

The following pictures may help in locating existing connections during the installation. The first picture shows a Lionel motherboard used in some applications. The part number is under the R2LC board that was removed for this picture (mounted

horizontally) and is 681-PCB1-089. The other approach used had the R2LC and the two sound boards mounted vertically and examples are shown later in this document.



The picture to the left shows this board and the location of the serial output. In this picture the pin with the two purple wires connects to the sound board and to the CCM, connector J4, pin 1. Patch into this wire on the supplied 10 pin connector.

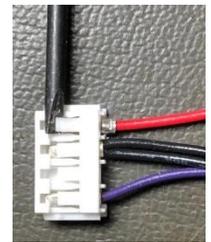


If your installation does not have this you can connect the serial line directly to the R2LC board as shown in the picture to the right.

J4 Connector Additional Connections

Those installations that previously had the 10 pin connector may already have the ditch lights, etc. Verify the pins are in the correct location. Then plug this into the new CCM.

If the old command unit had separate connectors for ditch and markers you will need to remove the pins from the pre-existing wires and connectors. This is accomplished by lifting the plastic tab with a small screwdriver and pulling the female pin out of the old connector as shown in this picture. The pins are then inserted in the appropriate locations of the CCM J4 connector (see page 3) as provided.



Ditch lamps flash when the horn is activated (command mode only). These four outputs are capable of driving LEDs or bulbs of low voltage. One common output may be used for either ditch lights or markers. The outputs will drive 1.5 volt LEDs or small bulbs provided by the manufacturer. Note that many LEDs and bulbs require a higher voltage if you are retrofitting the engine.

Cruise On/Off Switch

The earlier TMCC engines had an external Cruise On/Off switch. If this capability is preferred, the connector can be placed over pins 5 & 6 of the ISCP connector shown on page 3.

Motor Tach Signal

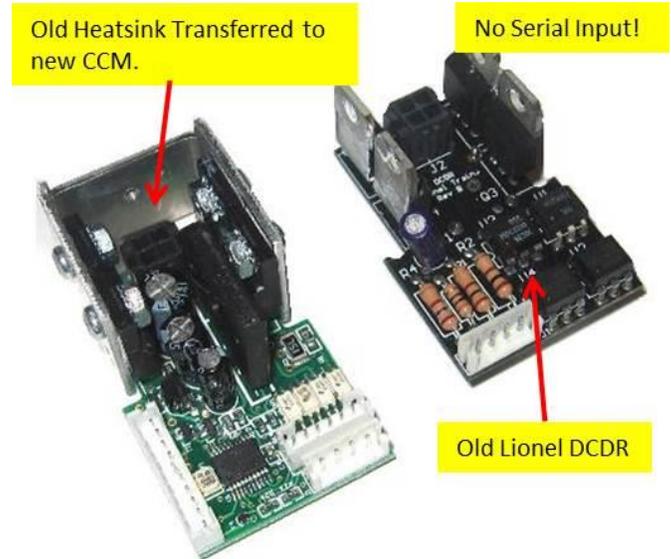
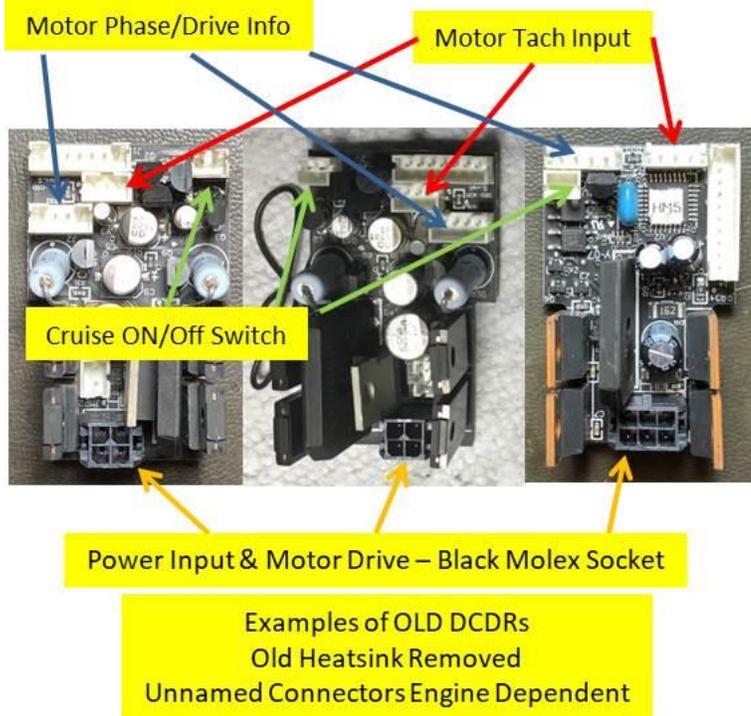
The older engines used a three pin connector from the command unit to receive a tach signal from the motor. This three pin connector is no longer required and may be removed.

Physical Mounting

Transplant the heat sink from the old unit to the CCM. Screws are provided in the kit if they are different from the original screws used. Mounting in the engine will use the original screws in the pre-existing heat sink and/or plastic tray. Be sure to retain the original mounting orientation when placing in the engine.

The picture on the right shows an old DCDR with only a motor phase/direction input and the 4 pin Molex connector. In this example the new unit is on the left and the heatsink has already been installed.

The following picture shows three other examples of old DCDRs taken out of Lionel and K-Line engines. The important sockets to note are the 4-pin motor phase/drive info and black Molex connector (4 or 6 pin). The Cruise On/Off switch



is not required but may be used by following the directions on the previous page.

In ALL cases the Motor Tach input will no longer be used and the associated cable/connector may be removed.

Each of the old units received the serial data in a different method. Only the far right unit used the same 10 pin connector as the new CCM with the serial data on pin 1! Make sure you make all required connections or the installation will not be complete.

Finish Installation

Complete the wiring using wire ties to ensure all wires are out of the way for reassembly. Make sure you employ the next two sections to ensure the new Cruise Commander MTM is properly installed and working! Finally reattach the cab and enjoy your upgraded engine.

Option Setting Overview

The Cruise Commander M™ product line is unique in that the R2LC firmware revisions may vary, as the R2LC is not included in the kit. As a result, to be compatible with the R2LC-C08 to R2LC-C11 and R2LC-C13, the option selection sequence is slightly different as indicated below. As a bonus, when using R2LC-C11 & R2LC-C13, the momentum commands are repurposed to adjust the speed step selection: L = 32-speed steps, M = 100-speed steps, and H = 100-speed steps. Note: The speed step selection can change only when the throttle is set to zero.

Speed Step Selection

The default speed step selection is 100 as shipped. The 100-speed steps are linear. The 100-speed steps start at a lower threshold, thus the motor is operating at a lower initial voltage with fine adjustment as the throttle is advanced. The momentum and stall features are not applicable and do not operate. The speed step selection is stored until changed, and survives power cycling. To switch Speed Steps do the following:

Activate 32-Speed Steps: AUX1 + DIR + AUX1 + DIR + BRAKE

Activate 100-Speed Steps: AUX1 + DIR + AUX1 + DIR + BOOST

Motor Type Selection

The CCM requires you to set the motor type. Motors are classified as small or large. Selecting the wrong motor size won't hurt anything, but operation is best when matched. The default motor type is "large motor" for the Cruise Commander. The motor type selection is stored until changed, and survives power cycling. To switch Motor Type do the following:

Activate Small Motor: AUX1 + DIR + AUX1 + 1

Activate Large Motor: AUX1 + DIR + AUX1 + 2

Cruise Off/On Selection

The Cruise feature may be turned off or on. This setting is stored and affects command and conventional mode operation. The cruise off/on selection is stored until changed, and survives power cycling. To turn the Cruise OFF or ON, do the following:

Cruise Off: AUX1 + DIR + AUX1 + BRAKE + 7 + BRAKE

Cruise On: AUX1 + DIR + AUX1 + BRAKE + 9 + BRAKE

"Nudge Mode" Operation

The Cruise Commander has a bit of "play" to allow engines to operate in a lash-up. At times the "play" is not optimal, so it is possible to match engines a bit closer with the "nudge" mode feature. This is used in Lash-up Mode *only* with very similar engines. The gear ratios of the two engines should be the same or one engine will pull while the other drags.

First, simply try the engines together in a lash-up at slow speeds. If they buck each other (operate at slightly different speeds), use the Cruise Commander “nudge” mode to try to match the engines a bit closer. Nudge mode basically increases the slower engine to match the speed profile of the faster engine. Although similar to a “stall” setting, the nudge mode is a bit more complex as it calculates the speed profile dynamically to hold the engines in sync throughout the throttle range.

Using the TR function

First create a “TRain” with the Cab-1. Once the engines are operating in TRain mode, do the following:

- Test run the engines (not coupled) to find the slower engine
- Place the slower engine behind the faster one
- Get them moving as a train, around 10 speed steps on the throttle
- Select the **slower** engine ENG ID #
- Press AUX2 4 times, with a 1 second pause between each press
- The lights should blink off twice, confirming the engine to be “nudged”
- Use the BOOST and BRAKE keys to adjust the slower engine to match the faster one
- Press “HORN” to lock the setting in the slower engine
- Couple the engines together and run as TRain

To operate the “Nudge” mode on an ENG ID, do the following:

Activate: AUX2 + AUX2 + AUX2 + AUX2

Nudge: BOOST to speed up, BRAKE to slow down

Save: Press HORN

To clear the nudge settings, select the speed step (32 or 100) on the “nudged” engine. The “nudge” selection is stored until changed, and survives power cycling.

Setting the R2LC ID and Feature Code

When upgrading an engine with a previously set ID and feature code, this section is provided only as information and nothing needs to be done. If you replace the R2LC with a new R4LC this section is required before operating the engine.

Setting the engine ID Number:

The R2LC Receiver comes with its engine ID set to ENG '1'. To change the engine ID, follow this procedure.

1. Make sure the Command Base is connected to the track
2. Set the engine PROGRAM / RUN switch to "PROGRAM"
3. Place the engine on the track and apply power
4. On the CAB-1, press [ENG] then the number (1 - 99) for the engine desired
5. Press [SET] (the engine ID is saved until you need to change it again)
6. Press [AUX1] [n], where n = the engine feature code (this must be done!)
7. Remove power from the track and place the switch back into the 'RUN' position

Feature Code information:

The R2LC receiver module can be programmed to operate different features for different engines. Use only codes "4" through "8" for proper operation.

Code	Engine Type	Feature Terminal
0	Steam w/ Signal sounds	Smoke Unit
1	Diesel w/ Signal sounds	Strobe Light
2	Diesel w/ Signal sounds	Cab / Marker Light
4	Steam w/ Rail sounds	Smoke Unit
5	Diesel w/ Rail sounds	Strobe Light
6	Diesel w/ Rail sounds	Cab / Marker Light
8	Diesel w/ Rail sounds	Smoke Unit

Why is it necessary to set the Feature Code?

The Cruise Commander uses the serial data from the R2LC receiver to detect the throttle settings. This serial data signal is dependent on the feature code. If this is not properly set, the engine will not respond to throttle commands and may even enter into conventional mode and rocket down the rails! Additionally, features like the smoke unit will not operate until the feature code is set. It is always a good idea to know your engine feature codes for proper operation of smoke/strobe/cab/marker lighting effects. This is true of your entire TMCC engine stable.

When running in Conventional mode:

Cycling of engine direction can be overridden by placing the programming switch in the 'PROGRAM' position. This will lock the engine to the last operating direction. You must replace the switch back to the 'RUN' position if you wish to run the engine in Command mode.

Installation Examples

The following examples may be helpful in identifying specific installation peculiarities. These are not a complete set of examples as many variations were used by the manufacturers.

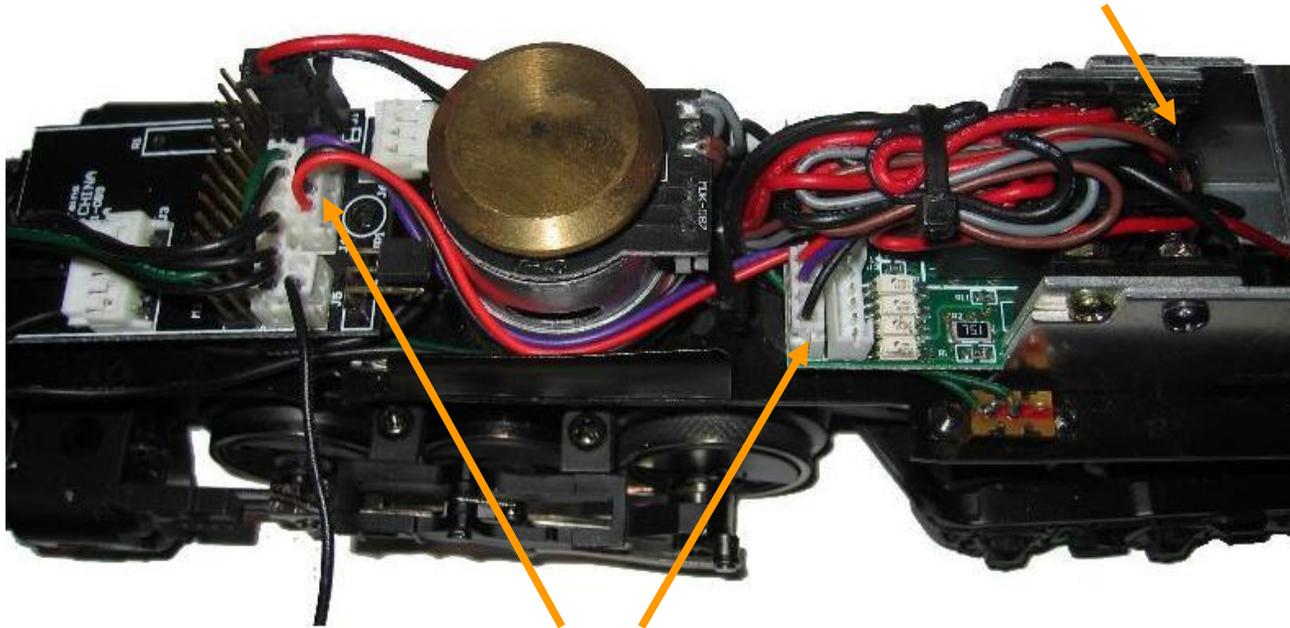
K-Line Allegheny

Shown below is the CCM installed in the K-Line Semi-Scale Allegheny. The CCM uses the same mounting as the original board that it replaces, so simply remove the original K-Line cruise, and use the same screws to install the CCM. When removing the K-Line cruise, there is a wire from the bottom of the circuit board that connects to the motor; cut this wire as close as possible to the motor.

Wiring Sequence:

- 1) On the CCM, attach the 4-pin Molex connector delivering power and motor connections.

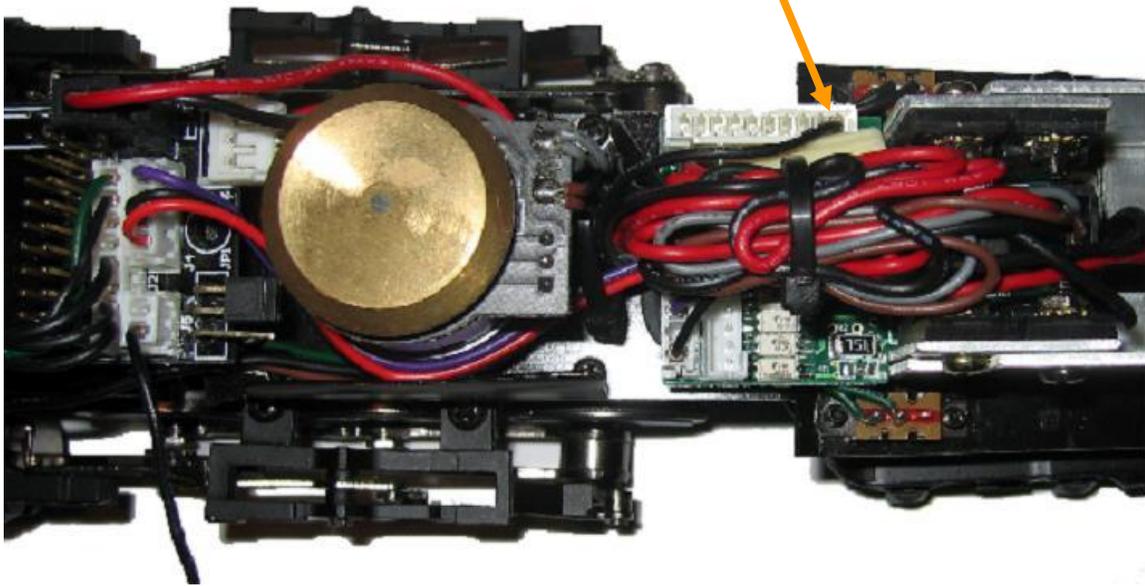
4 Pin Molex Connection



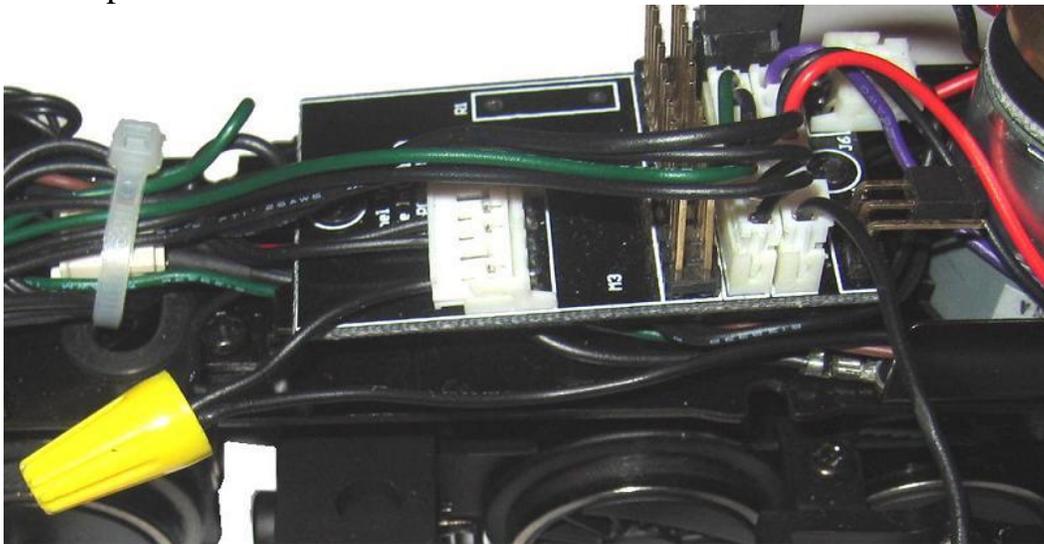
“J1” interconnect cable

- 2) Connect the supplied “J1” cable as shown. Connect from the R2LC motherboard to the CCM.
- 3) Locate the 10-pin connector in the kit, and plug this into the mating “J4” connector as identified below.

“J4” serial data connection



- 4) Locate the serial data line cluster wire nut, and attach the wire from “J4”, pin-1 to this cluster and replace the wire nut.



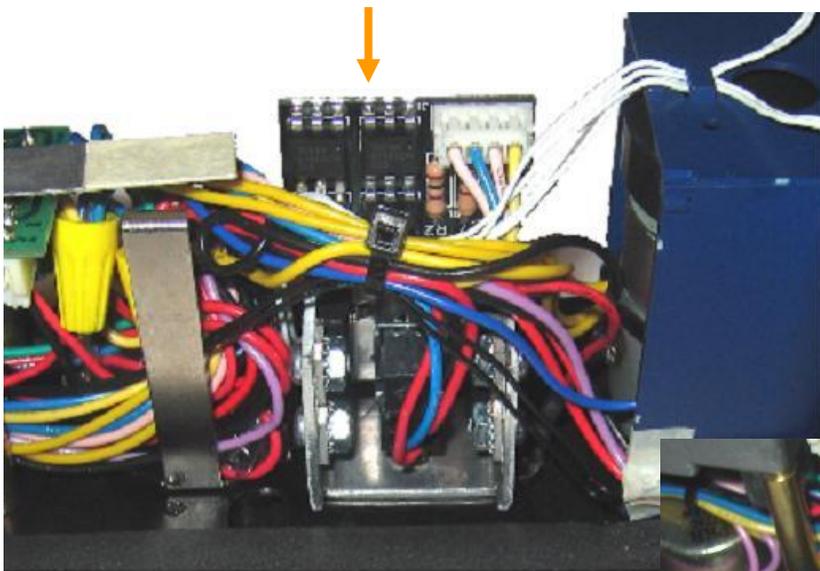
Lionel SD-60

Shown below is the CCM installation in the Lionel SD-60. The CCM uses the same mounting as the original DCDR that it replaces. Installation in this engine will require connecting the serial data line to a connector on the motherboard. If the serial data is not connected properly, the CCM will enter conventional operating mode. When this condition occurs, the throttle will be unresponsive.

Original wiring in SD-60 Engine



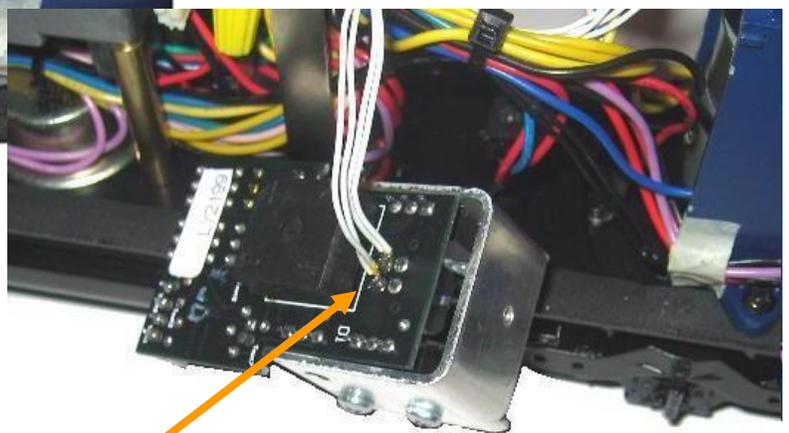
Motor Driver (DCDR) Identification 1



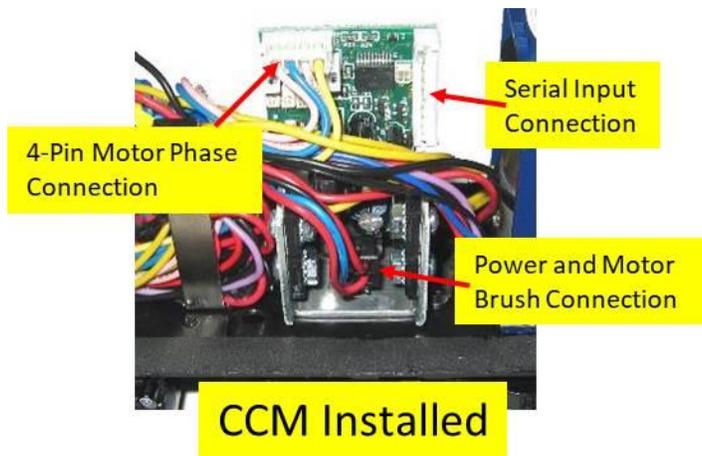
In this example, the DCDR will be removed and replaced with the CCM. Mounting of the DCDR in this engine was done with a single screw at the bottom center of the heat sink. The screw was easily removed by slipping a screwdriver through the truck by the wheel. Once the DCDR is free, unplug the 2 connections and remove the DCDR. On this engine the cab

lamps were soldered to the DCDR; next cut or unsolder these from the PCB.

This photo shows where cab light connections were made on the old unit and should be removed and reinstalled to the power input connections.



Cab Lamp Connections



Mount the new CCM using the old heat sink and in the same location as the old unit. Next attach the original cables to the CCM as shown.

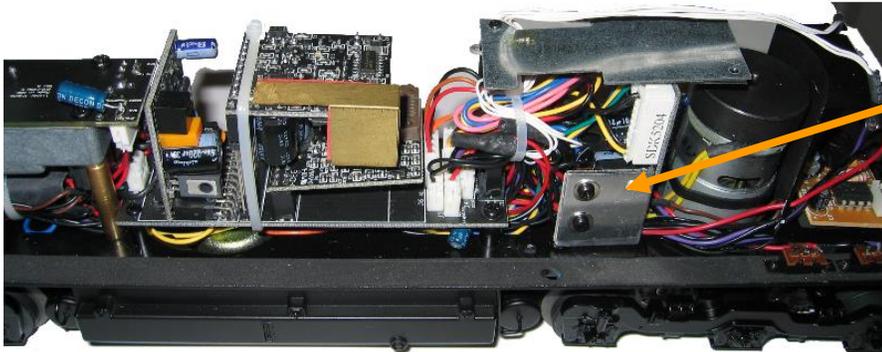
Plug in the 10-pin cable harness on the right in the photo. In this minimalist example, the only wire is the serial data on pin-1. Dress the wires and route the signal along the existing wiring harness, keeping all wires away from the smoke unit bowl, which can get fairly hot.

The serial line from the CCM will need to be attached as shown on page 5. It is best to route the wire above the R2LC to prevent the wire from being pinched between the shell and the motherboard. If the 10 pin connector did not previously exist, follow the directions on page 5.

Lionel SD-80 with Odyssey™

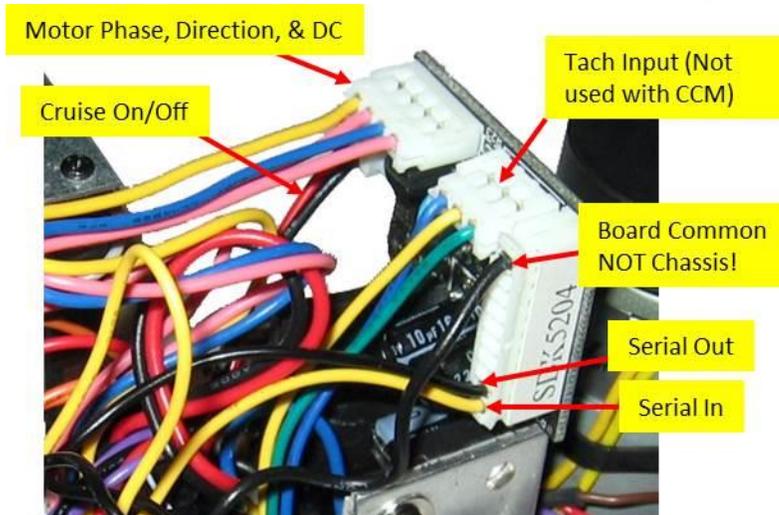
Shown below is the CCM installation in the Lionel SD-80 with the Odyssey speed control. The CCM uses the same mounting as the original DCDR that it replaces. Installation in this engine will require connecting the serial data line to a connector on the motherboard. If the serial data is not connected properly, the CCM will enter conventional operating mode. When this condition occurs, the throttle will be unresponsive.

Original wiring in SD-80 Engine



Odyssey Motor Driver

In this example, the Odyssey motor speed controller will be removed and replaced with the CCM. The first step is to swing the antenna out of the way, and review the wiring below to identify the major connections for easier migration to the CCM.

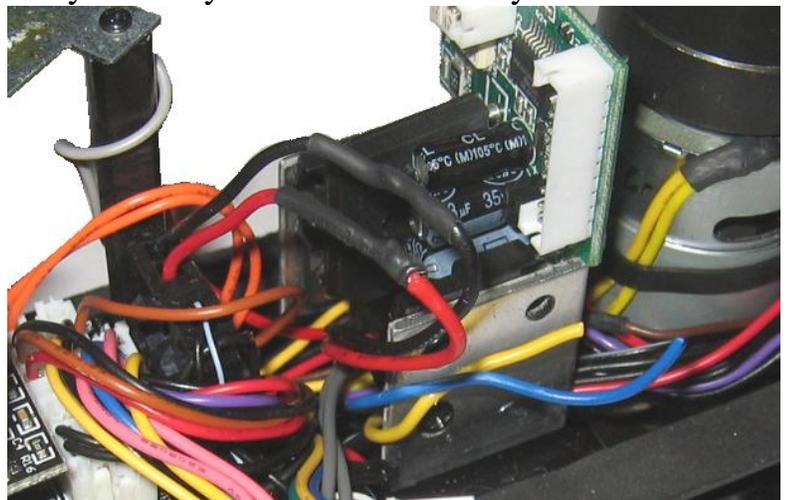


***** **WARNING** *****

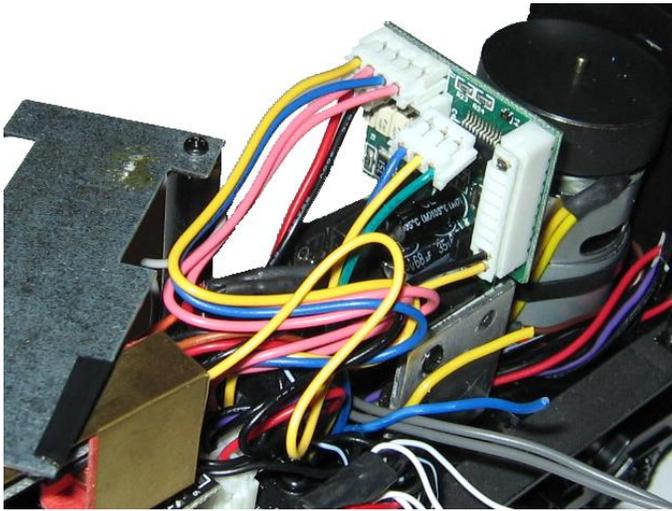
The wire, identified as Board Common is **NOT** the same as the engine chassis, and therefore **MUST NOT** be allowed to connect to the CCM board or serious damage will occur! ERR can sell you a replacement though!

The three pin “Tach Input” is no longer necessary and may be removed entirely.

Unplug all wire connectors and remove the 4 screws holding the Odyssey circuit board from the heat sink. Keep all mounting hardware as it will be reused. The heat sink can be removed from the chassis if desired; there are 2 screws under the engine chassis that secure the heat sink. It should not be necessary to remove the heat sink unless you find it difficult to install the screws to mount the CCM.



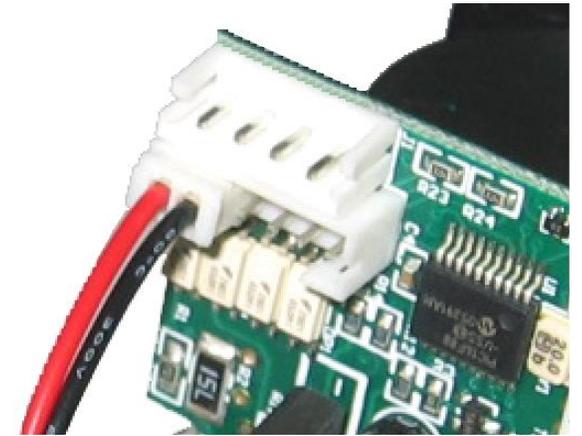
There will be a 6-pin Molex connector that supplies power and motor connections (hidden and located at the base of the command board). Cut the 4 wires going to the connector. These wires are usually Red (3rd rail), Black (common), Blue and Yellow (motor brushes). These wires will need to be spliced into the 4-pin Black Molex connector provided that attaches to the CCM.



Plug in the rewired black 4-pin connector and reattach the heat sink. Then splice the Red and Black wires, connecting the CCM and the wires that were cut from the 6-pin Molex connector as shown.

Cruise On/Off may be used as shown in the

Installation section. A detail is shown to the right of the “Cruise On/Off” switch connection. Note the connection on the far left 2 pins, and verify you can see 4 unconnected pins to the right of the plug, indicating that indeed the left 2 pins are connected to the plug. **Damage will occur if done incorrectly.**



Motor Connections

The last 2 connections required are for the motor brushes, which are typically the blue and yellow wires. These 2 wires need to be spliced to the gray wires from the CCM supplied black 4-pin Molex connector. Since the polarity and wire colors are not consistent, the only solution to making this connection with the correct polarity is to run the engine. When the engine operates in the correct direction (forward at power up), finalize these 2 wires by soldering and applying heat shrink.



When using the temporary splices, place a piece of heat shrink (do not shrink), to protect the wires from shorting to the frame or to each other. Shown above is the temporary wiring prior to testing the engine.

Complete wiring with wire ties - holding wires neatly in place. After the wires are secured, rotate the antenna back to the original position, and route the cab light wires away from the motor flywheel as shown to the left.

Limited Warranty

Sunset Models Inc. warrants to the original consumer purchaser that this product will be free of defects in materials and workmanship for a period of 90 days from the date of original purchase. This warranty does not cover service, repair, or replacement to correct any damage caused by improper installation, improper connection, external electrical fault, accident, disaster, misuse, abuse, or modifications to the product. All other express or implied warranties, including the implied warranty of merchantability and fitness for a particular purpose, are hereby disclaimed. If this product is not in good working order as warranted, the sole and exclusive remedy shall be repair or replacement. In no event shall Sunset Models Inc., or any dealer, distributor, or authorized installation and/or repair service provider be liable for any damages in excess of the purchase price of the product. This limitation applies to damages of any kind, including but not limited to, direct or indirect damages, lost profits, lost savings or other special, incidental, exemplary or consequential damages whether for breach of contract, tort or otherwise, or whether arising out of the use of or inability to use the product, even if Sunset Models Inc., or any dealer, distributor, or service provider has been advised of the possibility of such damages or any claim by any other party. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. During this warranty period, the product will either be repaired or replaced (at our option) without charge to the purchaser, when returned either to the dealer with proof of the date of purchase or directly to Sunset Models Inc. when returned prepaid and insured with proof of date of purchase. Some states do not allow limitations on how long an implied warranty lasts, so such limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

Repairs

Each and every product is thoroughly tested before it is shipped. The likelihood that it is not working when it reaches you is very small. However, if after troubleshooting it yourself you cannot get it to work properly, you should contact us to help determine the problem.

Should your product ever need repair, you should return it postpaid directly to Sunset Models Inc... If the product is within the warranty period, it will be repaired or replaced and returned to you free of charge. Units out of warranty will be repaired or replaced for a service charge of \$50.00 at our option.

Please email to err@3rdrail.com for return authorization before returning any product.

Disclaimer

Improper installation or configuration of the Cruise Commander Board can cause overheating and fires! Since it is not possible to understand every installation, it is the consumer's responsibility to verify proper operation of the upgrade to prevent malfunction. If you are unsure of install, please contact us first before taking any risks!

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