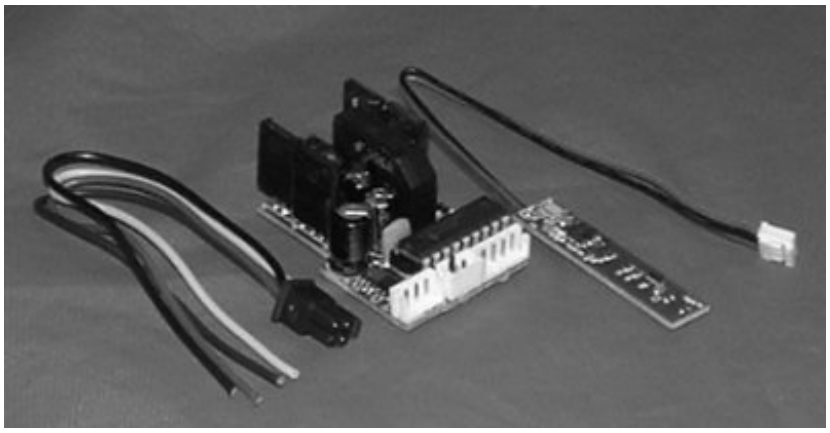
Installation Instructions
For
EOB Drop In Board



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Technical Assistance

If you should encounter a problem during your installation, please contact our technical support hotline at 330-533-7181. This line is manned Monday-Friday 9am-5pm EDT. You can also contact us by fax at 330-533-7208 or online at mike@tastudios.com or phil@tastudios.com. We urge you to read installation instructions specific for your locomotive thoroughly before you attempt the installation. Please take the time to become familiar with the process before attempting the installation this will help you understand all the steps involved.

Warranty

The EOB Drop In Board carries a 1-year limited warranty (from the date of purchase) on workmanship and operation. If you feel as though you need to return your Drop In Board for any reason please include a note explaining the problem. Also include your name, return mailing address and DAYTIME phone number. Return shipping will be covered if we are mailing just the Drop In Board in question in the continental United States. If you send a locomotive for repair the customer will be responsible for the return shipping costs. TAStudios will cover any labor or replacement costs plus return shipping on the electronics only. If you have any questions regarding this warranty, please call 330-533-7181 Monday-Friday 9a-5p EDT.

Kit Contents

Each EOB Drop In Board installation kit includes the following components:

- 1 EOB Drop In Board
- One 4-Position black Molex connector
- One 3-Position 2.0mm connector
- One Flywheel sensor with 3-position 2.54mm connector
- One sheet of flywheel tape stripes
- One complete set of installation instructions
- 1K Ohm ¼ Watt resistor

If you feel as though your installation kit is missing any of these components, please contact TAStudios immediately at 330-533-7181 Monday-Friday 9a-5p EDT.

Introduction

Congratulations on your purchase of the most technologically advanced cruise control system currently available for TMCC equipped locomotives. EOB will transform your locomotive into a smooth running steady puller on your railroad empire.

The Drop In Board has been a long time coming, and it is finally here! The EOB Drop In Board will give you all the benefits of EOB speed control without changing your locomotive's current wiring architecture. Further, the Drop In Board allows you to finally upgrade your late model locomotives affordably. This Drop In Board will allow you to retain your Lionel infrared tether on steam locomotives or retain the smoke units on smaller diesel locomotives.

The EOB Drop In Board replaces the current motor driver board in your locomotive with the Lionel modular board setup. Please keep in mind that there are literally hundreds of variations of Lionel's modular motherboards in circulation. That having been said, you may encounter a motherboard different from that shown in these instructions. If you do, don't panic. We ask that you visibly trace each wire to verify its termination point before you cut any wires. This way you can be certain you have the correct wires.

If you are uncomfortable performing this installation we do offer professional installation for a reasonable amount. Please contact us directly for current labor costs and current lead times.

Please locate the set of instructions that best fit the description of your particular locomotive and begin there.

Important Note

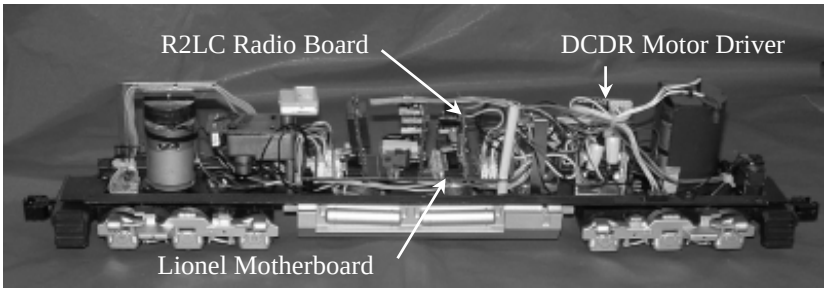
We ask that you please locate the instruction set closest to your locomotive and read it thoroughly BEFORE beginning the installation. We cannot stress enough how important it is to become familiar with the installation process prior to beginning your installation.

Conventional Operation

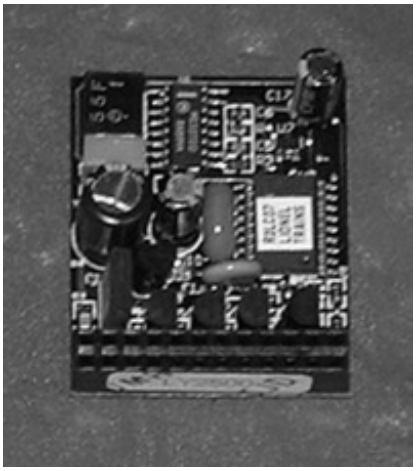
Your Drop In EOB Board is not equipped with cruise control when used in the conventional mode. The cruise features are only accessible in the TMCC mode. The locomotive will operate in conventional just fine; it just will not have the constant speed control feature like it does in a command environment. This was a decision we were forced to make based on available space on the board itself.

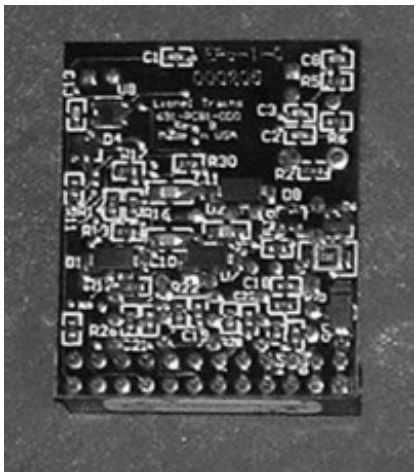
Installation into Lionel Scale Diesels without Odyssey®

Begin the installation by removing the screws that hold the shell to the frame. Once all the mounting screws have been removed take the shell off the frame and set it aside for the time being. The photo below illustrates the frame with the shell removed. The sample we are using for this installation is a Lionel scale BNSF Dash-9.



You need to identify the three primary components we will be working with before you go any further. These components are the DCDR Motor Driver, the Lionel Motherboard and the Lionel R2LC Radio Board. The DCDR will be mounted to a heat sink attached to the frame. The Radio Board will be plugged into the Lionel motherboard. The photo below illustrates the front and backsides of the radio board.


Front side of R2LC Radio Board


Backside of R2LC Radio Board

Now that you have identified the three main components we will be working with go ahead and locate the DCDR motor driver board. Unplug the 4-position white connector along the top edge of the DCDR board. Then unplug the black 4-position Molex connector that is located between the heat sink tabs. Be sure you depress the locking tab on the connector, so you do not break the tab off when unplugging it from the connector, as we will be reusing this plug.

There are only 2 connectors plugged into the DCDR board, both of them should now be unplugged. You want to rotate the heat sink 90 degrees so you can gain access to the screws that hold the existing DCDR in place. Once you have turned the heat sink, you want to remove the 4 screws and nuts that hold the DCDR to the heat sink. Save this

hardware! You will be reusing it to mount the EOB Drop In Board in the next step. Once you have the 4 screws removed go ahead and take the DCDR out of the heat sink.

Locate the EOB Drop In Board that came with your installation kit. You want to mount the EOB Drop In Board in the same position the DCDR was mounted in. Using the original hardware, screw the tabs of the EOB Board to the heat sink. Be careful not to over tighten the screws, as this will cause the cases to crack and void the warranty. Once you are satisfied with the assembly turn the heat sink back to its original position. You may have to tighten the screw and nut that holds the heat sink to the frame. If this is required do so now.

***NOTE**: You may want to add some heat sink paste between the EOB Drop In tabs and the heat sink to help facilitate the heat transfer between these components and the heat sink. It is not a requirement, but it is recommended. You can acquire heat sink paste at any good electronics supply store such as Radio Shack.*

Our sample had 2 wires soldered to the bottom of the DCDR board, which ran the cab lights. We suggest cutting these wires from the bottom of the DCDR board and soldering them into the pickup and ground wires. The pickup wire will be the red wire in the black 4-position Molex connector. The ground wire is the black wire in the black 4-position Molex connector. It is best not to attempt to solder these wires on the bottom of the EOB Drop In Board due to the very fragile surface mount parts located there.

Locate the black 4-position Molex connector you unplugged from the DCDR. Plug it into the 4-position connector on the EOB Drop In Board, located between the heat sink tabs. Do not force the connector, it is keyed and will only fit in one position. Carefully align the connector until it slides into the plug. Then press it down until the locking tab locks in place.

Now locate the 4-position white connector you unplugged from the DCDR. Plug it into the only available 4-position plug on the EOB Drop In Board. Once the connector is in place plug it in so it sits flush with the bottom edge of the connector.

Mounting the Flywheel Sensor Board

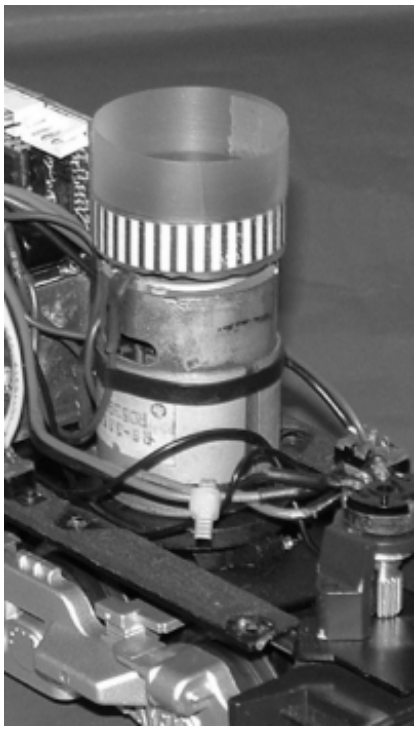
Now that the EOB Drop In Board is in place you want to mount the sensor board to the motor. This is the device that provides the necessary feedback to the EOB Drop In Board to maintain the constant speed control. There are two very critical steps in this process. The first critical step is the flywheel tape that is applied to the flywheel. It is absolutely imperative that the stripes align perfectly at the mating end of the strip. The second critical step is the distance of the flywheel sensor from the flywheel itself. The distance of 0.030” must be exact otherwise the sensor will not read the stripes properly and result in a jerky action at low speeds.

You want to mount the sensor to the motor closest to the EOB Drop In Board. On our sample it was the front motor, your locomotive it may be the rear motor. Begin by removing the interior shield around the front motor. This can be done by removing the two small screws that holds the shield on the frame The shield will most likely have lights attached to it, so remove the screws so they are not lost and set the shield aside (without disconnecting the light wires). You will reinstall the shield once the flywheel sensor is mounted.

Locate the flywheel tape strip set that came with the installation kit. You will notice there are 5 stripe sets to choose from. Every one of these stripe sets will fit on your flywheel, in some instances you may need to stretch the tape, but they will all fit.

The stripe set with the lines closest together “Williams” is the stripe set to start with. The closer the lines are together the slower the locomotive will run. If you plan on a lot of high speed operation you may want to choose a stripe set with lines a little further apart such as the MTH set or K-Line set. Cut the “Williams” stripe set out of the paper, cutting as close to the stripes as possible.

Clean the flywheel with some Goo Gone or similar degreasing compound so the tape strip will securely adhere to the side of the brass flywheel. Remove the backing on the flywheel tape strip to expose the adhesive. Carefully apply the tape strip to the flywheel. Make absolutely certain that the stripes line up exactly even with one another where the strip ends. If there is even the slightest hint of the lines not being perfect the locomotive will exhibit a jerky motion when running. Take the time to ensure the lines are perfect! Once you have the stripe set applied to the flywheel use some clear Scotch Tape to apply over top of the flywheel tape strip. This will protect the stripes from smudging and prevent the tape strip from coming loose. Try to overlap the Scotch Tape at least half an inch. Be sure to smooth out any and all air bubbles under the tape. Using a sharp X-Acto knife blade trim the clear tape even with the flywheel top and bottom. The photo below illustrates the flywheel tape on the left and the clear tape covering the strip on the right, before trimming.

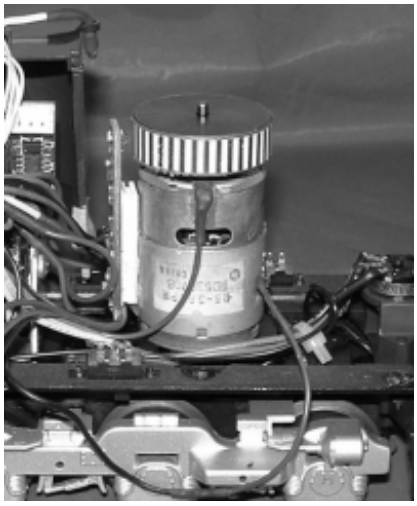


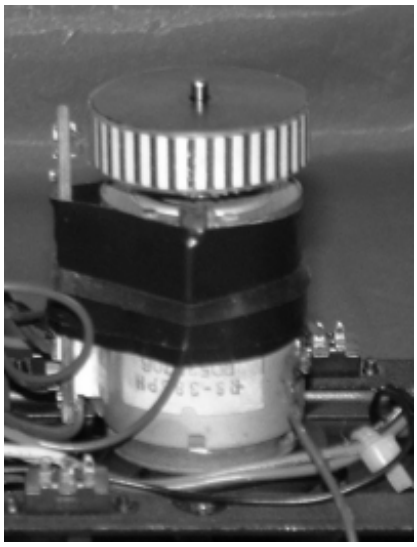
Once you have the flywheel protective cover trimmed locate the flywheel sensor board and the small baggie of white plastic spacers. The flywheel sensor board will mount to the backside of the motor where it will not inhibit the rotation of the motor with the shell walls. You will use the white plastic spacers to properly space the flywheel

sensor from the flywheel. Inside the baggie there is a piece of plastic tagged with a black mark. This piece is exactly 0.030" thick and will be used as the spacer to achieve the exact spacing between the sensor and the flywheel.

Using the plastic spacers determine the necessary combination required to space the flywheel sensor exactly 0.030" from the flywheel. Once you have the proper combination of plastic spacers use super glue to glue them together. Then glue the spacers to the backside of the sensor. Finally using the super glue, glue the sensor along with the spacers to the side of the motor. Using the 0.030" spacer, ensure the spacing is correct by inserting the spacer between the flywheel sensor board and the flywheel. There should be no play between the two. Once you have the sensor board mounted to the motor side use a piece of electrical tape to wrap around the motor and the sensor to provide added support. It is critical that the sensor board not be able to move. It must be securely adhered to the motor.

The photo below on the left shows the flywheel sensor glued to the motor with the spacers. The photo on the right shows the electrical tape wrapped around both devices.





When you apply the electrical tape around the motor and the flywheel sensor board, make sure you do not cover the bottom ¼" of the sensor board. This is where the flywheel sensor LED indicator is located. You will need to verify this LED is flashing when you perform the testing procedures.

Once you are satisfied with the flywheel sensor mounting go ahead and reattach the front motor shield using the mounting screws you removed earlier.

Locate the 3-position connector at the end of the flywheel sensor board. Plug this connector into the only 3-position plug on the EOB Drop In Board that it will fit into.

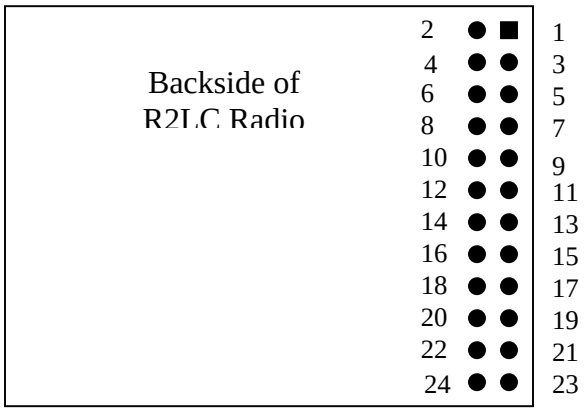
Wiring the Communication Lines

The EOB Drop In Board communicates with the R2LC Radio Board through serial data (much like the Railsounds communicate with the radio board). Unfortunately the preexisting DCDR did not have this capability so two connections need to be made to open up this line of communication between the two boards. The process is done by

soldering two wires between the EOB Drop In Board and the Lionel motherboard as well as the Lionel R2LC radio board.

Locate the remaining 3-position white connector in the installation kit. Plug it into the EOB Drop In Board, in the only remaining 3-position connector available. Please refer to the diagram on the last page of this instruction booklet; you will want to clip the wire from the connector labeled “chuff input”. This wire is not required for diesel applications, so clip it out of the harness altogether.

Locate the Lionel motherboard and more specifically the R2LC Radio Board 24-pin connector on the motherboard. You are required to clip one of the pins on the 24-pin connector for the R2LC. The pin you will clip is Pin 24. The numbering for the R2LC pins is shown in the diagram below.



You want to clip the corresponding pin on the motherboard for pin 24 (this is for the Radio Board position only, do not clip any of the other 24-pin connectors on the motherboard!). Clip the pin so it does not insert into the R2LC, but so it is still inside the black retainer and still connected to the motherboard. Once you have clipped the pin for position 24 reinsert the R2LC back into the motherboard 24-pin connector. The diagram below illustrates how to clip the pin on the motherboard.

24-pin before cutting pin 24-pin after cutting pin

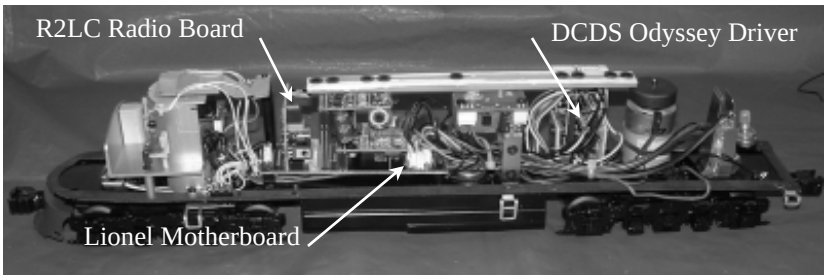
Referring to the diagram on the last page locate the wire labeled “Serial Out” in the 3-position connector you just plugged in. You need to solder the “Serial Out” wire to the pin you cut on the motherboard. Solder the wire to pin 24 where it terminates in the motherboard; you should be able to access the pin with little trouble. Be sure the wire is only soldered to pin 24. If it touches any other pins a short may occur and void the warranty.

Once the “Serial Out” wire is soldered in place locate the “Serial In” wire. Solder the “Serial In” wire to the backside of the R2LC on Pin 24. Make certain the wire only touches pin 24 and none of the surrounding pins or components, otherwise a short will occur and void the warranty of the EOB Drop In Board and the R2LC radio board.

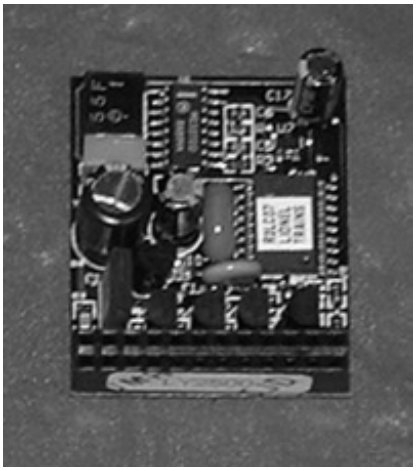
The EOB Drop In Board is now completely wired. Please refer to the section titled “Testing and Programming your EOB Drop In Board” to complete the final stages of this installation.

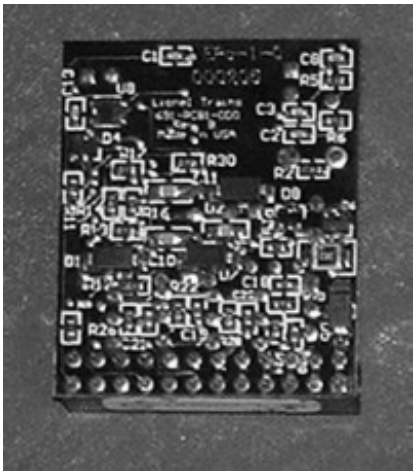
Installing into Lionel scale diesel locomotives with Odyssey®

Begin the installation by removing the screws that hold the shell to the frame. Once all the mounting screws have been removed take the shell off the frame and set it aside for the time being. The photo below illustrates the frame with the shell removed. The sample we are using for this installation is a Lionel scale E-6 A unit.



You need to identify the three primary components we will be working with before you go any further. These components are the DCDS Odyssey® Motor Driver, the Lionel Motherboard and the Lionel R2LC Radio Board. The DCDS will be mounted to a heat sink attached to the frame. The Radio Board will be plugged into the Lionel motherboard. The photo below illustrates the front and backsides of the radio board.


Front side of R2LC Radio Board


Backside of R2LC Radio Board

Now that you have identified the three main components we will be working with go ahead and locate the DCDS Odyssey® motor driver board. Unplug the 4-position and 3-position white connectors along the top edge of the DCDS board. Unplug the 10-position white connector along the edge of the DCDS board. Then unplug the black 6-position Molex connector that is located between the heat sink tabs. Be sure you depress the locking tab on the connector, so you do not break the tab off when unplugging it from the connector. You will not be reusing the 3-position connector or the 10-position connector, you can either clip these connectors out of the engine or tuck them some place where they will be out of the way.

There were a total of four connectors plugged into the DCDS board; all of them should now be unplugged (only 3 connectors if there was not a 10-position connector on your model). You want to rotate the heat sink 90 degrees so you can gain access to the screws that hold the existing DCDS in place. Once you have turned the heat sink, you

want to remove the 4 screws and nuts that hold the DCDS to the heat sink. Save this hardware! You will be reusing it to remount the EOB Drop In Board in the next step. Once you have the 4 screws removed go ahead and take the DCDS out of the heat sink.

Locate the EOB Drop In Board that came with your installation kit. You want to mount the EOB Drop In Board in the same position the DCDS was mounted in. Using the original hardware screw the tabs of the EOB Board to the heat sink. Be careful not to over tighten the screws, as this will cause the cases to crack and void the warranty. Once you are satisfied with the assembly turn the heat sink back to its original position. You may have to tighten the screw and nut that holds the heat sink to the frame. If this is required do so now.

***NOTE**: You may want to add some heat sink paste between the EOB Drop In tabs and the heat sink to help facilitate the heat transfer between these components and the heat sink. It is not a requirement, but it is recommended. You can acquire heat sink paste at any good electronics supply store such as Radio Shack.*

Now that the EOB Drop In Board is mounted to the heat sink locate the 4-position white connector that you previously unplugged from the DCDS board. Plug it into the only 4-position plug on the EOB Drop In Board.

The locomotive has a preexisting 6-position black Molex connector; unfortunately this connector will not fit into the EOB board. You will be required to replace this connector with the 4-position black Molex connector included with the installation kit. Locate the 4-position black Molex connector from the installation kit. You will need to clip 4 wires from the existing 6-position black Molex connector; these wires are pickup, ground and two motor leads. Leave some length between the connector and the cut, so you can reuse the connector in the future if necessary.

Plug the new 4-position black Molex connector into the EOB Drop In Board (between the heat sink tabs). The plug is polarized so it will only fit in one direction. Do not force the plug, otherwise it may break, simply turn the connector until it slides into the connector, then press it down until it locks.

Using the wires in the new 4-position connector you need to solder the red, black, blue and yellow wires into the wires you just cut. Because there is very little consistency in the color-coding of wires in these locomotives we strongly recommend that you visibly trace each wire to verify its termination point. The red wire in the new connector is center rail (AC Hot). The black wire in the new connector is chassis (AC Ground). Keep in mind that some of the original Lionel 6-position connectors have more than one wire in the pickup and ground pins. If this is the case with your application be sure to connect all the wires in your solder connection, otherwise some components will not receive the power they require. Carefully solder each wire to its proper connection and cover the solder joint with some shrink tube to minimize the amount of space it takes up.

The blue and yellow wires are for the motor. Carefully solder each wire to its proper connection and cover the solder joint with some shrink tube to minimize the amount of space it takes up. As for the motor leads, you have a 50/50 chance of wiring the motor leads the correct way. You will not know until the installation is complete, so if they are backwards you will have to reverse the motor leads.

Now that the black 4-position Molex connector is wired and the 4-position white connector is plugged in it is time to mount the sensor board to the motor.

Mounting the Flywheel Sensor Board

Now that the EOB Drop In Board is in place you want to mount the sensor board to the motor. This is the device that provides the necessary feedback to the EOB Drop In Board to maintain the constant speed control. There are two very critical steps in this

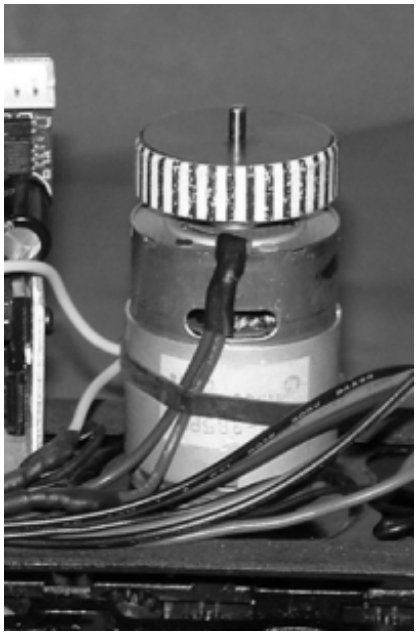
process. The first critical step is the flywheel tape that is applied to the flywheel. It is absolutely imperative that the stripes align perfectly at the mating end of the strip. The second critical step is the distance of the flywheel sensor from the flywheel itself. The distance of 0.030" must be exact otherwise the sensor will not read the stripes properly and result in a jerky action at low speeds.

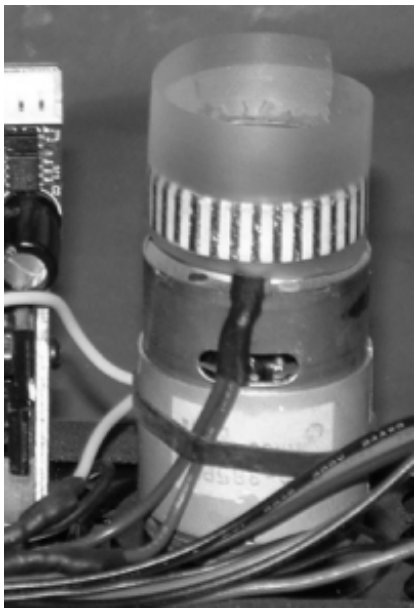
You want to mount the sensor to the motor closest to the EOB Drop In Board. If this is the front motor, then you will need to remove the shield that surrounds the front motor. If this is the rear motor, then there is no need to remove any shields.

Locate the flywheel tape strip set that came with the installation kit. You will notice there are 5 stripe sets to choose from. Every one of these stripe sets will fit on your flywheel, in some instances you may need to stretch the tape, but they will all fit.

The stripe set with the lines closest together "Williams" is the stripe set to start with. The closer the lines are together the slower the locomotive will run. If you plan on a lot of high speed operation you may want to choose a stripe set with lines a little further apart such as the MTH set or K-Line set. Cut the "Williams" stripe set out of the paper, cutting as close to the stripes as possible.

Clean the flywheel with some Goo Gone or similar degreasing compound so the tape strip will securely adhere to the side of the brass flywheel. Remove the backing on the flywheel tape strip to expose the adhesive. Carefully apply the tape strip to the flywheel. Make absolutely certain that the stripes line up exactly even with one another where the strip ends. If there is even the slightest hint of the lines not being perfect the locomotive will exhibit a jerky motion when running. Take the time to ensure the lines are perfect! Once you have the stripe set applied to the flywheel use some clear Scotch Tape to apply over top of the flywheel tape strip. This will protect the stripes from smudging and prevent the tape strip from coming loose. Try to overlap the Scotch Tape at least half an inch. Be sure to smooth out any and all air bubbles under the tape. Using a sharp X-Acto knife blade trim the clear tape even with the flywheel top and bottom. The photo below illustrates the flywheel tape on the left and the clear tape covering the stripes on the right, before trimming.



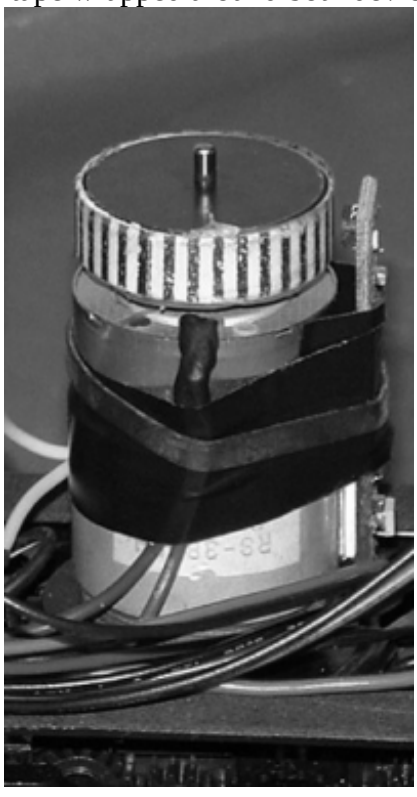


Once you have the flywheel protective cover trimmed locate the flywheel sensor board and the small baggie of white plastic spacers. The flywheel sensor board will mount to the backside of the motor (between the motor and the EOB Drop In Board). You will use the white plastic spacers to properly space the flywheel sensor from the flywheel. Inside the baggie there is a piece of plastic tagged with a black mark. This piece is exactly 0.030” thick and will be used as the spacer to achieve the exact spacing between the sensor and the flywheel.

Make sure the sensor is mounted equally spaced between the shell sides so the pivot of the motor truck does not interfere with the sides of the shell. Make sure it is centered on the motor, between the shell sides.

Using the plastic spacers determine the necessary combination required to space the flywheel sensor exactly 0.030” from the flywheel. Once you have the proper combination of plastic spacers use super glue to glue them together. Then glue the spacers to the backside of the sensor. Finally using the super glue, glue the sensor along with the spacers to the side of the motor. Using the 0.030” spacer, ensure the spacing is correct by inserting the spacer between the flywheel sensor board and the flywheel. There should be no play between the two. Once you have the sensor board mounted to the motor side use a piece of electrical tape to wrap around the motor and the sensor to provide added support. It is critical that the sensor board not be able to move. It must be securely adhered to the motor.

The photo below on the left shows the flywheel sensor glued to the motor with the spacers. The photo on the right shows the electrical tape wrapped around both devices.



When you apply the electrical tape around the motor and the flywheel sensor board, make sure you do not cover the bottom ¼" of the sensor board. This is where the flywheel sensor LED indicator is located. You will need to verify this LED is flashing when you perform the testing procedures.

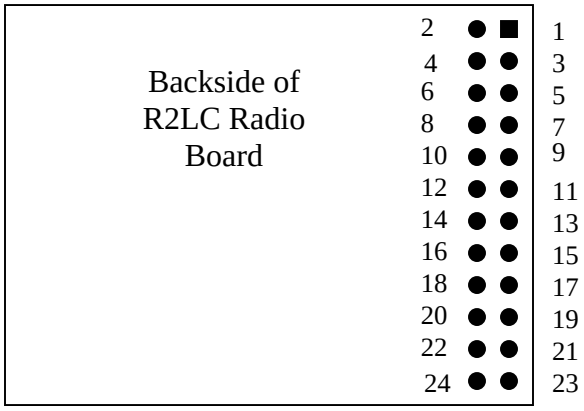
Once you are satisfied with the flywheel sensor mounting go ahead and reattach the front motor shield using the mounting screws you removed earlier (if you had to remove a shield).

Locate the 3-position connector at the end of the flywheel sensor board. Plug this connector into the only 3-position plug on the EOB Drop In Board that it will fit into.

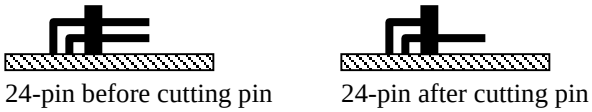
Wiring the Communication Lines

The EOB Drop In Board communicates with the R2LC Radio Board through serial data (much like the Railsounds communicate with the radio board). Unfortunately the preexisting DCDS did not have this capability so two connections need to be made to open up this line of communication between the two boards. The process is done by soldering two wires between the EOB Drop In Board and the Lionel motherboard and Lionel R2LC Radio Board.

Locate the remaining 3-position white connector in the installation kit. Plug it into the EOB Drop In Board, in the only remaining 3-position connector available. Please refer to the diagram on the last page of this instruction booklet. Locate the Lionel motherboard and more specifically the R2LC Radio Board 24-pin connector on the motherboard. You are required to clip one of the pins on the 24-pin connector for the R2LC. The pin you will clip is Pin 24 (on the Lionel motherboard). The numbering for the R2LC pins is shown in the diagram below.



You want to clip the corresponding pin on the motherboard for pin 24 (this is for the Radio Board position only, do not clip any of the other 24-pin connectors on the motherboard!). Clip the pin so it does not insert into the R2LC, but so it is still inside the black retainer and still connected to the motherboard. Once you have clipped the pin for position 24 reinsert the R2LC back into the motherboard 24-pin connector. The diagram below illustrates how to clip the pin on the motherboard.



24-pin before cutting pin 24-pin after cutting pin

Referring to the diagram on the last page locate the wire labeled “Serial Out” in the 3-position connector you just plugged in. You need to solder the “Serial Out” wire to the pin you cut on the motherboard. Solder the wire to pin 24 where it terminates in the motherboard; you should be able to access the pin with little trouble. Be sure the wire is only soldered to pin 24. If it touches any other pins a short may occur and void the warranty.

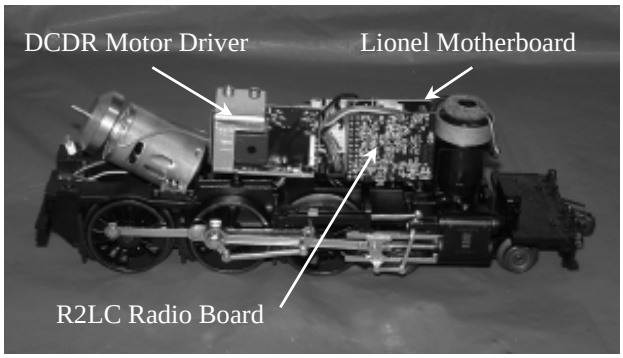
Once the “Serial Out” wire is soldered in place locate the “Serial In” wire. Solder the “Serial In” wire to the backside of the R2LC on Pin 24. Make certain the wire only touches pin 24 and none of the surrounding pins or components, otherwise a short will occur and void the warranty of the EOB Drop In Board and the R2LC radio board.

The remaining wire will be the “Chuff Input” wire. This wire should be soldered to pin 17 on the backside of the Lionel R2LC. Make certain the wire only touches pin 17 and none of the surrounding pins or components, otherwise a short will occur and void the warranty of the EOB Drop In Board and the R2LC radio board.

The EOB Drop In Board is now completely wired. Please refer to the section titled “Testing and Programming your EOB Drop In Board” to complete the final stages of this installation.

Installation into Lionel Smaller Scale Steam Locomotives without Odyssey®

Begin the installation by removing the shell from the locomotive. Disconnect any wires that tether the engine shell to the frame so you can completely separate the shell from the frame. Set the shell aside for now. You now have the frame of the locomotive in front of you. You will want to identify the three main components we will be working with for this conversion. The photo below illustrates these components. Our sample is a Lionel scale Camelback.



Once you have identified the three main components; Lionel motherboard, Lionel R2LC Radio Board and the DCDR Motor Driver move to the next step.

Begin by unplugging the 4-position white connector from the DCDR Motor driver. Then locate the black 4-position Molex connector and unplug it (this connector is located between the heat sink tabs). It has a locking tab, so be careful you depress the tab so the connector can be unplugged without breaking. (You will be reusing this connector so it is imperative that it does not break.)

Once you have the 2 connectors unplugged it is time to remove the 4 screws and nuts that hold the DCDR to the heat sink. Use a small pair of needle nosed pliers and a Phillips head screwdriver to remove the hardware. Save the screws and nuts, as you will need to reuse them to reinstall the EOB Drop In Board. Once you have all screws removed go ahead and remove the DCDR from the heat sink

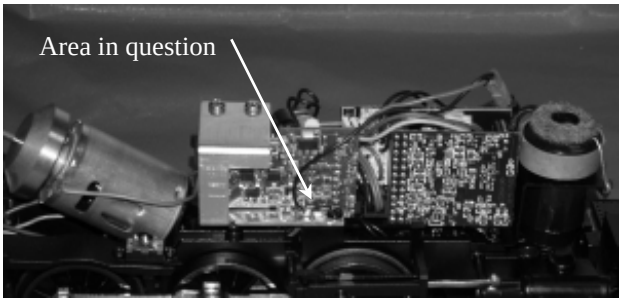
Locate the EOB Drop In Board from the installation kit. Plug in the 4-position white connector you unplugged from the DCDR into the only 4-position connector on the Drop In Board. Plug the black 4-position Molex connector you unplugged from the DCDR into the EOB Drop In Board 4-position plug, located between the heat sink tabs. This plug is polarized and will only plug in one way. Do not force the connector! Once the holes line up it will slide into the connector. Firmly press the connector down until it locks into place with the locking tab.

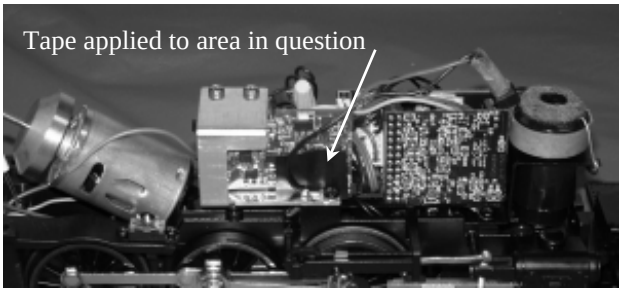
Using the hardware you just removed from the DCDR mount the EOB Drop In Board in the heat sink in the same position the DCDR was in. Do not over tighten the screws or the cases for the tabs will break and void the warranty of the EOB Drop In Board. Once you have the Drop In Board mounted to the heat sink go ahead and mount the heat sink to the frame using the original mounting screw. If there was a ground lug on this screw make sure you put it back in place.

***NOTE**: You may want to add some heat sink paste between the EOB Drop In tabs and the heat sink to help facilitate the heat transfer between these components and the*

heat sink. It is not a requirement, but it is recommended. You can acquire heat sink paste at any good electronics supply store such as Radio Shack.

NOTE: For our Camelback sample we had to remove the heat sink from the frame to access the connectors and the screws. If this is required on your model, do so, but remember to reattach any ground lugs that were attached to the mounting screws for the heat sink. It was also necessary for us to clip down the pins on the bottom of the EOB Drop In Board and apply electrical tape between the bottom of the Drop In Board and the heat sink mounting tab. The fit here is very tight and the electrical tape is required to keep the Drop In Board from shorting against the frame. Please take the time to review this area carefully so a short does not occur. The area in question is shown in the photos below. (The first photo shows the area without the tape in place. The second photo shows the tape applied to the area.)





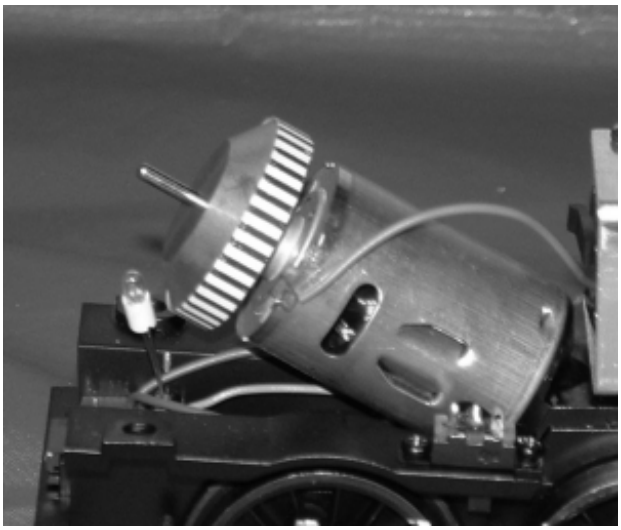
Once the EOB Drop In Board is securely mounted in the heat sink and the heat sink is once again mounted to the frame it is time to install the flywheel sensor.

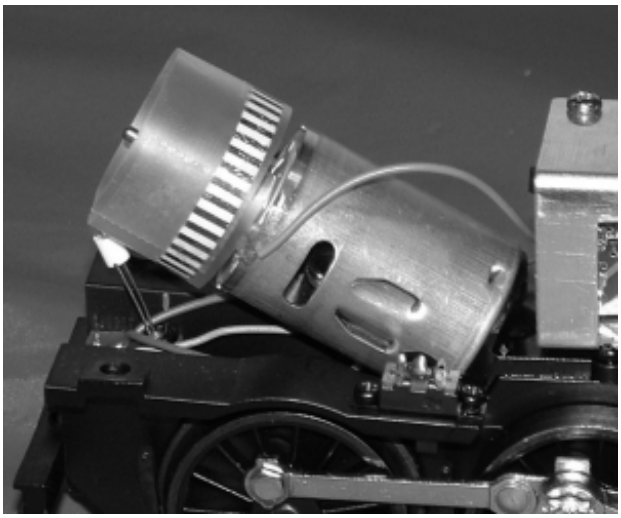
Mounting the Flywheel Sensor

Now, using the flywheel tape included in the installation kit cut a stripe set and test fit it to the flywheel. There are 5 different stripe sets available. The closer the lines are together the slower the locomotive will run at the first speed step. If you plan on using the engine for slow speed operation use the stripe set labeled “Williams”. If you plan on a lot of high-speed operation use the stripe set labeled “SS 2”. We recommend starting with the “Williams” strip. The recommended order would be “Williams, MTH, K-Line, SS 1 then SS 2”. Every tape strip will fit your flywheel. It may be necessary in some instances to “stretch” the strip when you apply it to the flywheel. The paper will give and most of the time it will give enough for almost 3 stripes worth of stretching!

It is absolutely imperative that the mating end of the tape strip line up exactly. If even one line is larger than the others the locomotive will exhibit a jerky motion when operating. Be certain the stripes line up exact, there is no room for error here!

Once you are satisfied with the position of the tape strip we recommend you apply a piece of clear Scotch Tape over top of the flywheel strip. This will keep the strip from smudging and will protect the strip from coming loose over time. Try not to capture any air bubbles in the tape, if you do be sure to prick the air bubble and press the air out. Make sure the tape is securely adhered to the tape strip and that it overlaps itself at least a half an inch or more. The photo below to the left illustrates the tape strip applied to the flywheel. The photo to the right illustrates the Scotch Tape protective cover before being trimmed. You will want to trim the tape even with the edges of the flywheel using a sharp X-Acto knife.



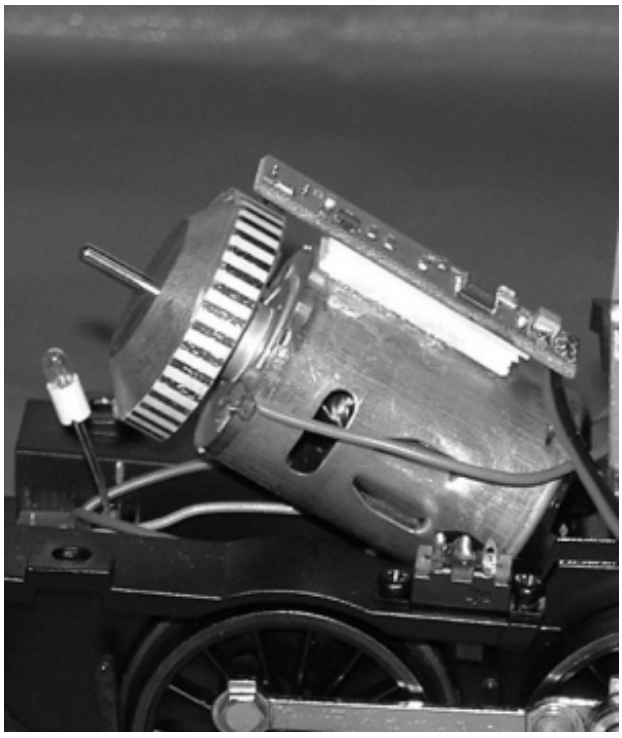


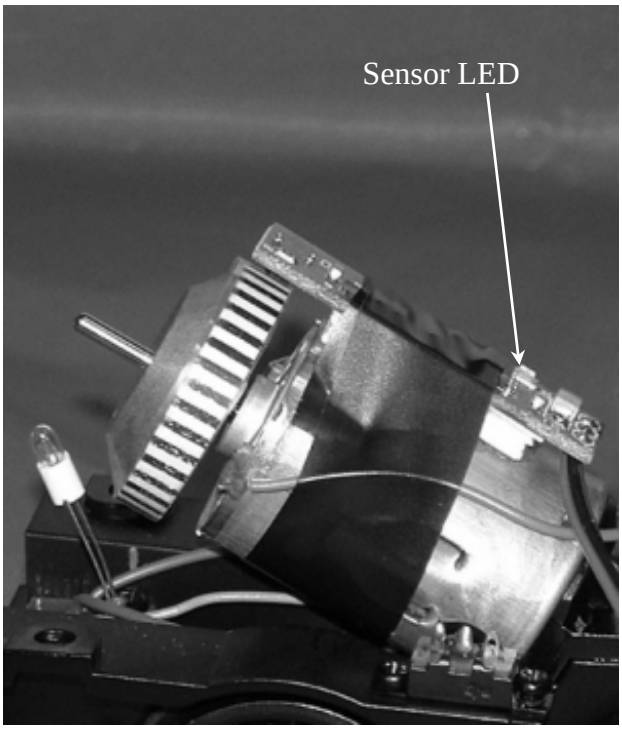
It is imperative that the flywheel tape strip be applied properly. This is the first of two very important alignment steps for the flywheel sensor. If the tape strip is not evenly aligned at the ends you will see it every time you run the locomotive, a visible jerk will appear in the operation. Take the time to make sure it is done right!

Now that the flywheel tape strip is applied to the flywheel it is time to mount the flywheel sensor board. The spacing of the sensor board is the second critical step in mounting the flywheel sensor. Locate the small bag of styrene spacers that came with the installation kit. Each baggie has 2 sets of the following thicknesses: .010”, .015”, .020”, .040” and .060”. There is also one piece of 0.030”, which is tagged with a black mark. This 0.030” plastic piece is the spacer used to space the flywheel sensor from the flywheel.

Use whatever combination of styrene spacers is required to space the flywheel sensor exactly 0.030” from the flywheel. Once you have the proper combination of spacers selected use crazy glue or super glue to adhere the strips to the unpopulated side of the flywheel sensor. Then using the same adhesive glue the sensor board, along with the spacers to the top of the motor. Hold the assembly in place until the glue sets up. Using the 0.030” spacer ensures the distance between the flywheel sensor and the flywheel is

exactly 0.030”. The spacer should slide between the two with very little effort. If the sensor is not spaced properly it will not read the stripes and hence it will not function properly. The photo on the next page shows the sensor board mounted to the top of the motor.



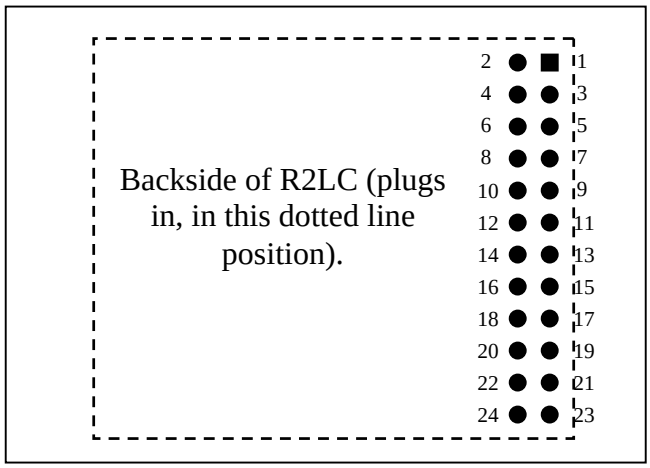


We recommend that you place a wrap of electrical tape around the motor and the sensor board. Be certain you do not cover up the sensor LED, as this LED allows you to verify the flywheel sensor is working properly. The tape will hold the sensor board to the motor in addition to the super glue between the sensor and the styrene spacers. The sensor board is now mounted to the motor.

Now locate the 3-position white connector at the end of the Flywheel Sensor wires. Plug this wire into the only 3-position connector on the EOB Drop In Board that it will fit into. The Flywheel Sensor mounting is now completed.

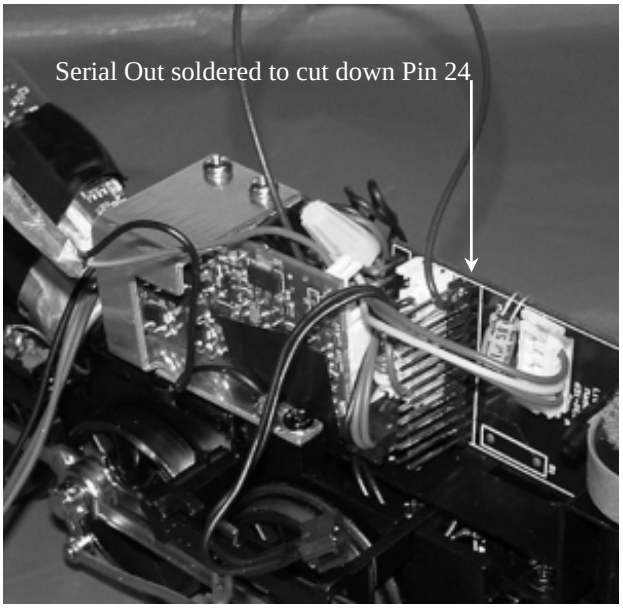
Connecting the communication lines

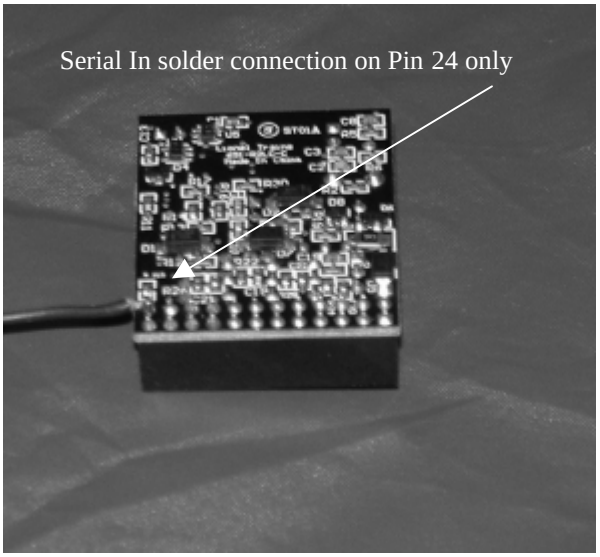
The EOB Drop In Board communicates with serial data, between the radio board and the EOB Drop In Board. These communication lines did not exist between the radio board and the old DCDR board that you removed. So they need to be soldered in place. The connection is made on the Lionel motherboard by clipping out a single pin in the 24-pin header. The diagram on the next page illustrates the numbering system used on Lionel motherboards. Please study this drawing carefully before making any cuts.



You need to clip the pin numbered 24 on the above diagram. When you clip this pin you want to leave enough of the pin sticking up, out of the motherboard to allow you to solder to, but ensure that it does not insert into the R2LC (radio board). The diagram on the last page illustrates the proper orientation of these communication wires. If you reverse them, no damage will occur, but the EOB board will not function properly either.

Locate the only remaining 3-position connector from the installation kit and plug it into the only remaining 3-position plug on the EOB Drop In Board. Solder the wire labeled Serial OUT to the pin you clipped on the motherboard (Pin 24). Then solder the wire labeled Serial IN to the backside of the R2LC in the position shown as 24. Be careful you do not solder this wire to any other components on the board, just the single pin, nothing else; otherwise a short will occur and void the warranty on the R2LC as well as the EOB Drop In Board. The photo below to the left illustrates the connection on the motherboard. The photo to the right illustrates the solder connection on the R2LC.





The communication lines are now connected. Now the radio board can communicate with the EOB Drop In Board.

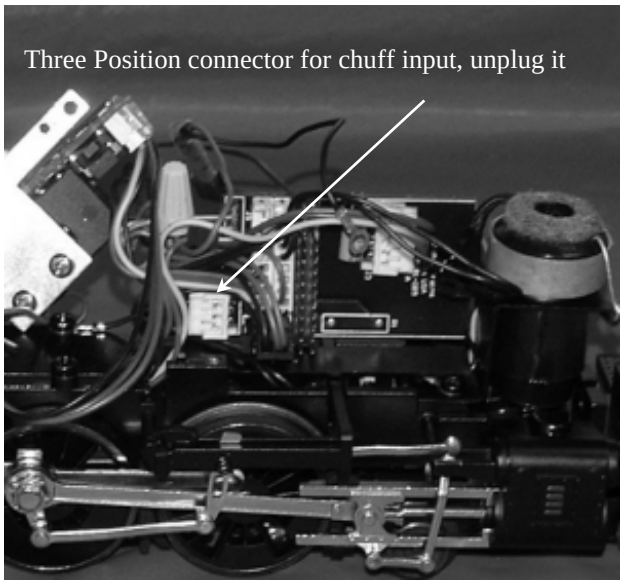
Chuff Rate Decision

Now is the time to make a decision. There are 2 options to choose from regarding the chuff rate of your steam locomotive. You can choose to leave the chuffing the way it has been or you can choose to select the chuff rate from the remote (either 1, 2 or 4 chuffs per revolution). The key factor to keep in mind is whether the locomotive has a mechanical smoke unit with a plunger or a fan driven smoke unit. If it has a mechanical smoke unit and you choose to select the chuffing from the remote, then the puffing will not be in sync with the chuffing sounds. If you choose to leave it as stock the puffing will stay in sync with the chuffing, but it will be fixed at 1 or 2 chuffs per revolution.

If you decide to leave it as stock, simply clip off the wire labeled “Chuff Input” on the diagram on the last page at the connector.

If you choose to have the chuff rate selectable from the remote, you will need to disconnect 1 plug (or wire) and solder the only remaining wire on the EOB Drop In Board (Chuff Input) to a pin on the R2LC.

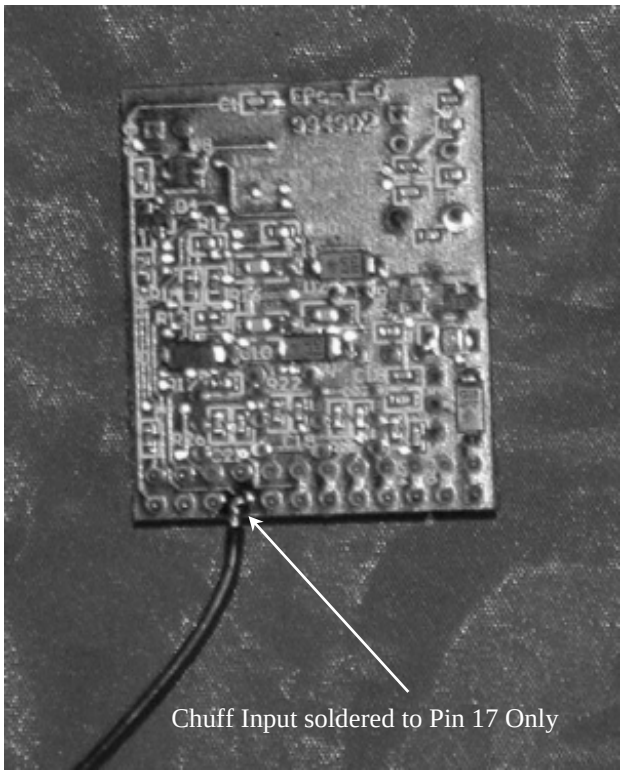
To find the location of the plug you need to locate the cherry switch on your locomotive. This switch will be located on the frame near one of the driver axles. It will have 2 wires soldered to it. One will go to ground and the other wire will connect to the motherboard. You must locate the wire that connects to the motherboard and disconnect it. Whether you cut it off or unplug it, it doesn’t matter it simply must be disconnected. The photo below illustrates where the connector is located on this Lionel Camelback.



(As you can see, we had to remove the EOB Drop In and the heat sink to access this connector.)

Once you have located the factory chuff input wire, simply disconnect it, if it is a plug, stuff it out of the way, if it is a wire that you had to cut, make sure the end is insulated and stuff it out of the way. These wires will not be reused for this installation.

Once the factory chuff wire (plug) is removed it is time to install the EOB Drop In Board Chuff Input wire to the backside of the R2LC, similar to the way we wired the Serial In wire. Locate the diagram showing the pin numbering of the backside of the R2LC (on the last page). The EOB Chuff Input wire will connect to pin 17 of the R2LC. You can either solder this wire to the pin on the motherboard, or directly to the pin on the backside of the R2LC, it is up to you. Regardless of where you solder the wire make certain it does not touch any of the surrounding pins, just pin 17 only. The photo below illustrates the "Chuff Input wire soldered to pin 17 of the R2LC Radio Board.

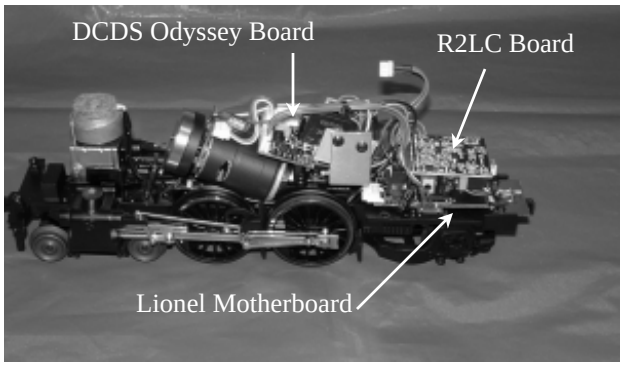


Plug the R2LC back into the motherboard making sure you align the pins properly, if the pins are not aligned properly the board will short out on power up and void the warranty.

The EOB Drop In Board is now completely installed. Please refer to the section entitled "Testing and Programming your EOB Drop In Board" to complete the final stages of this installation.

Installation into Smaller Lionel steam locomotives with Odyssey®

Begin the installation by removing the shell of the locomotive. Disconnect any plugs or wire nuts between the shell and the locomotive frame, so the two will be separated. The photo below is of a Lionel 4-4-2 Atlantic with Odyssey®. This photo shows the location of the Lionel R2LC, Motherboard and DCDS Odyssey® driver board.



Remove the R2LC from the motherboard and set it aside for now. Carefully unplug the connectors that are currently plugged into the DCDS Odyssey® Driver. There should be a total of 3 different plugs:

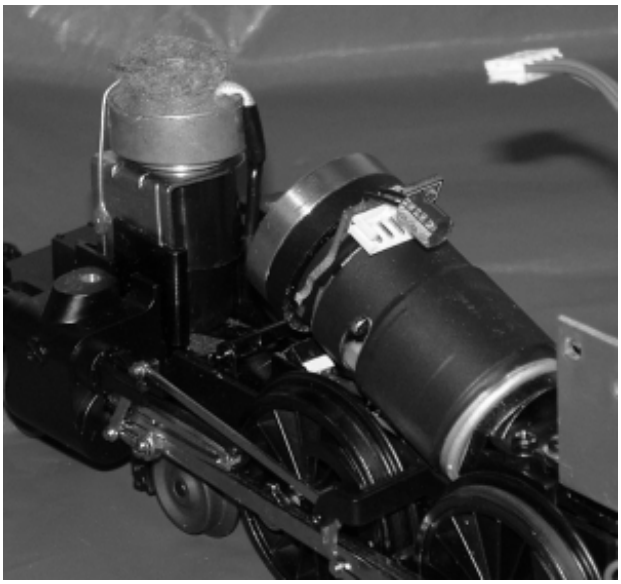
- One 6-position black Molex connector, power, ground and motors. This connector has a locking tab that must be depressed to remove the plug (located between heat sink tabs).
- One 4-position white connector, connected to the motherboard.
- One 3-position white connector, connected to the flywheel sensor.

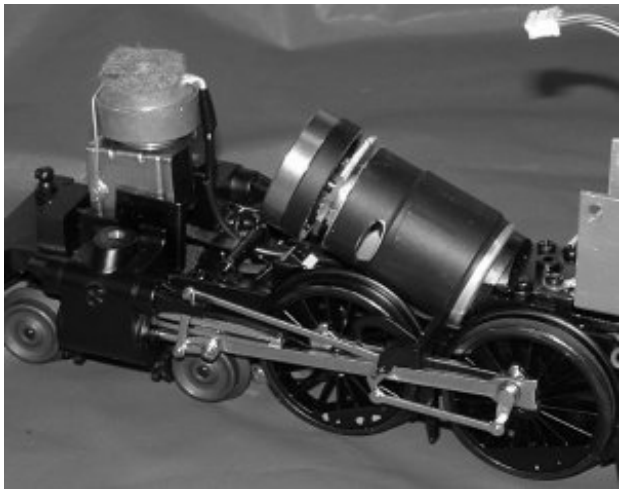
Once these 3 different plugs have been unplugged you must remove the 4 screws that hold the DCDS Odyssey® Driver in place on the heat sink. There are 4 Phillips head screws, 4 nuts and 4 nylon shoulder washers. You will be reusing all of this hardware to mount the EOB Drop In Board (with the exception of the nylon shoulder washers). Once the screws and nuts have been removed you can pull the DCDS board out of the heat sink. Now is a good time to mount the flywheel sensor board to the motor, while the driver board is out of the heat sink. Follow the instructions below to perform this step.

Mounting the Flywheel Sensor to the motor

Locate the flywheel sensor board that came with the installation kit as well as the flywheel tape strips.

Before you can mount the sensor board to the motor you must first make room for the new sensor. To do this you will be required to cut the preexisting sensor circuit board from between the motor and the flywheel. We recommend using a pair of wire cutters to slice through the circuit board. The photos on the next page illustrates a before and after view of the Lionel sensor board. The left photo is before; the right photo is after.



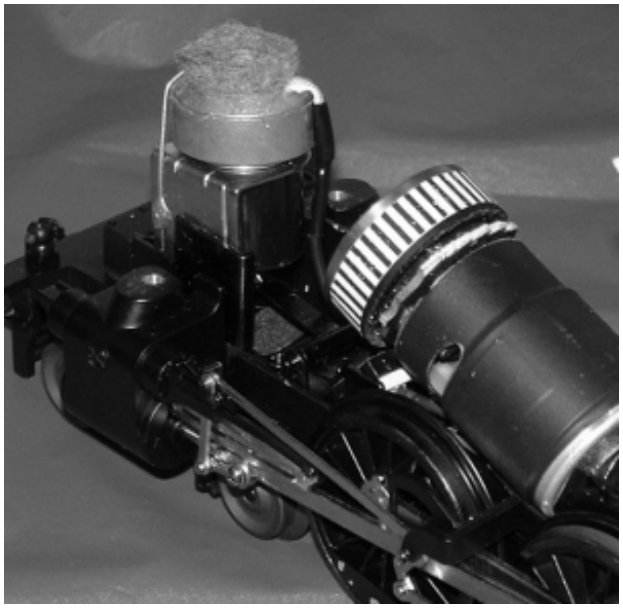


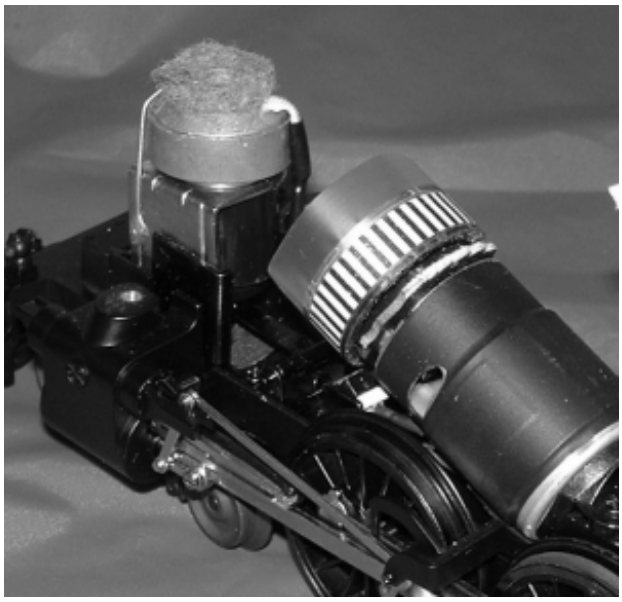
Please note that the motor leads (yellow and blue wires) are most often connected to the part of the circuit board we are cutting off, so before you begin unplug the 3-position connector and discard it. Carefully cut the motor wires from the circuit board we will be cutting. Once these wires are out of the way insert the cutters as close to the side of the motor as possible and firmly cut the board. You will want to try to trim the fiberglass board material so it is flush with the side of the motor, however, if it is not, at least try to get it as close to flush with the flywheel.

Now, using the flywheel tape included in the installation kit cut a stripe set and test fit it to the flywheel. There are 5 different stripe sets available. The closer the lines are together the slower the locomotive will run at the first speed step. If you plan on using the engine for slow speed operation use the stripe set labeled “Williams”. If you plan on a lot of high-speed operation use the stripe set labeled “SS 2”. We recommend starting with the “Williams” strip. The recommended order would be “Williams, MTH, K-Line, SS 1 then SS 2”. Every tape strip will fit your flywheel. It may be necessary in some instances to “stretch” the strip when you apply it to the flywheel. The paper will give and most of the time it will give enough for almost 3 stripes worth of overlap!

It is absolutely imperative that the mating end of the tape strip line up exactly. If even one line is larger than the others the locomotive will exhibit a jerky motion when operating. Be certain the stripes line up exact, there is no room for error here!

Once you are satisfied with the position of the tape strip we recommend you apply a piece of clear Scotch Tape over top of the flywheel strip. This will keep the strips from smudging and will protect the strip from coming loose over time. Try not to capture any air bubbles in the tape; if you do, be sure to prick the air bubble and press the air out. Make sure the tape is securely adhered to the tape strip and that it overlaps itself at least a half an inch or more. The photo on the next page to the left illustrates the tape strip applied to the flywheel. The photo to the right illustrates the Scotch Tape protective cover before being trimmed. You will want to trim the tape even with the edges of the flywheel using a sharp X-Acto knife.

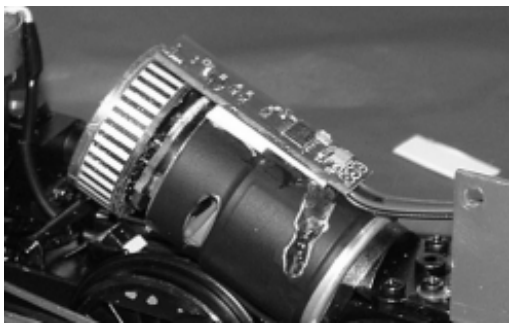


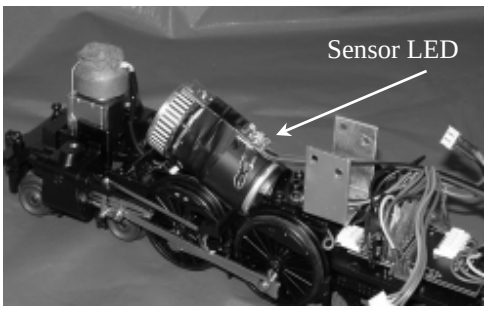


It is imperative that the flywheel tape strip be applied properly. This is the first of two very important alignment steps for the flywheel sensor. If the tape strip is not evenly aligned at the ends you will see it every time you run the locomotive, a visible jerk will appear in the operation. Take the time to make sure it is done right!

Now that the flywheel tape strip is applied to the flywheel it is time to mount the flywheel sensor board. The spacing of the sensor board is the second critical step in mounting the flywheel sensor. Locate the small bag of styrene spacers that came with the installation kit. Each baggie has 2 sets of the following thicknesses: .010”, .015”, .020”, .040” and .060”. There is also one piece of 0.030”, which is tagged with a black mark. This 0.030” plastic piece is the spacer used to space the flywheel sensor from the flywheel.

Use whatever combination of styrene spacers is required to space the flywheel sensor exactly 0.030” from the flywheel. Once you have the proper combination of spacers selected use crazy glue or super glue to adhere the strips to the unpopulated side of the flywheel sensor. Then using the same adhesive glue the sensor board, along with the spacers to the top of the motor. Hold the assembly in place until the glue sets up. Using the 0.030” spacer ensures the distance between the flywheel sensor and the flywheel is exactly 0.030”. The spacer should slide between the two with very little effort. If the sensor is not spaced properly it will not read the stripes and hence it will not function properly. The photo below shows the sensor board mounted to the top of the motor.





We recommend that you place a wrap of electrical tape around the motor and the sensor board. Be certain you do not cover up the sensor LED, as this LED allows you to verify the flywheel sensor is working properly. The tape will hold the sensor board to the motor in addition to the super glue between the sensor and the styrene spacers. The sensor board is now mounted to the motor.

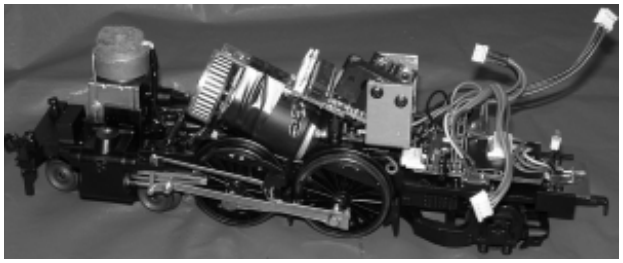
Mounting The EOB Drop In Board

Locate the EOB Drop In Board along with the 4 Phillips head screws and nuts. You can remove and discard the insulator plates that were located between the DCDS tabs and the heat sink. Place the EOB Drop In Board into the heat sink in the same position the DCDS was. Be certain you place the EOB Drop In Board in the same position as the original DCDS board as this is imperative for clearance when you place the shell back on the frame.

Using the hardware you removed (without the nylon shoulder washers), carefully mount the EOB Drop In Board tabs to the heat sink. DO NOT over tighten the screws! Otherwise the cases will crack and void the warranty on the EOB Drop In Board. Once you are satisfied with the position of the EOB Drop In Board set the old DCDS, insulator plates and nylon shoulder washers aside.

***NOTE**: You may want to add some heat sink paste between the EOB Drop In tabs and the heat sink to help facilitate the heat transfer between these components and the heat sink. It is not a requirement, but it is recommended. You can acquire heat sink paste at any good electronics supply store such as Radio Shack.*

If it looks like the EOB Drop In Board is touching the flywheel sensor board we recommend insulating the area where they touch with some electrical tape. If they are close, but are not touching, a little tape will be some good insurance that they never do. The photo below illustrates the EOB Drop In Board mounted to the heat sink with the original hardware.



Now that the EOB Drop In Board is in place you need to plug in the preexisting 4-position white connector that is currently connected to the motherboard. There is only one 4-position plug on the EOB Drop In Board, plug the harness into this position.

The flywheel sensor board that you just mounted to the motor has a 3-position connector. Plug this connector into the only 3-position plug that it will fit into.

The preexisting 6-position black Molex connector must be replaced with the 4-position Molex connector included with your EOB Drop In kit, as it will not fit into the 4-position plug that came on the EOB Drop In Board. Locate the 4-position Molex connector that came with the installation kit. Carefully cut the 4 wires currently connected to the existing 6-position Molex connector. Be sure to leave some length of wire between the cut and the plug so the connector can be reused in the future if necessary.

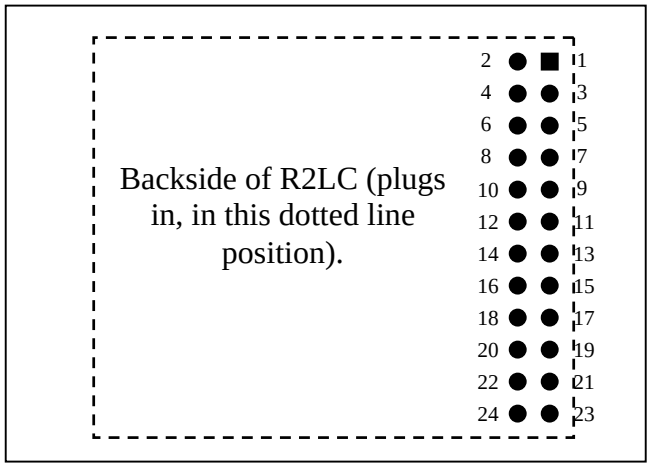
There will be a total of four wires that you cut: red (or gray), black, blue and yellow. These wires are center rail hot, chassis ground and 2 motor leads, respectively. Using the new 4-position Molex connector included in the installation kit splice the red, black, blue and yellow wires into the respective matching color wires you just cut. We recommend using shrink tube to cover the solder connections you make to keep the space consumption to a minimum. If the preexisting wires do not include red, use the gray wire to connect to the new 4-position plug red wire. Plug the new 4-position Molex connector into the EOB Drop In Board, the plug is polarized, so do not force it, otherwise you may break the connector. When properly aligned it will easily slip into place, then press down until the tab locks in place.

Reconnecting the motor leads

The blue and yellow wires are still disconnected since we cut them from the circuit board we cut off the motor. Locate the blue and yellow wires in the 4-position Molex connector harness. Carefully strip the end of the insulation and expose the wire. You will have to solder these leads to the very small tabs under the flywheel. The tabs are what hold the circuit board that we cut to the motor. Carefully apply a small dab of solder to each motor lead tab. You need to solder the yellow motor lead to the fireman's side of the motor and the blue wire to the engineer's side of the motor. (Looking at the locomotive as if you were in the cab, the fireman's side is on the left; engineer's side is the right.) Make sure the motor leads are not touching the flywheel. Carefully turn the flywheel by hand and verify the wires do not touch (it is very important the wires do not touch the flywheel or a short will occur). Once these motor leads are soldered in place you are ready to move to the next section. (During the final testing procedure you may have to reverse these motor leads in the event the locomotive starts in reverse instead of forward.

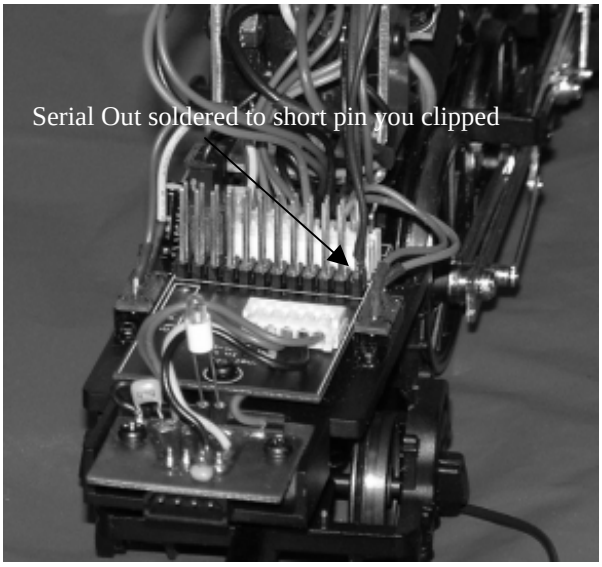
Connecting the communication lines

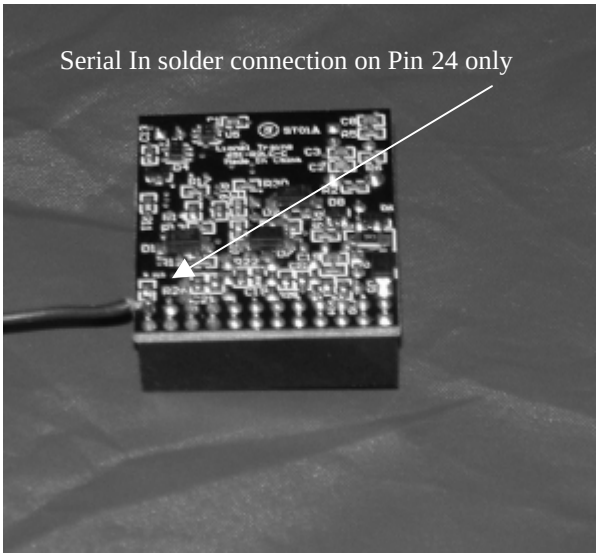
The EOB Drop In Board communicates with serial data, between the radio board and the EOB Drop In Board. These communication lines did not exist between the radio board and the old DCDS board that you removed. So they need to be soldered in place. The connection is made on the Lionel motherboard by clipping out a single pin in the 24-pin header. The diagram below illustrates the numbering system used on Lionel motherboards. Please study this drawing carefully before making any cuts.



You need to clip the pin numbered 24 on the above diagram. When you clip this pin you want to leave enough of the pin sticking up, out of the motherboard to allow you to solder to, but ensure that it does not insert into the R2LC (radio board). The diagram on the last page illustrates the proper orientation of these communication wires. If you reverse them, no damage will occur, but the EOB board will not function properly either.

Locate the only remaining 3-position connector from the installation kit and plug it into the only remaining 3-position plug on the EOB Drop In Board. Solder the wire labeled Serial OUT to the pin you clipped on the motherboard. Then solder the wire labeled Serial IN to the backside of the R2LC in the position shown as 24. Be careful you do not solder this wire to any other components on the board, just the single pin, nothing else; otherwise a short will occur and void the warranty on the R2LC as well as the EOB Drop In Board. The photo below to the left illustrates the connection on the motherboard. The photo to the right illustrates the solder connection on the R2LC.





The communication lines are now connected. Now the radio board can communicate with the EOB Drop In Board. You can now plug the R2LC back into the motherboard.

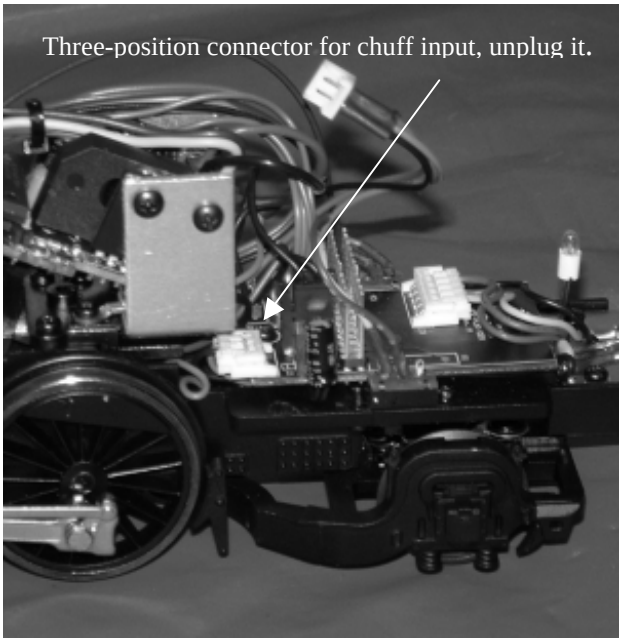
Chuff Rate Decision

Now is the time to make a decision. There are 2 options to choose from regarding the chuff rate of your steam locomotive. You can choose to leave the chuffing the way it has been or you can choose to select the chuff rate from the remote (either 1, 2 or 4 chuffs per revolution). The key factor to keep in mind is whether the locomotive has a mechanical smoke unit with a plunger or a fan driven smoke unit. If it has a mechanical smoke unit and you choose to select the chuffing from the remote, then the puffing will not be in sync with the chuffing sounds. If you choose to leave it as stock the puffing will stay in sync with the chuffing, but it will be fixed at 1 or 2 chuffs per revolution.

If you decide to leave it as stock, simply clip off the wire labeled “Chuff Input” on the 3-position connector on the EOB Drop In Board. You can locate this on the diagram on the last page at the connector.

If you choose to have the chuff rate selectable from the remote, you will need to disconnect 1 plug (or wire) and solder the only remaining wire on the EOB Drop In Board (Chuff Input) to the backside of the R2LC.

To find the location of the plug you need to locate the cherry switch on your locomotive. This switch will be located on the frame near one of the driver axles. It will have 2 wires soldered to it. One will go to ground and the other wire will connect to the motherboard. You must locate the wire that connects to the motherboard and disconnect it. Whether you cut it off or unplug it, it doesn't matter it simply must be disconnected. The photo below illustrates where the connector is located on this Lionel Atlantic.



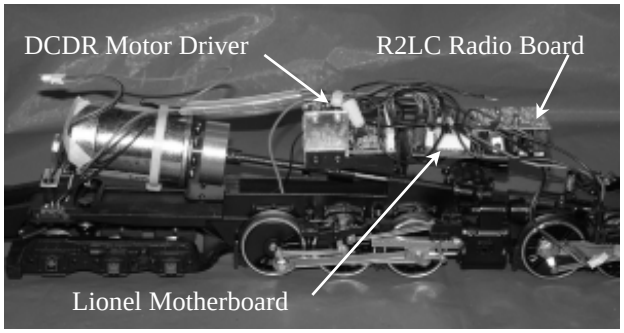
Once you have located the factory chuff input wire, simply disconnect it, if it is a plug, unplug it and stuff it out of the way. If it is a wire, cut it, make sure the end is insulated and stuff it out of the way. These wires will not be reused for this installation.

Once the factory chuff wire (plug) is removed it is time to install the EOB Drop In Board Chuff Input wire to the backside of the R2LC, similar to the way we wired the Serial In wire. Locate the diagram showing the pin numbering of the backside of the R2LC. The EOB Chuff Input wire will connect to pin 17 of the R2LC. You can either solder this wire to the pin on the motherboard, or directly to the pin on the backside of the R2LC, it is up to you. Regardless of where you solder it, make certain it does not touch any of the surrounding pins, just pin 17.

The EOB Drop In Board is now completely installed. Please refer to the section entitled "Testing and Programming your EOB Drop In Board" to complete the final stages of this installation.

Installation into Lionel Scale Steam Locomotive without Odyssey®

Begin the installation by removing the shell from the locomotive. Disconnect any wires that tether the engine shell to the frame so you can completely separate the shell from the frame. Set the shell aside for now. You now have the frame of the locomotive in front of you. You will want to identify the three main components we will be working with for this conversion. The photo below illustrates these components. Our sample is a Lionel scale Allegheny.



Once you have identified the three main components; Lionel motherboard, Lionel R2LC Radio Board and the DCDR Motor Driver move to the next step.

Begin by unplugging the 4-position white connector from the DCDR Motor driver. Then locate the black 4-position Molex connector and unplug it. It has a locking tab, so be careful you depress the tab so the connector can be unplugged without breaking. (You will be reusing this connector so it is imperative that it does not break.)

Once you have the 2 connectors unplugged it is time to remove the 4 screws and nuts that hold the DCDR to the heat sink. Use a small pair of needle nosed pliers and a Phillips head screwdriver to remove the hardware. Save the screws and nuts, as you will need to reuse them to reinstall the EOB Drop In Board. Once you have all screws removed go ahead and remove the DCDR from the heat sink

Locate the EOB Drop In Board from the installation kit. Plug the 4-position white connector you unplugged from the DCDR into the only 4-position connector on the Drop In Board. Plug the black 4-position Molex connector into the EOB Drop In Board 4-position plug, located between the heat sink tabs. This plug is polarized and will only plug in one way. Do not force the connector! Once the holes line up it will slide into the connector. Firmly press the connector down until it locks into place with the locking tab.

Using the hardware you just removed from the DCDR mount the EOB Drop In Board in the heat sink in the same position the DCDR was in. Do not over tighten the screws or the cases for the tabs will break and void the warranty of the EOB Drop In Board. Once you have the Drop In Board mounted to the heat sink it is time to mount the flywheel sensor.

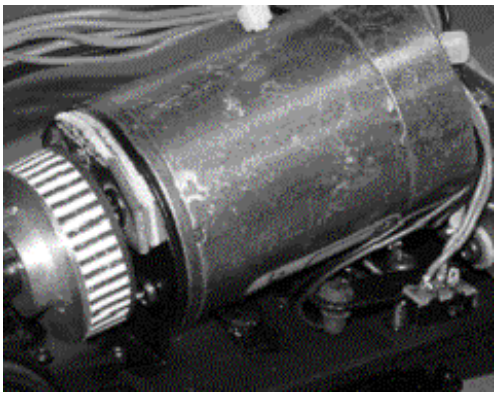
***NOTE**: You may want to add some heat sink paste between the EOB Drop In tabs and the heat sink to help facilitate the heat transfer between these components and the heat sink. It is not a requirement, but it is recommended. You can acquire heat sink paste at any good electronics supply store such as Radio Shack.*

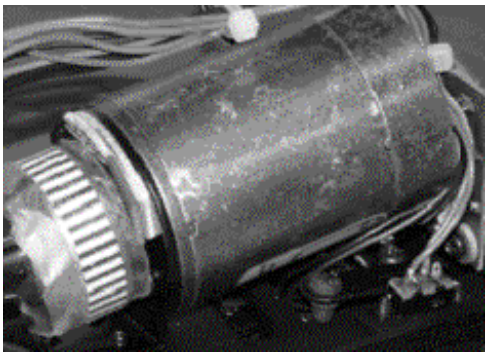
Mounting the Flywheel Sensor

Now, using the flywheel tape included in the installation kit cut a stripe set and test fit it to the flywheel. There are 5 different stripe sets available. The closer the lines are together the slower the locomotive will run at the first speed step. If you plan on using the engine for slow speed operation use the stripe set labeled “Williams”. If you plan on a lot of high-speed operation use the stripe set labeled “SS 2”. We recommend starting with the “Williams” strip. The recommended order would be “Williams, MTH, K-Line, SS 1 then SS 2”. Every tape strip will fit your flywheel. It may be necessary in some instances to “stretch” the strip when you apply it to the flywheel. The paper will give and most of the time it will give enough for almost 3 stripes worth of stretching!

It is absolutely imperative that the mating end of the tape strip line up exactly. If even one line is larger than the others the locomotive will exhibit a jerky motion when operating. Be certain the stripes line up exact, there is no room for error here!

Once you are satisfied with the position of the tape strip we recommend you apply a piece of clear Scotch Tape over top of the flywheel strip. This will keep the strips from smudging and will protect the strip from coming loose over time. Try not to capture any air bubbles in the tape, if you do be sure to prick the air bubble and press the air out. Make sure the tape is securely adhered to the tape strip and that it overlaps itself at least a half an inch or more. The photo below to the left illustrates the tape strip applied to the flywheel. The photo to the right illustrates the Scotch Tape protective cover before being trimmed. You will want to trim the tape even with the edges of the flywheel using a sharp X-Acto knife.



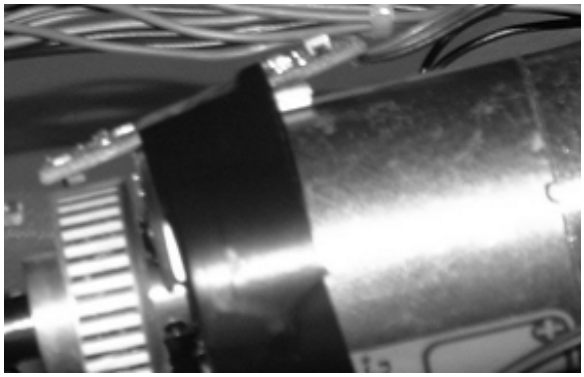


It is imperative that the flywheel tape strip be applied properly. This is the first of two very important alignment steps for the flywheel sensor. If the tape strip is not evenly aligned at the ends you will see it every time you run the locomotive, a visible jerk will appear in the operation. Take the time to make sure it is done right!

Now that the flywheel tape strip is applied to the flywheel it is time to mount the flywheel sensor board. The spacing of the sensor board is the second critical step in mounting the flywheel sensor. Locate the small bag of styrene spacers that came with the installation kit. Each baggie has 2 sets of the following thicknesses: .010”, .015”, .020”, .040” and .060”. There is also one piece of 0.030”, which is tagged with a black mark.

This 0.030” plastic piece is the spacer used to space the flywheel sensor from the flywheel.

Use whatever combination of styrene spacers is required to space the flywheel sensor exactly 0.030” from the flywheel. Once you have the proper combination of spacers selected use crazy glue or super glue to adhere the strips to the unpopulated side of the flywheel sensor. Then using the same adhesive glue the sensor board, along with the spacers to the top of the motor. Hold the assembly in place until the glue sets up. Using the 0.030” spacer ensures the distance between the flywheel sensor and the flywheel is exactly 0.030”. The spacer should slide between the two with very little effort. If the sensor is not spaced properly it will not read the stripes and hence it will not function properly. The photo below shows the sensor board mounted to the top of the motor. If the sensor needs to be placed on an angle, that is fine, just ensure it does not exceed the overall height of the existing components on the frame, otherwise the shell may not fit when you reinstall it.

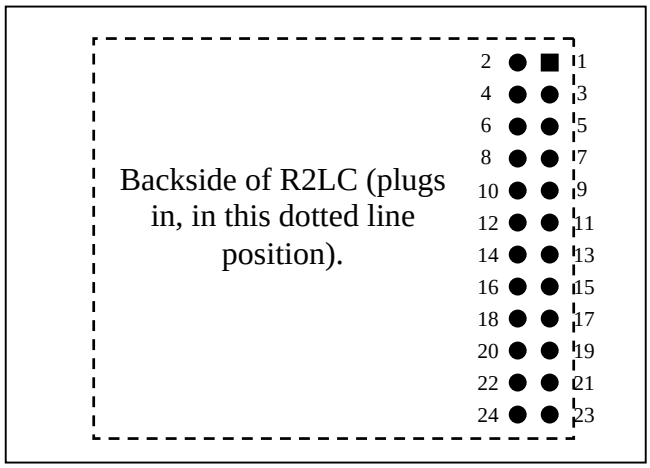


We recommend that you place a wrap of electrical tape around the motor and the sensor board. Be certain you do not cover up the sensor LED, as this LED allows you to verify the flywheel sensor is working properly. The tape will hold the sensor board to the motor in addition to the super glue between the sensor and the styrene spacers. The sensor board is now mounted to the motor.

Now locate the 3-position white connector at the end of the Flywheel Sensor wires. Plug this wire into the only 3-position connector on the EOB Drop In Board that it will fit into. The Flywheel Sensor mounting is now completed.

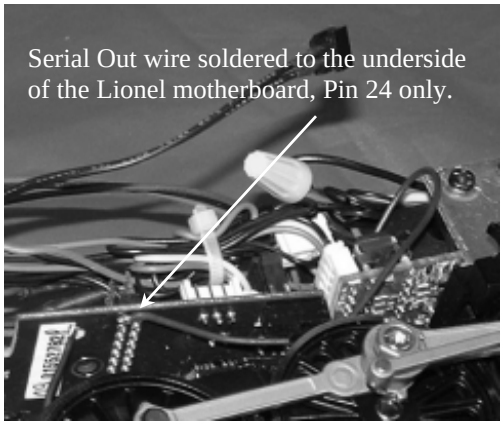
Connecting the communication line

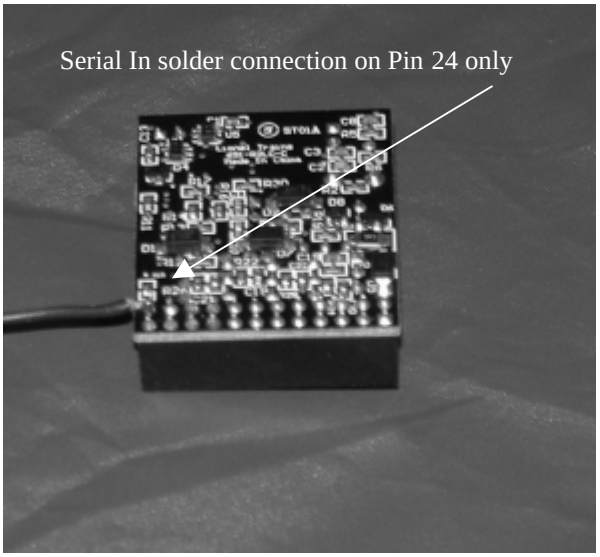
The EOB Drop In Board communicates with serial data, between the radio board and the EOB Drop In Board. These communication lines did not exist between the radio board and the old DCDR board that you removed. So they need to be soldered in place. The connection is made on the Lionel motherboard by clipping out a single pin in the 24-pin header. The diagram on the next page illustrates the numbering system used on Lionel motherboards. Please study this drawing carefully before making any cuts.



You need to clip the pin numbered 24 on the above diagram. When you clip this pin you want to leave enough of the pin sticking up, out of the motherboard to allow you to solder to, but ensure that it does not insert into the R2LC (radio board). The diagram on the last page illustrates the proper orientation of these communication wires. If you reverse them, no damage will occur, but the EOB board will not function properly either.

Locate the only remaining 3-position connector from the installation kit and plug it into the only remaining 3-position plug on the EOB Drop In Board. Solder the wire labeled Serial OUT to the pin you clipped on the motherboard (Pin 24). Then solder the wire labeled Serial IN to the backside of the R2LC in the position shown as 24. Be careful you do not solder this wire to any other components on the board, just the single pin, nothing else; otherwise a short will occur and void the warranty on the R2LC as well as the EOB Drop In Board. The photo below to the left illustrates the connection on the motherboard. The photo to the right illustrates the solder connection on the R2LC.





The communication lines are now connected. Now the radio board can communicate with the EOB Drop In Board.

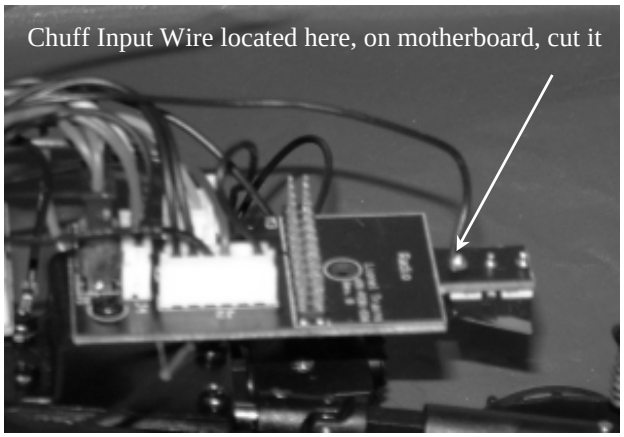
Chuff Rate Decision

Now is the time to make a decision. There are 2 options to choose from regarding the chuff rate of your steam locomotive. You can choose to leave the chuffing the way it has been or you can choose to select the chuff rate from the remote (either 1, 2 or 4 chuffs per revolution). The key factor to keep in mind is whether the locomotive has a mechanical smoke unit with a plunger or a fan driven smoke unit. If it has a mechanical smoke unit and you choose to select the chuffing from the remote, then the puffing will not be in sync with the chuffing sounds. If you choose to leave it as stock the puffing will stay in sync with the chuffing, but it will be fixed at 1 or 2 chuffs per revolution.

If you decide to leave it as stock, simply clip off the wire labeled “Chuff Input” on the diagram on the last page at the connector.

If you choose to have the chuff rate selectable from the remote, you will need to disconnect 1 plug (or wire) and solder the only remaining wire on the EOB Drop In Board (Chuff Input) to a pin on the R2LC.

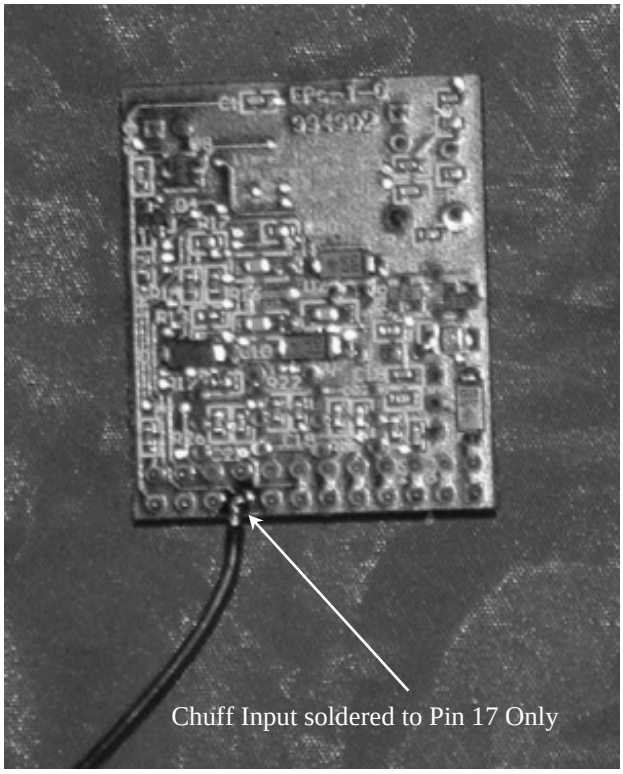
To find the location of the plug you need to locate the cherry switch on your locomotive. This switch will be located on the frame near one of the driver axles. It will have 2 wires soldered to it. One will go to ground and the other wire will connect to the motherboard. You must locate the wire that connects to the motherboard and disconnect it. Whether you cut it off or unplug it, it doesn’t matter it simply must be disconnected. The photo below illustrates where the connector is located on this Lionel Allegheny.



Once you have located the factory chuff input wire, simply disconnect it if it is a wire. If it is a plug unplug it and stuff it out of the way, if it is a wire that you had to cut, make sure the end is insulated and stuff it out of the way. These wires will not be reused for this installation.

Once the factory chuff wire (plug) is removed it is time to install the EOB Drop In Board Chuff Input wire to the backside of the R2LC, similar to the way we wired the Serial In wire. Locate the diagram showing the pin numbering of the backside of the R2LC (on the last page). The EOB Chuff Input wire will connect to pin 17 of the R2LC.

You can either solder this wire to the pin on the motherboard, or directly to the pin on the backside of the R2LC, it is up to you. Regardless of where you solder the wire make certain it does not touch any of the surrounding pins, just pin 17 only. The photo below illustrates the “Chuff Input wire soldered to pin 17 of the R2LC Radio Board.



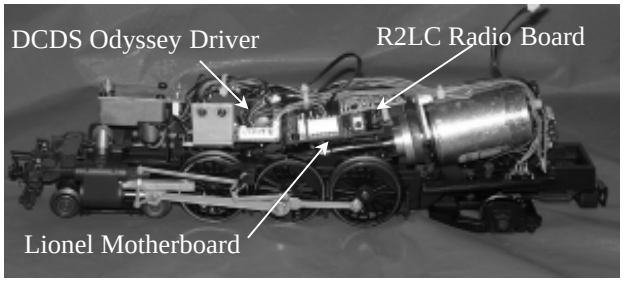
Plug the R2LC back into the motherboard making sure you align the pins properly, if the pins are not aligned properly the board will short out on power up and void the warranty.

The EOB Drop In Board is now completely installed. Please refer to the section entitled “Testing and Programming your EOB Drop In Board” to complete the final stages of this installation.

Installation into Lionel Scale Steam Locomotives with Odyssey®

To begin the installation you want to remove the shell of the locomotive from the frame. Disconnect or unplug any wires or plugs between the shell and the frame so that you can separate the shell and the frame. Set the shell aside for now.

You will want to identify the boards inside your locomotive before beginning the installation. The photo below is of a Lionel scale K-4 Pacific. You will notice the three primary circuit boards: R2LC Radio Board, Lionel Motherboard and DCDS Odyssey® Driver Board. While your locomotive may not have this exact configuration, it will have at least these three primary boards.



For the time being, go ahead and unplug the R2LC Radio Board and set it aside. It pulls straight up off of its connector.

Locate the DCDS Odyssey® Driver board and unplug the 4-position connector, the 3-position connector and the 6-position black Molex connector. (The 10-pin plug should have been unplugged when you separated the shell and the frame.) The DCDS board should have no plugs in it now.

Using a Phillips head screw driver and a pair of needle nosed pliers unscrew the 4 screws that hold the tabs of the DCDS to the heat sink. You should have a total of 4 screws, 4 nuts with or without lock washers and 4 nylon shoulder washers. Set the nylon shoulder washers aside, as they will not be reused.

You can now remove the DCDS board from the heat sink. There will be 2 or 4 insulators located between the DCDS tabs and the heat sink; you can discard those insulators, as they will not be reused.

Locate the EOB Drop In Board that came with the installation kit and place it into the same location that you just removed the DCDS from. Using the 4 screws and nuts you just removed from the DCDS mount the EOB Drop In Board to the heat sink. Do not over tighten the screws and nuts, as this will cause the cover of the EOB tabs to break and will void the EOB Drop In Board warranty. The screws should be snug, but do not over tighten them!

***NOTE**: You may want to add some heat sink paste between the EOB Drop In tabs and the heat sink to help facilitate the heat transfer between these components and the heat sink. It is not a requirement, but it is recommended. You can acquire heat sink paste at any good electronics supply store such as Radio Shack.*

Now that the EOB Drop In Board is mounted to the heat sink locate the 4-position white connector that you previously unplugged from the DCDS board. This 4-position connector will be plugged into the Lionel Motherboard. Plug it into the only 4-position plug on the EOB Drop In Board.

The locomotive has a preexisting 6-position black Molex connector; unfortunately this connector will not fit into the EOB board. You will be required to replace this connector with the 4-position black Molex connector included with the installation kit. Locate the 4-position black Molex connector from the installation kit. You will need to clip 4 wires from the existing 6-position black Molex connector; these wires are pickup, ground and two motor leads. Leave some length between the connector and the cut, so you can reuse the connector in the future if necessary.

Plug the new 4-position black Molex connector into the EOB Drop In Board. The plug is polarized so it will only fit in one direction. Do not force the plug, otherwise it may break, simply turn the connector until it slides into the connector, then press it down until it locks.

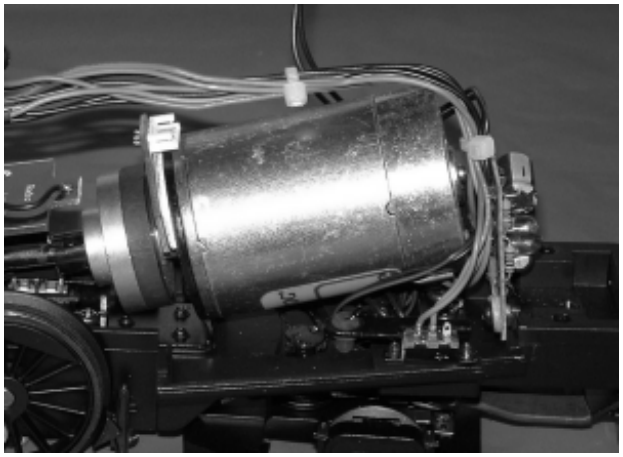
Using the wires in the new 4-position connector you need to solder the red, black, blue and yellow wires into the wires you just cut. Because there is very little consistency in the color-coding of wires in these locomotives we strongly recommend that you visibly trace each wire to verify its termination point. The red wire in the new connector is center rail (AC Hot). The black wire in the new connector is chassis (AC Ground). Keep in mind that some of the original Lionel 6-position connectors have more than one wire in the pickup and ground pins. If this is the case with your application be sure to connect all the wires in your solder connection, otherwise some components will not receive the power they require. Carefully solder each wire to its proper connection and cover the solder joint with some shrink tube to minimize the amount of space it takes up.

The blue and yellow wires are for the motor. Carefully solder each wire to its proper connection and cover the solder joint with some shrink tube to minimize the amount of space it takes up. As for the motor leads, you have a 50/50 chance of wiring the motor leads the correct way. You will not know until the installation is complete, so if they are backwards you will have to reverse the motor leads.

Now that the 4-position connector is wired it is time to mount the sensor board to the motor.

Mounting the Flywheel Sensor Board to the Motor

Before you can mount the sensor board to the motor you must first make room for the new sensor. To do this you will be required to cut the preexisting sensor circuit board from between the motor and the flywheel. We recommend using a pair of sharp wire cutters to slice through the circuit board. The photos below illustrates a before and after view of the Lionel sensor board. The left photo is before and the right photo is after.



Before

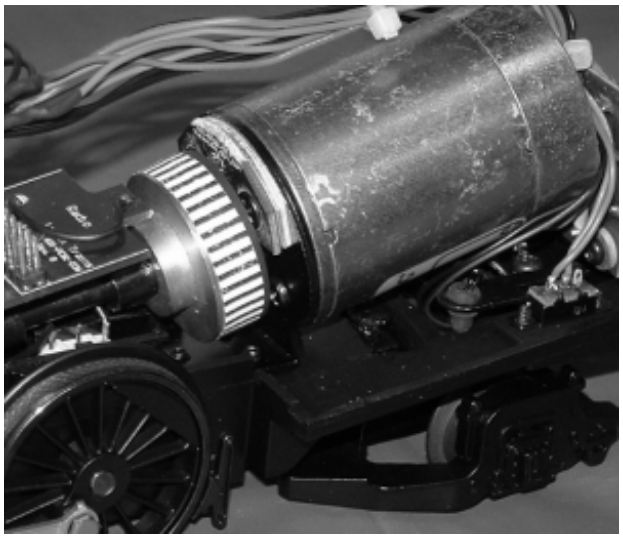
After

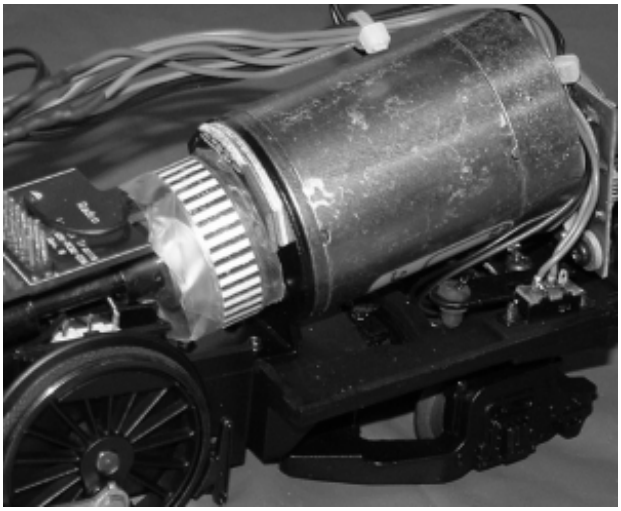
Please note that the 3-position connector in the sensor board can be unplugged and discarded. Once this harness is out of the way insert the cutters as close to the side of the motor as possible and firmly cut the board. You will want to trim the fiberglass board material so it is flush with the side of the motor.

Now, using the flywheel tape included in the installation kit cut a stripe set and test fit it to the flywheel. There are 5 different stripe sets available. The closer the lines are together the slower the locomotive will run at the first speed step. If you plan on using the engine for slow speed operation use the stripe set labeled “Williams”. If you plan on a lot of high-speed operation use the stripe set labeled “SS 2”. We recommend starting with the “Williams” strip. The recommended order would be “Williams, MTH, K-Line, SS 1 then SS 2”. Every tape strip will fit your flywheel. It may be necessary in some instances to “stretch” the strip when you apply it to the flywheel. The paper will give and most of the time it will give enough for almost 3 stripes worth of overlap!

It is absolutely imperative that the mating end of the tape strip line up exactly. If even one line is larger than the others the locomotive will exhibit a jerky motion when operating. Be certain the stripes line up exact, there is no room for error here!

Once you are satisfied with the position of the tape strip we recommend you apply a piece of clear Scotch Tape over top of the flywheel strip. This will keep the strips from smudging and will protect the strip from coming loose over time. Try not to capture any air bubbles in the tape, if you do be sure to prick the air bubble and press the air out. Make sure the tape is securely adhered to the tape strip and that it overlaps itself at least a half an inch or more. The photo below to the left illustrates the tape strip applied to the flywheel. The photo to the right illustrates the Scotch Tape protective cover before being trimmed. You will want to trim the tape even with the edges of the flywheel using a sharp X-Acto knife.

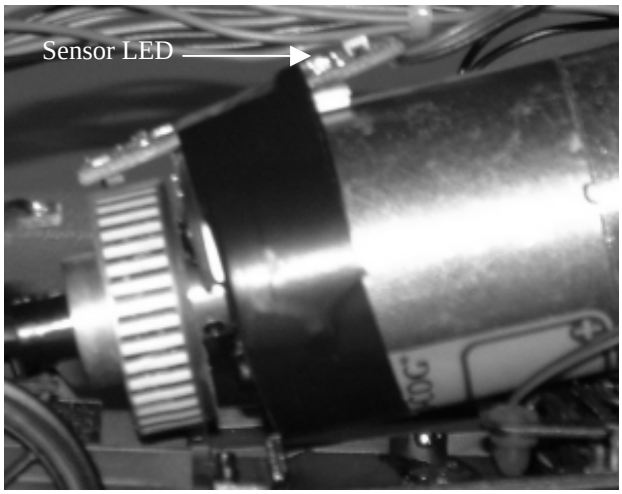




It is *imperative* that the flywheel tape strip be applied properly. This is the first of two very important alignment steps for the flywheel sensor. If the tape strip is not evenly aligned at the ends you will see it every time you run the locomotive, a visible jerk will appear in the operation. Take the time to make sure it is done right!

Now that the flywheel tape strip is applied to the flywheel it is time to mount the flywheel sensor board. The spacing of the sensor board is the second critical step in mounting the flywheel sensor. Locate the small bag of styrene spacers that came with the installation kit. Each baggie has 2 sets of the following thicknesses: .010”, .015”, .020”, .040” and .060”. There is also one piece of 0.030”, which is tagged with a black mark. This 0.030” plastic piece is the spacer used to space the flywheel sensor from the flywheel.

Use whatever combination of styrene spacers is required to space the flywheel sensor exactly 0.030” from the flywheel. It is sometimes necessary to mount the sensor on an angle to get the eye close enough to the flywheel, just make sure it does exceed the maximum height of the frame components. Otherwise the shell will not fit back onto the frame. Once you have the proper combination of spacers selected use crazy glue or super glue to adhere the strips to the unpopulated side of the flywheel sensor. Then using the same adhesive glue the sensor board, along with the spacers to the top of the motor. Hold the assembly in place until the glue sets up. Using the 0.030” spacer ensures the distance between the flywheel sensor and the flywheel is exactly 0.030”. The spacer should slide between the two with very little effort. If the sensor is not spaced properly it will not read the stripes and hence it will not function properly. The photo below shows the sensor board mounted to the top of the motor.

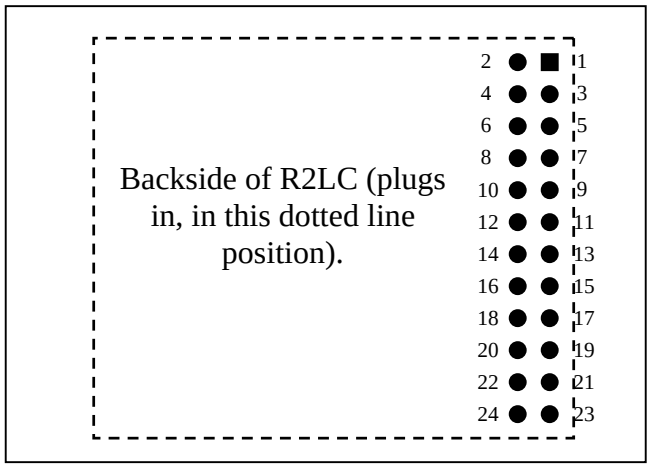


We recommend that you place a wrap of electrical tape around the motor and the sensor board. Be certain you do not cover up the sensor LED, as this LED allows you to verify the flywheel sensor is working properly. The tape will hold the sensor board to the motor in addition to the super glue between the sensor and the styrene spacers. The sensor board is now mounted to the motor. It is important that the sensor board not move once it is mounted to the motor so make sure it is secure against the motor.

Plug the 3-position connector on the end of the Flywheel Sensor board into the only 3-position connector that it will fit in on the EOB Drop In Board. The sensor board is now mounted.

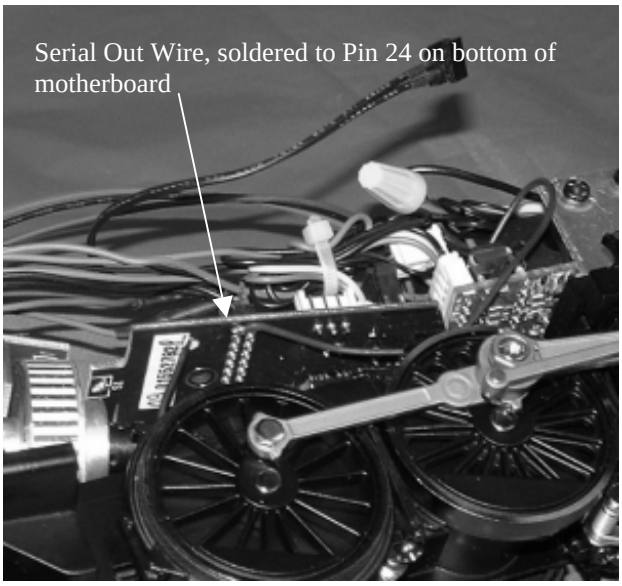
Connecting the communication lines

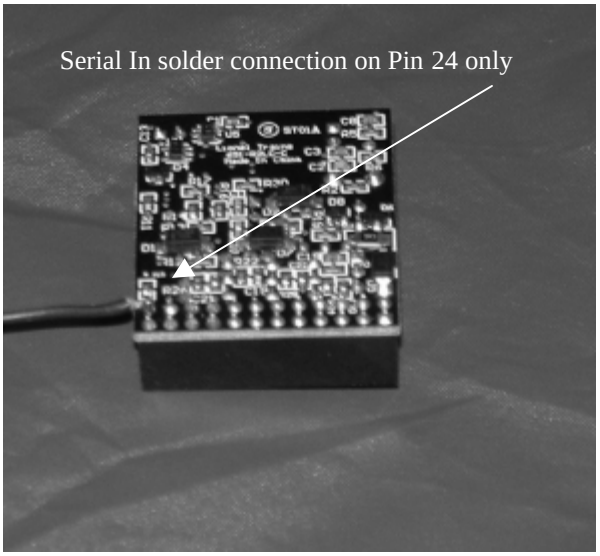
The EOB Drop In Board communicates with serial data, between the radio board and the EOB Drop In Board. These communication lines did not exist between the radio board and the old DCDS board that you removed. So they need to be soldered in place. The connection is made on the Lionel motherboard by clipping out a single pin in the 24-pin header. The diagram below illustrates the numbering system used on Lionel motherboards. Please study this drawing carefully before making any cuts.



You need to clip the pin numbered 24 on the above diagram. When you clip this pin you will clip it flush with the motherboard. You will then solder the communication line to the backside of the motherboard. You must be certain the pin will not insert into the R2LC (radio board). The diagram on the last page illustrates the proper orientation of these communication wires. If you reverse them, no damage will occur, but the EOB board will not function properly either.

Locate the only remaining 3-position connector from the installation kit and plug it into the only remaining 3-position plug on the EOB Drop In Board. Solder the wire labeled Serial OUT to the pin on the backside of the motherboard that you just clipped off. Then solder the wire labeled Serial IN to the backside of the R2LC in the position shown as 24. Be careful you do not solder this wire to any other components on the board, just the single pin, nothing else; otherwise a short will occur and void the warranty on the R2LC as well as the EOB Drop In Board. The photo on the next page to the left illustrates the connection on the motherboard. The photo to the right illustrates the solder connection on the R2LC.





The communication lines are now connected. Now the radio board can communicate with the EOB Drop In Board.

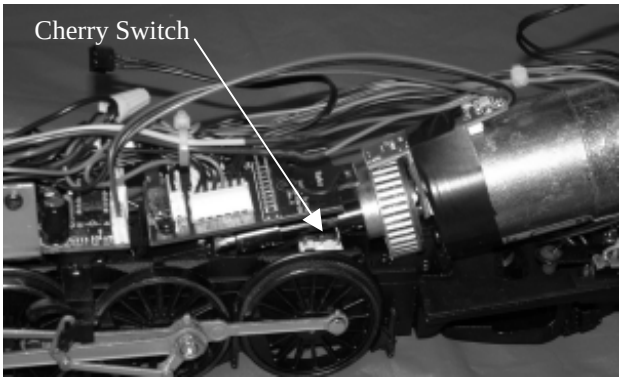
Chuff Rate Decision

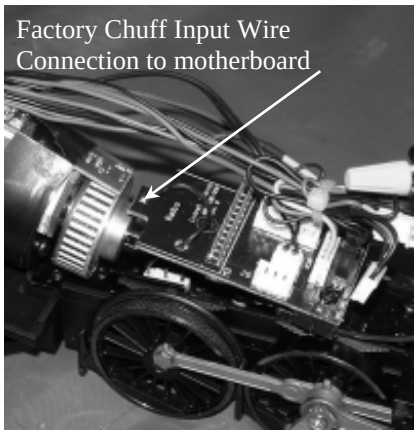
Now is the time to make a decision. There are 2 options to choose from regarding the chuff rate of your steam locomotive. You can choose to leave the chuffing the way it has been or you can choose to select the chuff rate from the remote (either 1, 2 or 4 chuffs per revolution). The key factor to keep in mind is whether the locomotive has a mechanical smoke unit with a plunger or a fan driven smoke unit. If it has a mechanical smoke unit and you choose to select the chuffing from the remote, then the puffing will not be in sync with the chuffing sounds. If you choose to leave it as stock the puffing will stay in sync with the chuffing, but it will be fixed at 1 or 2 chuffs per revolution.

If you decide to leave it as stock, simply clip off the wire labeled “Chuff Input” on the diagram on the last page at the connector.

If you choose to have the chuff rate selectable from the remote, you will need to disconnect 1 plug (or wire) and solder the only remaining wire on the EOB Drop In Board (Chuff Input).

To find the location of the plug you need to locate the cherry switch on your locomotive. This switch will be located on the frame near one of the driver axles. It will have 2 wires soldered to it. One will go to ground and the other wire will connect to the motherboard. You must locate the wire that connects to the motherboard and disconnect it. Whether you cut it off or unplug it, it doesn’t matter it simply must be disconnected. The photos on the next page illustrates where the cherry switch is located on this Lionel K-4 Pacific. The second photo illustrates where the factory chuff input wire connects to the motherboard.





Once you have located the factory chuff input wire, simply disconnect it, if it is a plug, unplug it and stuff it out of the way. If it is a wire, cut it and make sure the end is insulated and stuff it out of the way. These wires will not be reused for this installation.

Once the factory chuff wire (plug) is removed it is time to install the EOB Drop In Board Chuff Input wire to the backside of the R2LC, similar to the way we wired the Serial In wire. Locate the diagram showing the pin numbering of the backside of the R2LC. The EOB Chuff Input wire will connect to pin 17 of the R2LC. You can either solder this wire to the pin on the bottom of the motherboard, or directly to the pin on the backside of the R2LC, it is up to you. Whether you solder it to the backside of the R2LC or the bottom of the motherboard, make certain it does not touch any of the surrounding pins, just pin 17.

The EOB Drop In Board is now completely installed. Please refer to the section entitled “Testing and Programming your EOB Drop In Board” to complete the final stages of this installation.

Your specific locomotive may have had wires in the 10-position connector that was originally plugged into the length of the DCDS Odyssey® board. If this is the case the connections for these wires are covered in the “Replacing the shell” section.

Testing and Programming the EOB Drop In Board

At this point your EOB Drop In Board should be mounted to the heat sink, all harnesses should be plugged into the EOB Drop In Board connectors and the flywheel sensor should be mounted to the motor with the flywheel tape applied to the flywheel. If your model is not at this point, please return to the section that best fits your locomotive and complete the installation steps.

Make sure the Lionel R2LC radio board is reinstalled on its 24-pin connector. Place the locomotive on the track (with a command base connected to the outside rail) and SLOWLY apply power to 18 Volts AC. Pay attention to the transformer when you apply power, make sure there is not a short when you apply power. (On the Lionel scale K-4 I found a couple component legs from the EOB Drop In Board that were shorting against the heat sink, which created a short.) If this occurs on your model, please locate the potential short by unplugging the black 4-pin Molex connector and reapplying power. If the short is not present, then you know the short is somewhere between the Drop In Board and the heat sink and/or the 4-pin Molex connector. If you think it is in the connector, recheck your wiring to ensure the red wire connects to the pickup rollers and the black wire connects to the frame. If the component legs are shorting against the frame simply apply a couple small pieces of electrical tape between the Drop In Board and the heat sink. Once you feel as though the short is resolved plug the 4-position black Molex connector back into the Drop In Board and slowly reapply power again. Once again watching to ensure there are no shorts.

Once power is applied you need to check the flywheel sensor and ensure it is properly reading the flywheel tape strip. Locate the flywheel sensor board LED and verify the red LED lights each time a black stripe passes in front of it. This can be done by slowly turning the flywheel manually with your finger. The LED should turn on and off each time a black line passes the sensor. Make sure you rotate the flywheel 360 degrees and that the red LED blinks evenly, if it blinks intermittently then it is not properly reading the flywheel tape strip. (If this is the case on your model you will need to recheck the spacing and ensure there is 0.030” between the sensor and the flywheel. Also make sure the tape strip is not smudged or there are air bubbles under the clear tape coating.) Once you have spun the flywheel and verified the LED blinks evenly you need to program the EOB Drop In Board.

Programming the EOB Drop In Board

The EOB Drop In Board uses a little different programming sequence than the EOB Motherboard. We have modified the software to help eliminate the motor squeal often heard with the EOB Motherboard. Please follow these instructions closely.

There are 2 adjustable settings in the programming of the EOB Drop In Board. These settings are the “Background Pulse” and the “Master Chuff Reset Code”. The Background Pulse is used to “quiet” down the motor from squealing. This is a scale that goes from 01 (the highest setting) to 99 (the lowest setting). The lower the setting the slower the locomotive will run at the first speed step. The higher the setting the faster the locomotive will run at the first speed step. The Master Chuff Reset Code is used to select the number of black stripes the flywheel sensor counts per one complete revolution of the

flywheel. For instance, the flywheel may make 6 complete revolutions before the Drivers make one complete revolution. The Master Chuff Reset Code allows you to manually adjust the setting until the locomotive only chuffs once per revolution. (The selectable chuff settings are not a program mode setting, but something that can be done on the fly.) These settings will be covered below.

Because the EOB Drop In Board communicates with Railsounds and provides audible key pad confirmation echoes we recommend you place the tender on the track if you have a steam locomotive or turn the volume up on a diesel so you can hear it clearly.

Using your Lionel Cab-1 remote you need to follow the following programming steps with the program/Run switch in the Run position:

The parentheses identify the sound confirmation you will hear from the Railsounds.

To set the background pulse setting use this command set:
ENG + ## + DIR + AUX1 + AUX1 + AUX1 *(whistle/horn blast)* **+ 4** *(coupler sound)* **+ 9** *(coupler sound)* **+ 9** *(whistle/horn blast)*

To select the 128-speed step mode for testing purposes use this command set:
ENG + ## + DIR + AUX1 + AUX1 + AUX1 *(whistle/horn blast)* **+ 2** *(whistle/horn blast)*

The locomotive is now set up to run in the 128-speed step mode. Turn the power off for 15 seconds. Turn the power back on and press ENG + ## + BOOST. (Press the boost key only one time). The sounds will kick on and the locomotive will begin moving. Make sure the locomotive starts moving FORWARD. If the locomotive starts out in the REVERSE direction you will need to swap the yellow and blue wires that are in the black 4-position Molex connector (please make this change now before proceeding). If the locomotive starts out in the FORWARD direction continue to the next step.

Watch the locomotive run, check to see if the locomotive is jerky at all. If you do notice a lot of jerkiness it may be flywheel tape. However, you can change the background pulse settings to see if the jerkiness smoothes out first. To adjust the background pulse setting; follow these commands:

ENG + ## + DIR + AUX1 + AUX1 + AUX1 *(whistle/horn blast)* **+ 4** *(coupler sound)* **+ #** *(coupler sound)* **+ #** *(whistle/horn blast)*

The # + # can be any number between 01 and 99. We recommend starting with 35 and working your way up. You will notice a change in the speed of the first speed step at 35, but you should also see a difference in the jerkiness, it should smooth out. If the jerkiness still persists use a lower number such as 20. The lower the number the faster the locomotive will go the first speed step, but it will also apply power longer to overcome any jerkiness that may exist as well. If, after modifying the background pulse setting for a while you feel the jerkiness is not smoothing out, then we recommend applying a new tape strips set. If the ends of the tape strip have a seamless match and no stripe is larger or smaller than the others then the problem must be resolved with the background pulse

settings. You can change this setting as many times as needed. We prefer you get the jerkiness worked out in this stage before continuing with the instructions.

An adjustment from 35 to 37 will yield very little results, instead go from 35 to 45 to 55 and so on. Making an adjustment of about 10 per try. Once you have the jerk resolved, please continue with the programming.

Setting the Master Chuff Reset Code (Steam Locomotives)

If you chose to leave the stock cherry switch connected for the chuff rate, you can skip this set of instructions.

The Master Chuff Reset Code is the adjustment used to set the number of stripes counted per one complete revolution of the drivers. (If you have a diesel please follow the next block of instructions.) To make this setting you will have to do some experimenting. Using the Lionel cab-1 remote with the Program/Run switch in the Run position apply power to the locomotive and press the following keys:

ENG + ## + DIR + AUX1 + AUX1 + AUX1 *(whistle blast)* **+ 6** *(coupler sound)* **+ 5** *(coupler sound)* **+ 0 + 0** *(coupler sound)*

Press the BOOST key once and watch the connecting rods on the locomotive. Allow the engine to make at least 3 revolutions of the drivers and listen where the chuff hits. It should hit in the same place each time. If it chuffs more than one time per revolution then the setting is too low. If the driver rotates 360 degrees and chuffs in a different place each time, then the setting is too high. Repeat the process replacing 500 for a number either higher or lower. You want the chuff to sound in the same position each time. (Disregard the very first chuff you hear when you press the BOOST key that one doesn't count.) Once you have the setting to your liking mark the number down here:

Master Chuff Reset Code

Manufacturer:_____ Locomotive:_____

Master Chuff Reset Code:_____ + _____ + _____

We recommend you save this number to save time if the setting should ever be lost (this would only occur if you overwrite the setting).

To increase the chuffs per revolutions use this command set:

ENG + ## + AUX1 + AUX1 + 5

The whistle will echo the number of chuffs per revolution with one blast for 1 chuff per rev. 2 whistles for 2 chuffs per rev. and 4 whistles for 4 chuffs per rev. (Articulated locomotives will yield 2 chuffs on the one chuff setting, 4 chuffs on the 2 chuff setting and 8 chuffs on the 4 chuff setting.) This command can be issued at any time whether the locomotive is moving or stopped.

Setting the Master Chuff Reset Code for Diesels

Diesel locomotives that were originally equipped with Odyssey® are the only locomotives that must follow this procedure. If you diesel did not have Odyssey® you can move to the next block of instructions.

Place the locomotive on the track and apply power. The Program/Run switch needs to be in the Run position. Using the Lionel Cab-1 remote follow these steps:

ENG + ## + DIR + AUX1 + AUX1 + AUX1 *(horn blast)* **+ 6** *(coupler sound)* **+ 1** *(coupler sound)* **+ 1 + 1** *(horn blast)*

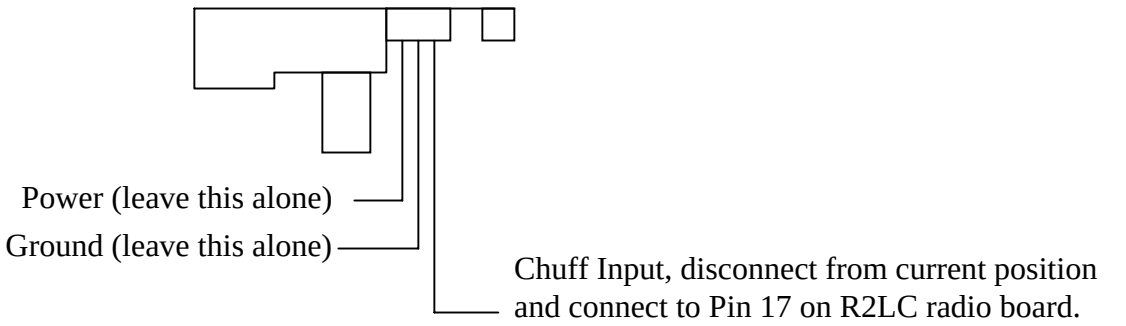
Now press the following keys: **ENG + ## + AUX1 + AUX1 + 5** *(two horn blasts).* Now press this sequence one more time: **ENG + ## + AUX1 + AUX1 + 5** *(four horn blasts)*

The chuff code for your diesel will always be 111. This will allow the Railsounds to increase and decrease based on speed. NOTE: The sounds will rev up at the first few speed steps in the 128 mode, then after approx. 15 seconds the sounds will rev back down to idle. The sounds will not stay revved up until you reach the 10th speed step or so. The master chuff reset code is now set. Please proceed to the next step.

Wiring a TAStudios Turbo Smoke Unit to the Drop In Board

If your locomotive is equipped with a TAStudios smoke unit you will need to relocate the chuff input wire so the puffing stays in sync with the chuffing. This is accomplished by relocating one wire from the smoke unit. This wire is the chuff input wire on the smoke unit, shown in the diagram below.

Left side view of TAStudios Turbo Smoke Unit



As the diagram points out, the chuff input wire to the smoke unit needs to be disconnected from its current position in the locomotive and reconnected to the backside of the R2LC on pin 17. The diagram on the last page illustrates where pin 17 is located on the R2LC. You can solder this wire to either the backside of the R2LC or the bottom of the Lionel motherboard. Regardless of where you solder it make sure it does not touch any of the surrounding pins, otherwise a short will occur and void the warranty of both the EOB Drop In Board and the R2LC.

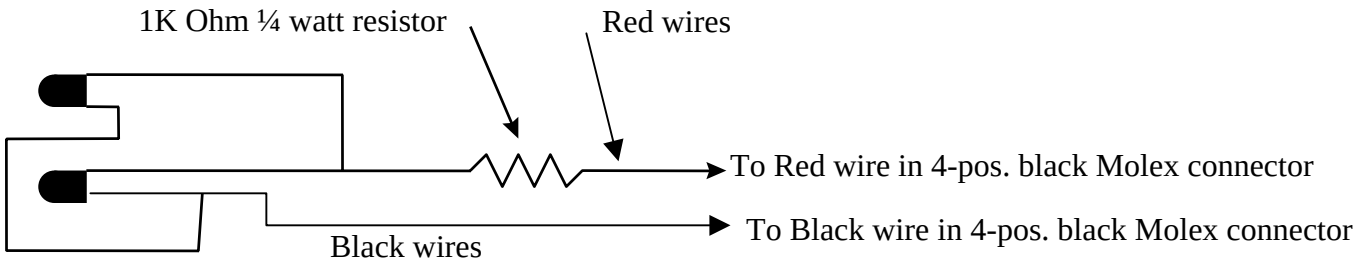
Reinstalling the shell

If you have a diesel locomotive simply replace the shell on the frame and reinstall the screws. Most all diesels have a set of spring contacts between the shell and the frame. If your locomotive had connectors, then reconnect the lights into their appropriate harnesses and reattach the shell. The diesel installation is complete. Please move to the final section of operating instructions for your EOB Drop In Board.

If you have a steam locomotive chances are you unplugged a couple connectors to remove the shell from the frame. One of these connectors was the antenna. You either disconnected the wire nut, or unplugged a harness. You will need to plug that harness into the Lionel motherboard or reattach the wire nut to the antenna leads.

You also may have removed a plug or two for the front headlight and the front marker lights. Go ahead and reconnect these plugs now.

If you had a 10-position connector that you removed from the Lionel DCDS Odyssey® Driver it has the marker light leads in it. These leads need to be removed from this connector and reconnected to pickup and ground. But, you will need to include a 1K Ohm ¼ Watt resistor to prevent the marker lights from burning out. This resistor is included with your installation kit. Locate this resistor and place it as shown in the diagram below:



The DCDS Odyssey® Driver had a 3 volt tap to run these marker lights. Unfortunately the EOB Drop In Board does not have this feature, so the marker lights need to be connected to the pickups with the addition of the resistor.

Once you have the marker lights connected to pickup and ground you are ready to reattach the shell to the frame. We recommend wire tying the wires together to keep them from becoming pinched between the shell and the frame. Reinsert the screws and attach the shell to the frame for good. The installation is complete!

EOB Drop In Board Operating Instructions

(You may want to detach this page for easy reference during operation.)

Your EOB Drop In Board has 3 modes of operation. These modes are as follows:

- 32 speed steps, cruise on
- 128 speed steps, cruise on
- 32 speed steps, cruise off

32 speed steps, cruise on

The 32 speed steps, cruise on is intended for lash-ups with Odyssey® equipped locomotives. The command set for accessing this mode is:

ENG + ## + DIR + AUX1 + AUX1 + AUX1 *(whistle/horn blast)* **+ 1** *(whistle/horn blast)*

128 speed steps, cruise on

The 128 speed steps, cruise on is intended for lash ups with Proto 2 locomotives and other EOB equipped locomotives. The command for accessing this mode is:

ENG + ## + DIR + AUX1 + AUX1 + AUX1 *(whistle/horn blast)* **+ 2** *(whistle/horn blast)*

When using the 128 speed step mode the red thumbwheel on the Lionel remote will increase the speed 2 speed steps at a time. The BOOST and BRAKE keys will increase and decrease the speed one step at a time respectively. The squealing brake sounds will not be heard when the brake key is held down in this mode.

32 speed steps, cruise off

The 32 speed steps, cruise off is intended for lash ups with non cruise equipped locomotives. The command for accessing this mode is:

ENG + ## + DIR + AUX1 + AUX1 + AUX1 *(whistle/horn blast)* **+ 3** *(whistle/horn blast)*

Selectable chuff rate

For steam locomotives you can change the chuff rate on the fly. The command for changing the chuff rate is:

ENG + AUX1 + AUX1 + 5

The whistle will echo the number of chuffs per revolution. For instance, one whistle = one chuff per revolution. Two whistles = two chuffs per revolution. Four whistles = four chuffs per revolution. (Articulated locomotives will have twice as many chuffs per revolution.)

EOB Drop In Board Connector Legend

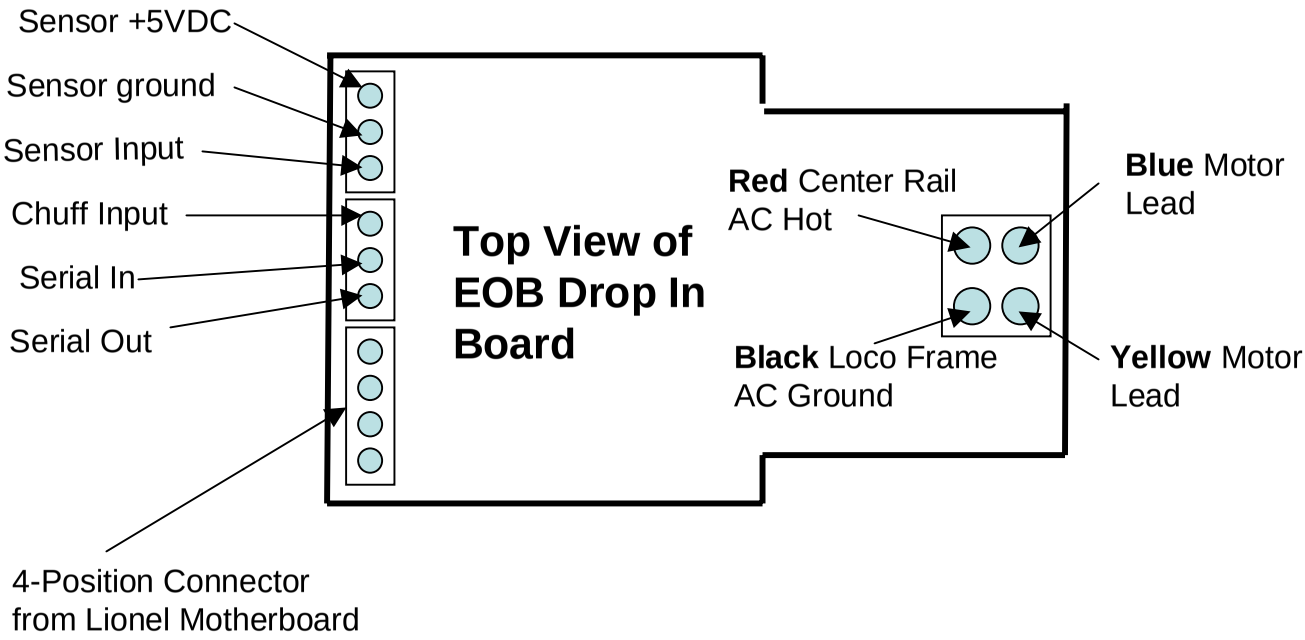


Photo of the backside of the Lionel R2LC Radio Board

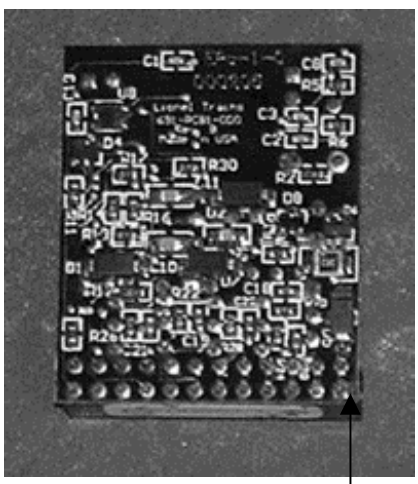
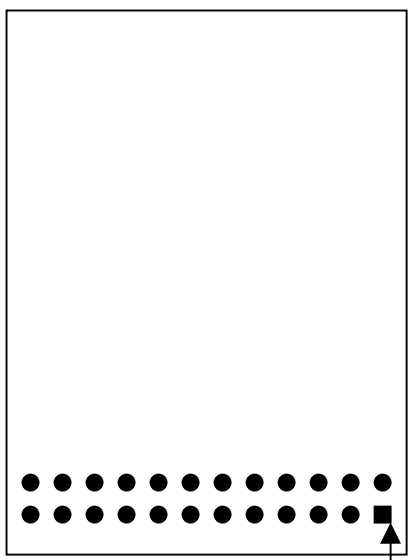
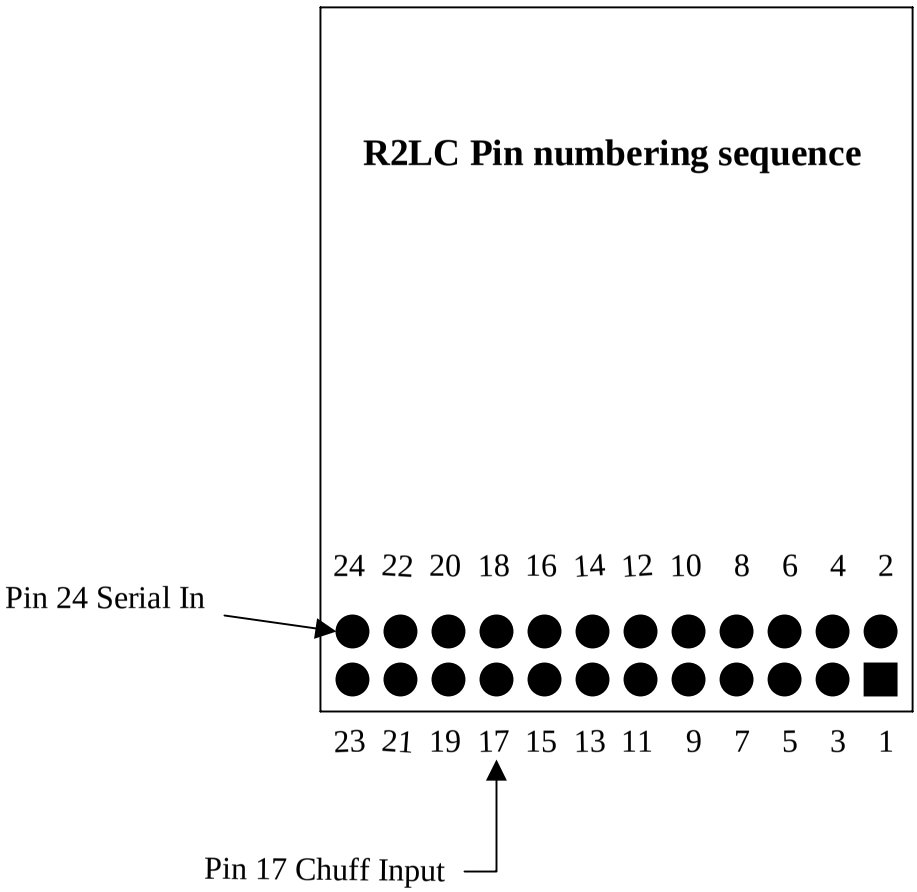


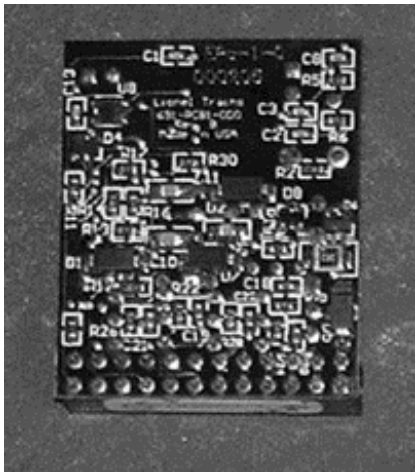
Diagram of the backside of the Lionel R2LC Radio Board



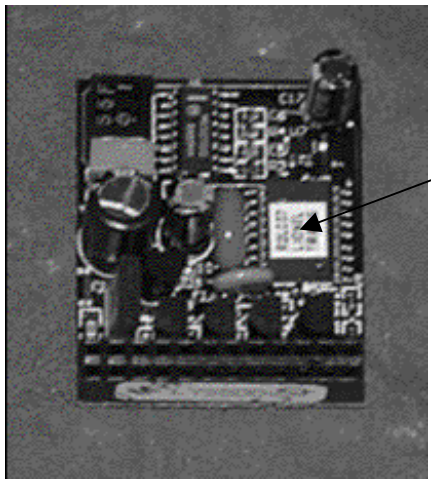
The square pad is pin number 1
The backside of this diagram illustrates the pin numbering of the R2LC.



Backside of R2LC



Front side of R2LC



Label says;

R2LC XX
Lionel
Trains