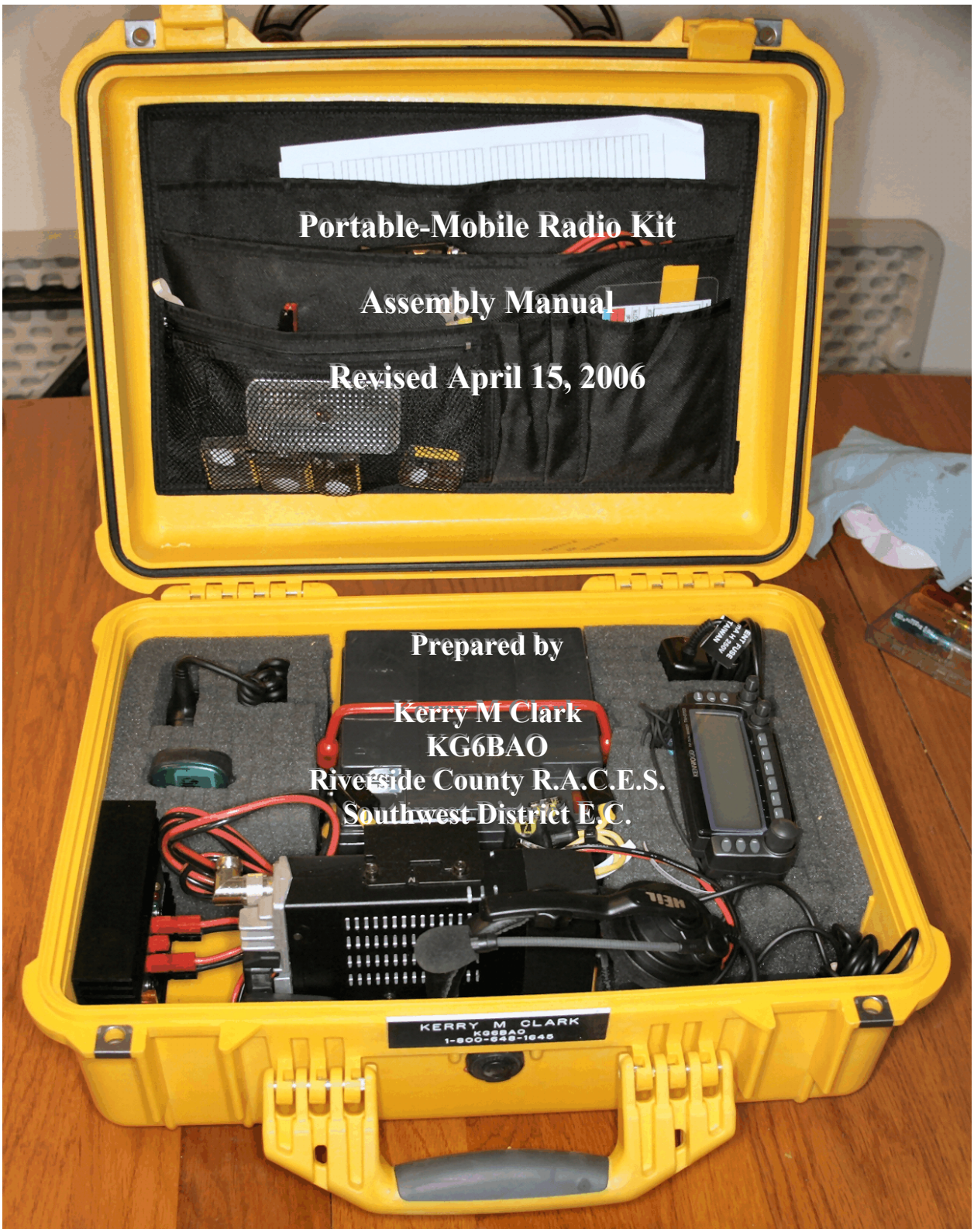

Portable-Mobile Radio Kit

Assembly Manual

Revised April 15, 2006

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Southwest District E.C.

Portable-Mobile Radio Kit
Assembly Manual

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The radio kit described in this manual is a compilation of custom-made and commercially available components. The prototype was designed and funded by members of the Riverside County (California) Radio Amateur Civil Emergency Service, Southwest District.

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High resolution photographs are available for many of those found in this manual.

Inquiries, comments, and questions regarding this manual, including requests for high resolution photographs, may be sent to:

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Introduction

Emergency communications presents constantly changing challenges that Amateur Radio Operators have been tackling for decades. Radios that once required a small building and massive antennas went mobile. Then mobile radios became portable and even hand-held. Some today are as small as a credit card. Evolving technology has also brought the ability to track the location of the radio and send text-based messages as well as television signals.

All of these technologies are useful to emergency communicators, such as the Radio Amateur Civil Emergency Service (R.A.C.E.S.) and the Amateur Radio Emergency Service (A.R.E.S.). The challenge is to find an ideal package that can meet multiple missions, and operate in difficult and varied conditions. The Portable-Mobile Radio Kit discussed in this manual is intended to meet this challenge.

The selected radio is a dual-band (VHF/UHF) model, which is widely used in emergency communications. It has the ability to monitor other Amateur Radio bands as well, although it can only transmit on the two primary bands (2M and 70cm). It has the output of a mobile radio (50W and 35W respectively), but is powered by a hefty 26ah battery, making it truly portable.

Amateur Radio Operators have used a number of schemes to make their mobile radios portable, and most work quite well. A common problem has been the ability of a vehicle's electrical system to handle the radio's power requirements without modifying at least some wiring. This becomes especially problematic when it is necessary to put the radio in a temporary mobile installation – modifying the wiring isn't always a welcome task from either party's perspective.

The Portable-Mobile System solves the power problem by utilizing a West Mountain Radio Super PWRgate smart charging and battery isolation system. This allows the on-board battery to keep charging from the power source, such as the vehicle's cigarette lighter connection, puling less than 5 amps of power – well below the usual critical power threshold of most any vehicle. The radio can still operate at full power using the on-board battery as a buffer. Thus, the vehicle's electrical system is safe and requires no modifications for the temporary installation.

In addition to being a capable two-way radio, the System is APRS[1] capable. A small GPS receiver (either a small hand-held, or a GPS "puck") plugs directly into the radio providing position, speed and heading information constantly. Radio settings determine the frequency with which the information is transmitted, and any additional message that accompanies each transmission. The radio sports five "pre-sets" to allow quick APRS and/or two-way radio setup. The radio also tracks other APRS stations and can interface with APRS software.

Whether used as an emergency base station, temporary mobile and/or APRS system, or a field portable unit, the Portable-Mobile System can meet the challenge. It is not only full featured, but durable, too. A virtually indestructible Pelican® case with document storage in its lid completes the System. The modest sized Pelican® case is easily seat-belted into a vehicle, or placed out of the way. If needed, radio controls can then be placed wherever convenient for the operator via their remote cables.

This easy-to-build system is both enjoyable to use and versatile. Enjoy!

---

[1] APRS. Automated Packet Reporting System, also known as the Automated Position Reporting System.

System Specifications

The following components comprise the portable-mobile system.

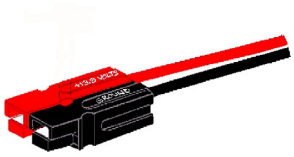
1. **The radio**: Kenwood® TM-D700A dual-band, with APRS, SSTV, and packet capabilities. The control panel of the TM-D700A is separate from the radio electronics, thus allowing the radio to remain mounted in the protective case while placing the control panel in a more convenient location for the operator. In many cases, though, the control head can remain in the case – depending upon the particular need.

2. **Power source**: A 26ah battery is used to provide primary or supplemental power to the System. The MK M12260SLDM, or PowerSonic WP26-12 sealed lead acid/AGM battery is required. It is non-spillable and certified for transport on aircraft; thus, it is unlikely to create acidic fumes that might otherwise cause significant damage to the radio. The battery measures approximately 7" x 7" x 5" h and weighs about 21 pounds. Based on recent tests using a similar radio, the system should operate about 24 hours on low power without requiring a re-charge or an external power source.

3. **Charge controller**: The charge controller not only charges the battery at the proper voltage and charge rate, but limits the load on the power source to less than 5 amps. The West Mountain Radio Super PWRgate® PG40S was selected due to its intelligent design and versatility. The Super PWRgate has three connections, all utilizing the Anderson PowerPole® connectors: *Source*, *Load*, and *Battery*. The *Source* connector is for any external power source not exceeding 18 volts. The radio is wired directly to the battery. The *Battery* connector provides charge current to the battery and/or supplemental current when the battery is under load.

If the radio or battery is connected to the *Load* connector, the Super PWRgate® will draw up to 5A for the battery charge circuit, but will pass through up to 40A to the *Load* port; this will certainly overload most vehicle power receptacles. *If the battery should fail, the full load can be drawn through the* Load *connector by simply switching the PowerPole® connector's position.*

4. **Connectors**: The Anderson PowerPole® connector has long been a standard for R.A.C.E.S. use and has become a standard for most power accessories on the market as well. This standard was adopted for all power connections on this system. Adapters to connect the system to external power of all types from cigarette lighter connectors, to ring terminals, or even other PowerPole® equipped panels are easily configured with minimal wire and bulk. The two halves of the PowerPole® connectors (red and black) are permanently attached to one another using "super glue" as opposed to roll pins (the latter of which tend to fall out). All connections should be crimped using an approved PowerPole® crimp tool for a strong mechanical attachment. Connections can also be soldered, if desired. *It is assumed the builder is familiar with Anderson PowerPoles®; if not, please contact the author for guidance.*



5. **GPS Receiver**: The Garmin E-Trex Venture® GPS receiver was selected due to its low cost, small size, and easy, reliable configuration for APRS use with the TM-D700A radio. A power/data

connector is also incorporated with an extended data cable to allow the GPS to be located up to 8 feet or more from the system case.

6. **Antenna**: Any durable, magnetic mounted antenna works well with this radio for mobile use. The Diamond NR770H dual-band antenna or equivalent works exceptionally well. Just be sure the antenna that is used does not require a direct ground if a magnetic mount is to be employed.

7. **Other Accessories**: A single headset with boom microphone is recommended.. While not an absolute necessity, the headset is invaluable in noisy environments. The standard included microphone is also packed in the system case for uses where wearing a headset is impractical or ill advised.

   To facilitate wiring and fusing of the system, a West Mountain Radio RigRunner® #4005 is used to distribute power and connect the battery to the radio and charger/controller.

8. **System Case**: The Pelican® #1520 hard case was selected for its size and outstanding durability. It is lockable, will float even with all of the equipment on board, and machines easily (for mounting equipment). A compatible lock and desicant cartridge, as well as a custom nameplate; are available from Pelican® or their suppliers.

Component Specifications

Pelican Case #1520

Manufacturer:	Pelican Products, Torrance, CA
Exterior Dimensions:	19-1/8"L x 15-7/16"W x 7-9/16"H
Interior Dimensions:	17-7/8"L x 12-3/4"W x 6-3/4"H

Super PWRgate PG40S

Manufacturer:	West Mountain Radio, Norwalk, CT
Maximum Voltage:	18 Volts dc
Maximum Current:	40 Amperes
Circuit:	Diode OR-Gate
Diodes:	Two Schottky 80 Ampere, 20 volt
Voltage Drop:	0.25 Vdc Quiescent
	0.50 Vdc at 40 Amperes
Charging Circuit:	Charging Regulator IC
	Field Effect Pass Transistor
	Schottky Diode
	Fuse Switched for 1, 4, 7, or 10 Amperes (+2%, -8%) maximum
	Peak voltage limit: 13.8 (Gelled Cells), 14.2 (AGM), (+,-2%)
	Float voltage: 13.5 volts (+,-2%)
	Reference voltages are temperature compensated
Connectors:	Anderson PowerPoles®, 40A
Size:	5.25 x 3.90 x 1.65in, 13.4 x 9.9 x 4.2 cm
Weight:	0.9 lbs, 0.4 kg
Mounting Holes:	Two, 0.175 d, at 4.875 in distance, for #8 hardware

RigRunner 4005

Manufacturer:	West Mountain Radio, Norwalk, CT
Maximum voltage:	18 volts dc
Maximum Current:	40 Amperes
Total Ports:	6 (1 input, 5 output), always “on”, all fused
Size:	5-1/2" x 3" x 1.4"h
Mounting holes:	4, two on each flange
Connectors:	Anderson PowerPoles® 40A

Kenwood TM-D700A Radio

SPECIFICATIONS

Specifications are subject to change without notice due to advancements in technology.

General		VHF Band	UHF Band
Frequency range	U.S.A./ Canada [1]	144 ~ 148 MHz	438 ~ 450 MHz
	Europe	144 ~ 146 MHz	430 ~ 440 MHz
	General market	144 ~ 146 MHz	430 ~ 440 MHz
Mode		F3E (FM), F1D (GMSK), F2D (FSK)	
Antenna impedance		50 Ω	
Usable temperature range		–20°C ~ +60°C (–4°F ~ +140°F)	
Power supply		13.8 V DC ±15% (11.7 ~ 15.8 V)	
Grounding method		Negative ground	
Current	Transmit (max.)	11.5 A or less	10.0 A or less
	Receive (at 2 W output)	1.0 A or less	
Frequency stability (–10°C ~ +50°C)		Within ±3 ppm	
Dimensions (W x H x D projections not included)	Front panel	140 x 60 x 33 mm/ 5.51" x 2.36" x 1.30"	
	Main unit	140 x 40 x 195 mm/ 5.51" x 1.57" x 7.68"	
Weight	Front panel	Approx. 180 g/ 6.3 oz	
	Main unit	Approx. 1.2 kg/ 2.6 lb	

[1] Band A receive range: 136 ~ 200 MHz, 118 ~ 136 MHz (sub), 200 ~ 300 MHz (sub), 300 ~ 400 MHz (sub), 400 ~ 470 MHz (sub)
Band B receive range: 400 ~ 524 MHz, 136 ~ 175 MHz (sub), 300 ~ 400 MHz (sub), 800 ~ 1300 MHz (sub/ excluding specific frequency ranges)

Transmitter		VHF Band	UHF Band
Power output	High	50 W	35 W
	Medium	Approx. 10 W	
	Low	Approx. 5 W	
Modulation		Reactance	
Spurious emissions		–60 dB or less	
Maximum frequency deviation		±5 kHz	
Audio distortion (at 60% modulation)		3% or less	
Microphone impedance		600 Ω	

Receiver		VHF Band	UHF Band
Circuitry		Double conversion superheterodyne	
Intermediate frequency (1st/ 2nd)		38.85 MHz/ 450 kHz	45.05 MHz/ 455 kHz
Sensitivity (12 dB SINAD)	VHF or UHF band	0.16 µV or less	
	Sub VHF or UHF band	0.25 µV or less	
Selectivity (–6 dB)		12 kHz or more	
Selectivity (–40 dB)		28 kHz or less	
Squelch sensitivity		0.1 µV or less	
Audio output (8 ohms, 5% distortion)		2 W or higher	
Audio output impedance		8 Ω	

Note: *Receiver specifications apply only when using the main VHF or UHF band. They do not apply to the sub VHF or UHF band.*

ES26-12

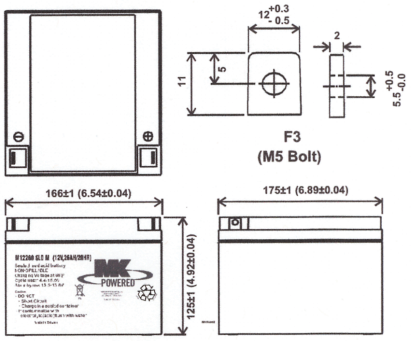
Maintenance-Free Rechargeable Sealed Lead-Acid Battery

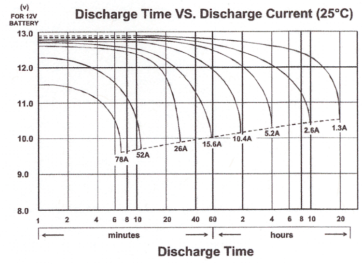
SPECIFICATIONS

Nominal Voltage (V)	12V
Nominal Capacity	
20hour rate (1.3A to 10.50V)	26Ah
10hour rate (2.6A to 10.50V)	26Ah
5hour rate (4.42A to 10.20V)	22.1Ah
1C (26A to 9.60V)	11.7Ah
3C (78A to 9.60V)	9.36Ah
Weight	20.96 Lbs. (9.528 kg)
Internal Resistance (at 1KHz)	8 mΩ
Maximum Discharge Current for 30 seconds :	520A
Maximum Discharge Current for 5 seconds :	1040A
Operating Temperature Range	
Charge	0°C(32°F) to 40°C (104°F)
Discharge	-15°C(5°F) to 50°C (122°F)
Storage	-15°C(5°F) to 40°C (104°F)
Charge Retention (shelf life) at 20°C (68°F)	
1 month	92%
3 month	90%
6 month	80%
Charging Methods at 25°C (77°F)	
Cycle use :	Charging Voltage 14.4 to 15.0V Maximum Charging Current 7.8A
Standby use :	Float Charging Voltage 13.50 to 13.80V No current limit required
Life expectancy :	
Cycle Use :	100% depth of discharge 250 cycles 80% depth of discharge 350 cycles 50% depth of discharge 550 cycles
Standby Use :	3~5 years
Case Material	ABS (94-HB & 94V-0 flame retardant case)
Terminal	F3

DIMENSIONS

mm(inch)





MK Battery
1645 South Sinclair Street • Anaheim, California 92806
Toll Free: 800-372-9253 • Fax: 714-937-0818 • E-Mail: sales@mkbattery.com

Note: The ES 26-12 is another model name for the M 12260 SLDM battery.

Parts List

The following is a comprehensive list of components and hardware required for the system. The source of each component or hardware item is included, along with the approximate cost. Please note that some items, such as stainless steel bolts, well-nuts, and certain other parts are normally purchased in quantity; these quantities are noted in parentheses () to give the reader a better idea of initial cost outlay that may be required. All costs noted are based on those available at the time this manual was prepared and are provided as a guide; they will likely change over time. Shipping costs, if any, and sales tax *are not included* in prices. It is recommended that other sources be investigated for better pricing, shipping costs, etc.

Qty	Unit	Description/Use	Source	Cost	Ext
1	Ea	Pelican® #1520 Case, Yellow	Rocky Mountain Tool Co	109.97	109.97
1	Set	Pelican® Lid Organizer® #1509	Rocky Mountain Tool Co	28.50	28.50
1	Ea	Pelilock® #1506	Rocky Mountain Tool Co	11.95	11.95
1	Ea	Desiccant #1500D	Rocky Mountain Tool Co	13.20	13.20
3	Ea	Aluminum Battery Hold-down blocks (custom fabricated from ½" x 1-1/4" aluminum stock)	McMaster-Carr #89215K444 ($15.66, 1' length)	2.00	6.00
1	Ea	Kenwood® TM-D700A Radio	Ham Radio Outlet	495.95	495.95
1	Ea	MK M12260 SLDM Battery	PowerWerx	60.00	60.00
1	Ea	Super PWRgate® PG40S	West Mountain Radio	119.95	119.95
1	Ea	RigRunner® #4005	PowerWerx	59.95	59.95
1	Ea	Garmin E-Trex Venture® GPS	Amazon.com	123.95	123.95
1	Ea	Garmin® Data/Power cord	Amazon.com	33.99	33.99
1	Set	1/8" 3-conductor phono plug & receptacle for GPS extension	Radio Shack	7.50	7.50
1	Ea	Heil® Headset	Ham Radio Outlet	94.95	94.95
1	Ea	Aluminum mounting bracket (custom fabricated) 2" x 8" x 1/8"	Home Depot	5.00	5.00
1	Ea	Proflex® PC12 Polycord (battery hold-down) #3097T61	McMaster-Carr	2.13	2.13
2 (10)	Ea	8-32 x 1-1/8 SS turned eyebolts #9489T53	McMaster-Carr	1.19	2.38
3(100)	Ea	8-32 x 3/4" SS binding-head machine screws	McMaster-Carr or any industrial hardware	.07	.21
15(100)	Ea	8-32 x 5/8" SS binding-head machine screws	McMaster-Carr or any industrial hardware	.07	1.05
18 (100)	Ea	8-32 SS Locknuts #91831A009	McMaster-Carr	.06	1.08

Qty	Unit	Description/Use	Source	Cost	Ext
30 (100)	Ea	#8 SS Washers #92141A009	McMaster-Carr	.02	.60
2 (25)	Ea	8-32 Well Nuts #93495A130	McMaster-Carr	.50	1.00
1	Ea	Cigarette Lighter Adapter (male)	West Mountain Radio	11.95	11.95
1	Ea	Cigarette Lighter Adapter (female)	West Mountain Radio	10.95	10.95
20	Ft	12ga Red/Blk Zip Cord (Wire)	Orvac Electronics	.71	14.20
12	Pr	Anderson PowerPole® 45A Terminals	West Mountain Radio	12.49	12.49
2	Ea	ATC Fuse in-line fuse holders	Orvac Electronics	4.50	9.00
6	Ea	Ring Terminals #10/12 (yellow), 1/4" round	Orvac Electronics	.15	.90
6 (50)	Ea	½" x ½" x 1" square vinyl caps (50 pk – $8.78) #9092K14	McMaster-Carr	.20	1.20
1	Ea	UHF Angle Adapter	Cable Xperts	6.99	6.99
1	Ea	PowerPole® to Alligator Clip Adapter	West Mountain Radio	11.95	11.95
1	Ea	Diamond® NR770H Antenna	Ham Radio Outlet	56.95	56.95
1	Ea	Diamond® Magnetic Antenna Mount #SPM35	Ham Radio Outlet	39.95	39.95
Total all items, excluding shipping, handling, sales tax					1355.84

Smaller quantities of some items are generally available from local hardware stores, and electronic supply stores. Some items, such as machine screws, may be more convenient to use if slightly longer or shorter screws are used. The builder should adjust such items as needed to suit his or her particular preferences.

Prices shown were effective in early 2006. With the rising costs of fuel and certain metals, it is almost certain that some of these costs have increased.

The original prototype utilized some parts that were fabricated from stainless steel. Stainless steel, for the uninitiated, can be a difficult metal to fabricate as it tends to "work harden" unexpectedly. This can result in broken blades, bits, and taps. In this manual, aluminum has been substituted in most cases which the builder will undoubtedly find to be much more forgiving.

Tools Required for Assembly and Fabrication

Power Drill
Screwdriver(s), including a right-angle screwdriver for tight quarters
Nut-drivers 5/16" and 11/32"
Adjustable wrench (small)
Box end wrench 5/16" and 3/8"
Utility knife
Hammer (preferably 2# machinist's hammer)
Vise
Drill Press (optional, but recommended)
Drill bits (5/32", 5/16", and #29)
8-32 machine tap
Tap wrench
PowerPole® Crimp Tool
Wire stripper
Diagonal Cutting Pliers
Hacksaw
LockTite "medium duty" thread compound (blue)

Preparing the Pelican® Case

It is imperative that the proper size Pelican® Case be used (see parts list). Using an improper size case may result in poor fitment of the battery or other components.

1.1 Remove all foam fillers from the case and set aside for now. Do not mount the Pelican® Lid Organizer until all other components are mounted.

1.2 Operate the latches and inspect the seal around the perimeter of the case to insure there are no defects. You may wish to coat the seal with silicone grease (available from most auto parts stores). Once you are sure the case is in good condition, proceed with the component installation.

Figure 9: Proper sizing of the Pelican Case and pre-installation inspection are imperative. The charge controller and radio mounting plate are already installed in this photo.

Mounting Accessories

The primary accessories to be mounted are the charge controller, power distribution panel, battery and radio. All other items will be fit into the foam filler around the primary accessories. The radio and battery installations are covered later; therefore, the charge controller and power distribution panel are dealt with in this section.

When fabricating parts or modifying the Pelican® Case, it is assumed the builder has a reasonably good understanding of basic mechanics. Precise templates are not provided here, and should not be necessary; small variations in the kit construction are expected. Where certain procedures are critical, a note or diagram is included.

Mounting Super PWRGate®

2.1 Position the West Mountain Radio Super PWRGate® charge controller along the **left** side of the case as close as possible toward the front. See photograph for suggested mounting position and orientation. Be sure the unit sits solidly against the case sidewall and not on the radius of the corner (this could cause the case to bend and damage the unit). Once satisfied with the positioning of the unit, mark the rear-most mounting hole and drill a 5/32" hole.

2.2 Place the unit on the opposite side of the case wall (exterior side) and insert an 8-32 machine screw thru the mounting hole to temporarily hold the unit in place. Using the unit as a template, mark the front-most mounting hole. Remove the unit and drill the second hole from the exterior side of the case.

Figure 10: The Super PWRGate is mounted along the left sidewall of the Pelican Case, shown at upper left. The RigRunner distribution panel is shown lower left. Note orientation of both modules.

2.3 The unit may now be mounted on the interior of the case using the two mounting holes just drilled. Mount with an 8 -32 machine bolts with the bolt heads to the outside of the case. Secure with a thin washer under the bolt head on the exterior side, and a nylon locknut with a flat washer on the interior side. Tighten securely, but do not over-tighten – excessive torque may damage the Pelican® Case or the bolt itself!

Mounting the Power Distribution Panel

2.4 Position the West Mountain Radio RigRunner® power distribution panel along the front side of the case near the right end. See photograph for suggested mounting position and orientation. You will want to be sure fuses and connectors are readily accessible.

2.5 The RigRunner® uses four mounting bolts. As with the Super PWRGate®, mark and drill the more accessible holes (inboard or left) first, then move the unit to the exterior to mark and drill the remaining holes. Use machine screws to hold the unit in place while marking the second pair of holes.

2.6 Once drilled, mount the unit on the interior side of the case with 8-32 machine screws, washers, and nuts.

2.7 Install a 40A fuse into the ***left*** socket on the Super PWRgate®. This will set the charge controller to a limited 4A charge.

Installing Radio

The radio must be installed before the battery, due to the weight and space constrictions posed by the battery's bulk.

3.0 As supplied by the factory, the Kenwood® radio has a lengthy power supply wire with multiple fuses in-line. Since the kit's components handle most of the circuit protection, the Kenwood's® power wire can be shortened considerably.

3.1 Figure 11 shows the radio with the supply wire shortened, leaving only one of the in-line fuses intact, and fitted with Anderson PowerPole® connectors. The overall length of the remaining wire set is 15". Also note another set of Anderson PowerPole® connectors is installed at about the half-length point in the overall wire run – this facilitates re-routing of wiring under unusual conditions once all the components are installed. This second set of connectors is optional, but recommended. (You can add the additional connectors later, if you wish – this is the beauty of PowerPoles®!

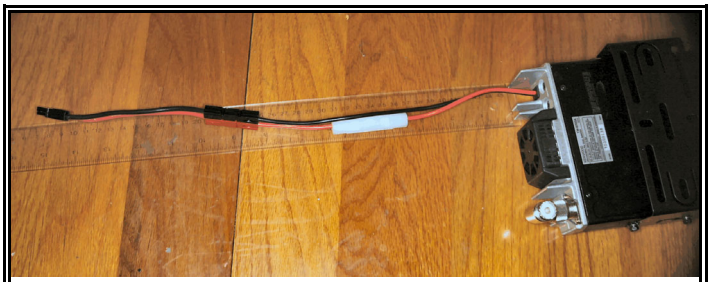


Figure 11: The power wire must be shortened to about 15" as shown. Attach Anderson PowerPole® connectors to the end. An additional set of PowerPoles® about mid-line are recommended, but optional.

3.2 Attach the radio's factory-supplied bracket to the radio as shown in Figures 12 and 13. Note the bracket orientation relative to the radio's connectors. This is important to insure the radio will be oriented correctly in the case for maximum accessibility. The bracket will be removed from the radio in the next steps; just be sure to note (or mark) its orientation so that it can be replaced for the final mounting steps.

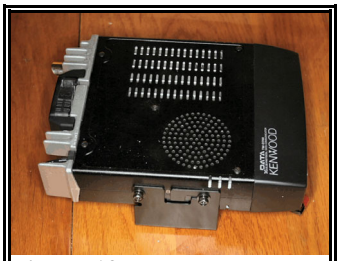


Figure 12

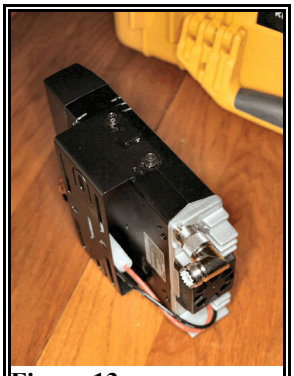


Figure 13

3.3 The radio requires a custom-fabricated mounting support to which its factory-supplied bracket will be mounted. The custom aluminum support is bolted to the Pelican® Case providing a sturdy vertical "tab" to support the radio. The aluminum support is fabricated

from flat aluminum stock; therefore, it is easiest to drill all of the necessary holes in the stock before bending it into its final form.

3.4 Cut an 8" length of 2" wide x 1/8" aluminum stock. From one end of the stock, measure 3" of the length and draw a line across the width of the stock. This will be the line at which the stock will eventually be bent to form a 90 degree "L".

3.5 On the 2" x 3" "tab" formed by the drawn line, mark four points where mounting holes will be drilled. Essentially, a 1" x 1" square can be drawn in the center of the "tab" and a hole drilled at each of the four corners of the square. See Figure 14. Drill a 5/32" hole at each of the four selected points.

Figure 14: The mounting holes for the radio mounting bracket's "tab" can be seen in this view.

3.6 Holes for mounting the radio must be drilled on the "long" portion of the aluminum support. Note in Figure 14 that the radio will mount *forward* of the aluminum support so the radio case is above the tab portion. The radio's orientation will also place the antenna connector toward the Super PWRgate® and on "top".

3.7 Keeping this orientation in mind, place the radio and bracket on the unfinished aluminum stock so that the radio, its bracket and screws are at least 3/8" above the bend line, and the opposite end of the radio's bracket is even with, or protrudes slightly past the "top" end of the aluminum stock. Once bent, you don't want the radio, its bracket, or mounting screws to interfere with the mounting tab or bolts.

3.8 Mark the radio bracket and aluminum stock once positioned. Removed the radio bracket from the radio. Re-position the bracket on the aluminum stock and mark four to six points to be drilled for mounting bolts. The radio's bracket has slots for most of its mounting points, so you will have some leeway in marking the points to be drilled.

3.9 Once marked, drill 5/32" holes for each of the selected points on the aluminum stock.

You are now ready to bend the aluminum support into its final form.

3.10 Place the stock into a sturdy vise with its length oriented vertically and with about 5" of the stock protruding above the vise, aligning on the previously marked bend line. Use a heavy machinist's hammer to *gently and gradually* tap the aluminum stock so the protruding portion bends over 90 degrees to form an "L".

You may wish to mount the radio with two or three bolts to the newly fabricated aluminum support to facilitate positioning the radio in the Pelican® Case. Remember: The radio will cover the mounting tab of the aluminum support, so don't permanently mount the radio just yet.

3.11 Place the radio and aluminum support into the Pelican® Case with the tab portion of the aluminum support extending forward, and the long portion of the aluminum support extending upward (See Figure 14 again). The assembly should be positioned so the entire radio assembly is roughly centered between the Super PWRgate® and RigRunner®, as both ends of the radio need to be accessible once mounted. Mark the position of the aluminum support on the Pelican® Case and remove the radio.

3.12 Re-position the aluminum support on the mark and, using the support as a template, drill *one hole* through the Pelican® case. Insert a 8-32" x 5/8" machine screw with a flat washer from the outside of the case and secure the support from the inside with a nylon locknut.

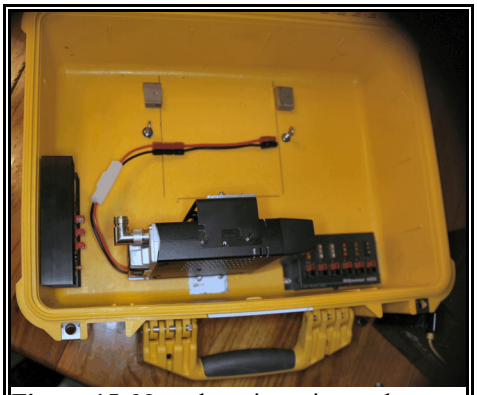


Figure 15: Note the orientation and position of the radio – centered between the Super PWRgate® and RigRunner® with the antenna connection to the left and on top.

3.13 Adjust the position of the support, if needed, and continue to drill each of the remaining three holes *one at a time* and securing with the machine screws and nylon locknuts.

3.14 You may now mount the radio to the aluminum support. Be sure the radio's bracket is securely attached to the radio and at the proper orientation. Place the radio against the aluminum support and insert a 8-32" x 5/8" machine screw and flat washer through the *radio's bracket* (between the radio and bracket) through the aluminum support. Secure with nylon locknuts.

Tip: Use needle nose pliers to position the machine screw thru the radio bracket and aluminum support. Once fed into the pre-drilled hole, you can remove the plier and use your finger to hold the bolt in place. Use a nut driver to tighten the nylon locknut until you can't hold it with your finger any longer. Once all of the bolts are in place, use a right-angle screwdriver to hold the slotted heads while you torque the nylon locknuts securely.

3.15 Route the power line from the radio under the radio's bracket and back to the RigRunner®. You may plug the radio into a 25A fused port on the RigRunner®.

Installing and Securing Battery

Installation of the battery requires proper placement, orientation, and retention to achieve good balance for the Pelican® Case and to minimize damage to the battery under rough handling conditions.

4.1 Place the battery as shown in Figure 16 as far to the rear of the Pelican® Case as practical, and centered between the left and right sides of the case. Be sure the battery sits flat on the bottom of the case.

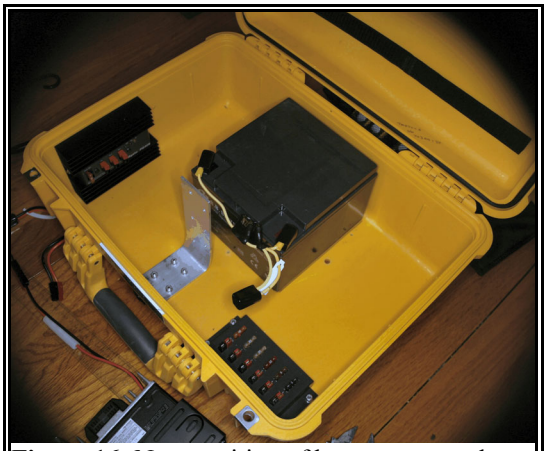


Figure 16: Note position of battery centered between the sides and as far to the back as practical. Battery is shown with fuses and connectors already attached.

4.2 Use a fine-tip marker to mark the footprint of the battery in the case.

4.3 The battery will require **three** retainer blocks to prevent sliding about in the case. Start by cutting three 1" long pieces of the 1-1/4" x ½" aluminum stock.

4.4 Lay each retainer block flat and mark the approximate center of each. Drill each block through with a #29 bit then tap each with an 8-32 tapered tap. Be careful to lubricate the tap and clear chips to insure a clean thread.

4.5 Examine each block for sharp edges. Round off all edges and remove any protruding burrs. Clean each block thoroughly to remove debris and oils.

4.6 Place a block on the right and left sides of the battery near the rear of the Pelican® Case, and one along the front edge. See Figure 17 for guidance. Using a smaller drill bit, such as a 5/64", mark the location of each block's tapped hole on the Pelican® Case. ***You may want to mark each block so they are placed at the proper fitting location after mounting holes are drilled!***

Figure 17: Aluminum blocks are shown in place with battery position outlined. Battery hold-down eyebolts are also shown in this view.

4.7 Remove the battery and set aside. Drill a 5/32" hole at each of the locations previously marked for the blocks. Insert an 8-32 x 3/4" machine screw with a flat washer thru the bottom of the Pelican® Case at each location drilled for the blocks. Add a drop of LockTite® to the ends of the machine screws then thread the machine

screws into the blocks. Tighten firmly, but be careful not to over-tighten – aluminum can strip easily. The LockTite® will prevent casual loosening of the machine screws.

4.8 The battery will need eyebolts to which its hold-down strap can be connected. These will be mounted using well-nuts giving the eyebolts a more flexible, rubber mount. Drill a 5/16" hole in the bottom of the Pelican® Case to the left and right of the battery outline, approximately centered along the length of the side of the battery (see Figure 17 again).

4.9 Thread a hex nut onto an eyebolt followed by a flat washer. Thread the eyebolt into a 5/32" well-nut until the eyebolt just starts to protrude from the open end. Be sure the flange of the well-nut is nearer the washer and hex nut (See Figure 18).

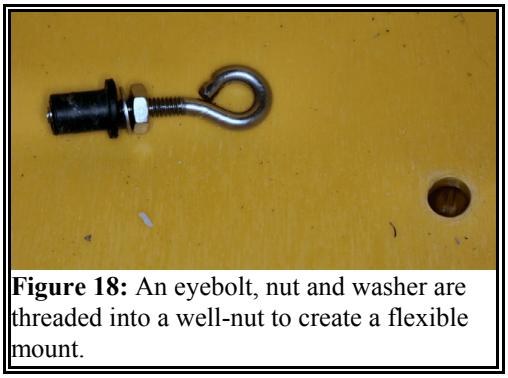


Figure 18: An eyebolt, nut and washer are threaded into a well-nut to create a flexible mount.

4.10 Slide the well-nut into the 5/16" hole. Without moving the eyebolt, use a box end wrench to tighten the hex nut against the well-nut's flange. As the hex nut is tightened, the well-nut will expand and the flange will spread a bit. Repeat for the other eyebolt.

4.11 Place the battery into the case with the terminals toward the front of the case. Attach a urethane hold-down to the eyebolts to secure the battery into the case.

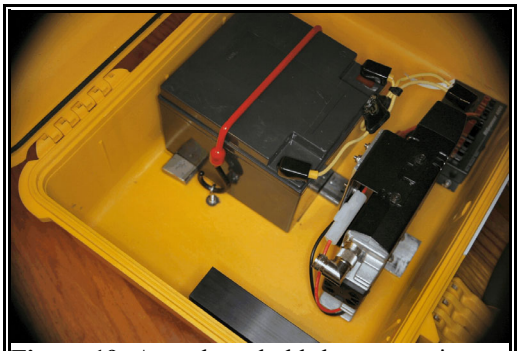


Figure 19: A urethane hold-down strap is used to secure the battery to the Pelican® Case.

Congratulations! You should now have the radio, battery, charge controller and power distribution panel installed.

Now is a good time to check the Pelican® Case to be sure the lid closes without interference. Be sure the lid closes securely and all latches can be locked down.

Once you are satisfied with the installation so far, move on to the next section to complete the necessary electrical wiring for the battery and accessories.

Wiring Power Circuit

The battery is wired with fused connections on both terminals and PowerPole® connectors to allow the battery to be disconnected when not in use. This insures the battery is not drained by transient current leaks while in storage.

5.1 If the ATC fuse holders are supplied with a looped wire, cut the wire at about mid-point so connectors can be installed.

5.2 Fabricate a terminal cap for each battery terminal from ½" square x 1" deep vinyl caps. Note in Figure 20 how the caps are used to cover the battery terminals. Simply cut a section from the side of the cap approximately ½" sqare near the closed end of the cap. The open end of the cap is then slid over the end of the wire and the wire end fed thru the opening that you cut out.

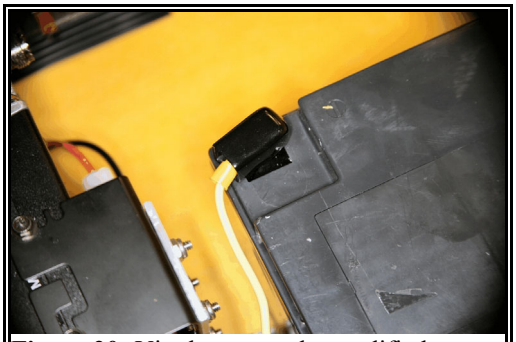


Figure 20: Vinyl caps can be modified as terminal caps for the battery.

5.3 Slide the fabricated battery cap (vinyl cap) over one end of the fuse holder harness. Attach a ring terminal to the wire and crimp securely. Repeat for one end of the other fuse holder harness.

5.4 The opposite ends of the fuse holder harnesses can now be fitted with Anderson PowerPole connectors®. **You may wish to attach a label to the PowerPole® end of these wires noting this harness is a "battery disconnect." Some labels must be attached before attaching the PowerPole® connectors.**

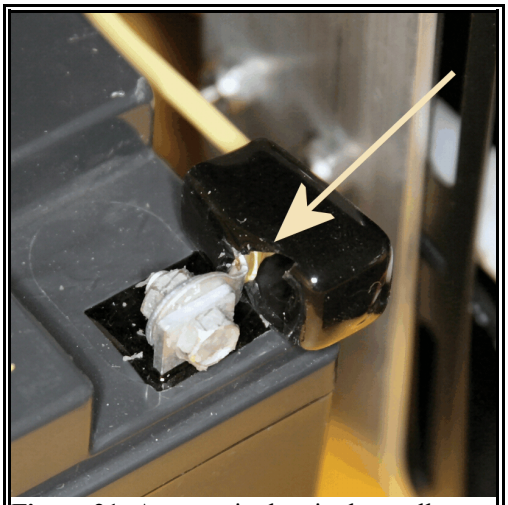


Figure 21: A cutout in the vinyl cap allows the wire to be passed thru and attached to the battery. The cap can then be slid forward and pushed over the terminal.

5.5 Be sure the fuses are removed from the fuse holder harness. Attach the ring terminal leading from the *red* PowerPole® block to the positive (+) battery terminal post. Tighten securely. Attach the wire leading from the *black* PowerPole® block to the negative (-) battery terminal.

5.6 **Double-check that the red PowerPole® block is connected via the fuse holder harness to the positive (+) terminal of the battery and the black PowerPole® block is connected to the negative (-) terminal. If not connected correctly the radio and/or accessories can be permanently damaged**.

5.7 Note how the fuse holder assemblies form a wiring harness and are routed on the battery. Use cable ties to hold wires in place.

5.8 Cover the Anderson PowerPole® connector with another vinyl cap to preclude unintentional shorting of the connector.

5.9 Cut a 6" piece of red and black "zip" wire. Attach a PowerPole® connector (red & white in proper orientation) to each end of the 6" wire. **You may wish to label this assembly as a battery disconnect. Some labels require that you attach the label before attaching the PowerPole® connectors.**

5.10 Plug one end of the 6" wire assembly into the 40A fused port on the RigRunner®. Cap the other end with a vinyl cap.

5.11 You may now insert ATC fuses into the fuse harness on the battery. Use 30A fuses.

Figure 22: The fuse holders form the battery disconnect harness. The harness wires are routed and held in place with cable ties. The PowerPole® connector is covered by a protective vinyl cap.

5.12 A wire is needed to connect the charge controller to the power distribution block. Cut an 18" to 20" long piece of red/black 12ga "zip" wire and attach a set of PowerPole® connectors to each end.

5.13 Connect one end of the 18" wire to a 25A port on the RigRunner® power distribution panel. Connect the other end to the "battery" port on the Super PWRgate® charge controller. Route the wire between the radio and its mounting bracket to offer some protection from damage.

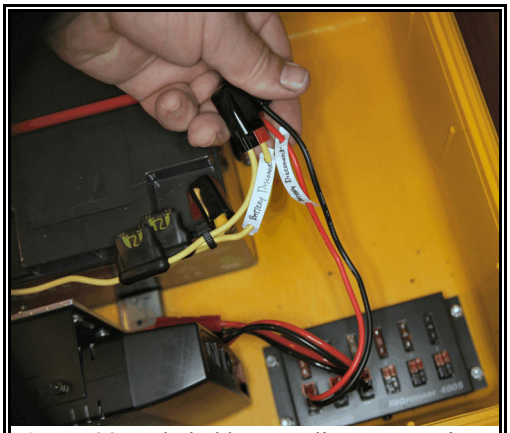


Figure 23: Labeled battery disconnect wires help avoid confusion. RigRunner® (bottom right) is shown with the radio, charge controller and battery wires connected.

5.14 Fabricate a power source feed line using about five feet of 12ga "zip" wire fitted with PowerPole® connector sets. Connect one end of the line to the Super PWRgate® Power Source (PS) port. Cap the other end with a vinyl cap and wrap the wire for storage.

5.15 You may use the remaining zip wire to make any necessary wire extensions or adapters for your particular purpose.

Wiring Accessories

Accessories used in this kit will depend upon the uses you intend. The most common accessory is a GPS receiver. You may wish to add a headset (recommended and included in the parts list).

Most accessories, including the headset, have standard connectors, such as RJ-45 or RJ-11 (these look like telephone connectors), mono or stereo phono connectors (such as for speaker connections used by the headset), or similar ready-to-use assemblies. Consult the manufacturer's instructions for connecting these items.

A notable exception to the ready-to-use connectors is the GPS. GPS units come in a variety of forms, but they have certain common characteristics:

- All will have three wires to carry data to and from the GPS. If using a GPS receiver that has no display (such as the Garmin GPS-18 "puck"), it may require only two wires for data plus one additional wire for power. One wire sends data to the radio, one carries data from the radio to the GPS, and the third wire is a ground.

  No matter which GPS you use, it will be necessary to fabricate your own connector between the GPS and radio for data. Even ready-made connectors are generally too short to be useful for use with this kit.

  The Kenwood® radio is supplied with a "pigtail" that can be fitted with a connector. One end of the pigtail is already fitted with a stereo plug that connects to the radio's GPS port. The other end has bare wires. Similarly, most GPS manufacturers either provide a data cable with a DB-9 connector on one end and usually a proprietary connector at the GPS end. Some offer pigtail versions of the proprietary connector at additional cost.

  In either case, you will need to consult the manufacturer's data as to which wires represent data-in, data-out, and ground wires. An elegant solution is to fit the ends of a radio and GPS data harness with an in-line 1/8" stereo plug/receptacle so they can be connected. Just keep in mind that the "data-in" wire on the GPS will be the "data-out" wire on the radio (and vice-versa), so you will need to wire the connectors accordingly. Be sure to solder the wires carefully – these cannot be simply crimped as they are very small and there is no strong mechanical connection inside the connectors.

- All GPS units require power. You *can* use batteries, but these can become problematic in an extended use situation. The GPS can be powered from your radio kit with little drain on the power system ***Do not connect the GPS power wires directly to the 12 volt battery – you will destroy the GPS!!!*** All GPS units (at least those of recent vintage) require a 5 volt power source. Magellan units often have the voltage step-down circuit in an in-line "box," so the wiring beyond the box can be attached directly to a 12 volt power source; this is convenient allowing PowerPoles® to be connected to the wire and plugged directly into the RigRunner®. This also makes extending the power line very convenient.

Many GPS units incorporate the voltage step-down circuitry into the cigarette lighter adapter plug. With this setup, the plug must be left attached (unless you want to re-build the circuit) and an in-line cigarette lighter socket adapter used to connect to the RigRunner®. These are readily available and included on the parts list.

You may wish to make a variety of power connectors to connect the kit's power wire to a cigarette lighter socket, power supply, or even alligator clamps. Such adapters need only a short length of wire with PowerPoles® at one end, and the desired adapter at the other end. The short adapter can then be connected to the longer power cord in the kit to supply supplemental or charge voltage to the charge controller.

Storage Compartments

Two foam "pick and pluck" blocks provide storage for GPS, some adapters, microphone, and radio control head. In addition, a "lid organizer" provides room for additional adapters, paperwork, and other working utensils (pens, pencils, etc).

6.1 Install the lid organizer following the manufacturer's directions. Be sure to thoroughly clean the lid's internal surface to insure a strong bond for the supplied Velcro® tape.

6.2 You will note that you will have substantially more foam than needed. Using Figure 24 as a guide, cut one block of foam to fit snugly on the left side of the battery and between the rearmost end of the charge controller and back of the case. You will then need to "pick and pluck" the foam to accommodate the GPS unit (if used) and the microphone.

Do not allow the foam to surround the charge controller or encompass the radio as this will create excessive heat when in use.

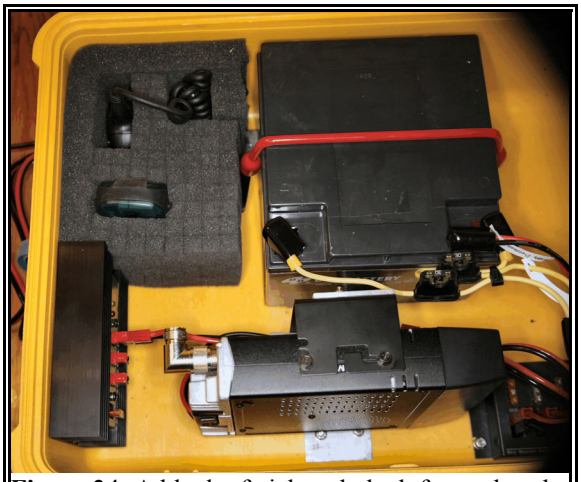


Figure 24: A block of pick and pluck foam placed to the left of the battery provides storage for the microphone (rear portion of foam) and GPS unit (foreground)

6.3 Cut a second block of foam to fit on the right side of the battery (see figure 25). This second block of foam should fit snugly between the battery and right sidewall of the case, and extend forward to a point approximately even with the rearmost portion of the RigRunner® power distribution panel.

6.4 Pluck foam to allow the control head to sit approximately flush with the top of the foam and oriented to the right of the case. Foam can be pulled apart a bit to allow the foot of the control head to slide down into the block. In this orientation the radio head can be "read" when sitting in the seat of a vehicle to the right of the vehicle operator.

Figure 25: Complete kit with headset and power cord stored. Foam on right side of case holds adapter (rear) and radio control head (front).

Pluck an additional hole to the rear of the control head to hold the cigarette lighter plug and/or socket adapter.

Finishing Touches

Congratulations! You're almost done. Here is a list of final tasks to finish your Portable Mobile Kit. Where appropriate, consult the radio, GPS, or other manufacturer's instructions for details.

7.1 Add a UHF right-angle adapter to the radio antenna connection.

7.2 Connect an antenna or dummy load to the radio before attempting to operate or program its settings. ***The Kenwood TM-D700A radio may transmit when turned on, depending on how it may have been used or programmed. Transmitting without an antenna or dummy load can seriously damage the radio.*** Connect the battery to the power distribution panel by connecting the PowerPole® connectors at the battery disconnect. You should now be able to power up the radio. If the radio does not power up, be sure all power connections are connected and the radio control head is connected to the radio.

7.3 After verifying the radio can power up, turn the radio off. Connect the power supply wire to a radio power supply or other 12 volt source. ***The battery will charge best if powered from a 14.0 to 14.5 volt source.*** You will notice the charge controller's red light will illuminate. Leave the power source attached until the yellow light illuminates – the battery is then fully charged.

7.4 Program the radio and GPS. You will find the five radio "presets" useful for programming different radio modes, such as APRS, no APRS, SSTV, etc. Each preset can even be used to send a different symbol or message on APRS, if desired. **Note: When programming the APRS *Path*, don't use "Relay" or similar antiquated terms. Special paths may be used for special events; but, for most general mobile uses, a path of "Wide1-1, Wide2-1" works exceptionally well and avoids excessive QRM.** If you are unsure about how to program your radio or GPS, there are a myriad of good websites and Elmers available to assist you!

7.5 Stock your kit with necessary paperwork and other supplies

7.6 Order a name label from Pelican®. An order form should have been included with the case; if not, contact Pelican in Torrance, CA – they are very helpful!

7.7 Program your Pelican® lock and use it! You have a marvelous radio system, so protect it from pilfering hands!!

7.8 Always disconnect the battery before storing your radio kit. This will prevent transient current drain and accidental discharging of the battery. The battery can be damaged if completely discharged – see battery literature for similar warnings.

7.8 Pat yourself on the back and enjoy the Ham Radio hobby!

Sources for Parts

Amazon.com	www.amazon.com
Cable Xperts	www.cablexperts.com
Ham Radio Outlet	www.hamradio.com
Home Depot	www.homedepot.com
McMaster-Carr	www.mcmaster.com
Orvac Electronics	Fullerton, CA
PowerWerx	www.powerwerx.com
Radio Shack	Lake Elsinore, CA
Rocky Mountain Tool Company	www.pelicanproducts/us
West Mountain Radio	www.westmountainradio.com

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