Warranty Information

This warranty covers substantial defects in materials and workmanship in the RF1300 Wireless Throttle.

What This Warranty Does Not Cover

This warranty does not cover any problems which result from improper operation, leaking batteries, modifications or damage caused by exposure to moisture and rain. Normal wear and tear are also not covered. Items subject to wear and tear include battery clips, the removable antenna, antenna mounts, and the speed control.

Leaky Batteries Will Destroy The Throttle

Always remove batteries from an unused throttle. If the battery leaks on to the circuit board, the throttle suffer damage that can not be replaced. The warranty does not cover leaky batteries.

How Long The Warranty Lasts

The coverage of this warranty lasts for 1 year. After this period, standard repair rates apply.

30 Day Money Back Guarantee

The RF1300, like the decoder, comes with a 30 day money back guarantee provided it has not been modified, damaged or in any way changed from its original condition. Should you decide you do not want the throttle, it may be returned, at your expense, for a full refund (less shipping).

Need Help?

If you have questions or need help, please use the phone number below. In some cases, we will busy helping other customers or it will be after hours. Please leave a message. Be sure to leave both daytime and evening numbers along with your city and state. Have your manual and equipment nearby before you call.

Do not send items to us for repair without first obtaining authorization. In many cases, problems are easily solved via phone or email without the need or expense to return items to us. If we request you return an item, be sure to mark the "Return Material Authorization" (RMA) number on the outside of the box.

You are responsible for all shipping charges.

UPS Street Address: CVP Products 921 N. Bowser, Richardson, TX 75081

AIRWIRE900™ Wireless Throttle
Model RF1300

If you have suggestions for improving this manual, please email them to us and we'll consider incorporate them into the next revision of this manual. Updated manuals and application notes can be found on the website.

Contents

This package contains one RF1300 throttle, one screw-on antenna and documentation. Batteries are not included. You will need four AAA size batteries.

WARNING - REMOVE BATTERIES

Remove all batteries from the throttle when not being used. Batteries can leak and damage and or destroy the throttle. If the batteries leak onto the throttle circuit board it can not be repaired.

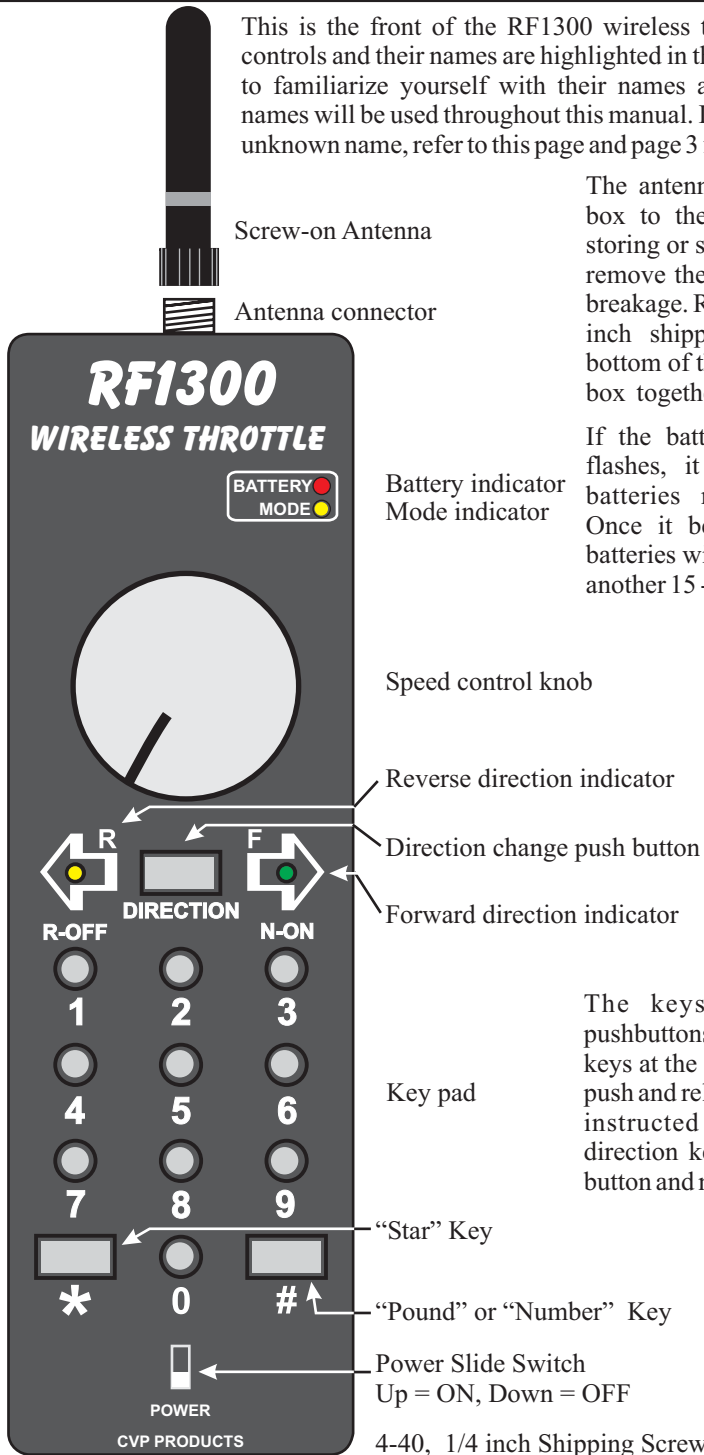**AIRWIRE™**
900

This is the front of the RF1300 wireless throttle. The various controls and their names are highlighted in this illustration. Use it to familiarize yourself with their names and locations. These names will be used throughout this manual. If you come across an unknown name, refer to this page and page 3 for its location.
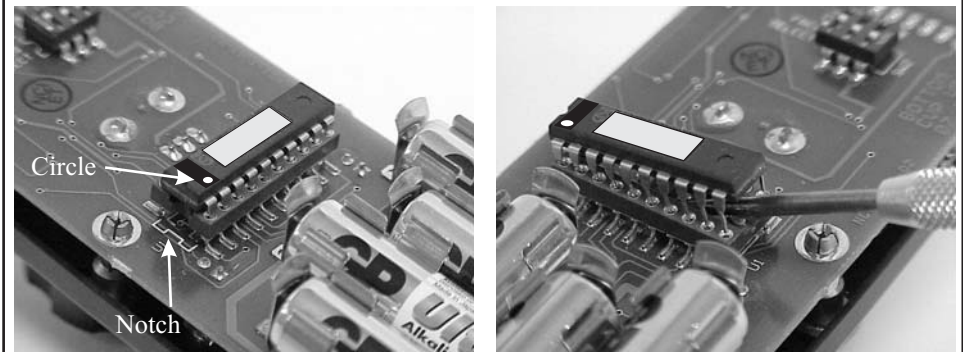
Screw-on Antenna

Antenna connector

The antenna holds the plastic box to the face plate. When storing or shipping the throttle, remove the antenna to prevent breakage. Reinstall the 4-40 1/4 inch shipping screw on the bottom of the box the plate and box together.

If the battery LED indicator flashes, it signifies that the batteries need replacement. Once it begins to flash, the batteries will usually last about another 15 - 30 minutes.

RF1300
WIRELESS THROTTLE

BATTERY ●
MODE ●

Battery indicator
Mode indicator

Speed control knob

Reverse direction indicator

R   F

Direction change push button

DIRECTION

Forward direction indicator

R-OFF   N-ON

1   2   3

4   5   6

The keys are click-style pushbuttons. Do not press two keys at the same time. Always push and release the key (unless instructed otherwise). The direction key is a also a push button and not a rocker switch.

Key pad

7   8   9

*   0   #

"Star" Key

"Pound" or "Number" Key

POWER

Power Slide Switch
Up = ON, Down = OFF

CVP PRODUCTS

4-40, 1/4 inch Shipping Screw (on bottom)


Circle

Notch

If new features are added to the AirWire throttle, the chip containing the software will have to be changed. Follow the instructions carefully to avoid costly damage to the circuit board. If you would rather have CVP install the chip, please call for authorization. You are responsible for shipping and insurance plus the cost of the chip if any.

Turn the throttle power switch to off. Open up the throttle. There is no need to remove the batteries. The software chip is in a socket. The chip will be removed from the socket. Don't make the mistake of prying the socket off the board. Doing so will destroy your throttle. Be careful!

Note the orientation of the chip. This orientation must be the same for the new chip. The upper white arrow points to the pin 1 identifier on the chip. The lower white arrow points to the silkscreen outline beneath the socket which also shows the orientation of the chip. The notch on the chip faces the notch on the board's silkscreen.

Using a small screwdriver, gently pry the old chip out of its socket. It is best to lift each end a little at a time so as not to put any strain on the socket. Take care not to damage or touch adjacent components. Before handling the new chip, touch your hand to a grounded metal object to discharge any accumulated static electricity. Remove the new chip from its shipping tube. It is OK to gently bend the pins inward for easier insertion into the socket. Orient the chip correctly, check that all pins are started into the socket and then press it firmly until seated. Inspect for bent pins or pins not in the socket. Turn the power switch on and check that the direction LEDs work normally. Reassemble the throttle.

The old chip may be discarded.

Chip Socket

Notch

Pin 1

Software Chip

Notch   LABEL

Pin 1
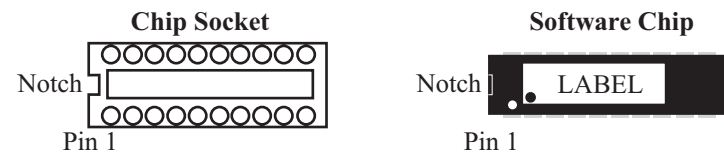
Double Check Orientation
If the chip is plug in backwards it will be damaged or destroyed

Troubleshooting

Remember B - F- A

If your AirWire throttle doesn't seem to be working, use the acronym B-F-A as a quicky checklist.

B = Battery

• Are the batteries run down? If all indicators are dark, or momentarily flash when the power switch is turned on, replace the batteries.

• Are the batteries oriented properly? Double check orientation. A reversed battery will short out its adjacent battery and quickly run both down. The two batteries will also become hot to the touch. If this occurs, remove and discard all batteries and install fresh batteries.

F = Frequency

• Does the throttle's frequency match the frequency setting on the locomotive? Check the throttle's frequency selector switches and the decoder's frequency selector switch against the chart on page 5.

A = Address

• Is the throttle on the wrong address? Did you enter the address incorrectly? Key in the correct address again. Push each key firmly and smartly. Don't press and hold a key when entering addresses. Just push and release each key, one at a time.

The AirWire Decoder Must Be Turned On When Programming

Programming commands are sent directly to the decoder. They are not stored in the throttle. The decoder must be powered on and within range of the throttle to receive programming commands. The decoder will indicate receipt of valid programming commands by beeping and with a short pulse of the motor. If nothing is seen or heard, double check B-F-A and decoder power.

Programming Commands Affect Optional Decoder

Any decoder attached to the AirWire's DCC output terminals will "hear" all service mode programming commands sent by the throttle. Usually this isn't a problem since the most common command is an address change and both decoders should be on the same address. If this is not desired, insert a SPST on/off switch in one of the two wires between sound decoder and the AirWire DCC output terminals. Turn the switch off to prevent the optional decoder from receiving any programming commands. Don't forget to turn it back on during normal operation.

Programming Problems

If your optional sound decoder doesn't respond to programming commands, but otherwise works OK, reverse the two leads between the sound decoder and the DCC output terminals on the AirWire decoder.

Service Mode programming will program both the AirWire decoder and the decoder connected to the auxiliary DCC outputs.

Wireless Throttle - RF1300

This is the interior of the RF1300 wireless throttle. Important items are highlighted in this illustration. Use it to familiarize yourself with their names and locations. These names will be used throughout this manual.

Antenna Jack

Frequency Selector "DIP" Switches

ON

Movable
Selector

1   2   3

Switch Number

Software Chip

Chip Notch Orientation

Battery Clips

AAA Battery

Battery Orientations

Battery Clips
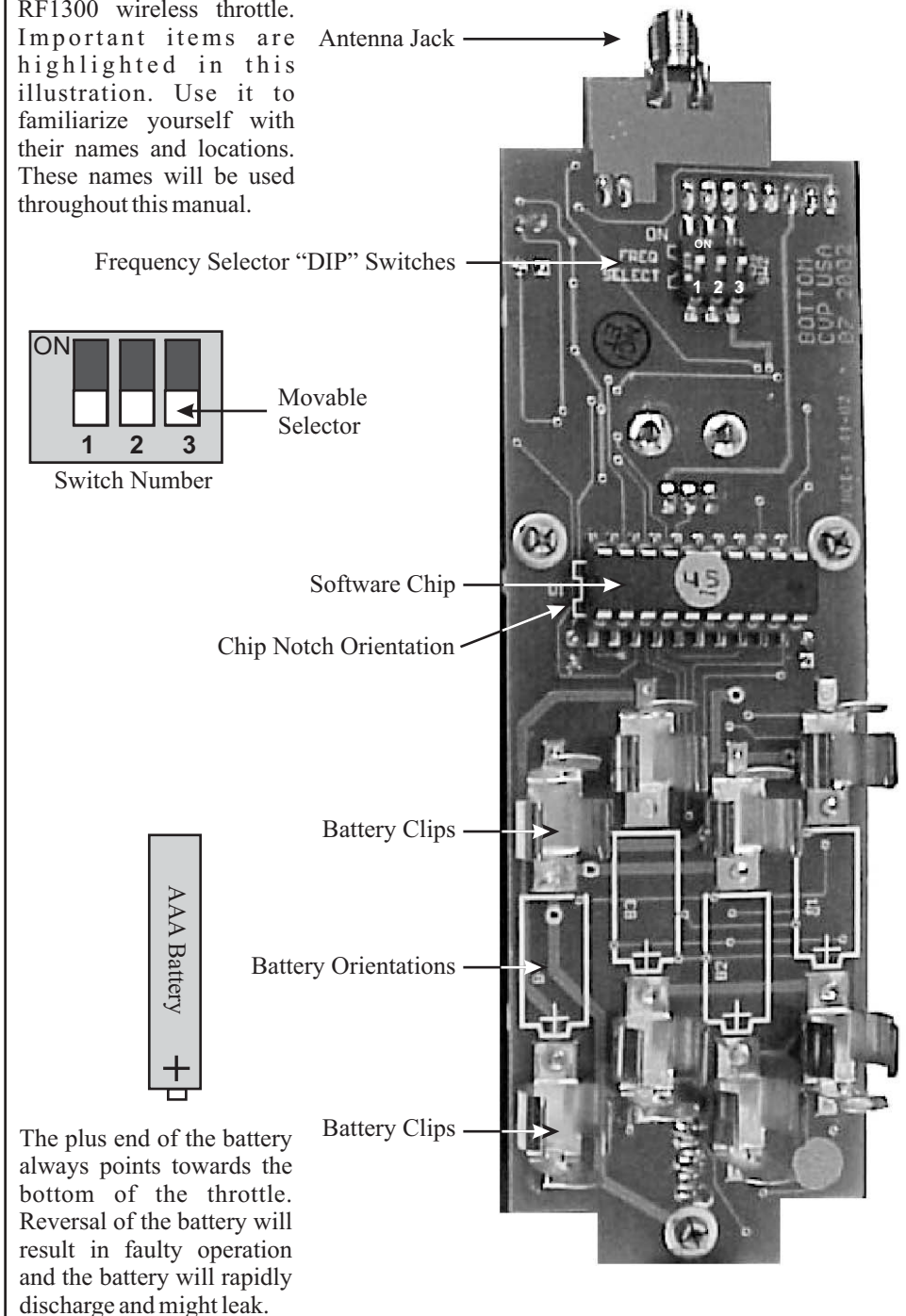
The plus end of the battery always points towards the bottom of the throttle. Reversal of the battery will result in faulty operation and the battery will rapidly discharge and might leak.

Battery Installation Information
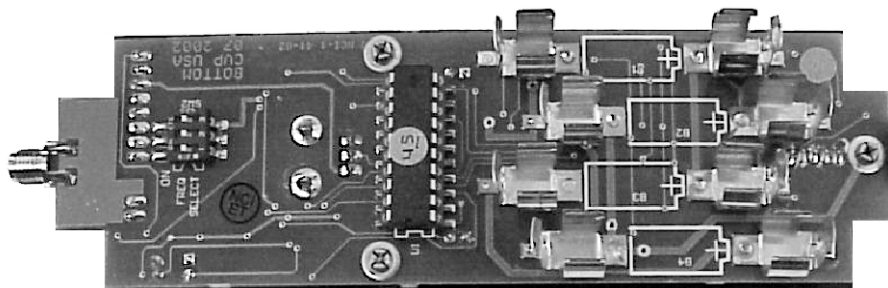
First, unscrew the antenna and set it aside. If your throttle has a shipping screw still attached at the bottom, remove it.

AAA Battery +
AAA Battery +
AAA Battery +
AAA Battery +

Now, just like pulling your foot out of a shoe, slip a fingernail into the opening at the bottom corner (the end nearest the CVP name) and pull the cover plate up and out of the box. If the plate seems too tight, use a small screwdriver to gently pry up the plate at the bottom corner.

Use four AAA-size batteries. For longest life, use Alkaline-type batteries. The batteries are staggered so the clips don't touch. Squarely snap the batteries into the clip taking care not to bend the somewhat brittle spring clips.

The battery orientation is marked on the circuit board. Note the batteries all face the same direction with the plus end towards the bottom.

For best results, use batteries having a paper cover. Some inexpensive batteries are covered with a very thin layer of paint. This paint is easily scratched when the battery is snapped into the battery holder. If this occurs, the battery can be shorted out and the throttle will not function properly. Shorted batteries become hot. Feel them before closing up the throttle.

Slip the face plate back into the box and screw the antenna on finger tight. Do not over tighten or you risk damaging the antenna threads. The shipping screw is not necessary. The antenna holds the faceplate to the box.

Battery Life Estimate And Removing Batteries

Standard alkaline batteries will run operate for about 40 hours before needing replacement. Use a dull plastic or wooden object to gently pry the batteries up and out of the holder starting from the outside and working towards the center. Do not use sharp objects or there is risk of scratching and damaging the circuit board. Do not pry the batteries out from either end or the somewhat brittle clip will break.

Using Rechargeable Batteries

Rechargeable Nicad batteries may be used along with an external charger. The newer Nickel-metal Hydrides (NMH) cost a little more but have none of the annoying characteristics of Nicads. Be sure to use AAA size batteries. Most Nicad chargers will charge the Nickel-metal Hydride batteries. However, for best results and the fastest recharge, always use a charger designed for the specific type and chemistry of the rechargeable battery used.
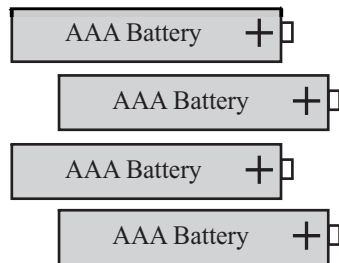
Programming Custom Speed Curves *continued*

Programming the AirWire Decoder (Service Mode Programming Required)
This may be a bit tedious but it you can always go back and fine tune the speed values based on the first pass results. Before starting, make sure the AirWire decoder is turned on and all other decoders are turned off.

1. Turn throttle off. Push and hold the 9 key and turn the throttle power switch on. Release the 9 key to enter Service mode programming.

2. Push * 67 * and then # nnn #. The nnn represents your speed step value. The decoder will beep, indicating the new speed step value has been stored in CV67.

CV Number	Your Speed Value	Your Speed Value
67		
68		
69		
70		
71		
72		
73		
74		
75		
76		
77		
78		
79		
80		
81		
82		
83		
84		
85		
86		
87		
88		
89		
90		
91		
92		
93		
94		

3. Push * 68 * and then # nnn# to store the next speed value in CV68.

Continue entering CVs and values in the same manner until all entries have been stored.

4. Finally, enable the new table by programming a new value for CV29 using service mode programming.

Assuming the decoder is using a short address, custom speed table, 28 speed steps and normal motor direction, the value to enable the custom speed table is 18. Push *29* and #18#. This sets the decoder to use the new custom speed table.

5. Turn off the throttle and turn it back on. The new speed table is automatically used when the throttle is set for either 14 or 28 speed steps. The new table *is not* used when the throttle is set for 128 speed steps.

Program CV29 To Use The New Speed Table
To use the new custom speed table, CV29 must be set to a value based on the locomotive address.
If the address is from 1 to 99, program CV29 for a value of 18.
If the address is from 100 to 9999, program CV29 for a value of 50

Programming Custom Speed Curves

Creating a Speed Curve

Your AirWire throttle can program custom speed curves, or tables, into the AirWire decoder. This is sometimes done to help speed match two dissimilar locomotives, especially when used together in a consist. Start by writing down how you want to assign the speed values to the decoder. A table makes it easy to keep track of the values.
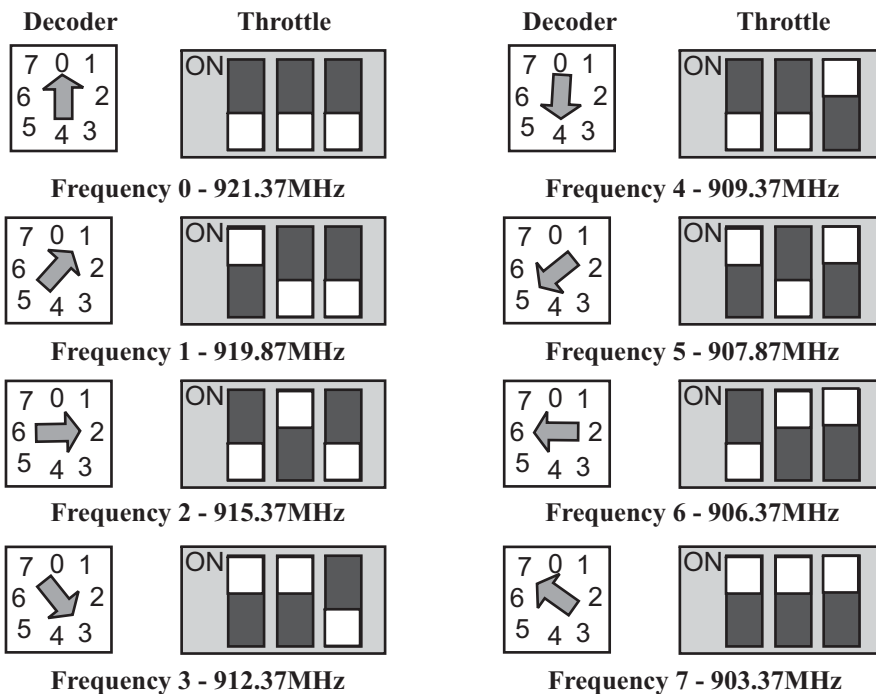
Note: CV2 (Start Voltage) is used as part of the calculation even when the decoder is using a custom speed table.

If the throttle is set for 128 speed steps, this table is not used and the throttle directly drives the motor without using CV3, CV4, CV5 or CV6.

Speed Step in 14 step mode	Speed Step in 28 step mode	Default Speed Value	CV Number
1	1	2	67
	2	12	68
2	3	24	69
	4	36	70
3	5	48	71
	6	60	72
4	7	70	73
	8	80	74
5	9	90	75
	10	100	76
6	11	110	77
	12	120	78
7	13	130	79
	14	140	80
8	15	150	81
	16	160	82
9	17	170	83
	18	180	84
10	19	188	85
	20	196	86
11	21	204	87
	22	212	88
12	23	216	89
	24	224	90
13	25	232	91
	26	240	92
14	27	248	93
	28	254	94

Select Operating Frequency

The throttle must match the decoder's frequency. And each throttle must be on a unique frequency so as not to jam other throttles. Any unused frequency can be used. Use the illustrations to ensure that the decoder and throttle have matching frequencies. Use a small tipped screwdriver or other suitable tool to move the small white switch selectors. The switches can be changed at any time and the new setting takes affect immediately.

Decoder	Throttle	Decoder	Throttle

Frequency 0 - 921.37MHz   **Frequency 4 - 909.37MHz**

Frequency 1 - 919.87MHz   **Frequency 5 - 907.87MHz**

Frequency 2 - 915.37MHz   **Frequency 6 - 906.37MHz**

Frequency 3 - 912.37MHz   **Frequency 7 - 903.37MHz**

Beware of Other Transmitters

The AirWire Wireless Throttle 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 throttle's 8 frequencies. The sources of these external interfering signals can be from your own home or from adjacent homes and businesses.

Here's a list of devices known to have caused interference to the AirWire throttle: wireless devices attached to computers, TV 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.

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

Only One Throttle Per Frequency!

With batteries installed and the operating frequency selected, your throttle is ready for use. Reattach the antenna, gently turn the speed control knob fully counter-clockwise (off) and turn on the power switch. The green indicator above the F arrow will turn on. The forward direction is the default setting whenever the throttle is turned on. Direction is not remembered if the throttle is turned off.

Address Selection
To control a decoder, the address set in the throttle must match the address set in the decoder. Assuming this is the first time the throttle and decoder have been used, the default address for the decoder and throttle is 3. For practice, set the throttle to address 3 using the following steps:

1. Push and release the key labeled with the pound symbol, #. Both direction indicators turn on showing that the throttle is waiting for an address to be entered.

2. Push and release the 3 key, then push and release the # key. Notice that the R indicator turns off leaving the F indicator on. This indicates the new address has been accepted.

If used outside, the indicators may be difficult to see. Making them brighter would have significantly decreased the battery life. Use the locomotive movement as the best indicator for direction or simply cup your hand around the LEDs if you need to see them in bright sunlight.

Throttle Address Entry Tips
■ Leading zeroes are not needed.

■ An addresses can be in the range of 1 to 9999.

■ Make sure the decoder is also set to the same address.

■ Changing the throttle address can be done at any time and without turning off power. The address change takes affect immediately.

■ To cancel an address change after pressing the # key, press the # key again. The address remains unchanged.

■ Address 0 is not allowed. If an attempt is made to enter 0, the throttle will ignore it and retain the previous address.

■ When the address is changed, the current direction is retained. This means if the throttle is set for reverse and a new address is entered, the reverse setting will be retained.

■ The address is always retained even if the power is turned off and the batteries are removed.

■ If in doubt as to the current address in the throttle, don't guess. Just key in the desired address.

■ When power is turned on, the default direction is always forward.

> The keys are click style keys and should be pushed and released quickly. Don't push and hold the key unless this is a stated requirement.

Using A Lanyard Protects The Throttle From Drops
The 4-40 shipping screw has a matching 4-40 nut permanently mounted on the faceplate. This nut makes a convenient point to attach a 4-40 threaded eye bolt to which a simple lanyard can be attached. Lanyards are usually found in office supply stores. If you attend railroad or trade show conventions, lanyards are often given away with name badges. Next time you find some, ask for a few extras.

Take Advantage of Different Speed Step Settings
The AirWire decoder can have two different responses to speed commands by using two different speed step settings. As a reminder, when using either 14 or 28 speed steps, the decoder calculates a speed using CV2, CV3, CV4, CV5 and CV6. Since CV5 sets the top speed, it can be set to ensure the locomotive can reach no more than half of its maximum speed. This specific response occurs as long as the throttle is set for either 14 or 28 speed steps.

However, if the throttle is set for 128 speed steps, only CV2 is used. Thus the locomotive will always achieve top speed. That is why 128 speed steps is called direct drive. No intervening CVs are used to modify the speed command.

By using the two settings, slow speed switching can be enhanced in yard operations. Yet, full speed operation can be achieved when going out on the mainline by punching a few keys on the throttle.

Flashing Headlights
If the headlights turn on and off as the speed is increased, the AirWire throttle is set for 28 speed step mode, and the AirWire decoder is in 14 speed step mode. Either change the throttle or change the decoder so both have the same setting.

No Control Of Headlights
If the AirWire decoder is set for 28 or 128 speed steps, the throttle must also be set for 28 or 128 speed steps. Otherwise the headlights can not be controlled.

Speed Control Is Somewhat Fragile
Be gentle with the speed control knob. There is no need to twist the knob beyond the stop. Doing so will **not** make the train stop quicker. Such action can damage the pot and require the throttle to be returned to the shop for replacement.

Be Wary Of Other Transmitters
Always insure that each transmitter is on its own frequency. Even if the transmitters are on different addresses, the AirWire decoder can be jammed by having two nearby transmitters.

Be Wary of Lurking Decoders When Programming
Always make sure all decoders sharing the same frequency are turned off when using service mode programming. The throttle signal is not bothered by bushes, walls or trees and it is possible that nearby AirWire decoders will be reprogrammed.

Throttle and AirWire System Compatibility

AirWire Compatibility with Other Wireless Systems

The AirWire900 Wireless Throttle operates in the 902MHz to 928 MHz frequency band. As of the date of this printing, all other large scale wireless systems do not use this band.

Thus the AirWire Wireless Throttle can be used along with other systems without fear of interference. This feature is especially useful if you are upgrading from another wireless system to AirWire. Locomotives can be gradually upgraded as budget and time permits.

AirWire Throttle Compatibility With Other CVP Products Systems

The AirWire throttle can not be used with any other wireless equipment from CVP Products. However, since the AirWire software chip is in a socket, you can purchase the appropriate chip to convert an AirWire throttle for use by the wireless basestations used with EasyDCC, Railcommand, Atlas and Lenz DCC systems. The chip costs $49.95 plus shipping.

Using An EasyDCC Wireless Throttle with the AirWire System

The EasyDCC wireless throttle must have the AirWire throttle chip installed to be compatible with the AirWire decoder. The chip costs $49.95 plus shipping.

CV29 Options and Settings

This table is from the AirWire decoder book is included for reference. This CV is programmed in the same way as any other decoder CV.

Address	Speed Table	# Steps	Motor Direction	CV29 Value
Short	Standard	14	Normal	0
Short	Standard	14	Reversed	1
Short	**Standard**	**28**	**Normal**	**2**
Short	Standard	28	Reversed	3
Short	Custom	14	Normal	16
Short	Custom	14	Reversed	17
Short	Custom	28	Normal	18
Short	Custom	28	Reversed	19
Long	Standard	14	Normal	32
Long	Standard	14	Reversed	33
Long	Standard	28	Normal	34
Long	Standard	28	Reversed	35
Long	Custom	14	Normal	48
Long	Custom	14	Reversed	49
Long	Custom	28	Normal	50
Long	Custom	28	Reversed	51

Speed, Speed Steps, Direction And Function Controls

Speed Control Knob: This single turn knob provides speed control to the locomotive. Turning the knob fully counterclockwise sends the STOP speed command. Full clockwise sends the full speed command. How the locomotive interprets the command is dependent on the decoder programming. Always turn the speed control to off before changing directions.

Direction Key: The direction key toggles between forward and reverse with the direction LEDs indicating which direction is selected. ***This key is a push button, not a rocker switch.*** Push on the center of the key. The throttle always powers up in the forward direction. A failsafe feature prevents rapid direction changes. This feature is activated whenever the acceleration/deceleration rate values (CV3 and CV4) stored in the decoder are set to either 0 or 1. If a direction change is attempted and the speed control is not off, the decoder will temporarily override the rates to bring slowly to a halt before changing directions and raising the speed up to the speed set by the speed control knob. This override remains in effect until power to the decoder is turned off. A minimum value of 2 in CV3 and CV4 will disable this feature, yet prevent harm to motor or gears if sudden direction changes are made at a speed other than zero.

Function Controls: All decoders support a range of different function controls. A function is usually called Fn where n is the desired function number. When the keypad is not being used to enter addresses, it provides direct access to functions F0 through F8. For example, to activate function 0 shortened to F0, press and release the 0 key. Do not push and hold the key (unless this is a stated requirement).

All functions except F2 are toggle functions. This means the first press turns ON the function and the second press turns the function OFF. F2 is momentary and is normally used with sound systems having horns or whistles. F2 is ON when pressed and OFF when released.

The AirWire decoder, supports the F0 function which controls the headlights and the F6 function which controls the smoke generator.

Speed Step Selection: It is important to match the throttle's transmitted speed steps to what is programmed into the decoder. There are 3 options: 14, 28 and 128 steps. As shown below, the actual decoder response is affected by several CVs, and the speed step setting on the transmitter. You may change this setting at any time. The default speed step setting is 28 steps unless you have changed it to another value. To change the speed step setting, use the following procedure:

Changing The Number Of Throttle Speed Steps: Press and release #, then the direction key. The R indicator goes out and the MODE indicator turns on. Push one of the 3 keys listed below for the desired speed step selection. Pushing one of the keys sets the steps and returns the throttle to normal operation. The # key does not have to be pushed again.

1 = 14 speed steps

2 = 28 speed steps — Uses CV2,3,4,5 and 6 to adjust speed step response.

3 = 128 speed steps, direct drive. Only CV2 is used in direct drive.

AirWire Decoder Uses F0 and F6

Function 0 and Function 6 are decoder by the AirWire decoder. F0 is used to turn headlights on and off. F6 is used to turn the smoke generator output on and off.

Multi-Unit Consists

Creating a multi-unit consist is easy. As many as 4 locomotives may be in a consist. Individual locomotives can be added or dropped from the consist at any time without affecting the remaining locomotives.

Multi-unit Consist Capabilities

- The lead locomotive is the first address set in the throttle.
- The lead locomotive address receives all function commands.
- A total of 4 locomotives can be in a consist - three plus the lead locomotive.
- Each consisted locomotive must be on the same frequency.
- Consisted locomotives can have different addresses.
- Consisted locomotives can be facing either forward or backward.

Creating a Consist

This will seem very similar to setting an address into the throttle. The pictorial shows the creation of a 3 unit consist with two locomotives, address 45 and address 110. Note that the last locomotive is, facing backwards. The lead locomotive is address 12.

1. Enter the first or lead locomotive   #12 #

    This locomotive will receive all function commands.

2. Enter the second locomotive, forward   *45 #

3. Enter the third locomotive, reverse   *110 [dir] #

    [dir] means push direction key which tells the throttle the locomotive is backward

Dropping A Locomotive From Consist

Removing a consisted locomotive is simple. For this example the middle locomotive, address 45, will be removed.

Removing consisted locomotive, 45   *45 *

Tips and Notes About Consists

- The speed step setting of the lead locomotive is used for all locomotives in the consist.
- Upon keying in new locomotive address, the entire consist is deleted automatically.
- If the consist is already filled with the maximum of 4 locomotive addresses, any further entries are ignored.
- Locomotives should already be relatively close to running at the same speed at the same throttle setting. This will prevent unnecessary wear and tear on couplers and gears.
- Consists are remembered even if the throttle is turned of or until a new address is keyed in.

Forward ⟶

However, since the bell's bit positions are shifted, the actual decimal values are different and the range is from 64 to 240. Thus the value programmed into CV60 represents both a horn volume setting PLUS a bell volume setting.

Here is a completed table that shows all possible settings and decimal values for both the bell and horn volumes.

Horn Vol	Binary	Decimal	Bell Vol	Binary	Decimal	Notes
off	0 0 0 0	0	off	0 0 0 0	0	Off
1	0 0 0 1	1	1	0 0 0 1	16	Min Volume
2	0 0 1 0	2	2	0 0 1 0	32	
3	0 0 1 1	3	3	0 0 1 1	48	
4	0 1 0 0	4	4	0 1 0 0	64	
5	0 1 0 1	5	5	0 1 0 1	80	
6	0 1 1 0	6	6	0 1 1 0	96	
7	0 1 1 1	7	7	0 1 1 1	112	
8	1 0 0 0	8	8	1 0 0 0	128	1/2 Max Volume
9	1 0 0 1	9	9	1 0 0 1	144	
10	1 0 1 0	10	10	1 0 1 0	160	
11	1 0 1 1	11	11	1 0 1 1	176	
12	1 1 0 0	12	12	1 1 0 0	192	
13	1 1 0 1	13	13	1 1 0 1	208	
14	1 1 1 0	14	14	1 1 1 0	224	
15	1 1 1 1	15	15	1 1 1 1	240	Max Volume

This section will conclude with a simple example. CV60 will be ops mode programmed for a decimal value that puts both the horn and the bell at half maximum volume. Using the table above, half volume is equal to 128 + 8 which is 136. The throttle is already set to the desired locomotive address. And since both addresses are the same, the ops mode programming of CV60 will automatically be received by the sound decoder and ignored by the AirWire motor decoder.

1. Push the 9 key to initiate OPS mode programming

    The direction indicators will begin to alternately flash. To cancel OPS mode programming, push the 9 key again.

2. Enter the CV to be programed   * 60 *

    Notice that the mode indicator is added to the flashing LEDs upon entering the first *. Once the number is entered and the * is pressed again, the mode indicator turns on solid while the direction indicators continue to flash.

3. Enter the value to be programmed.   # 136 #

4. Push the 9 key to terminate OPS mode programming. The changes take affect immediately.

If the resulting volume level is not correct, simply repeat the above sequence with a new value for CV60. Don't forget that the value is the sum of the horn volume setting and the bell volume setting. It is easy to forget this and find that one or the other has been shut off.

Advanced OPS Mode "Bit" Programming

Almost all CVs can be programmed with values in the range of 0 to 255. However, some decoders, especially sound decoders, may need to have a specific "bit" programmed into a CV. This is perhaps the most confusing aspect of decoder programming. This section presents an overall scheme to program bits of a CV. Fortunately, a little arithmetic and a bit of record keeping makes bit programming easier. Let's start with an explanation of a standard value and how it can be converted into bits. With that knowledge it will become an easy matter to then convert bits back into decimal values that the AirWire throttle uses during programming.

AirWire uses decimal values that range from 0 to 255. Converting the value into binary bits is easy as long as you remember that it takes 8 bits to represent this range of values. Each bit can only represent one of two possible values, a 0 or a 1. And like familiar decimal numbers, the position of the bit indicates its associated value. The table below shows what each bit position value is worth. If you add up all the position values, the total is 255.

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	bit number
128	64	32	16	8	4	2	1	bit position value

Complex sound decoders use a single CV value to control many effects. This is possible because each bit in the value controls a specific effect. Thus a single decimal value can actually represent up to 8 individual effects where each effect is assigned to a specific bit number. The CV can also be split in half to control two different items such as volume levels.

For example, the diesel sound decoder by Soundtraxx uses CV60 to control the volume of the horn and bell. Notice that CV60 has the 8 bits split into two groups. Bits 0-3 control the horn volume and bits 4-7 one group for the bell volume.

The horn volume has 16 possible settings from 0,0,0,1 to 1,1,1,1. Converted to binary, this becomes 0 to 15. The bell volume also has 16 possible settings from 0,0,0,1 to 1,1,1,1.

CV 60 - Horn and Bell Volume Level Control

bit 7	bit 6	bit 5	bit 4		bit 3	bit 2	bit 1	bit 0	bit number
128	64	32	16		8	4	2	1	bit position value

0	0	0	1		1	1	1	1	

CV60 = 16+1 = 17

Minimum Bell Volume Decimal Value 16 | Minimum Horn Volume Decimal Value 1

0	1	1	1		0	1	1	1	

CV60 = 112+7 = 119

Half Maximum Bell Volume Decimal Value 112 | Half Maximum Horn Volume Decimal Value 7

1	1	1	1		1	1	1	1	

CV60 = 240+15 = 255

Maximum Bell Volume Decimal Value 240 | Maximum Horn Volume Decimal Value 15

Decoder Customization and Programming

The AirWire RF1300 throttle is also a full feature, DCC programmer capable of programming the AirWire decoder plus any NMRA_DCC compatible decoder connected to the AirWire decoder's auxiliary DCC output.

There are two modes of programming: Service mode and OPS mode.

Service Mode Programming, the throttle sends programming commands direct to any decoder that is powered up and on the same frequency as the throttle. Service mode means that an address is not necessary - any and all decoders that hear the programming command will be affected. The most common use for this mode is setting the decoder's address.

OPS Mode Programming, the throttle sends programming commands to the locomotive address currently set in the throttle. All other locomotives on the same frequency, but having different addresses, will ignore the OPS mode programming command. The most common use for this mode is fine-tuning sound decoders connected to the AirWire decoder's auxiliary DCC output. Note: the AirWire decoder ignores all OPS Mode programming commands.

Programming commands send values to a decoder's configuration variables (CVs) and each command will be comprised of the specific CV number and a value. The AirWire RF1300 throttle can program all of the NMRA-DCC configuration variables and their full range of values.

Service Mode Programming Example

Since service mode programming can change everything including addresses, a special sequence is used. This sequence insures that the throttle can not be placed into service mode programming accidentally. For this example, the decoder address will be set to 45.

Initiating Service Mode Programming
1. Turn off the throttle
2. Push **and hold** the 9 key. This is the one time where you must hold the key down.
3. Turn on throttle power switch while continuing to press the 9 key.
4. Release the 9 key. Notice the direction indicators are alternately flashing signifying the throttle is in the programming mode.

Programming an Address - Configuration Variable Number 1 (CV1)
5. Enter the CV to be programed   * 1 *
    Notice that the mode indicator is added to the flashing LEDs upon entering the first *. Once the number is entered and the * is pressed again, the mode indicator turns on solid while the direction indicators continue to flash.

*The CV number entry sequence is always the same. The * key starts the sequence, followed by the specific CV number (1 in this case) and terminates with the * key.*

6. Enter the value to be programmed.   # 45 #
    Notice that the battery indicator and both direction indicators turn on solid after the first push of the # sign. This is your sign that the throttle is waiting for a number. Upon pressing the # key again, the throttle sends the programming command to the AirWire decoder. The decoder will beep twice if the address is in the range of 1 to 99 and with will beep 3 times if it is in the range of 100 to 9999. After sending the command, the throttle reverts to awaiting another CV entry. This is shown with the flashing direction indicators only, with all other indicators off.

7. Another CV can be entered at this time and programmed by repeating steps 5 and 6. If no further CVs are to be programmed, turn off the throttle to cancel service mode programming. Don't forget to set the throttle to the new address.

Tips and Tricks For Service Mode Programming

■ If a sound decoder, or any other type of decoder is connected to the Auxiliary DCC output of the AirWire decoder, it too will also have its address changed at the same time as the AirWire decoder. If this is not desired, disconnect the sound decoder from the AirWire decoder's Auxiliary DCC outputs with a SPST switch.

■ Multiple CVs may be programmed in sequence without having to reinitiate Service mode programming.

■ Service mode programming is canceled by turning the throttle's power switch off.

■ Only one decoder should be on during service mode programming. All other decoders should be turned off. All decoders sharing the same frequency as the throttle and powered on will be re-programmed. The throttle's transmitter can reach quite far and is not bothered by walls, roofs trees earth or bushes. Just because you can't see another locomotive, don't assume it will not be programmed if it is sharing the same frequency.

■ The AirWire decoder supports only specific CVs shown in the table below Service mode programming commands sent to CVs not listed are ignored.

AirWire Decoder - Supported CVs

CV#	Function		Default
1	Locomotive Address	Address	3
2	Motor Starting Voltage	MSV	7
3	Acceleration Rate	ACCL	2
4	Deceleration Rate	DECL	2
5	Maximum Voltage	Vmax	1
6	Midpoint Voltage	Vmid	1
8	Reset to factory defaults	RESET	n/a
11	Loss of Signal Timer	Packet Timeout	0
17	Extended Address	Automatic - do not use	0
18	Extended Address	Automatic - do not use	0
29	Decoder Setup	See decoder manual	2
67- 94	Custom Speed Table	See decoder manual	-

OPS Mode Programming

The AirWire RF1300 throttle uses OPS Mode programming to send reprogramming commands to a specific locomotive while it is operating on the railroad, even with other locomotives present. This feature is useful for fine tuning sound decoders attached to the AirWire Decoder's Auxiliary DCC outputs. The sound effects can be customized, in the middle of operation, without worrying about reprogramming any other locomotives.

Keep in mind that the OPS mode programming is sent to the address currently in use on the throttle. If the throttle is set for address 4, OPS mode commands will automatically be sent to address 4.

Initiating OPS Mode Programming - An Example
For this example, locomotive address 110, with a DSX sound decoder, will have CV55 changed to a value of 32.

The desired address of the locomotive to be programmed must first be set into the throttle. Push # 1 1 0 #. To verify the proper address has been keyed in, activate one of the sound decoder functions.

1. Push the 9 key to initiate OPS mode programming.

   The direction indicators will begin to alternately flash. To cancel OPS mode programming, push the 9 key again.

2. Enter the CV to be programed: ∗ 5 5 ∗

   Notice that the mode indicator is added to the flashing LEDs upon entering the first ∗. Once the number is entered and the ∗ is pressed again, the mode indicator turns on solid while the direction indicators continue to flash.

3. Enter the value to be programmed: # 3 2 #

   Notice that the battery indicator and both direction indicators turn on solid after the first push of the # sign. This is your sign that the throttle is waiting for a number. After entering the value and pressing the # key again, the throttle sends the programming command to the decoder. After sending the command, the throttle reverts to awaiting another CV entry. This is shown with the flashing direction indicators only, with all other indicators off.

4. Push the 9 key to terminate OPS mode programming

Tips And Tricks For OPS Mode Programming
■ Some decoders, such as early version of Lenz decoders, require a power cycle for the new CV values to take affect.

■ The commands are sent direct to the Auxiliary DCC outputs. Any compatible NMRA-DCC decoder that is connected to these outputs will be reprogrammed.

■ The AirWire RF1300 throttle supports all 1024 of the NMRA-DCC configuration variables.

■ The entire range of values from 0 to 255 can be used. However, check the decoder manual for the decoder's acceptable value range. It may be different.

■ The CV number must be entered each time. Re-entry of new values only is not supported at this time.

■ Programming specific "bits" of a multifunction CV is covered in the next section.