



**samlex**power

**Inverter  
Installation Kit**

DC-1000-KIT  
DC-2000-KIT  
DC-2500-KIT  
DC-3500-KIT

**Owner's  
Manual**

Please read this  
manual before  
operating your  
Inverter  
Installation Kit

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**IMPORTANT SAFETY PRECAUTIONS****Installation and wiring compliance**

Installation and wiring must comply with the local and National Electrical Codes and must be done by a certified electrician.

**Preventing fire and explosion hazards**

Working with the inverter may produce arcs or sparks. Thus, the inverter should not be used in areas where there are inflammable materials or gases requiring ignition protected equipment.

These areas may include spaces containing gasoline powered machinery, fuel tanks, battery compartments.

**Precautions when working with batteries**

- Batteries contain very corrosive diluted sulphuric acid as electrolyte. Precautions should be taken to prevent contact with skin, eyes or clothing.
- Batteries generate hydrogen and oxygen during charging resulting in evolution of explosive gas mixture. Care should be taken to ventilate the battery area and follow the battery manufacturer's recommendations.
- Never smoke or allow a spark or flame near the batteries.
- Use caution to reduce the risk of dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion.
- Remove metal items like rings, bracelets and watches when working with batteries. The batteries can produce a short circuit current high enough to weld a ring or the like to metal and thus, cause a severe burn.
- If you need to remove a battery, always remove the ground terminal from the battery first.

Make sure that all the accessories are off so that you do not cause a spark.

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## GENERAL

The Inverter Installation Kit consists of two cables and fuse arrangement for connecting the battery to the inverter in a safe manner.

### Fuse Protection in the Battery Circuit

A battery is an unlimited source of current. Under short circuit conditions, a battery can supply thousands of Amperes of current. If there is a short circuit along the length of the cables that connect the battery to the inverter, thousands of Amperes of current can flow from the battery to the point of shorting and that section of the cable will overheat, the insulation will melt and the cable will ultimately break. This interruption of very high current will generate a hazardous, high temperature, high energy arc with accompanying high pressure wave that may cause fire, damage nearby objects and cause injury. To prevent occurrence of hazardous conditions under short circuit conditions, an appropriate fuse should be used in the battery circuit that has the required current interrupting capacity (Termed AIC – Ampere Interrupting Capacity). For this purpose, fuse with AIC rating of 10000 A at 14 V / 5000 A at 32 V, or higher should be used.

The following types of fuses are included in the Kit:

- 400 A, 125 VDC, Model JLLN 400 manufactured by Littelfuse
  - AIC of 20,000 A
  - UL Class “T” rated, UL listed as per UL Standard 248-15
- Marine Rated Battery Fuse (MRBF Series) made by Cooper Bussmann
  - Voltage rating of max 58 VDC
  - Current ratings of 100 A (MRBF-100), 200 A (MRBF-200) and 300 A (MRBF-300)
  - AIC of 10000 A at 14VDC, 5000 A at 32 VDC and 2000 A at 58 VDC
  - Ignition protected as per SAE J1171
  - Weather Proof (IP66)

**Caution!** The fuse should be placed as close to the battery Positive terminal as possible, preferably within 7” of the battery terminal.

### Sizing of Cables to Reduce Voltage Drop, Heating and Power Loss

The flow of electric current in a conductor is opposed by the resistance of the conductor. The resistance of the conductor increases linearly as the length of the conductor is increased and decreases as the cross-section (thickness) of the conductor is increased. Flow of current through the resistance of the conductor produces voltage drop and power loss due to heating. The voltage drop due to resistance of the conductor increases linearly as the current increases.

The power loss because of heating due to resistance of the conductor increases by the square of the increase in the current - e.g. if the current increases 2 times, the heating / power loss increases 4 times. Thus, it is desirable that thicker and shorter conductors be used to reduce the undesirable effects of voltage drop, heating and power loss.

The size (thickness / cross-section) of the conductors is designated by AWG (American Wire Gauge). Please note that a smaller AWG # denotes a thicker size of the conductor up to AWG #1. Wires thicker than AWG #1 are designated AWG 1/0, AWG 2/0, AWG 3/0 and so on. In this case, increasing AWG # X/0 denotes thicker wire.

The DC input circuit of an inverter is required to handle very large DC currents and hence, the size of the cables and connectors from the battery to the inverter should be properly sized to ensure minimum voltage drop, minimum heating and minimum power loss between the battery and the inverter. Thinner cables and loose connections will result in larger voltage drop, increased loss of power and consequent reduction in efficiency, poor inverter performance and will produce abnormal heating that may lead to risk of insulation melt down and fire.

For safety against overheating and consequent deterioration of the insulation and possibility of fire, Table 310.17 of the National Electrical Code (NEC) specifies the maximum current carrying capacity (Ampacity) of various types of cables for installation in free air. Apart from the consideration of safety as explained above, reducing the voltage drop as a result of longer distance of the cable between the battery and the inverter is also important for improving the efficiency of the DC input side of the inverter system. Longer distance between the battery and the cable will require thicker cable. Normally, the thickness of the cable should be such that the voltage drop from the battery terminal to the inverter is as low as possible, preferably less than 5%.

Inverters are designed to operate normally within a specified lower and upper input voltage range. The lower operating voltage limit of inverters is normally 10 V, 20 V and 40 V for 12 V, 24 V and 48 V battery systems respectively. When this limiting voltage is seen at the input terminal of the inverter, it will shut down due to low input voltage protection. Thus, if there is excessive voltage drop in the input connection between the battery and the inverter due to thinner cable / longer distance / larger current, the inverter will shut down even if the battery is fully charged.

As the distance between the battery and the inverter may vary depending upon the user requirement, 10 ft length of cable is provided in the Inverter Installation Kits for convenience. The specifications of the Kits include the **approximate voltage drops for distances of 3, 6 and 10 ft. between the battery and the inverter.**

Please note that for the purposes of the calculation of the voltage drop based on the resistance per unit length, the length of the cable has been taken as twice the distance between the battery and the inverter to include the overall length of the Positive and Negative cables e.g. if the distance between the battery and the inverter is taken as 3 ft, the length of the cable has been taken as 6 ft for calculation purposes.

Please ensure that the distance between the battery and the inverter is kept as short as possible to limit the voltage drop to less than 5%. **Cut off the extra length of cable if the distance between the battery and the inverter is less than 10 ft.**

# 2

## GENERAL

### Characteristics of the Cable Provided with the Kits

We have provided the highest quality, industrial and transportation grade, flexible cable with the Kits. The cable is UL and CSA listed and is also classified as Type "DLO" or Diesel Locomotive. DLO Cable was originally developed for wiring diesel-electric locomotives, its applications now range far beyond that specific use. These cables are designed for use as motor and power leads where flexibility and portability are required. The inherent nature of the design makes the cables suitable for battery cables for automotive and renewable energy applications. Key features of the cable provided with the Kits are as follows:

- 2000 V rating under DLO, 1000 V under CSA Type R-90 and 600 V under UL Type RHH / RHW.
- Very wide operating temperature of -40 C to 90 C.
- High strand count, annealed, and tinned copper conductors for high flexibility. The tinned copper conductors provide additional protection against corrosion.
- Has three layers of insulation / protection – Tape separator, inner EPDM rubber (Ethylene Propylene Diene Monomer) insulation and outer CPE (Chloro Poly Ethylene) jacket. This provides the high 2000 V insulation and resistance to abrasion, oils, acids and heat.
- UL listed to UL Standard UL44 (Thermo set Insulated Wires and Cables) – Type RHH / RHW.
- CSA listed to CSA Standard C22.2 No. 38 (Thermoplastic Insulated Wires and Cables) Type R-90.

### Characteristics of Fuses and Fuse Holders Provided with the Kits

DC-1000-KIT, DC-2000-KIT and DC-2500-KIT are provided with 100A, 200A and 300A fuses respectively (Fig. 3.3). These fuses are Marine Rated Battery Fuses (MRBF-XXX Series) made by Cooper Bussmann. The MRBF Fuse provides easy, practical weatherproof and economical circuit protection in tight space constraints. The fuse is installed between the Positive Battery Terminal Stud and the Positive Battery Cable with the help of a special Clamping Fixture. The Clamping Fixture consists of the following:

- Clamping Fixture Bar (CFBAR), Fig. 3.4. Has a base plate for connecting to the battery stud ( with a hole to accommodate battery stud of up to stud size 3/8" / M10) and a stud (size M-8) for connecting the fuse MRBF and the battery cable.
- Stainless Steel nut (thread size M8, will require 1/2" or 13 mm wrench for tightening), Flat Washer and Spring Washer, Fig. 3.5.
- An Insulating Cap, Fig. 3.6. It slides over the base plate of CFBAR and is used to insulate the exposed stud and the nut of the CFBAR.

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## INSTALLATION INSTRUCTIONS

### Tools Required

- ½" Wrench
- Wire Cutting Tool and Wire Stripper (for DC-3500-KIT)
- 5/16" Allen Key (for Samlex DC-3500-KIT)
- Appropriate screw driver or wrench depending on the DC input terminal of your inverter.

### DC-1000-KIT, DC-2000-KIT, DC-2500-KIT

- A. Identify the Positive & Negative cables:  
Positive cable: Terminal lugs at each end are covered with red heat shrink as in Fig. 3.1.  
Negative cable: Terminal lugs at each end are covered with black heat shrink as in Fig. 3.2.

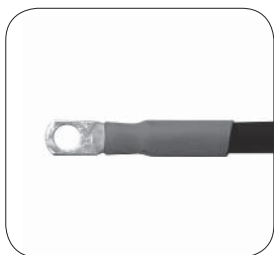


Fig. 3.1. Positive cable end

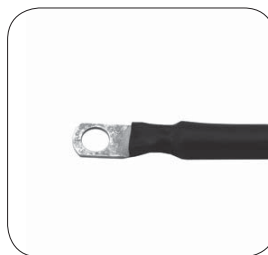


Fig. 3.2. Negative Cable end

- B. Connect one end of the positive cable to the positive terminal of the inverter usually red in color.  
C. Identify the components of the Fuse Assembly. Refer to Figures 3.3 to 3.6.



Fig. 3.3. Marine Rated Battery Fuse (MRBF)



Fig. 3.4. Clamping Fixture Bar (CFBAR)

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## INSTALLATION INSTRUCTIONS



Fig. 3.5. M-8 Nut, Flat Washer and Spring Washer



Fig. 3.6. Insulating cap

- D. Insert the fuse MRBF into stud provided on the CFBAR. See Fig.3.7.



Fig. 3.7. Fuse MRBF inserted into the stud on CFBAR

- E. Next insert the cable lug (crimped to the free end of the Positive cable) into the CFBAR stud so that it sits over the fuse MRBF. See Fig. 3.8.
- F. Next insert the flat washer, the spring washer and the M-8 nut on to the CFBAR stud and tighten the nut with a 1/2" wrench. See Fig. 3.9.

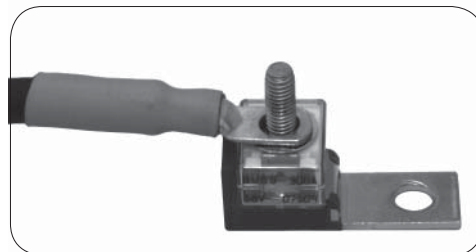


Fig. 3.8.



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## INSTALLATION INSTRUCTIONS



Fig. 3.9. Fuse MRBF and Positive cable fixed to the CFBAR

- G. Slide the Insulating Cap into the rectangular strip of the CFBAR and then insert the hood portion into the exposed portion of the stud of the CFBAR. See Figures 3.10 and 3.11.



Fig. 3.10. Insulating Cap slid over the rectangular portion of CFBAR



Fig. 3.11. CFBAR with fitted fuse MRBF

- H. Bolt the CFBAR to the Positive terminal stud of the Battery usually denoted by the '+' sign as shown in Fig. 3.12.

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## INSTALLATION INSTRUCTIONS



Fig. 3.12. Installed arrangement

- I. Connect one end of the Negative cable to the Negative terminal of the inverter usually Black in Color
- J. Connect the other end of the Negative cable to the battery Negative terminal stud usually denoted by the '-' sign.
- K. Please ensure that all the connections are tight.

### DC-3500-KIT

- A. Identify the Positive & Negative Cables:  
Positive cable: Terminal lugs at each end are covered with Red heat shrink as in Fig. 3.13.  
Negative cable: terminal lugs at each end are covered with Black heat shrink as in Fig. 3.14.

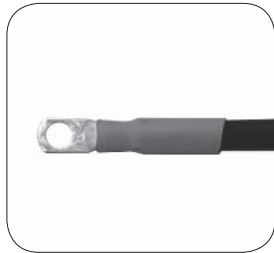


Fig. 3.13. Positive cable end



Fig. 3.14. Negative cable end

- B. The Class T Fuse Assembly (Fig. 3.15) consists of the following components assembled as one unit:

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## INSTALLATION INSTRUCTIONS

- **Class T Fuse** – Fig. 3.16: This is rated at 125 V, 400 A. It is UL Class “T” rated and UL listed as per UL Standard 248-15. It has AIC (Ampere Interrupting Capacity) of 20,000
- **Fuse Holder** – Fig. 3.17: This consists of a fiberglass insulated base with studs / bolts (5/16” diameter, 18 Threads Per Inch) and nut (requires ½” size wrench) for holding the fuse. The two terminals for cable entry are designed for #4/0 cable (Hole size is 0.6” / 15.5 mm). Hexagonal headed socket screws ( requires Allen Key size 5/16”) are used to clamp the cable ends.
- **Snap on cover** : Is made of clear polycarbonate and provides touch safety.

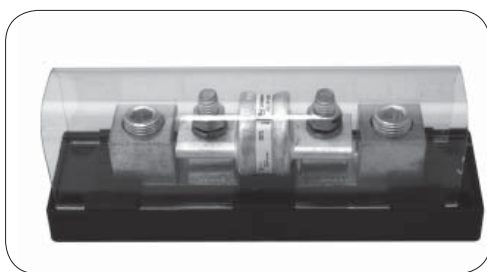


Fig. 3.15. Class “T” Fuse Assembly



Fig. 3.16. Class “T” Fuse

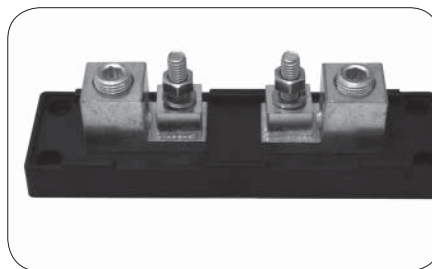


Fig. 3.17. Fuse Holder

- C. The fuse should normally be installed within 7 inches of the Positive Terminal of the battery. Cut the Positive cable based on the desired location of the Class “T” Fuse Assembly using an appropriate wire cutter. Strip 1.05” of the insulation at the cut ends using a suitable wire stripper. Please ensure that the innermost layer of the tape separator is completely removed. See Fig. 3.18.

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## INSTALLATION INSTRUCTIONS



Fig. 3.18. Battery end of Positive cable cut and prepared for inserting into the Class "T" Fuse Assembly

- D. Insert the bare ends of the cable into the hole for the cable entry and tighten the screw down terminals firmly. Fix the clear polycarbonate snap on cover for touch safety. See Fig. 3.19.

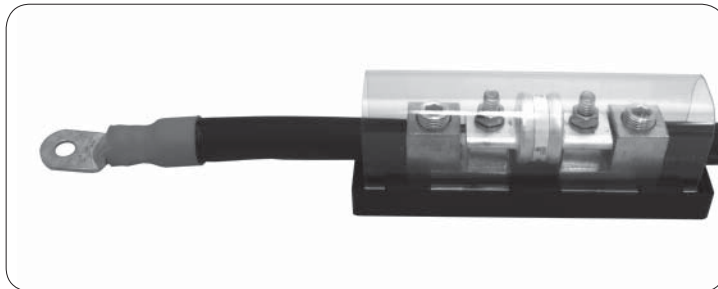


Fig. 3.19. Fitted Class "T" Fuse Assembly

**NOTE:** The diameter of the hole in the screw down terminal for the cable entry is 0.6" and is just big enough for the diameter of the bare AWG #4/0 stranded cable. It is likely that the ends of the strands towards the cut face of the cable get bent / frayed / spread outwards during cutting and thereby, the diameter of the cable near the cut face may increase slightly. Also, the strands towards the cut face will be required to be pressed together closely to reduce the diameter near the cut face to less than 0.6". To help keep the strands towards the cut face pressed together for easier entry into the terminal for cable entry, tightly warp insulation tape around 0.2" to 0.3" from the cut face. If required, straighten and compress the bent / frayed / spread out ends to reduce the diameter to the minimum. Now insert the leading 0.2" to 0.3" bare portion into the hole. Once this leading portion has entered the hole, remove the insulating tape and insert the bare end of the cable fully.

**Please ensure that all the strands get inserted into the hole and that no strand(s) is left forced out of the hole.**

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## INSTALLATION INSTRUCTIONS

- E. Connect the terminal lug of the shorter section of the cut Positive cable to the Positive terminal of the Battery usually denoted by the '+' sign. See Fig. 3.20.

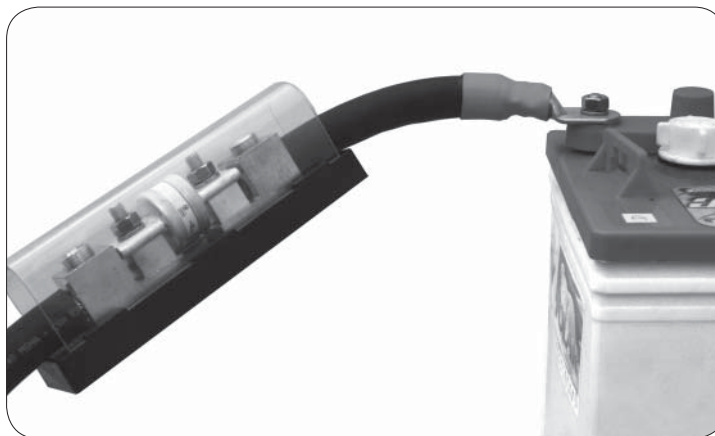


Fig. 3.20. Positive cable connection to the battery – with Class "T" Fuse Assembly

- F. Connect the terminal lug of the longer section of the cut Positive cable to the positive terminal of the inverter usually Red in color.
- G. Connect one end of the Negative cable to the Negative terminal of the inverter usually Black in color.
- H. Connect the other end of the Negative cable to the battery Negative terminal usually denoted by the '-' sign. When the lug of the Negative cable first makes a contact with the Negative terminal of the battery, a spark may be observed. This is normal. This spark occurs because of the initial charging current of the input side capacitors inside the inverter.
- I. Ensure that all the connections are tight.

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## SPECIFICATIONS

Model		DC-1000-KIT	DC-2000-KIT	DC-2500-KIT	DC-3500-KIT
Cable Gauge		AWG 4	AWG 2	AWG 2/0	AWG 4/0
Cable Length		10 feet	10 feet	10 feet	10 feet
Voltage drop 12 V system	3 ft length	0.8 %	2.5 %	1.2 %	1.0 %
	6 ft length	1.6 %	5.1 %	2.3 %	2.0 %
	10 ft length	2.7 %	8.4 %	3.9 %	3.3 %
24 V system	3 ft length	0.4 %	1.3 %	0.6 %	0.5 %
	6 ft length	0.8 %	2.5 %	1.2 %	1.0 %
	10 ft length	1.3 %	4.2 %	1.9 %	1.7 %
Fuse Size		100 Amp*	200 Amp*	300 Amp*	400 Amp*
Included hardware		6 Nos. 11.5" Black Tie Wraps 6 Nos. 1/2" Cable clamps 6 Nos. #8 x 3/4" Pan head screws	6 Nos. 11.5" Black Tie Wraps 6 Nos. 1/2" Cable clamps 6 Nos. #8 x 3/4" Pan head screws	6 Nos. 11.5" Black Tie Wraps 6 Nos. 3/4" Cable clamps 6 Nos. #8 x 3/4" Pan head screws	6 Nos. 11.5" Black Tie Wraps 6 Nos. 1" Cable clamps 6 Nos. #8 x 3/4" Pan head screws
Inverters		12 Volt 600-1000 Watt	12 Volt 1000-2000 Watt	12 Volt 2000-2500 Watt	12 Volt 2500-3500 Watt
		24 Volt 600-2000 Watt	24 Volt 2000-3000 Watt	24 Volt 3000-4000 Watt	24 Volt 4000-6000 Watt

### NOTES

- \* The current ratings of the fuses are less than the ampacity (maximum current carrying capacity) of the cables used based on NEC Table 310.17 for free air.
- For the purposes of the calculation of the voltage drop based on the resistance per unit length, the length of the cable has been taken as twice the distance between the battery and the inverter to include the overall length of the Positive and Negative cables e.g. if the distance between the battery and the inverter is taken as 3 ft, the length of the cable has been taken as 6 ft for calculation purposes.
- Specifications are liable to change without notice.

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## WARRANTY

### **2 YEAR Limited Warranty**

The Samlex Inverter Installation Kits manufactured by Samlex America, Inc. (the "Warrantor" ) are warranted to be free from defects in workmanship and materials under normal use and service. This warranty is in effect for 2 years from the date of purchase by the user (the "Purchaser")

For a warranty claim, the Purchaser should contact the place of purchase to obtain a Return Authorization Number.

The defective part or unit should be returned at the Purchaser's expense to the authorized location. A written statement describing the nature of the defect, the date of purchase, the place of purchase, and the Purchaser's name, address and telephone number should also be included.

If upon the Warrantor's examination, the defect proves to be the result of defective material or workmanship, the equipment will be repaired or replaced at the Warrantor's option without charge and returned to the Purchaser at the Warrantor's expense.

No refund of the purchase price will be granted to the Purchaser unless the Warrantor is unable to remedy the defect after having a reasonable number of opportunities to do so.

Warranty service shall be performed only by the Warrantor. Any attempt to remedy the defect by anyone other than the Warrantor shall render this warranty void.

There shall be no warranty for defects or damages caused by faulty installation or hook-up, abuse or misuse of the equipment including exposure to excessive heat, salt or fresh water spray, or water immersion.

No other express warranty is hereby given and there are no warranties which extend beyond those described herein. This warranty is expressly in lieu of any other expressed or implied warranties, including any implied warranty of merchantability, fitness for the ordinary purposes for which such goods are used, or fitness for a particular purpose, or any other obligations on the part of the Warrantor or its employees and representatives.

### **DISCLAIMER OF LIABILITY**

There shall be no responsibility or liability whatsoever on the part of the Warrantor or its employees and representatives for injury to any persons, or damage to person or persons, or damage to property, or loss of income or profit, or any other consequential or resulting damage which may be claimed to have been incurred through the use or sale of the equipment, including any possible failure of malfunction of the equipment, or part thereof. The Warrantor assumes no liability for incidental or consequential damages of any kind.

### **Samlex America Inc. (the "Warrantor")**

110-17 Fawcett Road  
Coquitlam, B.C., Canada V3K 6V2  
(604) 525-3836



**samlex**power

110-17 Fawcett Rd  
Coquitlam, B.C.  
Canada V3K 6V2

T: 604 525 3836  
F: 604 525 5221

e-mail: [samlex@samlexamerica.com](mailto:samlex@samlexamerica.com)  
website: [www.samlexamerica.com](http://www.samlexamerica.com)