



Grassroots Emergency Communications Operations

KM6EON-R* EchoLink Station

© 2017, 2020 corr., KI6GIG. All rights reserved.

*KM6EON is the call sign of the Wanderer's Amateur Radio Club

www.neighborhoodlink.com/GECO

gecoradio@gmail.com

Ready to Serve and Sustain Our Community

Welcome to the home of the KM6EON-R (node #717585) in Alhambra, CA. The station is in the Los Angeles area. It is the result of mutual assistance between Greg Lee, KI6GIG, the KM6EON-R custodian and his Elmer Joe, N6WZK (whose interests are repeaters, EchoLink, and computer technology). Joe helped Greg set up an EchoLink "User" node (computer only) using Greg's old Acer e-machine D725 laptop computer. When Greg got a TYT TH-9800 quad-band radio and a Rigblaster Nomic interface, Joe gave Greg a suitable antenna and helped him to upgrade the "User" (KI6GIG, #384040) to a "Link" node (KM6EON-L, #717535).

Shortly after that, Joe had to move some of his repeaters from another site. In exchange for Joe's previous help, Greg offered to let Joe relocate his repeaters to the KM6EON-L station. This would help Joe retain his repeater frequency pairs.

Joe upgraded the KM6EON "Link" to a full "Repeater" node by providing the 440 MHz duplexer, a Rigblaster M8 interface, ADI AR-447 (for TX) and an ADI AR-446 (for RX) radios, and a

EchoLink-R

Rigblaster M8

**440 MHz
Repeater**

ADI AR-447 (TX)

(445.060 MHz)

ADI AR-446 (RX)

(440.060 MHz)

**TYT TH-9800
(KI6GIG Base
Station Radio)**



Greg (KI6GIG) at KM6EON-R EchoLink station.



The KM6EON-R EchoLink Station.

[Note: See more photos of the station rack at the end of this paper.]



The radios on the station rack.

Other Repeater

**Rigblaster Nomic
(Yellow to 220MHz TX)
(Blue to 2m TX)**

Split Repeaters

**TYT TH-9000
(223.860 MHz TX)**

**ADI AR-147
(147.180 MHz TX)**

KM6EON-R EchoLink Station
Grassroots Emergency Communications Operations



Joe (N6WZK) at the KM6EON-R
EchoLink station

Diamond X3200A antenna. Joe then decided to set up split repeaters for his 2m and 220 MHz repeaters. The transmitters are here; the receivers at his QTH.

Apartment living imposes limits for hams. Fortunately, I have a very good relationship with the building owner. They allowed me to set up an antenna system. I designed it to have minimum impact on the building. Everything is temporary and can be removed easily without affecting the building.

The antenna array has 3 vertical antennas and a Yagi. In the photo on the right (→), going from left to right the vertical antennas are: 1) a

home brew tri-band antenna (2m, 220, 440 MHz); 2) a tri-band Diamond X3200A (2m, 220, 440 MHz) antenna; 3) a dual band Diamond X200A (2m, 440 MHz). The Yagi is a dual band antenna (2m, 440 MHz). Joe furnished all the antennas and the rotator.

The rotational arc of the antenna array passes over the



porch. Plastic bird spikes prevent birds from roosting and making droppings on the porch or tenants. This is being a good neighbor. This also appealed to the building owner.

There are two other outdoor antennas. A quad-band mobile vertical whip magmounted antenna is on a temporary bracket clamped to the window awning. It is shadowed by the building on the north. However, N6WZK is located to the south. A discone antenna is suspended from the awning. [Note: We discussed the antenna installation with the building maintenance man and got his approval. Then we asked the the building owner's permission. They consented when they knew the maintenance man approved because nothing was permanently mounted to the building and there would be no damage the roof and walls.]



KM6EON-R EchoLink Station

Grassroots Emergency Communications Operations

The wireless weather station unit (white object in the red circle) operates at 433MHz. The photo on the right shows the horizontal separation of the weather station. [**Note:** The phone pole appears closer due to the camera angle. The telephone pole is more than 30 ft. from the weather sensors.] The weather sensors are 6 ft. above the roof. This does not meet International standards. It was a compromise with the building owner.



This station set up is the direct result of practicing mutual respect combined with clear and effective communication with the building owner. Joe (N6WZK) is my Elmer. This is a traditional practice in amateur radio. Without Joe's guidance and assistance, the KM6EON-R station would not be possible.

REPEATER LINKING FOR EmComm

Joe is very interested in linking repeaters for EmComm. He is also keen about using EchoLink. Joe wants to give more local hams the ability to "DX" with their VHF/UHF radios. Once the KM6EON-R was operational, he began working on an EchoLink network of 3 stations: KM6EON-R, his station N6WZK-R, and another friend's station N6WIV-R (John). These EchoLink stations are within RF range of each other. The repeaters are on different frequencies, but when the stations are "online," traffic via EchoLink is being shared on all the repeaters. This gives hams in the area multiple frequencies to access EchoLink.

Both Joe and I also feel that EchoLink has a role to play in EmComm. Many hams feel that EchoLink is not suitable for EmComm "because if the Internet is lost, EchoLink is useless."

However, recently, HF band conditions have been very poor. It has been so poor that many hams cannot make contacts via HF. Yet no one dares to say "therefore HF is useless for EmComm." The simple fact is that amateur radio and EmComm are all about communications. EchoLink is another communication tool that should be in the "tool kit" of EmComm hams.

An EchoLink station is more useful for EmComm if it is combined with a radio (i.e. set up in "SysOp" mode). This way, if the Internet is not available, the station can revert to RF operations. Though most EchoLink SysOp stations tend to be VHF/UHF, HF radios can be used, too.



STATION RESILIENCE

Electrical power is essential for EmComm radios. We installed battery back-up power for the station. Ideally we wanted solar PV (photo-voltaic) panels. But that was not possible at the apartment. So, we must rely on 120 VAC commercial main power for battery recharging. We get deep cycle sealed lead acid batteries through our association with Glendora Emergency Response Communications (GERC). The batteries (in left photo) are 16 Ah batteries. A bank of 12 batteries is dedicated to the radios. A bank of 9

batteries serves the 12 VDC-120 VAC inverter for back-up power to the EchoLink computer and other equipment needing 120 VAC power.

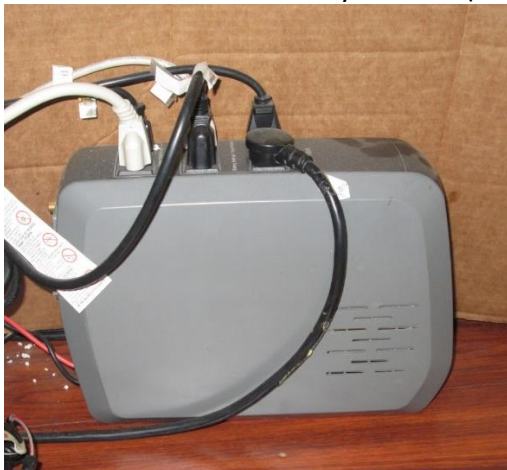
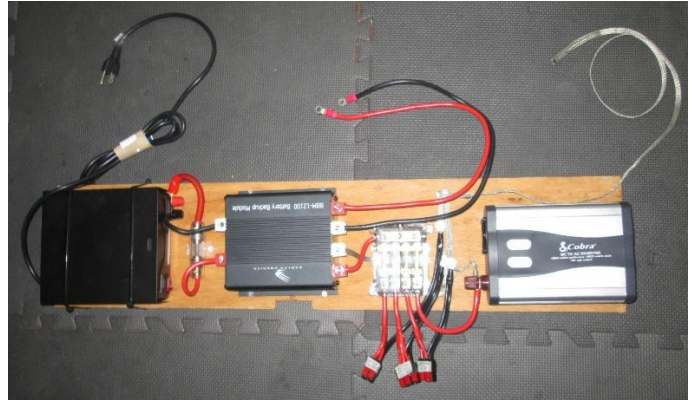
Each battery bank has a separate charging system that automatically draws power from the batteries when commercial main power is lost. The radio battery bank charging system components are:

- Surge protected power strip
- Radio Shack 13.8 v, 19 amp switching power supply
- 30-amp inline fuse
- BBM-12100 Battery Backup Module
- 4-Fuse block 12 v distribution

(The Cobra DC to AC inverter is for emergency use only if the 120 VAC battery bank fails.)

Equipment connected to the radio battery bank are;

- All the radios on the radio rack;
- Two cooling fans for the radios;
- Private Patch IV;
- LED light bar for the radio rack;
- Two 12 VDC accessory sockets (for alternate power for the HTs).



The Belkin 750VA Uninterruptible Power Supply charges a bank of 9 batteries.

The computer battery bank components are:

- Surge protected power strip
- Belkin 750VA Uninterruptible Power Supply

Equipment needing 120 VAC power are connected to this system include (listed in priority of use):

- Acer e-machine D725 dedicated EchoLink computer and cooling fan
- Internet modem and router
- Acurite weather station display and dedicated Asus Vivobook EH200A computer
- Antenna rotator
- Radio Shack Scanner / FM radio
- HT battery charging cradles

- AA/AAA battery chargers
- 12 VDC battery float chargers (for field battery boxes)

During normal operations, all batteries are being charged and power to all equipment is drawn from the battery banks. When commercial main power is lost, auto switching immediately shifts to battery power. When that happens, the Internet and EchoLink computer have priority for 120 VAC power. All other 120 VAC equipment is shut off and used only if absolutely needed.

We also have two field radio battery boxes. Each box has three 16 Ah sealed lead acid batteries. These batteries are on solar float chargers to maintain them. If several days have inadequate sunshine, we use commercial main power to maintain their charge. In needed, these battery boxes can be quickly connected to the station battery banks to extend operations.



STATION GROUNDING

Proper grounding is important to assure station survival. There are three aspects to grounding the station: 1) basic electrical safety; 2) eliminating RF interference; 3) lightning protection. (See the separate report for details: [KM6EON-R Station Grounding System](#))

The major components of the grounding system are:

- Main station ground rod (outside the station): We used a $\frac{3}{4}$ inch copper pipe. We “hydro drilled” it into the ground by attaching a garden hose and forcing water through the copper pipe. (See photo on the right.)
- Station ground bus bar (inside the station): We used a short length of copper pipe.
- Main station ground conductor (outside the station): We used salvaged coax cable to attach the station ground bus bar to the ground rod.
- Individual equipment ground strap (from unit to station ground bus bar): Be sure each unit has its own ground strap to the station ground bus bar. **Do not “daisy chain” equipment when grounding.** [Note: Daisy chaining is attaching more than one unit to a single ground strap. This is dangerous. A voltage surge or short in one unit would have to travel **through** the other units to get to ground.]



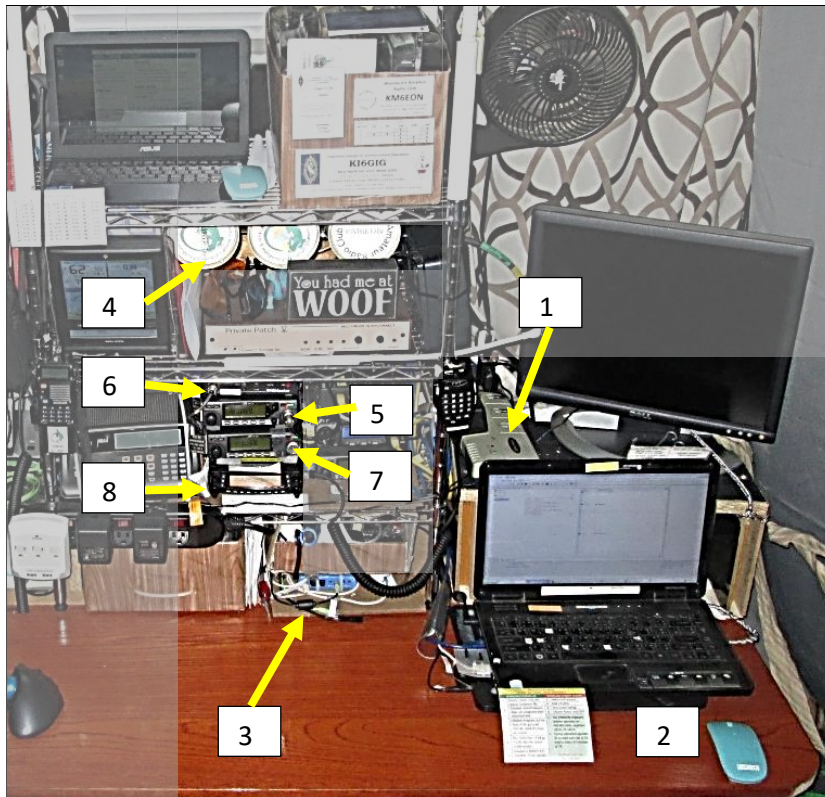
Additional Station Photos

These photos and details are intended to help satisfy the curiosity of some HAMs who have connected to our KM6EON-R EchoLink Repeater station. There is no “one” right way to set up the station. Every ham and situation is unique. Ham radio can be a very expensive hobby. But my thinking is to have a system which fits your budget, is robust (durable), gets you on the air to give you practice to prepare and enable you to help serve your community in times of need.



My radio station shares the same desk as my computer workstation. Since this article is about the KM6EON-R station, the following photos will show more details of the station. Above is a photo of the entire desk. The following pages and photos will give you a closer look at the station components.

KM6EON-R EchoLink Station
Grassroots Emergency Communications Operations



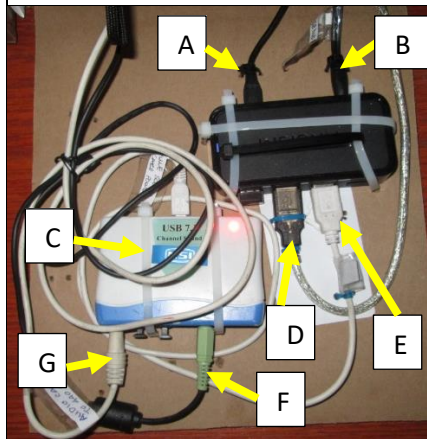
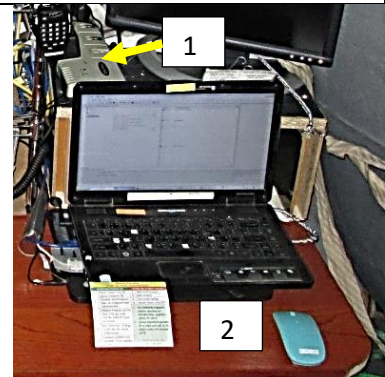
**KM6EON EchoLink Repeater
Node 717585**

1. 120 VAC battery backed-up power strip
2. Dedicated EchoLink computer
3. Powered USB hub and external sound card tray
4. 440 MHz Duplexer
5. Rigblaster M8 interface
6. 440 MHz Transmitter
7. 440 MHz Receiver
8. TYT TH-9800 mobile radio as base station radio

#1 120 VAC power strip connected to the auto switching battery bank back-up system.

#2 Dedicated EchoLink Computer sits on a cooling fan and is connected to 2 powered USB hubs for the 440-repeater external sound card and another external sound card for the 2-m and 220-repeaters.

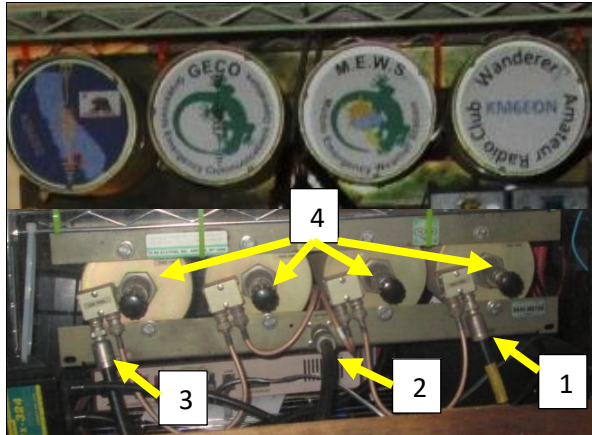
Note: The Acer e-machine D725 uses Windows XP to run the free EchoLink program. Joe has found this combination to be more stable than using subsequent Windows operating systems.



#3 Powered USB hub and external sound card tray.

- A Powered External USB hub and 120 VAC power cord.
- B USB cable to EchoLink computer.
- C External sound card
- D Serial cable to Rigblaster M8 interface
- E USB cable to external sound card.
- F Audio cable to Rigblaster M8 interface
- G Audio cable to 440 MHz receiver

Note: We chose to use a powered USB hub to assure having adequate power supplied to the external sound card. In Joe's experience, this improves system stability.



#1 Coax from antenna; #2 Coax to 440 RX radio; #3 Coax to 440 TX radio; #4 Tuning knobs.



#4. 440 MHz Duplexer

- A Front: The plain end caps were decorated with our logos.
- B Back: Connectors and tuning knobs.
- C Side view (right side when facing the rack)



#5. Rigblaster M8 interface: The mic cable goes from the 440 MHz transmitter to the M8 interface.

#6, #7. The 440 MHz Transmitter & 440 MHz Receiver are connected to the duplexer with separate coax cables. This repeater uses Diamond X3200A antenna.

#8. The TYT TH-9800 mobile radio serves as the KI6GIG base station radio. This radio connects to the 4-way antenna switch to access a homebrew tri-band antenna, the dual band Yagi, the mobile quad-band whip, and a dummy load.