London Bridge Amateur Radio Association

STATIC

K7LHC
Lake Havasu City, AZ
Home of the London Bridge

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GROUND LOOPS

Alan Applegate, K0BG

If there were but one bane in amateur radio, it would be the ground loop. Although they may appear in any type of installation, they're more often found in mobile ones. In any case, too many amateurs don't know what a ground loop is, or what causes them to occur. Even rarer, is the ability to recognize that a specific problem is caused by one.

The term *Ground Loop* in itself isn't very descriptive, but here's a stab at it with credit going to Mr. Webster: *An unwanted electric current path in a circuit resulting in stray signals or interference, occurring, e.g., when two earthed points in the same circuit have different potentials*. Please pay particular attention the last few words: *...when two earthed points in the same circuit have different potentials*. Another way to look at this is, one is a better ground than the other. Or, one has a lower resistance path back to the power source; the battery in this case.

Mobile ground loops are most often seen when the requisite DC wiring is not properly connected. With respect to mobile radio installations, most vehicle manufacturers recommend that both leads (positive and negative) go directly to the battery. In this case, both leads need to be fused. At a minimum, the negative power cable lead should be tied to the same point as the main battery's negative connection to the chassis of the vehicle in question. Here, the negative lead of the power cable doesn't need to be fused.

If instead, you decide to connect the negative lead to the nearest chassis ground point (seat support, trunk brace, etc.), there will be a difference in resistance between any of these points and the battery's chassis ground. A differential of three to five ohms is not uncommon. Whether this causes a ground loop to occur is moot, the resulting voltage drop under load is not.

Digressing for a moment... Vehicle batteries have two standard negative leads. The main one (bigger of the two) goes directly to the starter motor housing, or very near it. The other lead (always smaller) is connected to the chassis of the vehicle. The former is to lessen the losses to the starter motor, the latter to provide a return for the various on-board electrical loads (headlights, accessories, etc.). Manufacturers really don't try to minimize the potential between them; their only concern is powering the various inherent and requisite devices.

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LBARA MEETING SCHEDULE		
MONTH	**BOARD**	**REGULAR**
JANUARY	NOTE: BOARD	1/17
FEBUARY	MEETINGS WILL NOW	2/21
MARCH	TAKE PLACE ONE	3/20
APRIL	HOUR PRIOR TO THE	4/17
MAY	REGULAR MEETING	5/15

2008 LBARA Elections Results

Election of new officers for 2008 were held at the December LBARA General Meeting. Your new officers are:

President	**Bob Gilbertson**	**K6BBB**
Vice-President	**Jerry France**	**K7LY**
Secretary	**Sharon Fisher/Lyle Sibbald**	**KC7CTX/K7YQ**
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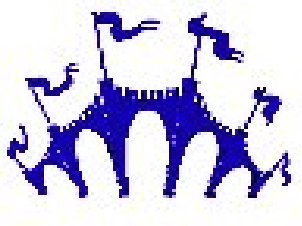
Monday Night Net (7 PM)

System	Location	Freq	Offset	PL
MCARS	Bullhead City	145.27	-	131.8
	Kingman	146.76	-	131.8
	Kingman	448.25	-	131.8
	Lake Havasu	146.62	-	131.8
	Willow Beach	147.12	-	131.8
CRRA	Lake Havasu City	146.96	-	162.2
	Lake Havasu City	224.24	-	156.7
	Lake Havasu City	146.64	-	156.7
	Lake Havasu City	449.95	-	141.3
BARN	Lake Havasu City	447.54	-	136.5
	Las Vegas, NV	449.95		136.5
	Onyx(Palm Springs)	449.34	-	136.5
	Orange County, CA	447.54	-	100



IT'S OFFICIAL!

Dick Zalewski, W7ZR, Sets A World Record!

Using CN2R's station in Casablanca, Morocco, North Africa and operating as 5C5Z, Dick set a world record for single operator, single band (20 meters) in the 2007 CQ World Wide WPX Contest. He worked 1009 prefix multipliers for a whooping score of 11,745,769!

Dick, W7ZF working the contest as 5C5Z

If you want to take a look of Dick in action, go to www.cn2r.net, click on Video and then 5C5Z Operating. Here you can actually watch Dick working his way to a world record. This site is very interesting, allowing you to take an inside look at a world-class contest station. Want to hear what you sound like on the other end of a contest QSO? Simply click on the Contest/QSO Logs button, enter your call letters and your QSO is played back to you. How cool is that! Give it a try by entering the call, K7LY (your editor's call), and take a listen.

UPCOMING ACTIVITIES AND HAMFESTS

2008 Quartzfest—January 20-26th. This is a gathering of RV's near Quartzite, AZ . See www.quartzfest.org

2008 Yuma HamExpo—February 15-17th. Yuma County Fairgrounds. See www.yumahamexpo.com

2008 Williams Hamfest/ARRL AZ State Convention, July 18-20th, Williams, AZ. See www.arca-az.org

2008 ARRL Southwester Division Convention—September 12-14th, Mesa, AZ. See www.AzHamCom.org

Some people try to turn back their odometers. Not me, I want people to know "why" I look this way. I've traveled a long way and some of the roads weren't paved .

The older we get, the fewer things seem worth waiting in line for.

**If you don't learn to laugh at trouble,
you won't have anything to laugh at when you are old.**

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Further, I don't want to get caught up in the argument about whether a mobile transceiver's ground lead should or should not be directly connected to the battery terminals, as there are pros and cons to each method. Suffice to say, the negative lead should be collocated close to the battery.

If I had to choose just one example of a ground loop, it would be the presents of alternator whine. Especially so when it only occurs, or predominantly occurs, in the transmitted signal. In some cases you can mask the whine by using a brute force filter in the positive lead. Besides the additional I^2R losses incurred, it's a band-aid rather than a cure. While a bad or leaky diode may cause alternator whine to occur, the truth is, it's a very rare occurrence (nowadays).

In the whine cases I've been involved with, there are usually three common themes, alone or in combination. First, power is taken from the vehicle's wiring rather than directly from the battery. Two, the negative lead was connected to the nearest chassis ground point (seat frame for example) rather than directly to a battery ground. Three (and most common), the use of a mag mount antenna.

It should be apparent that direct battery connections should be made, at least the positive connection, as using existing vehicle wiring is fraught with problems. This includes the use of Accessory Power sockets as neither the wire size nor the fusing are adequate for any HF radio. Adding insult, there are devices marketed which supposedly circumvent the inherent problems associated with using them; a incredulous advertising ploy with no merit!

If it makes you warm and fuzzy connecting the negative lead to the battery chassis connection, rather than to the negative battery connector itself, great! But don't use seat rails and other metal body parts unless you want to invite problems.

If you're using a mag mount antenna, and you have whine on your transmitted signal, try this. Replace the antenna with a dummy load. If you can still hear the whine on a near-by receiver, the problem is in the DC wiring, or the alternator (albeit doubtful). If you can no longer hear the whine, then ditch the mag mount and drill the necessary hole.

I have always been in favor of common grounds, and common power supply points. Doing so, lessens the possibilities for ground loops. One way to do this is to use a RigRunner or similar common connection device. If you do use one, you won't need the fuses which came preinstalled on your transceiver's power cable. In fact, you're better off shortening the cable (less I^2R losses) rather than bundling it up with a trap. Just remember, the RigRunner's power cable needs to be fused very close to the battery connection points.

Some amateurs tend to go crazy installing DC grounds on every single piece of installed gear as if God commanded it so. One common practice is to ground the transceiver's chassis to the nearest hard point. If this cured a problem (ground loop or RFI related), then something else in your installation was amiss, and it's usually a poor coax connection or ground plane issue.

It's assumed that most vehicle manufacturers scatter ground connections hither and yon throughout the vehicle. That is not the case. While there are multiple ground connections made, the same ground points are used for any given sub-assembly. For example, there are no separate grounding points for each headlight. Indeed, they're common. Another way to look at this is, if power for more than one device comes from the same supply point (relay, switch, battery, etc.), then the grounds for those devices should also be common. In case you missed the point, this is to lessen any potential for a ground loop (pun intended).

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If you cause a potential to appear between two factory ground points (e.g., ground lead to a seat frame, positive lead to the battery), the resulting ground loop may manifest itself as an RFI problem. This is especially important when high currents are involved (amplifier use for example). Split beads, brute force filters, and ground straps ad nauseam, won't cure the apparent RFI simply because RFI is not the cause!

The most important point that can be made in preventing ground loops is to use correct wiring practices. Not only are direct battery connections necessary, adequate sized conductors and fuses are also required. The truth is, most factory supplied mobile transceiver power cables are barely adequate for the load. Extending them just adds insult to injury, unless you're using a RigRunner or other device equipped with over-sized cabling.

It seems, no matter how many times a myth is dispelled, they keep raising their ugly head. One common myth is that power cable fuses protect the radio from damage. They don't. Myth number two is, that a fuse will open instantly as soon as the current exceeds the fuse's rating. They won't. Myth number three is, it's always okay to use fuses designed for 120 volts AC, in a nominal 12 volt DC system. It isn't.

The first truth is, fuses are there to protect the cabling. For example, the Icom IC-7000 has a 5 amp (system) fuse mounted inside the radio, and 30 amp fuses in the cabling (plus and minus). If you short out a supply connection (pin 3 of the tuner port for example), a circuit board trace and/or switching transistor will fail long before the 5 amp fuse opens. The 30 amp fuses will never open in this particular case. It can be argued that the power cable fuses do protect the radio if something fails catastrophically, a final perhaps, but chances are some other component in the circuitry will be damaged beyond repair before the power cable fuse(s) opens.

The second truth is, all fuses exhibit hysteresis. This is the time lag between any given ampere overload and when the fuse opens. For example, a nominal 20 amp fuse will handle a 30 amp load for about 90 seconds. It will hold a 100 amp load for about 1 second. This is one reason slow blow fuses are not recommended for amateur devices.

So, if the radio draws just 20 amps peak, why not use a 20 amp fuse instead? Here's why. Subjecting any given fuse to instantaneous loads close to their current rating will eventually cause them to fail due to element fatigue (sometimes referred to as erosion). Depending on the load characteristics (steady or varying), fuses are sized from 25% to 50% larger than their impressed loads.

Digressing again... In some cases, peak loads will exceed the rating of the fuse, like those encountered when starting an electric motor. Depending on the application, the designer may use a slow-blow fuse with an appropriately longer hysteresis rating. However, in an amateur application, it is only necessary to keep the average current draw below about 60% of the rating for any given fuse to avoid element fatigue. However, the correct wire size should be based on the peak current, not the average, if you want to keep I^2R losses low. In any case, should a dead short occur, the wire size needs to be large enough to carry the current imposed by the fuse's hysteresis time delay without exceeding the wire's temperature rating. After all, you don't want to turn the wire itself into a fuse!

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Aging: Eventually you will reach a point when you stop lying about your age and start bragging about it.

Old age is when former classmates are so gray and wrinkled and bald, they don't recognize you.

When you are dissatisfied and would like to go back to youth, think of Algebra.

SCENES FROM THE

LABARA CHRISTMAS PARTY

(continued from page 5)

As stated, part of the sizing calculation is the temperature rating the protected wire is designed for, as well as its ambient operating conditions. In other words, the fuse must open before the wire reaches its maximum rating for any given overload. Incidentally, underhood wiring should have a temperature rating of at least 90C, and preferably 105C.

The third truth is, all fuses elements have resistance, and when the current flows through them, they heat up. The elements are designed to melt at a specific temperature thus protecting the wire, and to a lesser the equipment connected to the wire. For any given ampere rating, fuses designed for high voltage (nominal 250 volts maximum) service typically have lower resistance than those designed for low voltage (nominally 32 volts maximum). Thus, their low voltage hysteresis time is elongated, which means they take longer to open under a given overload.

Further, fuses designed for AC service typically have longer arc paths and may be filled with arc suppressing material. While these facts alone don't preclude their use in low voltage applications, here too the hysteresis time delay may be extended. The bottom line is, you should select fuses specifically designed for the voltage range in use.

What ever you do, don't buy cheap fuses. Both Littelfuse and Bussmann manufacture high-quality fuses with consistent hysteresis ratings. Some off-shore types act more like a shorting bar than a fuse. That is to say, forewarned, is forearmed!

Do mobile radio correctly, and you can have a lot of fun. Do it wrong, and it can become your main bane!

First you forget names, then you forget faces. Then you forget to pull up your zipper.
It's worse when you forget to pull it down.

Ah, being young is beautiful, but being old is comfortable .

You know you are getting old when everything either dries up or leaks

LBARA OFFICERS AND DIRECTORS

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www.lbara.net

FROM THE EDITOR

If you have anything you would like to see included in these issues, please let me know. I'm always looking for articles, news items, construction articles, or anything that might be of interest to our readers. You can contact me at 928.855.7941 or email at grf@uneedspeed.net or francej@ajsinsurance.com.

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STATIC

ATTENTION READERS

Please note that this issue represents a "work-in-progress" and there are a number of changes to be made in subsequent issues. I would greatly appreciate your comments, both good and bad, as well as any suggestions for future issues. This issue also begins our first attempt to deliver the **STATIC** to your doorstep electronically. Please keep me abreast of any email address changes you may have and I promise to have this delivered promptly and accurately. Also, I still have a number of articles awaiting publication and will do so in the future. This is your newsletter, so keep the articles, letters, and pictures coming. I can be reached at home (855.7941), at work (855.3081) or via email at grf@uneedspeed.net .

EQUIPMENT FOR SALE

EDITOR'S NOTE : List your items for sale here. Ham radio related only, please. Include a picture if you like (please use a jpg format). Email all to me at grf@uneedspeed.net) along with your name and phone number.