



OWNER'S MANUAL

A810 Solar Obstruction Lighting System

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1.0 System Overview

1.1 System Description

The A810 is a FAA and ICAO compliant modular, stand-alone, self-contained solar-powered obstruction warning lighting system for towers and other structures. During the daytime, the solar module charges the battery. At dusk, the photocell automatically activates the obstruction luminaire until dawn. Dusk-to-dawn light control is activated by ambient solar lighting levels (Turn On at 35 foot candles / Turn Off at 52 foot candles) via FAA-approved photocell.

The system is designed to require very low maintenance for long periods, while operating in harsh environments. The system includes the following features:

- ◆ steady burning red light luminaire marking fixed obstructions to eliminate navigational hazards
- ◆ high-efficiency high-flux LED obstruction luminaire
- ◆ weather/corrosion resistant luminaire assembly and housing
- ◆ 32 cd brightness
- ◆ FAA certification AC 150/5345-43F
- ◆ ICAO certification Annex 14, Vol. 1, Low Intensity type B (32 cd)
- ◆ FAA-approved photocell
- ◆ minimum 5-year battery life

The A810 operates as follows:

1. Solar modules supply DC current to charge the deep cycle battery operating at 12 V.
2. Battery charging is regulated by the pre-installed and wired charge controller in the outdoor-rated battery and controller enclosure.
3. The A810 is powered by the energy stored in the battery. System design is based on monthly site climate data such that the average solar module output is greater than the average loading.

1.2 System Overview

Figure 1-1: System Layout shows an example of the typical system layout for the A810. All information for connecting the system is provided in *Appendix D: Wiring Diagrams*.

The A810 includes a red obstruction LED luminaire, which is L-810 FAA and ICAO-compliant; a solar module; a FAA-approved photocell; an enclosure, with charge controller and battery; as well as standard mounting hardware.

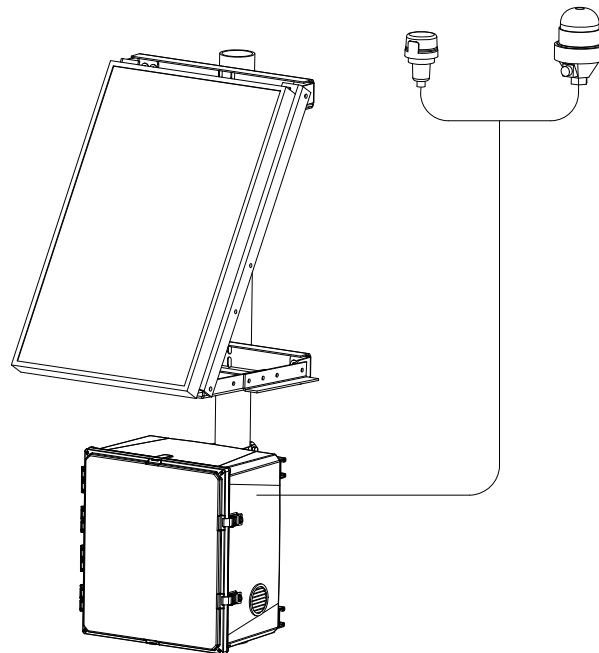


Figure 1-1: System Layout

Table 1-1: A810 part numbers lists the part numbers for the A810.

Table 1-1: A810 part numbers

Solar Module Size	Model Number	Mount	Solar Panel	Luminaire
20 W	A810-20-1-12 (58448)	58404	45446	58446
50 W	A810-50-1-12 (58447)	58410	44061	58446
80 W	A810-80-1-12 (58341)	58412	38809	58446

1.3 Components

The A810 package includes the following components:

- ◆ Rigid framed photovoltaic solar module
- ◆ Aluminum solar module mounting structure
- ◆ Polycarbonate Nema 4X enclosure
- ◆ Charge Controller
- ◆ Carmanah sealed deep cycle AGM battery
- ◆ Complete wiring kits for solar module and battery
- ◆ FAA-approved photocell
- ◆ FAA approved L-810 Luminaire

Customer supplied components:

- ◆ Wiring from the enclosure to the A810 luminaire/photocell, as per the requirements of the local electrical authority
- ◆ Mounting pole or attachment to a structure

1.4 Enclosure Dimensions

Table 1-2: Enclosure Dimensions lists the height, width, depth, and weight of the A810 enclosure.

Table 1-2: Enclosure Dimensions

	Height ¹	Width ¹ (front)	Depth ¹ (side)	Weight ² (bare)
Enclosure	19.00" (482.6 mm)	18.5" (469.9 mm)	11.25" (285.75 mm)	14 lb (6.35 kg)

¹ Outside dimensions including the enclosure and protrusions.

² The estimated weight of the bare enclosure, without control panel and cabling.

1.5 Battery Dimensions

Table 1-3: Battery Dimensions lists the height, width, depth, and weight of the EX-1050 battery for the A810.

Table 1-3: Battery Dimensions

Battery	Height	Width	Depth	Weight
EX-1050	9.25" (235 mm)	12.75" (324 mm)	6.75" (172 mm)	63 lb (28.6 kg)

2.0 Standards and Cautions for Installations

2.1 Standards

Installation and wiring must be in strict conformance with local building and electrical codes. Adherence to the National Electrical Code (NEC) or Canadian Electrical Code (CEC) is mandatory to comply with the UL, CSA, or any other certification markings. Non-adherence to code may void the warranty. Qualified, licensed professionals should perform all installation work.

NOTE

This owner's manual is provided to assist your certified installer. The use of this manual and the conditions or methods of installation, operation, use and maintenance of the equipment are beyond the control of Carmanah Technologies Corporation (Carmanah); therefore, Carmanah does not assume responsibility and expressly disclaims liability for loss, damage, or expense arising out of or any way connected with such installation, operation, use, or maintenance.

2.2 Cautions

1. Before lifting any heavy or bulky equipment, ensure that the load is secured so that moving parts do not shift and it can be lifted as far as needed without back strain or loss of grip. It is recommended that two or more persons be employed in performing the installation tasks.
2. The battery is shipped fully charged; therefore, care must be taken to avoid shorting out the positive and negative terminals of the battery.
3. Solar modules produce DC electricity when exposed to light and can produce an electrical shock or burn. Modules can be rendered inoperative by removing them from sunlight, or by fully covering their front surface with an opaque material.
4. Remove all metallic jewelry before performing electrical wiring or testing.
5. Circuit breakers should be turned off and fusing disconnected before installation and wiring until the system is ready for start-up.
6. Re-check all completed wiring for proper design voltage and polarity prior to energizing the system.

3.0 Tools and Materials

3.1 *Recommended Tools*

Carmanah does not supply tools with the A810. The following tools are recommended to complete the installation:

- ◆ 6" and 10" crescent wrenches
- ◆ Compass
- ◆ Digital voltmeter
- ◆ Level
- ◆ Marker
- ◆ Socket Set (Imperial)
- ◆ Tape measure
- ◆ #8 – #12 wire cutters
- ◆ Flat head screwdriver
- ◆ Phillips screwdriver
- ◆ Tongue and groove pliers
- ◆ Hammer
- ◆ Utility knife

3.2 *Additional Materials Required*

The following list of additional materials and hardware are required by the installer to complete the installation:

- ◆ foundations, masts, poles, etc., to support the solar module mounting structure and the battery and controller enclosure
- ◆ hardware to attach the solar module mounting structure and or the battery and control enclosure and A810 luminaire/photocell to the pole or other mounting structure. Standard mounting hardware for assembly to 4" pipe is provided by Carmanah, but additional hardware may be required
- ◆ wiring from the enclosure to the A810 luminaire/photocell
- ◆ ground rod and clamps

This is a general list and additional items may be required at specific sites.

4.0 Solar Array and Mounting Structure

4.1 Array Orientation

Full solar exposure is critical to the performance of the A810. Ensure that the solar module installation location has year-round, unrestricted sun exposure throughout the day. If required, the solar array may be attached remotely to the battery using an appropriately sized transmission cable. The bottom edge of the solar modules should be installed at a minimum height to clear growing vegetation and snow at the site.

NOTE

Shading even a small portion of the solar module will significantly reduce the output of the A810.

Solar modules should be installed facing the equator – within 10° of due south in northern latitudes and within 10° of due north in southern latitudes; see *Figure 4-1: Latitude (North America)* for a map of latitudes in North America. The optimum inclination angle varies depending on the latitude. Most arrays are installed at a fixed inclination angle. The inclination angle is the angle between the back of the solar module and the horizon; see *Figure 4-2: A810 Solar Module Inclination Angle*.

The module inclination angle is typically optimized for performance during the time of year with the lowest amount of solar activity. Use

Table 4-1: Inclination to determine the optimum inclination angle for your solar module. This table assumes the module will remain at a fixed inclination angle throughout the year and is, therefore, optimized for winter. For further information, or if seasonal adjustment of the module is desired, contact Carmanah.

Do not use inclination angles below 15° unless you are able to inspect and wash the solar modules frequently. At high latitudes where snow or ice build-up is an issue, the array should be installed at vertical or near vertical if winter performance is critical.



Figure 4-1: Latitude (North America)

Table 4-1: Inclination

Site Latitude	Near-Optimum Solar Module Inclination Angle
0 – 9°	15°
10 – 20°	Latitude + 5°
21 – 45°	Latitude + 10°
45 – 55°	Latitude + 15°

A810 system installed at a latitude greater than 55° are subject to special design considerations due to lower levels of solar radiation during the winter months.

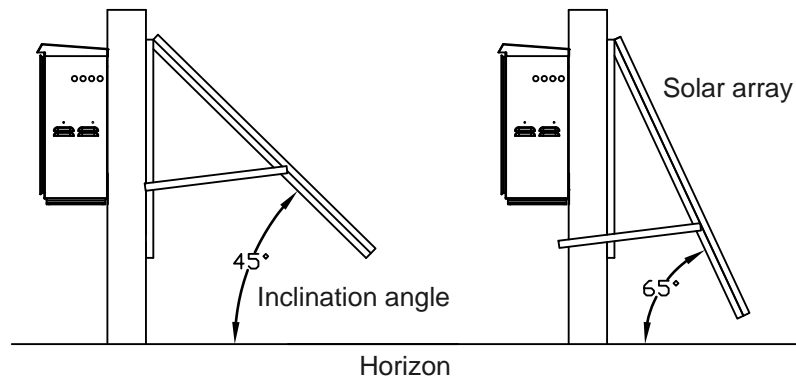


Figure 4-2: A810 Solar Module Inclination Angle

4.2 Solar Module Assembly and Mounting

A solar module mounting structure is provided for attaching the solar module to an appropriate support structure or foundation. Instructions for assembling the mount and attaching the solar module are provided in the mounting structure package.

If heavy lifting equipment is available, the module and mounting structure may be pre-assembled and wired on the ground and lifted into place.

The module and enclosure mounting kits are both designed to a standard 4" pipe (outer diameter 4.5" / 114 mm), having a wall thickness which is at least schedule 40 (0.237" / 6 mm). A short section of pipe (not supplied) can be used to mount the module and enclosure. The pipe can be attached to the obstruction structure or other location. You can also mount the units to pipes with sizes as small as 3" (outer diameter 3.5" / 89mm), having a wall thickness which is at least schedule 40 (0.237" / 6 mm). Additional fasteners (u-bolts) will be required. The solar modules may be mounted at whatever height is deemed safe.

NOTE

The module and mount are designed to specific wind loads. Mounts are rated to 150mph, Exposure category C, at 33'. Modules are rated at 50psf from the manufacturer. Actual wind loads will vary depending on the installation angle. Increasing the height can cause the assembly to experience increased wind loading. Consult local professionals for evaluation.

The following is the recommended torques for fasteners:

Fastener Size	Torque Imperial	Torque Metric
1/4 – 20	40 – 50 lbf-in	(4.5 - 5.6 N·m)
5/16 – 18	8 – 10 lbf-ft	(10.8 – 13.6 N·m)
3/8 – 16	14 – 16 lbf-ft	(19.0 – 21.7 N·m)

Array Wiring

1. Refer to the included Wiring Diagram addendum for the type of solar module for your system.
2. All wiring must be performed according to NEC or CEC code requirements.
3. To ensure compliance with local electrical code, use the conduit, connectors and wire from the supplied wiring kit.
4. Tighten wire connection screws in the solar module junction box to 1.7 lbf-ft (2.3 N·m).
5. Tighten junction box lid screws to 0.33 – 0.50 lbf-ft (0.45 – 0.68 N·m). Do not overtighten the lid screws.

The solar modules are provided with conduit-ready junction boxes. The diagrams in the included Wiring Diagram addendum contain generic junction box schematics to illustrate the typical interconnections and wire routing for a 12 V A810. Some modules have different arrangements of positive, negative, and floating terminals; see a 12 volt A810 *Appendix D-2: Junction Box* for specific details. Do not connect more than two wires to any module terminal.

4.3 Grounding and Lightning Protection



Failure to install and connect an appropriate grounding system will greatly increase the risk of system damage by lightning strikes.

Surges resulting from lightning strikes in the proximity of the installation are one of the most common causes of solar system failure. Installation of a proper ground system allows the static electricity that accumulates in the module and mounting structure to discharge. In addition to preventing the attraction of lightning, a properly grounded installation may divert the surge associated with lightning from electrical circuitry, limiting the potential for damage. An equipment grounding kit is included with the A810. See *Appendix D-4: Grounding*. System grounding is the responsibility of the installer.

Grounding techniques vary depending on site specifics. Consultation with a local grounding expert is recommended.

5.0 Battery and Control Enclosure

5.1 Enclosure Description

The A810 solar engine battery enclosure houses the battery and pre-installed control panel.

NOTE

This product is designed for use with the A810 luminaire only. Other loads may cause a reduction in the number of days of autonomy or lead to system failure.

Depending on the mounting options chosen, the user can mount the enclosure to the side of a pole, wall, or base foundation. See *Appendix D-6: Mechanical Layout for other options*.

5.2 Enclosure Preparation

Prior to mounting the enclosure, prepare all conduit and wiring requirements as described below.

Enclosure Preparation Instructions

1. Drill appropriate hole for the module wires; see *Appendix C: Recommended Hole Location*.
2. Drill appropriate hole for the A810 luminaire conduit; see *Appendix C: Recommended Hole Location*.
3. Attach the enclosure mounting options.
4. Secure all wires and remove loose objects from inside the enclosure. Close the door prior to mounting.

5.3 Mounting the Enclosure

The enclosure should be lifted and mounted by two people. When pre-installing the battery, ensure that it is strapped down to prevent it from shifting or falling out. Attachment clamps for a standard 4" pipe (out diameter 4.5"/114mm, schedule 40) are provided with the enclosures for attaching to a circular pole.

NOTE

User supplied hardware is required if the enclosure is attached to a square pole or other structure. If the enclosure is mounted at ground level, there may be local regulations which specify certain conditions for installation. For more information, consult with the relevant local governing bodies before installation. See local regulations. For vandalism suggestions, See *Section 4.2 Solar Module Assembly and Mounting*.

The following is the recommended torques for fasteners:

Fastener Size	Torque Imperial	Torque Metric
#10 – 16	3 – 4 lbf-in	(34 – 45 N·m)
1/4 – 20	40 – 50 lbf-in	(4.5 – 5.6 N·m)
5/16 – 18	8 – 10 lbf-ft	(10.8 – 13.6 N·m)

6.0 Battery Installation

6.1 Installing the Battery

Install the battery and battery strap in the enclosure.



Batteries are heavy, use caution when lifting them to prevent injury.

6.2 Wiring the Battery

1. Attach the ring terminals of the battery cables from the control panel to the battery terminals, as shown in *Appendix D-5: Battery wiring and Layout*.
2. Tighten to 12 lbf·ft (16 N·m).

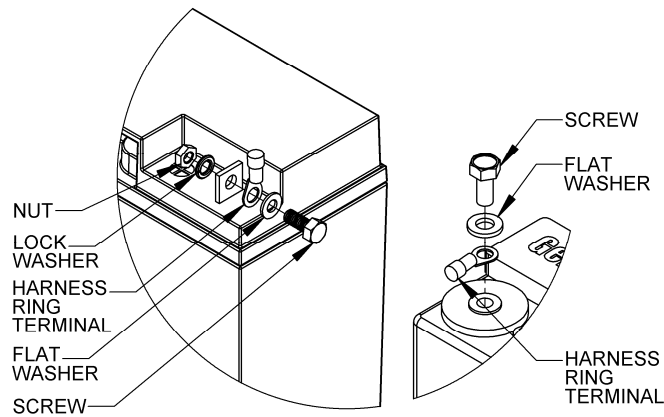


Figure 6-1: Connecting Battery Cables

7.0 Luminaire and Photocell Installation

7.1 Installing the Luminaire

Installation instructions are included with the A810 light. See *Appendix D-1: Wiring Schematic*.

7.2 Mounting the Luminaire

The A810 luminaire comes with a bottom hub, including a 1" (25.4 mm) NPT port and a 3/4" (19.05 mm) NPT bushing for mounting. The A810 luminaire must be mounted vertically; failure to do so will result in the luminaire not meeting optical requirements.

7.3 Height Restrictions

The distances listed in Table 7.1 are the maximum recommended distances from the luminaire to the enclosure with the recommended minimum wire gauge to ensure proper operation of the A810 luminaire.

Table 7.1: Distance and Wire Gauge

Distance between luminaire and enclosure	Minimum wire gauge
375 to 450 ft (114 to 137 m)	#8 (8 AWG)
250 to 375 ft (76 to 114 m)	#10 (10 AWG)
0 to 250 ft (0 to 76 m)	#12 (12 AWG)

7.4 Installing the Photocell

The photocell must be oriented due north in the northern hemisphere. The photocell can be mounted in the same location as the luminaire, but must not block the light from the luminaire. If needed, rotate photocell receptacle so that photocell window does not face artificial light.

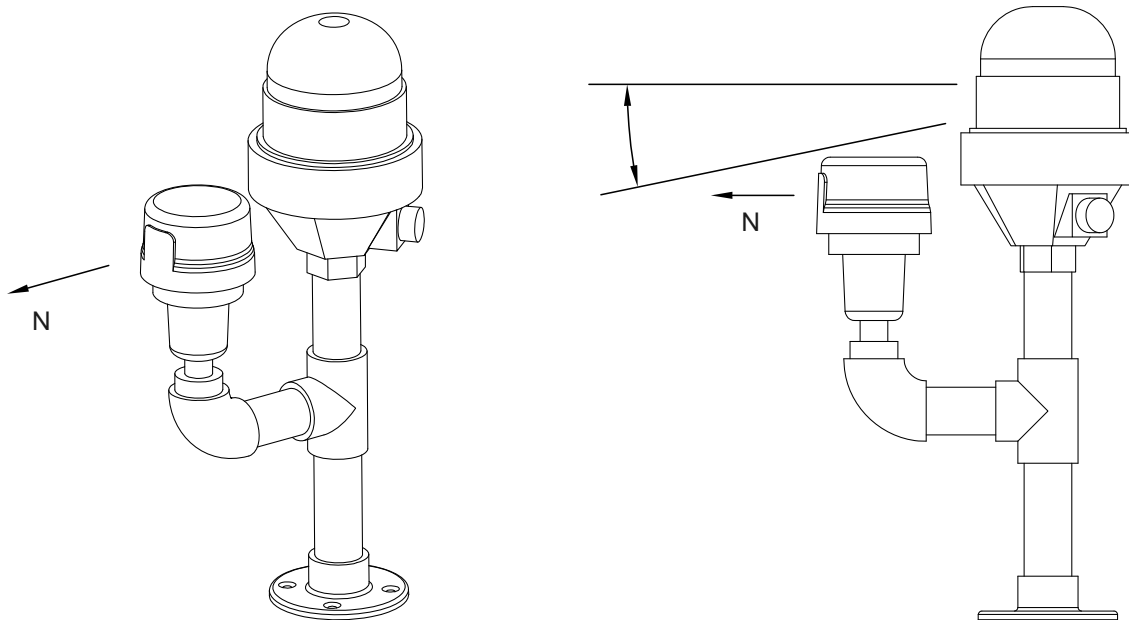


Figure 7-1: Example of Luminaire and Photocell

8.0 Control Panel Wiring

Ensure that the terminal block connections (except the ground terminal) are tightened to 1.67 lbf·ft (2.26 N·m). Tighten the ground terminal block connection to 0.6 lbf·ft (0.8 N·m).

See *Appendix D-3: Control Panel Wiring Detail* for the control panel wiring diagram.

8.1 Wiring the Control Panel

1. To avoid equipment damage, ensure all circuit breakers are in the OFF position.
2. Connect the module wires to the control panel ARRAY terminals
3. Route the L-810 luminaire/photocell wires into the control compartment using conduit and strain relief connectors. Connect the luminaire/photocell wiring; see *Appendix D: D-3: Control Panel Wiring Detail*.
4. Connect the bare copper ground wire to the ground terminal on the control panel.

NOTE

This product is designed for use with the A810 luminaire only. Any other loads may cause a reduction in the number of days of autonomy or lead to system failure.

9.0 System Operation

9.1 System Check and Start-up

Prior to turning the system on, check all wiring and connections to ensure the wires are correctly placed, the polarities are correct, and wires are secured. Check the attachments of the mounting structure and battery enclosure to the pole or mounting surface.

Energize the system by turning on the circuit breakers in the following order:

1. Battery
2. Array
3. Load

The charging light of the charge controller should turn on. Although the charging current falls to very low levels when the battery reaches full charge, the light will continue to stay on all day. This is to indicate that the controller is working and that energy is available from the PV module for charging (the light will turn off at night). The Low Voltage Disconnect light should be off. If it is on, indicating the controller is in Load Disconnect, disconnect the load, and disconnect then reconnect the battery circuit to reset the load relay and turn off the light. If the Low Voltage Disconnect light remains on, the battery charge state is low and should be recharged before completing the installation. If the charging light does not turn on at all, refer to the troubleshooting section of the controller manual. Turn on the load equipment as required.

9.2 Principles of Operation

The A810 operates automatically with no need for operator interaction under normal conditions. With normal daylight illumination, the solar module is capable of producing sufficient current to charge the battery. The charging light indicates the battery is being charged by the solar module.

If the battery discharges to the pre-set load disconnect voltage due to long periods of poor weather, the low voltage disconnect (LVD) relay is activated, the red LED turns on, and the L-810 luminaire is disconnected. Disconnecting the L-810 luminaire prevents battery damage associated with complete discharge of the battery. The Red LED will turn off when the battery recovers to about 50% of its rated capacity and the luminaire is automatically reconnected.

9.3 Maintenance

Proper maintenance of this system is vital for long term, reliable operation. A quarterly inspection (ie: once every four months) is recommended for the solar modules, battery, luminaire/photocell and controls.

Maintenance should include a general inspection to check for any wear due to the elements, for example, sun, wind, rain, etc. All connections should be checked to ensure that they are secure.

Depending on local conditions, the solar modules may require periodic cleaning. Solar modules with tilt angles less than 20° may require more frequent cleaning. Dust, if allowed to accumulate, will reduce the power output of the solar modules.

Sealed AGM batteries require no maintenance, but the user should inspect the battery for bulging or cracks.

Check the enclosure and electronic components for signs of water intrusion or condensation damage. No significant water should accumulate in the sealed control compartment.

Annually, all electrical and mechanical connections should be tightened to the proper torque specification, even if they appear sound.

Appendix A: *Warranty and Customer Service*

A-1: Warranty

This product is covered by the Carmanah warranty. Visit www.carmanah.com/content/products/warranty/ for additional information or to register your product online.

A-2: Customer Service

Before contacting Carmanah's customer service department, please have the A810 serial or identification numbers available, proof of purchase, and details on the location and nature of the failure.

To contact Carmanah's Customer Service Department:

Mail: Carmanah Technologies Corporation
Building 4 – 203 Harbour Road
Victoria, BC Canada V9A 3S2

Phone: 1.250.380.0052
1.877.722.8877 (Toll Free in U.S. and Canada)

Fax: 1.250.380.0062

Email: customerservice@carmanah.com

Website: carmanah.com

A-3: 12 Month Limited Warranty

The following items apply in addition to the standard Carmanah 12 Month Limited warranty.

1. Carmanah warrants the A810 for a period of 12 months from the date of shipment from its factory. This warranty is valid against defects in materials and workmanship for the 12 month warranty period. It is not valid against defects resulting from, but not limited to:
 - ♦ Misuse, abuse, neglect or accident.
 - ♦ Exceeding the unit's design limits.
 - ♦ Improper installation including, but not limited to, improper environmental protection and improper hook-up.
 - ♦ Acts of God, including lightning, floods, earthquakes, fire, and high winds.
 - ♦ Damage in handling, including damage encountered during shipment.
2. This warranty shall be considered void if the warranted product is in any way opened or altered. The warranty will be void if any eyelet, rivets, or other fasteners used to seal the unit are removed or altered, or if the unit's serial number is in any way removed, altered, replaced, defaced, or rendered illegible.
3. The 12 month term of this warranty does not apply to equipment where another manufacturers' warranty is available.

Appendix B: *Acronyms*

Term	Description
AGM	Absorbed Glass Mat
Carmanah	Carmanah Technologies Corporation
CEC	Canadian Electrical Code
CSA	Canadian Standards Association
DC	Direct Current
FC	Foot-candle
LVD	Low Voltage Disconnect
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NPT	National Pipe Thread
UL	Underwriters Laboratories Incorporated

Appendix C: Recommended Hole Location

Table 9-1: Recommended Hole Location lists the A810 model numbers and the corresponding size for the conduit.

Figure 9-1 shows the conduit location on a A810 solar engine enclosure.

Table 9-1: Recommended Hole Location

A810 Model Number	Conduit Size
A810 20-1-12 (58448)	½"
A810 50-1-12 (58447)	½"
A810 80-1-12 (58341)	½"

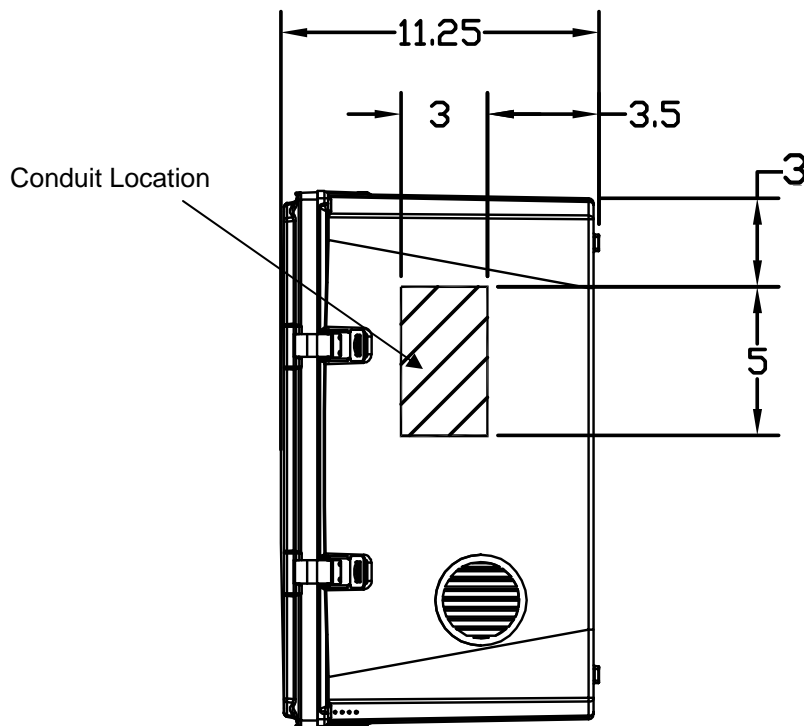
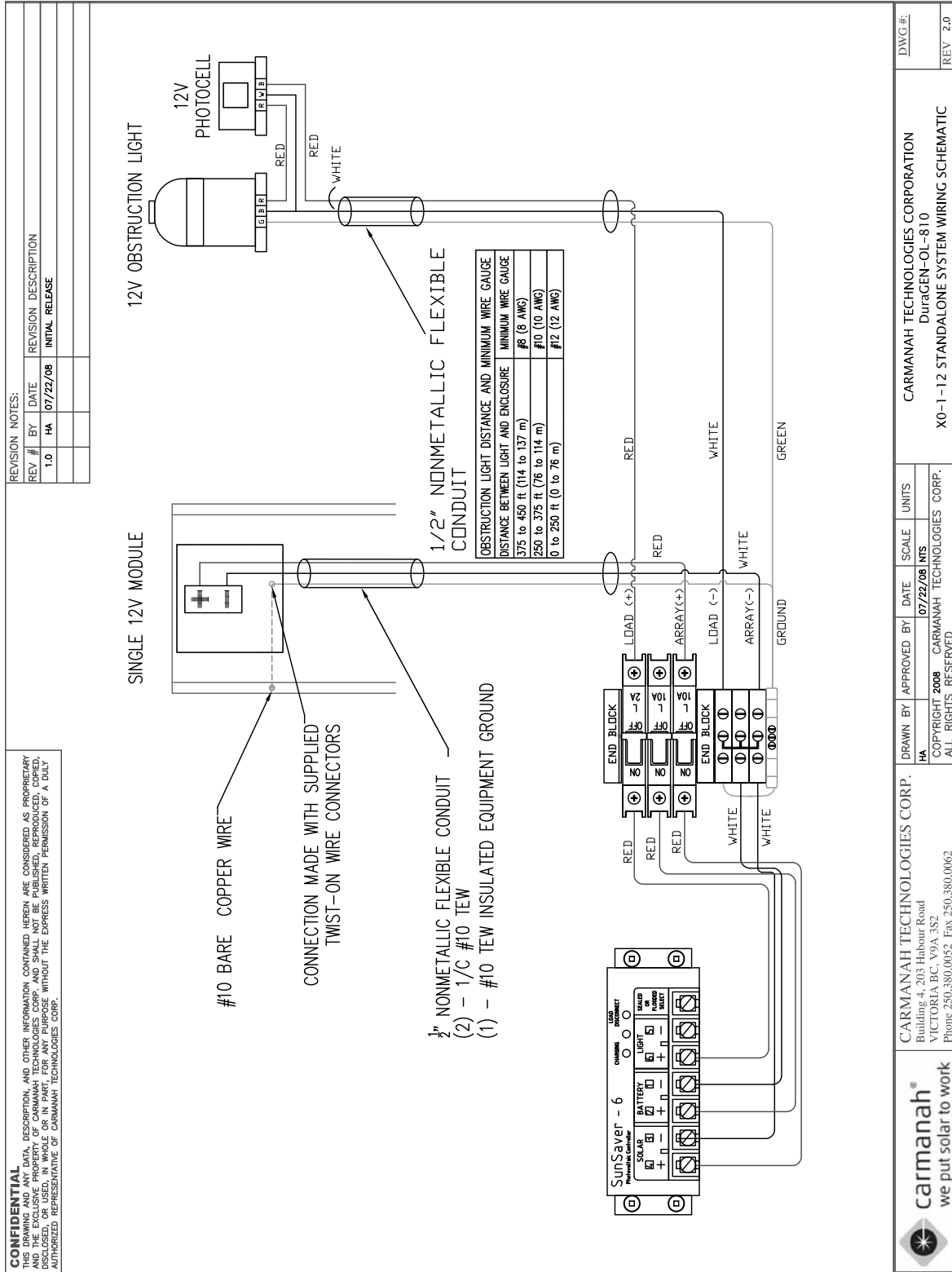


Figure 9-1: Conduit Location

Appendix D: Wiring Diagrams

D-1: Wiring Schematic



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APPROVED BY: HA
DATE: 07/22/08
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UNITS: _____

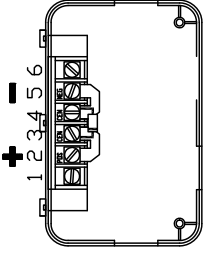
CARMANAH TECHNOLOGIES CORP.
Building 4, 203 Harbour Road
VICTORIA BC, V9A 3S2
Phone 250.380.0052 Fax 250.380.0062

CARMANAH TECHNOLOGIES CORPORATION
Duragen-OL-810
X0-1-12 STANDALONE SYSTEM WIRING SCHEMATIC

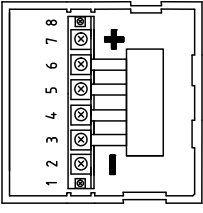
D-2: Junction Box

MODULE WIRING

REVISION NOTES:		
REV #	DATE	REVISION DESCRIPTION
1.0	07/22/08	INITIAL RELEASE



**BP-SX20U AND BP-SX350U
JUNCTION BOX**
TERMINAL 1 IS POSITIVE
TERMINAL 5 IS NEGATIVE

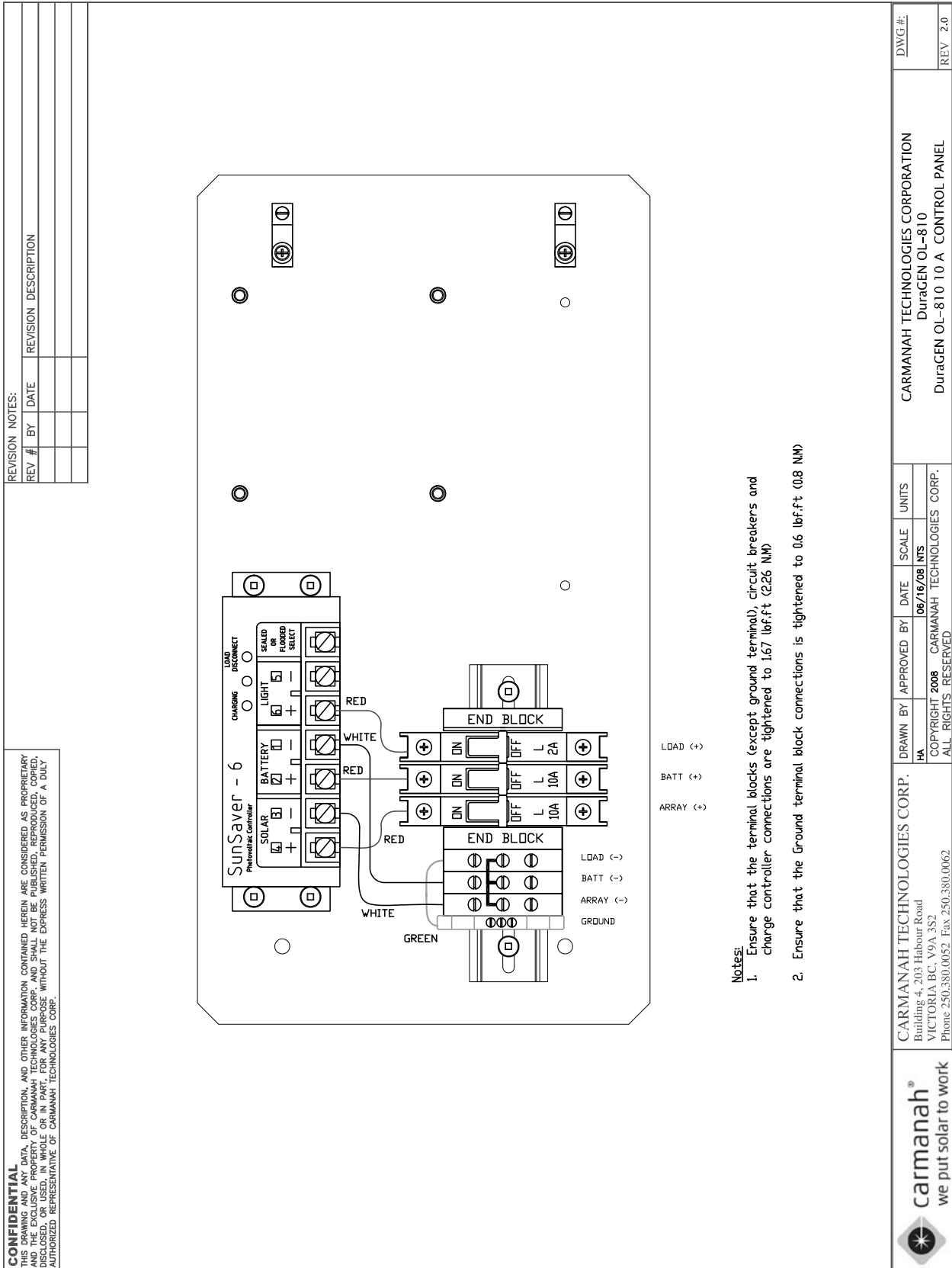


STANDARD SHARP JUNCTION BOX
TERMINAL 1, 8 ARE NOT USED
TERMINAL 2, 3 ARE NEGATIVE
TERMINAL 4, 5 ARE NOT USED
TERMINAL 6, 7 ARE POSITIVE

1. Tighten wire connection screws in the solar module junction box to 1.7 lbf.ft (2.3N.M)
2. Tighten junction box lid screws to 0.33 – 0.50 lbf.ft (0.45 – 0.68 N.M). Do not over-tighten the lid screws

 <p>carmanah we put solar to work</p>	CARMANAH TECHNOLOGIES CORP. Building 4, 203 Harbour Road VICTORIA BC, V9A 3S2 Phone 250.380.0052 Fax 250.380.0062	DRAWN BY: HA APPROVED BY: HA DATE: 07/22/08 SCALE: INTS UNITS: INTS COPYRIGHT 2007 CARMANAH TECHNOLOGIES CORP. ALL RIGHTS RESERVED
CARMANAH TECHNOLOGIES CORP. DuraGEN OL-810 MODULE WIRING JUNCTION BOXES		DWG #: _____ REV 1.0

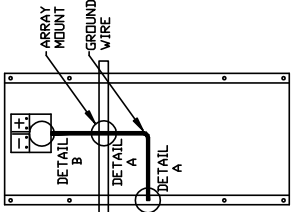
D-3: Control Panel Wiring Detail



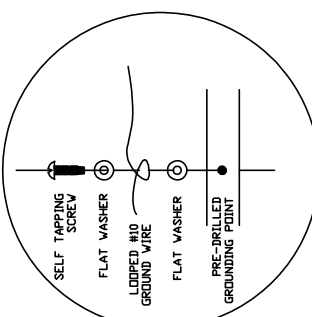
D-4: Grounding

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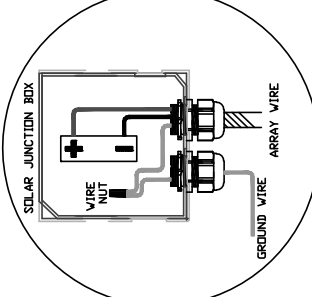
GROUNDING KIT - 1 MODULE



GROUNDING EXAMPLE ONLY.
GROUNDING LOCATIONS AND ARRAY LAYOUT WILL VARY



GROUNDING DETAIL A



GROUNDING DETAIL B

NOTES:

1. AS SHOWN IN "GROUNDING DETAIL A", ATTACH GROUNDING WIRE AT ONE POINT TO THE SOLAR MODULE AND AT ONE POINT ON THE SOLAR ARRAY MOUNTING STRUCTURE.
2. MOST SOLAR MODULES HAVE PRE-DRILLED GROUNDING HOLES.
3. MAKE SURE EACH GROUND CONNECTION IS TIGHT.

NOTES:

1. GROUNDING LOCATIONS AND ARRAY LAYOUT WILL VARY.
2. GROUNDING CODE MAY VARY - CONSULT A PROFESSIONAL.
3. FOR SMALLER SYSTEMS WITH AN ACCESSIBLE SOLAR MODULE JUNCTION BOX REFER TO "GROUNDING DETAIL B".

DWG #:

REV 1.0

REV #	BY	DATE	REVISION DESCRIPTION

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CARMANAH TECHNOLOGIES CORPORATION

Duragen OL-810

GROUNDING KIT - 1 MODULE

CARMANAH TECHNOLOGIES CORP.

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VICTORIA, BC, V9A 3G2
Phone 250.390.0052 Fax 250.390.0062



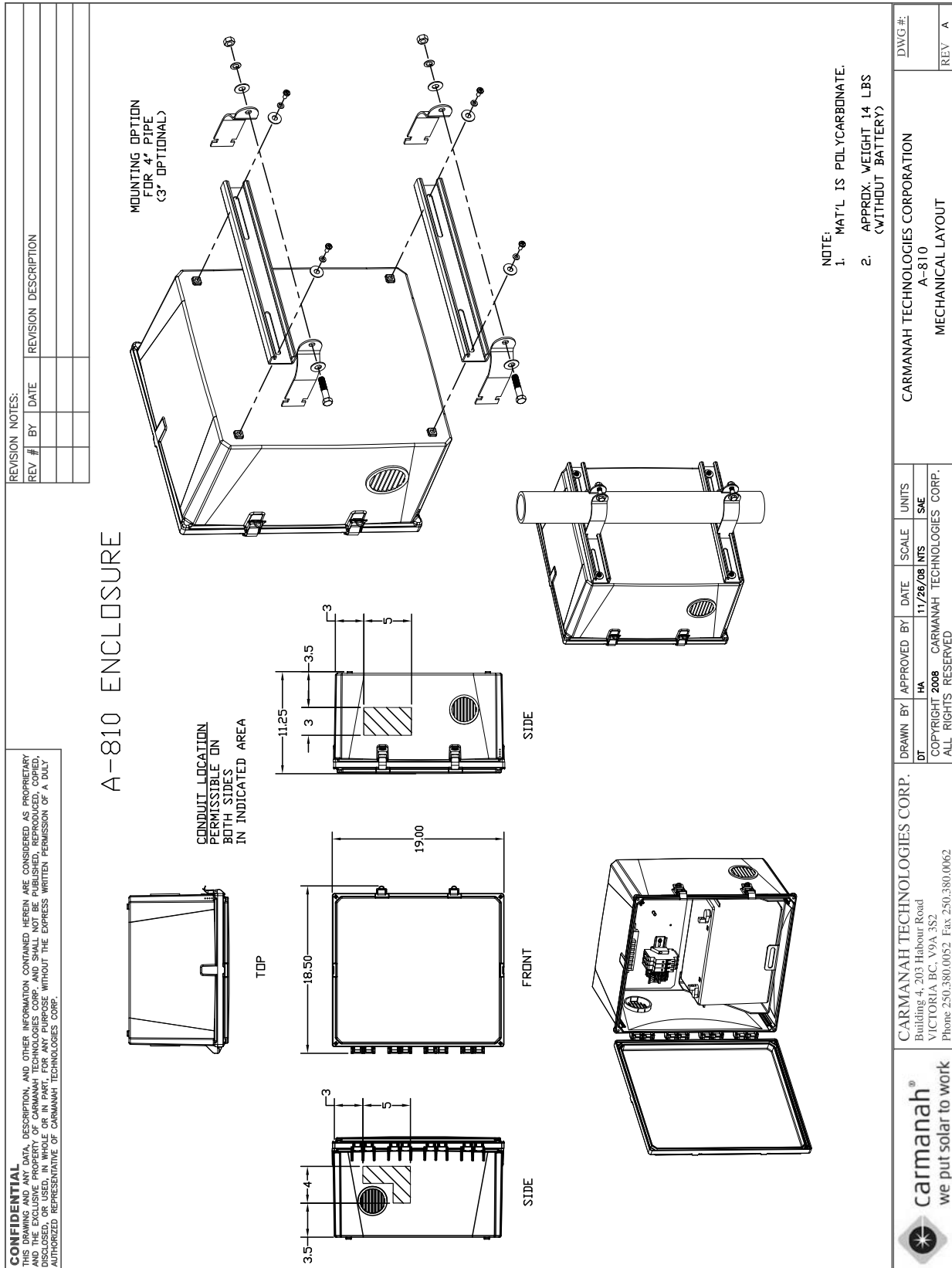
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we put solar to work

D-5: Battery Wiring and Layout

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REV #	BY	DATE	REVISION DESCRIPTION																			

D-6: Mechanical Layout





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