CONVRTR-15 Configuration Variables (CV)

Use the AirWire T5000 throttle to setup the CONVRTR-15 CVs as well as the attached decoder. Only a few CVs are used by the CONVRTR-15 and these are usually programmed at the same time as when programming attached decoder. The only CV unique to the CONVRTR-15 is CV200.

When programming the address, the throttle will automatically send appropriate information regardless of the number of digits in the address.

The CONVRTR-15 accepts both SERVICE PROGRAM commands and OPS PROGRAM commands.

Do not use OPS PROGRAM to change the address. The automatic setting of the CVs will be lost.

CV #	Factory Value	Value Range	Description
1	3	0-99	1-99 Primary Address
8	135	135	CVP Manufacturer ID
17	0	0-255	Loco Address Hi-Byte
18	0	0-255	Loco Address Lo Byte
29	2	0-255	Decoder configuration
200	0	0-16	Frequency Select

CONVRTR-15 Warranty Information

This warranty covers substantial defects in materials and workmanship in the CONVRTR-15 module.

What This Warranty Does Not Cover

This warranty does not cover any problems which result from improper installation, modifications, battery polarity reversal, improper operation, leaking batteries, excessive battery voltages, excessive decoder current draw, incorrect connections to decoders, abuse, accidents, or acts of God such as excessive heat, floods, damage caused by exposure to moisture and rain, lightning, earthquakes, volcanic events, tidal waves or hurricanes.

Warranty Duration

The coverage of this warranty lasts for 90 days. After this period, standard repair rates apply. Depending on the problem, CVP reserves the right to repair or replace.

Repairs and Returns

If you purchased your CONVRTR-15 from one of our AirWire900 dealers, please call them first. They are your best and quickest for answers to questions about CONVRTR-15. They are also experts in installation and offer such services should it be required. If you purchased your CONVRTR-15 *direct* from CVP Products, call us first.

If you are asked to return an item to CVP for service, you must follow the instructions on the website under service and support and you must obtain an RMA. There you will find the street address plus other helpful tips about sending packages to CVP Products.

Do not send items to us for repair without first obtaining authorization.

CONVRTR-15 Electrical Ratings

Maximum Input Battery Voltage . . . . 18 Volts DC
Minimum Input Battery Voltage . . . . 8.2 Volts DC*
Surge Current Pump-Up 1.6A
Pump-Up Time (to charge up Sound Decoder & Keep-Alive) . . . . Unlimited
Over-Current Trip . . . . 1.52 A
Maximum Continuous Output Current . . . . 1.5A at 25°C

*Decoder dependent - it might have a higher minimum input voltage

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The AirWire900®
CONVRTR-15™ User Guide

This Product Was Originally Called "*micro*Booster"

The *micro*Booster was the first very first item released in the "micro" series. The name was changed so it could take its place alongside the other members of the CONVRTR family. The product is the same; it is just a new name.

Need Help? Contact Your Dealer/Installer First!

Should you have any questions regarding AirWire or installations, your dealer is your best source of information, tips and techniques. Also, almost all dealers will do installations or can recommend good installers. It might take a little more time and cost more, but you'll be assured of an installation that works and works well.
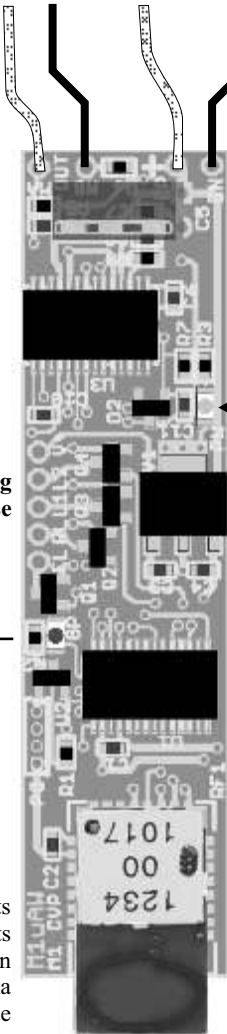
AirWire 900

Contents
CONVRTR-15 module
Test Diode
This User Guide

CONVRTR-15 Connections

DCC OUT
A   B

BATTERY INPUT
Plus   Minus

Use # 22 - #30 AWG stranded wire to make all connections. See next page for recommended soldering method.

PWR LED - Green
On when battery power is on

Non-Functioning Do Not Use

GP LED - Red
LED is on when any throttle data is received on the selected frequency (regardless of loco address).

CONVRTR-15 [shown]
Internal Antenna
Keep wires and other metal objects away from the radio module and its built-in antenna or your reception range will decrease. The antenna can be seen as a thin line on the blue circuit board.

CONVRTR-15X [not shown]
External Antenna
There is another model of the CONVRTR-15 that has an external 3 inch long whip antenna that snaps onto the radio module. Keep the antenna away from all wiring for best reception.

WARNING

There is no protection against reverse polarity. Be sure to check, double-check and re-check that the battery connections are properly polarized. Damage to the CONVRTR-15 will occur if the battery connections are reversed. Don't let out the magic smoke!

Battery Considerations And Options *continued*

Internal Wiring Diagram - LiPo Packs With Balance Connector Without PCB

The image shows the internal hookup of a protect pack and a cell-balance pack. Notice the protection PCB is absent in one, whereas the balancing connector is absent in the other pack.

Regardless of the type of battery pack or its voltage, the power connector (or its bare wires if it doesn't have a connector) is the power output and connects to the BAT input terminals of the .

Power Connector + -

Protection PCB

+ Cell #3
-

+ Cell #2
-

+ Cell #1
-

Power Connector + -

Balancing Connector

+ Cell #3
-

+ Cell #2
-

+ Cell #1
-
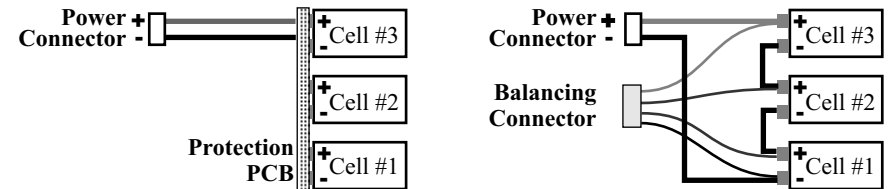
Recommended Battery Suppliers

The 4 companies listed below are where we purchase our batteries. Each offers literally hundreds of cells and battery packs. We have been doing business with them for many years. There are many more vendors but they come and go at a furious pace. It may be beneficial to spend some time shopping on the Internet to compare prices and availability. Mouser sells batteries from multiple suppliers.

There is one precaution when purchasing on the internet. Beware of sellers that don't show stock availability. They will take your order, charge your credit card but might not ship your order for many weeks or months. If availability is not stated, call the supplier and ask. But if they don't know or won't tell you, take your business elsewhere. Don't support this unethical business practice.

Finally, beware of extra fees when ordering batteries. Some vendors may tack on an extra handling fee, implying that it is fee charged by the carrier. However, there is no such fee when batteries are shipped via ground service. Always request UPS ground service.

All-Battery
436 Kato Terrace
Fremont CA 94539
(510) 979-9969
www.all-battery.com

PowerStream
1163 South 1680 West
Orem UT 84058
(801)764-9060
www.powerstream.com

* Battery Space
825 South 19th street
Richmond, CA 94804
(510)525-2328
www.batteryspace.com

Mouser Electronics
1000 North Main Street
Mansfield, TX 76063
(800) 346-6873
www.mouser.com

* Caution
When ordering batteries, always request United Parcel Service (UPS) **Ground** Shipping. Some vendor of batteries, but not all, may add "Hazardous Material Handling Fees" or other special handling fees when shipping Lithium batteries.

Battery Voltage Boost Converter Sources

Nearly all of the small and inexpensive 3.7V to 12V boost circuits come from China. The biggest collection of these can be found on ebay. You can also build your own.

If you want to build your own, this website link has the schematic, parts list and circuit board pattern: www.instructables.com Search for Booster since their part numbers change frequently.

Other sources of modules come from online RC drone stores or Amazon.

   Amazon: Ailavi DC-DC Boost Converter 3V-12V To 12V/1A   about $8.

   Helipal: www.helipal.com **Airy-Acc-LE-0318**,   2.7V - 12V to 15V adjustable, about $9.

Purchasing Batteries - Precautions

There are hundreds of sources for Lithium batteries and packs. Their widespread use in consumer electronics, RC cars, drones and planes means they are relatively inexpensive and come in lots of different sizes. Beware that many batteries in the RC hobby market do not have a built-in protection circuit board (PCB). If the battery feature list doesn't state that it is protected, then it does not have pcb. Don't use this battery. Instead, look for cells that specifically state that the PCB is included. Some vendors use the acronym PCM which stands for Protective Circuit Module. PCM or PCB mean the same thing - the cell is protected.

Li-Po 3.7V Cell without PCB

Battery marketing information is sometimes confusing. Lithium-Ion (Li-Ion) batteries are the most commonly available rechargeable battery. So are Lithium-Polymer. Some vendors claim one is better than the other. However, don't be fooled. The "Po" is short for polymer and simply means the Lithium-Ion battery is in a plastic pouch instead of a hard cylindrical shell. They both use the exact same Li-Ion chemistry.

Li-Po 3.7V Cell with PCB

The images to the left show two examples of Li-Po cells. Usually, a cell with a protection circuit board has wire leads and orange colored tape covering the PCB. A LiPo cell without the PCB, almost always has thin metal tabs for connection. Get the cell or pack that includes the PCB.

Battery Packs With Extra Plugs And Sockets - Can I Use Them?

Yes! This type of battery pack is inexpensive and readily available. It is most commonly used with RC Drones, cars and paint-ball guns. These packs do not include the protection circuit board.

The 11.1V pack will have three 3.7V cells in series. The "Cell Balance" connector provides access to the individual cells that make up the pack. It is used by a special smart charger to insure the pack's cells are safely charged to maximum capacity.

Cell Balance Connector

Power Output Connector

With the cell-balance connector and a smart charger with the cell balance feature (sometimes called a "LiPo Charger") the charger monitors the charge on each individual cell and insures that each cell is charged to the maximum capacity. If one cell requires more time to reach full capacity, the charger will charge that cell a bit longer than the others.

If your smart charger doesn't include the cell-balance feature, then the smart charger can only monitor the full pack voltage. It will monitor the pack voltage of 11.1volts and use this voltage plus the average charging current of the pack to determine when to terminate the charge. The balance connector is not used and nothing connects to it. Leave the connector attached - don't cut it off. Cutting off the connector risks shorting out the cells which will destroy the pack.

Hookup To TCS AK-MKB1 Mother Board+WOW-121

Battery Charging Jack
Center pin is PLUS +

Heatshink Tubing

Li-Ion BATTERY PACK

Battery Pack

RUN OFF CHARGE

SPDT Center - Off Power Toggle Switch

Use Small Gauge Stranded Hookup Wire

B

A

Light Connections Not Shown
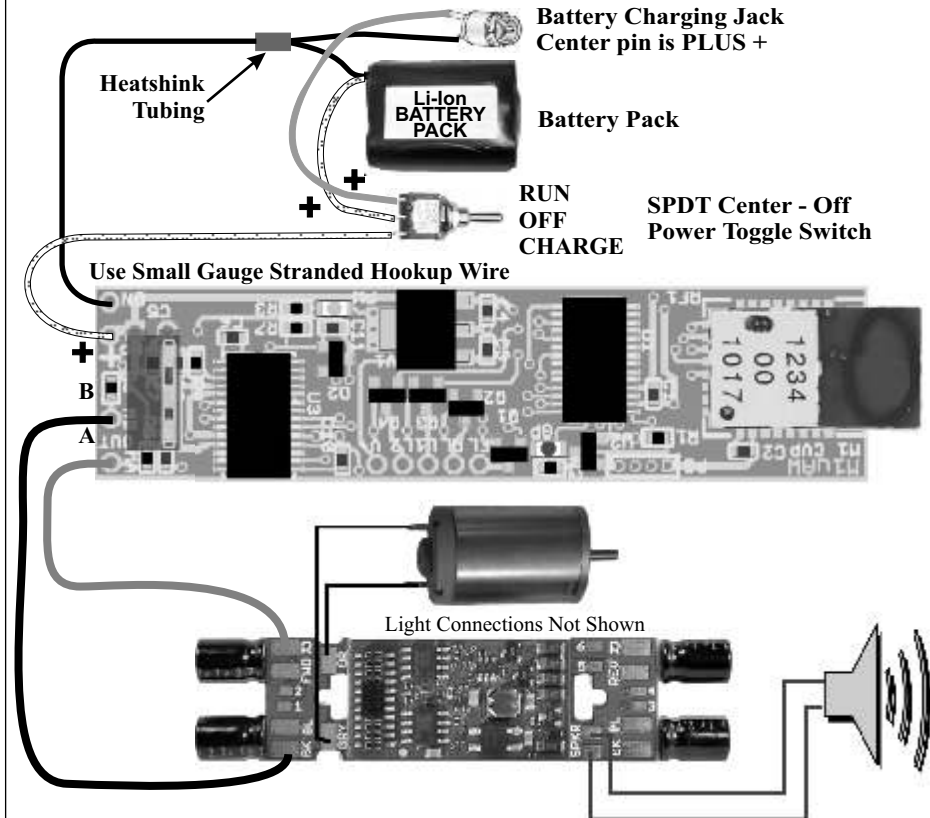
Hookup To A Soundtraxx Decoder
Use The Same Battery Hookup As Above

To Battery

B

A

Red Track Pickup

Black Track Pickup

Motor And Lighting Hookup Not Shown
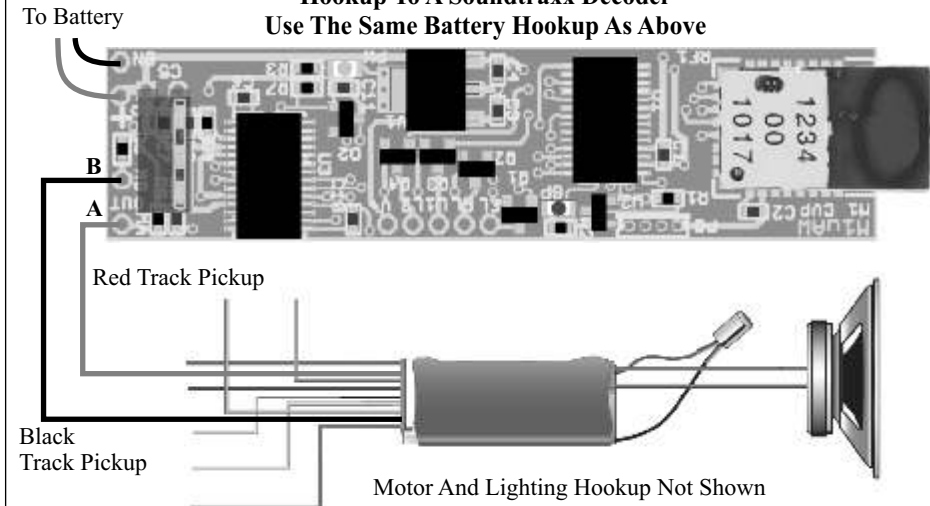
Basic Hookup Guidelines

Neatness Mandatory: Installation of the CONVRTR-15 and the DCC decoder will be in tight spaces with minimum clearances. Take extra care and extra time to keep wiring neat, with wires trimmed to the proper length and clear of mounting holes.

Basic CONVRTR-15 Connections: This is easy. There are two input pads for the battery connection that are polarity sensitive. There are two output pads for connecting the DCC decoder.

Verify Battery Polarity: There is no protection against polarity reversal. Connecting the CONVRTR-15 to the wrong polarity will destroy it. Use the suggestions on the next page if you are not sure of the wire or connector polarity.

Battery Requirements: The CONVRTR-15 is optimized for 11.1V Lithium-Ion battery packs. But, it will work with battery voltages as low as 8.2 volts or as high as 18 volts. If using higher voltages, verify that the DCC decoder will tolerate higher battery voltages.

Pick the highest energy capacity battery for which you have physical space. Energy capacity is stated in milliamp-hour abbreviated mAhr. This rating states how much current can be supplied by the battery for 1 hour. A 500mAhr rating means the battery will supply 500mA or 0.5A for one hour. The higher this number, the longer the battery will last, but its physical size will be bigger.

Make sure the battery fits the available space. There are many types and sizes available. Pick the battery that offers the best compromise in space and energy density. For easiest installation of a larger battery, use a separate battery car or a dummy locomotive.

See the battery suggestions and recommendations section at the end of this booklet.

DCC Decoder Types: Any NMRA-DCC compatible decoder may be connected to the CONVRTR-15. For sound+motion, the TCS-WWOW or the Soundtrax Tsunami are recommended.

When connected to the CONVRTR-15, the decoder will operate and be programmed as if it were sitting on the track and powered by a DCC system .

Wire: Small and flexible #22 - #30 AWG stranded wire is best although almost any kind of wire can be used. Use multiple colors to prevent confusion or polarity reversal.

Power Switch and Charging Jack: A power switch is not absolutely necessary. You can equip the battery with a simple plug and socket and that becomes the power switch. A latching reed relay can substitute for a switch. See page 10 for details.

Soldering Wires To The CONVRTR-15

Pad with Hole
Wire
Circuit Board
Bottom
Solder Joint
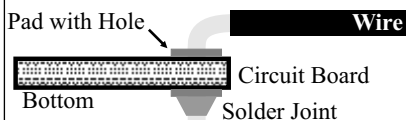
The traditional method usually requires a 90 degree bend in the wire. The bent wire is fragile and easily broken.

Traditional Method
- Strip the wire back ½ inch
- Tightly twist strands together and tin wire
- Insert tinned wire into hole
- Solder wire on bottom side of board
- Bend wire carefully to avoid breaking
- Trim wire to top of solder joint

Top
Wire
Circuit Board

This method eliminates the fragile bend. Before soldering, trim the wire and visually confirm the end of the wire will not touch adjacent pads or components.

• Better Method
- Strip the wire back about 1/10 inch
- Tightly twist strands together and tin wire
- Apply small amount of solder to pad
- Lay tinned wire on top of pad
- Heat joint top side of board - add a bit more solder

Battery Considerations And Options

Selection of a suitable battery is based on the battery size, the available physical space, the battery voltage and the battery capacity or runtime. Each factor has a direct influence on the other factors. The general guidelines will get you started down the right path. However, once you have completed your first installation, you'll be much better prepared for subsequent installations. There is no right or wrong battery answer. Let your skills and your experience guide your decisions.

Available Space - Use A Dummy Loco or Trailing Rolling Stock For The Battery

The simplest installation is where the battery is contained inside a dummy locomotive, box car or even a flat car. Not only can a larger battery be used, there is room for a charging jack, connector and toggle switch. Two small wires connect between the battery car and the locomotive.

Another consideration is to put everything inside the dummy loco or trailing car including the . This allows multiple locos to share a single CONVRTR-15 and battery.

Battery Voltage

The battery voltage rating is what the motor will receive when the throttle is at 100% of top speed. If your locomotive is primarily used as a slow speed switcher, the CONVRTR-15 will work with voltages as low as 8 volts. *Note that a standard 7.4 volt Li-Ion pack voltage is too low for the CONVRTR-15.* If the locomotive is used for mainline running at relatively high speeds, an 11.1V Lithium battery may be a more appropriate choice.

Runtime or Battery Capacity

A battery's capacity is labeled on the side of the battery. For small batteries, the label will usually list the capacity in milli-Amp-hours. If the label says 500mAh, the battery will deliver 500mA for one hour. If it says 1100mAh, the battery will deliver 1.1 Amps for one hour. Most modern HO scale locomotive motors draw less than 250mA when running at top speed on level track. But as the grade increases the motor current will go up. As the number of cars attached are increased, the motor current goes up. This is why it is impossible to say how long a battery will last before it needs to be recharged - it depends.

Battery capacity and battery voltage dictate the battery's physical size. A low voltage battery will have a higher mAh rating than a high voltage battery of the same size. But the high voltage battery will have a significantly lower capacity.

Battery Size and Format

Rechargeable Lithium battery packs are available in many different sizes and formats. They can be purchased flat or cylindrical. Higher voltage battery packs are composed of groups of individual cells. Each Lithium cell is rated at 3.7V. To make a higher voltage battery, the cells are connected in series which allows the individual cell voltages to add together. Thus, it takes 3 cells to make an 11.1V battery pack.

Battery Protection

Lithium battery packs are extremely safe with exceptionally long lifetimes when they are equipped with an internal protection circuit board. When buying packs, make sure it has the protection board built in.

Single Lithium Battery Plus Boost Circuit

The single cell plus boost circuit has emerged as an option for creating higher voltages from a 3.7V cell. lower voltage cell. This approach is common when space is very limited. A single Lithium cell rated at 3.7V is connected to circuit that converts the battery's low voltage to a higher voltage. This circuit is called a boost regulator circuit. These small and inexpensive boost regulators include both fixed and variable output voltages. Boost regulators will drain batteries quicker because they are not 100% efficient.

Operational Considerations

Beware of Lurking Locomotives When Using SERVICE PROGRAM Mode

SERVICE PROGRAM mode is a broadcast command that can be heard and understood by any other AIRWIRE decoder or CONVRTR sharing the same frequency as the CONVRTR-15. If another decoder receives the command, it too will be programmed. Play it safe and make sure to turn off all power switches on locomotives not being programmed.

Beware of Other Transmitters

The CONVRTR-15 decoder operates in an unlicenced band shared by many other transmitters. These transmitters can and will create interference, intermittent throttle operation or complete failure of one or more of your decoder's 17 frequencies. The sources of these external interfering signals can be from your own home or from adjacent homes and businesses. They can also be from other CVP wireless equipment.

Here's a list of devices known to have caused interference problems to AirWire900 equipment: wireless devices attached to computers, TV/Radio/Entertainment-center, remote controls, cordless telephones, alarm systems, baby monitors, unlicenced personal communication devices, lawn sprinkler controllers, remote starter switches, cordless light switches, outdoor lighting controllers, toys, wireless headphones, and games. Of course, if you have additional wireless throttles, make sure each is on its own frequency. Of course, two throttles on the same frequency will jam each other.

If you find a strong interfering signal on one or more of your frequencies, don't use those frequencies. Simply select another, different frequency.

Never Use RTV or Silicon Adhesive On The CONVRTR-15

NEVER use RTV or other liquid adhesive to attach the CONVRTR-15 to the locomotive. That material is conductive and will destroy the CONVRTR-15. Use only double-sided foam tape.

Placement Suggestion For Best Range - Metal Locomotives

If possible, mount the CONVRTR-15 horizontally and as high as possible within the locomotive. If you are using the CONVRTR-15 with a whip antenna, a vertical antenna may offer better range although you should also try horizontal. Keep the whip antenna away from motor and battery wiring as much as possible. Never let it touch anything metal. For metal locomotives, the use of the external antenna is mandatory. Make sure the antenna is as far outside of the metal chassis as possible.

Use Track Power? - Not Recommended

Warning

The CONVRTR-15 is designed for battery powered operation. Attempting to operate from power scavenged from some other form of track power can damage the battery and possibly the CONVRTR-15. Therefore attempting to use or recharge the onboard battery is highly discouraged.

However, we realize that this may be of interest to some users, especially if they intend to operate their battery powered locomotive on powered track. There are no specific precautions for the CONVRTR-15. However, it must stay within the absolute maximum ratings listed on page 2. The challenge will be the battery and the boost regulator and its restrictions.

Boost Regulator and 3.7V Lithium Cell - Maybe

In nearly all small scale applications, a 3.7V Lithium cell is used. This requires a boost regulator circuit between the cell and the CONVRTR-15. Be sure to understand the limitations of such a circuit. If no precautions or limits are described, be very careful to insure against damaging the CONVRTR-15, the battery or the boost regulator.

Using DCC Track Power Without Battery - NO!

You cannot use DCC track power as the power source; it will destroy the CONVRTR. There is no circuitry on the CONVRTR to condition and filter the DCC track voltage. Thus the CONVRTR-15 will be damaged beyond repair. This damage is not covered by warranty.

Recommended Soldering Tools and Solder

Soldering small wire is not difficult. However, if you don't have the correct tools, proper soldering is difficult and frustrating.

Use Small Diameter Rosin Core Solder. The choice of solder is also important. One of the things to remember is to never use acid core solder. Acid core solder will destroy the board and components. The best solder for electronics work is small diameter, 0.015 to 0.02 inch "no-clean-flux" core solder. Larger diameter solder should not be used as there is a risk of putting too much solder on the pad which will short out adjacent pads.

Use A Small Diameter Soldering Iron. Do not use so-called soldering guns. These are very high wattage and will damage delicate traces, pads and components. A 25 watt, temperature controlled iron is the best.

Tool Source: The following part numbers and prices are from Mouser Electronics www.mouser.com. They are an excellent supplier that we use as often as we use Digikey.

Apex Soldering Iron, 25W, Temperature Controlled	578-WP25
Soldering Iron Stand and Sponge Holder	578-PH100
60/40 Rosin Core Solder Roll	738-13427

Keep The Soldering Tip Clean. Buy an inexpensive soldering iron stand, that includes a holder for a small sponge. Keep the sponge damp. Swipe the tip across the damp sponge to clean it <u>before</u> soldering. Don't clean <u>after</u> soldering - the excess solder protects the tip. Before turning off the iron's power, put a blob of solder onto the tip. This solder coats the tip and prevents oxidation.

Always Twist and Tin Stranded Wires Before Using. Stranded wire must have their individual strands twisted together followed by a applying a small amount of solder - this is called tinning. It makes soldering the wire to the board much easier.

Soldering Tips

- <u>Do Not</u> use too much solder. A tiny amount is all that is needed.
- Never apply the solder directly to the iron and attempt to 'paint' it onto the lead.
- Proper soldering takes a little patience. This is the most important part of learning to solder. You must watch and wait if you want to have a good solder joint. Soldering can not be rushed.
- When the joint has cooled, trim the excess lead using the wire cutters. Do not cut off the solder joint - rather trim the lead to the top of the joint.

Hookup Wire and Heatshrink Tubing Source

To avoid confusion and possible damage, always use different colored wires for hookup. Standardize on a color for what each wire does. Take a few minutes document your installation. Make a record of the colors used and take pictures of your installation. You might remember what you did a month from now. But what will you remember a year from now?

The suggested hookup wire comes in 100 foot rolls. This wire is #30 AWG, stranded and tinned. More important is the thin outer insulation. Share the cost of this wire among friends - the roll will last a long time.

Hookup Wire Color and Digikey Part Numbers: www.digikey.com

Red #30 AWG Stranded and tinned	A1851R-100-ND
Black #30 AWG Stranded and tinned	A1851B-100-ND
Orange #30 AWG Stranded and tinned	A1851A-100-ND
Grey/Slate #30 AWG Stranded and tinned	A1851S-100-ND
Blue #30 AWG Stranded and tinned	A1851L-100-ND

Heatshink Tubing Kit of various diameters also from digikey.com

Heatshrink Kit - 180 variety pak of 6 inch pieces	Q2Z1-KIT-ND

Verify Battery Connector And Wire Polarity!

If you don't have a VOM meter, use the test diode that came with the CONVRTR-15 to verify that you have the plus and minus leads properly identified before permanently connecting the battery. There is no protection for reversed battery polarity.

To verify proper identification of the two battery wires, use the steps below. This is a temporary hookup. Do not allow the battery wires to short together or brush against the board. This will damage the board and the battery.

Step 1: Temporarily solder the black or negative wire from the battery (or what you think is the negative wire) to the pad labeled BN.

Step 2: Temporarily solder the banded end of the test diode into pad labeled with the large plus symbol.

Step 3: Touch the battery plus wire (or what you think is the plus wire) to the free end of the diode (the non-banded end). If the 's green LED turns on, then the polarity is correct. Label the battery's plus wire and note its color.

If the green LED does not turn on, first verify that the banded end of the diode is in the CONVRTR's + pad. If that is correct, then reverse the two battery wires. If the green LED now turns on, mark the wire connected from the battery to the diode as the + wire.

Once you have confirmed and identified the proper polarity, mark the wires or make a drawing so that you can refer to it when you are ready to make the permanent hookups. Disconnected the diode - do not leave it attached. It wastes too much energy to be permanently installed.

Battery Plus

Test Diode

Battery Minus

Green Power (PW) LED
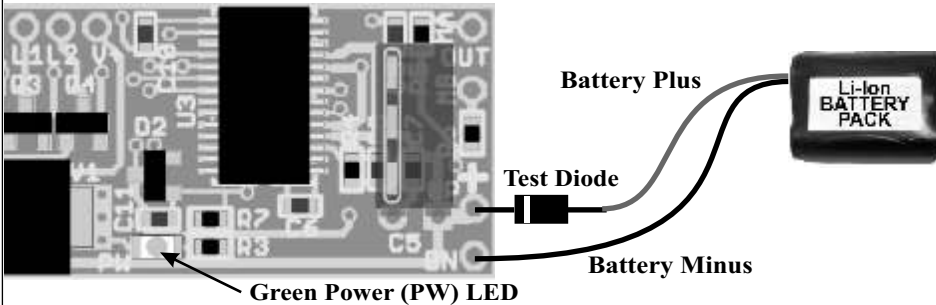
Warning!
Reversing the input polarity to the CONVRTR-15 will damage it beyond repair. This is not covered by the warranty.

Train Stops When It Is Far Away - This is an easy one. You need to set the decoder's loss of signal timer, set CV11 to a value of 0. Any other value and the locomotive will come to a halt when the throttle signal is gone and the timer has expired.

Throttle Loses Control When Locomotive Is Far Away - This is just the normal limitation of the radio system. Do not expect the throttle to control the train when it is a thousand yards away. However, if your railroad is in a large loop, then leave the throttle on its original setting and let the train come back to you.

Horn/whistle Won't Stay On When F2 is Pushed And Held - This is usually caused by a combination of noisy motors and distant operation and is not actually a problem. Instead, it is an automatic feature of the CONVRTR. If for any reason, the CONVRTR stops receiving throttle commands, and the last command was horn ON, then it will automatically issue a horn OFF command after a preset amount of time.

Limited Reception Range - There are many causes that contribute to shorter than expected range. Keep all wiring away from the antenna. If this will be an issue, consider using a trailing car or dummy locomotive and the external antenna version of the CONVRTR-15. Position the antenna and the circuit board as far away as possible from the battery and output wiring.

Locomotive Stops Running - But Resumes Running After A Short Rest - If the CONVRTR-15 output driver overheats, it will automatically shut down. When it cools sufficiently, it will resume normal operation. If this happens, it either needs more ventilation or the sound decoder requires higher current than the CONVRTR-15 can provide. Additional heat management tips are in the next section.

Not Sure About The CONVRTR-15's Frequency?
Not sure about the CONVRTR-15's frequency? Don't worry. Use the forgotten frequency procedure to set it to what you need. It's fast and painless as described on page 8.

Thermal Overload Management

The CONVRTR-15 is rated at 1.5 amp continuous at room temperature. If the CONVRTR-15 is stuffed inside a small locomotive and next to a hot motor, it will not be at room temperature. As the locomotive runs, additional heat is generated. If it becomes too hot, it will automatically shut down. No harm has occurred to the CONVRTR-15 and it will resume normal operation when its temperature drops below its over-temperature trip value which is about 100 degrees centigrade.

If this becomes a recurring issue, your CONVRTR-15 is telling you that the power demands are too great for the available amount of ventilation. You must improve airflow or limit the amount of current used by the attached decoder.

The CONVRTR-15 Supplies All Of The Decoder's Current. The total load on the CONVRTR-15 includes the motor and lights. If a smoke generator is also used, the total current load can exceed the 1.5 amp rating. Consider changing to low current LEDs and not using the smoke generator.

Another alternative is to lower the battery voltage. If using a boost-regulator, use one that includes the ability to change the output voltage. Instead of 12 volts, consider 11 or even 10.

A good cleaning of the mechanism can pay big dividends. This is a cheap way to lower the motor current especially if you have never cleaned or lubricated the locomotive mechanism. The older the unit, the more dividends a cleaning job will pay. Motor current will drop significantly once the old grease, cat and dog hair and other unknown crud is removed.

Consider removing the old motor and installing a more efficient motor. Not only will the motor current be much less, but the motor will run quieter too.

Installation Tips

Disconnect Track Pickups

The locomotive track pickup contacts and wiring must be disconnected and removed before hooking up the CONVRTR-15 especially if the locomotive has a factory installed DCC decoder.

If the track pickups are not removed, there is a risk that the onboard battery voltage may appear on the track pickups and thus on the rails. Contact between and external power source and the onboard battery will short out and destroy the battery and CONVRTR-15.

Using Locomotives With Factory Installed DCC Decoder

This is one of the easiest installations since the DCC decoder is already installed. However, because of the limited available space, a dummy locomotive or trailing car is required to hold the battery and the CONVRTR-15.

First, open up the locomotive and locate the track pickup wires going to the decoder. Unsolder these wires from the decoder or remove the plastic clips to free the wires. Note that a diesel locomotive,usually has a pair of track pickup wires soldered or clipped onto each end of the decoder circuit board. It is mandatory that <u>ALL</u> track pickups are disconnected from the decoder.

With the track pickup wires removed, decide how to route the wires from the locomotive to the dummy or car where the CONVRTR-15 and battery are located. For a diesel locomotive, one end of the board may be closer than the other end. Solder a pair of wires to the decoder's track input pads or decoder input wires. If the decoder uses wires, the NMRA-DCC color code is red and black. If the decoder uses tabs or contacts, carefully solder the input wires to these locations.

Using Connectors

Any two pin male-female connector can be used. Polarity is not important. Since the source of power is the CONVRTR-15, a shrouded connector or, at a minimum, a female connector should be used. This will provide some protection against inadvertent short circuits.

For ultra-small connectors, checkout the PicoFlex connector series from Molex. The PicoFlex connectors are available from Mouser and Digikey. The popular JST 2.0mm pitch connectors are also popular and carried by Mouser and Digikey.

For extremely small (and expensive) connectors checkout the micro and nano PZN series connectors available from Omnetics Connector Company. Omnetics has some of the smallest connectors available and their main markets are military and medical. Thus they are expensive and difficult to procure but they are very rugged and extremely small.

Reed Relay For A Power Switch

A latching reed relay makes a great power switch. Digikey sells one from the Meder series: part number 374-1062. Wire the switch in series with the battery plus connection as shown.

Bring the magnet near the switch to turn on the reed switch. Reverse the magnet orientation and bring it near the switch to turn it off. This is an elegant solution when a separate toggle switch is not wanted or space is at a premium. Since the magnet works through plastic, the reed switch does not have to be visible.

Battery Charging Jack
Center pin is PLUS +

Reed Switch

Li-Ion BATTERY PACK

Battery Pack

Plus

Minus
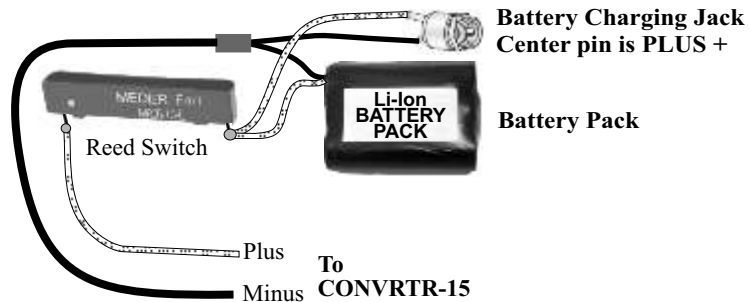
To CONVRTR-15

Quick Start Instructions

This "Quick Start"section assumes you have either installed the CONVRTR-15 and the decoder or you are testing the two devices on the bench. As delivered from the factory, the CONVRTR-15's frequency is set for 0 and its address is set for 3.

Step 1: Turn Power On To The CONVRTR-15 and Decoder

• The CONVRTR-15's green LED will glow brightly indicating power is connected.

• If you have not done so, now turn on your AirWire throttle and set it to frequency 0. If your decoder is brand new, set the throttle to loco 3 which is the default address for nearly all decoders.

• When the throttle is turned on and set to the proper frequency, the CONVRTR-15's red LED will glow brightly. If the red LED is not on, then your throttle is not on the proper frequency. Do not proceed to step 2 until both of the CONVRTR-15's red and green LEDs are on steady.

> The next step is very important. By setting the loco address into the attached decoder, the CONVRTR-15 gets the same address at the same time. Without doing this, the "stuck horn/whistle" feature will not work. The CONVRTR-15 must know to what loco address the "horn/whistle off" command is sent to. If you forget to do this, the decoder will continue to operate normally although the "stuck horn/whistle" feature is disabled.

Step 2: Set the Decoder Address Into The CONVRTR-15 Using SVC Program Mode

• Select SERVICE PROGRAM mode on your throttle. For T5000 throttle, press menu twice and then push the number 4.

• For T5000 users, push 1 and push ENT to select CV1 for changing the address.

• Enter the decoder address that you want to use. The address must be unique. The loco's cab number is always a good idea. Once you have entered the numbers, push ENT.

• Address 0 is not allowed. If you accidentally use 0, start over and use the desired address.

Step 3: Set the Throttle To The New Address And Run!

• If the new address is not already showing, enter the address using #, nnnn, # where nnnn is the locomotive address. Set the direction, turn up the speed knob and run the train.

• For T5000 users, you can store the decoder address and the CONVRTR-15's frequency in your throttle memory by pushing the LOCO MEM key twice. This is not mandatory but does make it easier to recall the address and automatically set the proper frequency in the throttle. For older AirWire throttles, see the appropriate user manual.

Two Very Important Decoder Setup Requirements

1. Turn Off Decoder Analog Conversion if this feature is available in the attached decoder. Use the SVC PROGRAM mode to set CV29 to one of the following values based on the decoder's locomotive address. Failure to make the change to CV29 will result in unexpected high speed runaway if the decoder is powered on without a throttle on a matching frequency being turned on.

For address between 1 and 99: Set CV29 to a value of 2.

For address between 100 and 9999: Set CV29 to a value of 34.

2. Set The Decoder Packet Timeout Value To 0 if this feature is available in the decoder. Use the SVC PROGRAM mode to set CV11 to a value of 0. This will permanently disable the feature.

If CV11 is set to a non-zero value, the locomotive will stop after the elapsed time specified by the value in CV11 when it goes out of range of the throttle. The preferred setting of 0 allows the locomotive to continue running at its current speed until it comes back into the throttle's range. If you would rather have the loco come to a stop when it is out of range, then set CV11 to a value other than zero. The value entered is the number of seconds that will elapse before the decoder automatically stops the locomotive if it no longer is receiving throttle commands.

Using OPS PROGRAM Mode

The CONVRTR-15 both understands and passes on to the attached DCC decoder, any OPS programming command from an AirWire throttle. This feature allows the attached decoder to be reprogrammed without modifying any other decoder that may be sharing the same frequency.

Do not change CV1 using OPS PROGRAM mode which is the locomotive address.

For the attached DCC decoder, any CV supported by the decoder can be changed. Any change to the decoder using OPS PROGRAM mode, takes effect immediately. Be sure to have your decoder's user guide available to verify the desired CV number for the effect or action to be changed.

OPS Programming Of The CONVRTR-15, is also possible for its own CVs. As with the attached decoder, don't use OPS programming to change the locomotive address. The two CVs of the CONVRTR-15 are:

CV200 - CONVRTR-15 frequency number with a range of 0 to 16 [17 total frequencies]

CV8 - CONVRTR-15 reset command

Here's how to change the CONVRTR-15 frequency using OPS PROGRAM mode**.** As delivered, the CONVRTR-15 is set to frequency 0. If you want to use a different frequency, follow the series of steps below.

• Make sure your throttle is set to the **present** CONVRTR-15 frequency **and** present decoder address. If you can run the train, then everything is set correctly. But if the train doesn't run, something is not set correctly and the following steps will not work and the frequency will not change.

• Select OPS PROGRAM mode. On the T5000, push MENU once, and then push the 0 key.

• Enter 200 followed by ENT. CV200 is the memory location where the desired frequency is to be stored in the CONVRTR-15.

• Enter the desired frequency number, from 0 to 16, and push ENT. Note that the red LED goes out because the decoder is now on the new frequency.

• Push ESC to cancel OPS mode.

• Change the throttle frequency to the new value (if it has not yet changed) and verify the train runs normally.

Forgotten Frequency? - Resetting CONVRTR-15's Frequency

There may come a time when the CONVRTR-15 no longer responds to what you believe is the correct frequency, or you can not remember the correct frequency. If this occurs, follow this procedure to temporarily force the CONVRTR-15 to frequency 0 where you can make a permanent frequency change.

Step 1 - turn off all AirWire throttles. This is very important. It is the absence of a throttle signal, plus turning the CONVRTR-15's power off and then back on (a power cycle), that allows the CONVRTR-15 to temporarily jump to frequency 0 where you can set a new frequency.

Step 2 - Turn off the CONVRTR-15 if it was powered on.

Step 3 - Turn on the CONVRTR-15 and wait at least 60 seconds.

Step 4 - Now turn on your throttle, and set it to frequency 0.

Step 5 - Use SERVICE PROGRAM to set CV200 to the desired frequency.

continued on next page

> **But make sure there are no lurking powered decoders assigned to frequency 0 or they too will have their frequency changed if they "hear" the throttle command.**

Resetting CONVRTR-15's Frequency - *continued*

Notes About The Temporary CONVRTR-15 Frequency Jump Mode

• The jump mode is canceled and normal operation resumes if a throttle is turned on that matches the present CONVRTR-15 frequency **within one minute** of the CONVRTR-15's power being turned on.

• If the CONVRTR-15 jumps to frequency 0 because you waited too long to turn on the throttle, just cycle the CONVRTR-15 power and make sure the throttle is turned on within one minute.

• The jump to frequency 0 is temporary and **nothing is changed** in the CONVRTR-15. You must now set the desired frequency before turning the power off again.

• The CONVRTR-15 will not jump to frequency 0 if any throttle with a matching frequency is on within one minute of turning on the power. The assigned loco address does not matter.

Using OPS PROGRAM Mode During Jump Mode

If you are confident you know the CONVRTR-15's assigned locomotive address, then you can use OPS PROGRAM to change the CONVRTR-15 assigned frequency. If you are not sure, then use SERVICE PROGRAM mode. OPS PROGRAM is the safest way to change the CONVRTR-15 assigned frequency and insures no other decoders will have their frequency changed. The only caution is that you must know the CONVRTR-15 assigned loco address.

• Step 1: Turn off **all** AirWire throttles. This is very important since it is the absence of any throttle signal that forces the CONVRTR-15 to temporarily jump to frequency 0.

• Step 2 - Turn off the CONVRTR-15 and then turn it back on. .

• Step 3 - Wait at least one minute. If you can see the GP LED, it will slowly blink during the wait time. After the wait time is up, it will be dark. You must wait the full minute.

• Step 4 - Turn on your throttle, set it to frequency to 0 and enter the decoder's address. If visible, the CONVRTR's GP LED will now turn on steady.

• Step 5 - Use **OPS PROGRAM** to set CV200 to the desired frequency. Be sure and reset your throttle to the new frequency. A power cycle is not needed.

Resetting CONVRTR-15 To Original Factory Settings

CV8 is used to reset the CONVRTR-15 back to original settings as it comes from the factory. Both the locomotive address and the frequency will be changed back to the original settings. After issuing the factory reset command, the CONVRTR-15's address is changed to 3 and its frequency is changed to 0.

The CONVRTR-15's reset command will have no affect on the attached decoder.

If you know your CONVRTR's present radio frequency, set your throttle on the same address and frequency.

If you do not remember the radio frequency, you must first use the forgotten frequency command to set the radio frequency. Once this is done, then you can reset the CONVRTR to its original factory values. See page 7.

Turn on the T5000 by pushing MENU. Verify it is set to the same frequency as the CONVRTR-15.

1. Push MENU twice followed by 4 to select SVC PROGRAM mode.

2. Press 8 and then ENT to enter CV8.

3. Press 1,3,5 then ENT to enter the reset value. All other values are rejected.

4. Press ESC to exit SVC PROGRAM mode.

At this time, the CONVRTR-15 has been reset to factory defaults. It will be on address 3 and frequency 0.

Remember, the attached decoder is still on its original locomotive address. Now is the time to set both the CONVRTR and the attached decoder to the desired address.