SC320 Crosswalk Safety System with In-Road-Warning-Lights

Installation Manual
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1 Introduction

1.1 SC320 System Overview

This manual provides instructions for installing the SC320 Controller with In-Road-Warning-Lights (IRWLs) and associated equipment. SC320 Controllers are offered in a variety of configurations. Detailed in this manual are instructions for installing IRWL systems in conjunction with beacons, Rectangular Rapid Flashing Beacons (RRFBs) and LED signs.

1.2 Installation Summary

Installation of the SC320 system consists of the following tasks:

- Install conduit from pole base locations to the edge of the roadway.
- Create pole foundations.
- Erect the system poles.
- Mount the SC320 Controller and the following optional equipment: Solar panels, pushbuttons, beacons, LED signs and RRFBs.
- Route AC power, if the SC320 is an AC-powered controller.
- Make cuts in the roadway for installing IRWLs and cabling.
- Thoroughly clean all holes and trenches in the roadway.
- Install IRWLs and system cabling in the roadway the provided Liquid Conduit epoxy.
- Terminate all components to the SC320.
- Power on and test the system.

1.3 Notices

- Spot Devices IRWLs should not be installed in asphalt or concrete that is less than 4" deep. The roadway should not be excessively cracked, uneven or otherwise damaged.
- When determining the location of poles and the height of pushbuttons and static signage, installers must comply with local design and code requirements.
- The installing party is responsible for avoiding damage to any pre-existing equipment and utility lines. USA marking should be used to identify any buried utility lines where pole bases will be dug.
Always point solar panels due south. Choose a location that is open to the sky and not shaded during the day. Shading can prevent the battery from charging and cause system failure.

The SC320 Controller must be installed in accordance with these instructions. Mounting the top of the controller lower than 84” above grade, cutting into or modifying the cabinet in any way, or otherwise changing the installation procedure will void the manufacturer’s warranty.

If the system is being installed in conjunction with an SC315 or other Spot Devices Controller, please refer to the appropriate installation manual for that equipment.

1.4 Who to Contact?

For technical assistance, please contact Spot Devices Customer Service Department at 888-520-0008, Option 1.
2 Installation Equipment

*Required Tools/Materials:*

- Walk-behind road saw equipped with a 14” diameter asphalt diamond blade
- Hand-held road saw equipped with a 14” diameter asphalt diamond blade (optional, but recommended)
- Small – medium sized demolition hammer equipped with a 1” chisel tip
- Strong wet/dry vacuum
- Fresh water and hose, or pressure washer
- High pressure air and a long nozzle to direct it
- 12’ or taller ladder, or bucket truck
- Plug-in drill and large paint-mixing bit
- Plastic trowels, 2” – 6”
- Duct tape, several roles
- Downward-spraying marking paint
- String line
- 1” Unibit
- Hole saw, 1 1/8”
- Hole saw, 2 1/4”, if installing beacons
- 1/4 - 20 tap and tap handle
- 5/16-18 tap and tap handle
- Electrical tools: fish tape, strippers, crimpers
- Banding tool, banding and clips
- Allen key set
- Large pipe wrench or chain wrench
- Magnetic level
- Silicone sealant and caulking gun
- Small pipe wrench, if installing beacons
- Concrete (See pole foundation drawings for quantity)
- 2” conduit & elbows
- Duct seal
- Pull boxes (optional, but recommended)
**Equipment Provided by Spot Devices:**

- 5/16-18 bolts with rubber washers, for mounting signs
- Crimp-on quick-disconnect terminals
- All cabling required* (except cables for running AC power, if required)
- IRWL template
- Torx TP-30 security bit
- Liquid Conduit epoxy
- Poles, J-bolts, nuts and washers*

*Not included with all orders. Check with your purchaser.
3 Pole Foundations

This section describes how to create foundations for 4" (type 1B) and 2.5" poles. These instructions are recommendations only; adhere to local requirements. Beacons and SC320 Controllers must be installed on 4" poles or larger.

2.5" and 4" Pole Foundation Recommendations

Note: This drawing is a recommendation only. Follow local guidelines and regulations when creating pole foundations.

### 2.5" Pole

- Fill gap with thick mortar
- Level base plate by adjusting upper and lower nuts
- Conduit, routed to pull-box or directly to roadway

**Concrete Requirements:**
- Approximately 3.5 Cubic feet

**Installs grounding rod as per the NEC**

### 4" Pole

- Fill gap with thick mortar
- Level base plate by adjusting upper and lower nuts
- Conduit, routed to pull-box or directly to roadway

**Concrete Requirements:**
- Approximately 9.5 Cubic feet

**Installs grounding rod as per the NEC**

Figure 3-A: Pole Foundation Detail
4 System Layout

SC320 Crosswalk Safety Systems vary significantly in size and layout. The number and placement of IRWLs, the types of peripheral devices and pushbuttons can all vary significantly. Consult engineering plans or other layout documents to determine the proper location for devices. Refer to Figures 4-A and 4-B for basic guidelines.

Cable Routing

For components mounted on far-side poles, cables pass through the roadway with the IRWL cables. These cables are installed in 1” wide, 3.5” deep trenches cut with a road saw. After installation of the IRWLs and cables, they are sealed into the roadway with the provided Liquid Conduit epoxy.

For components on the same pole as the SC320 Controller, route cables through the pole.

![Figure 4-A: Sample IRWL System with Beacons](image-url)
IRWLs, Trenches and Other Considerations

Spot Devices recommends installing pull boxes near the poles to assist with routing system cables. From the pull boxes install 2” conduit stub-outs into the roadway just underneath the asphalt. These conduits can be accessed by excavating through the asphalt. System trenches, which route all cables to the IRWLs and far-side components, should originate at the stub-outs. See Figure 4-B.

![Figure 4-B: Top-Down Layout Diagram](image-url)
5 Install Pole-Mounted Equipment

This section details how to install pole-mounted components. Before installing any equipment, use a marker to lay out where each component will be installed to ensure adequate spacing.

ATTENTION
After installing components on the pole, seal all pole openings with silicone sealant. No water should be allowed to enter the pole.

Where possible, create drip-loops in system cables so that moisture does not flow along a cable and into a device.

Equipment detailed in this section:

- SC320 Controller
- Beacons
- RRFBs
- LED signs
- Solar panels
- Polara XAV Talking Pushbutton Systems
- Polara Bulldog pushbuttons
5.1 Install the SC320 Controller

**Step 1**

Band-strap the template to the pole, then mark the location of the four guide-holes with a drill or marker.

**Step 2**

Remove and dispose of the template. Keep the nuts for Step #3. Use a hole saw to drill four 1 1/8" holes using the marks created in Step #1.

**Step 3**

Mount the SC320 to the banding buckles and attach it with the two break-away nuts. Tighten the nuts until the ends snap off.

**You Will Need:**
- 1 1/8" Hole Saw
- Band-it tool, banding and clips
- Plug-in Drill
- Basic hand tools

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**Figure 5-A: Install the SC320 Controller**
5.2 Install Beacons

- **Mount the beacon to the pole**
  
  - Attach beacon to the pole using four banding straps.
  - Drill 2½” hole into the pole for the lower beacon arm.

- **Connect the beacon**
  
  - Loosen mounting nuts to rotate beacon arms or point the beacon.
  - Loosen retaining screws and rotate the bulb so that the "top" indicator is at 12 O’clock.
  - Connect red and black beacon wires to the wiring terminal as shown. Use crimp-on terminations (included).

**You Will Need:**

- 2 ¼” Hole saw
- Band-it tool, banding and clips
- Plug-in Drill
- Electrical tools
- Basic hand tools
- Small pipe wrench

**Figure 5-B: Install Beacons**

*Beacons can mount straight onto or 90 degrees out from the pole.*
5.3 Install RRFBs

Secure RRFB’s to the pole using heavy duty hose clamps (supplied).

If equipped, the side-facing pedestrian indicator should face towards the street.

Drill a 1 ¼” hole for the slip fitting. The RRFB *DOES NOT* thread into the pole.

Systems on one-way streets have only one RRFB per pole.

Caution: The hole must be drilled so that the RRFB points toward oncoming traffic 150' - 200' away.

You Will Need:

- 1 ¼” Hole saw
- Plug-in Drill
- Electrical tools
- Basic hand tools

Figure 5-C: Install RRFBs
5.4 Install LED Signs

**You Will Need:**
- Band-it tool, banding and clips
- Drill with drill bits
- Electrical tools
- Basic hand tools

*Figure 5-D: Install LED Enhanced Signs*
5.5 Install Solar Panels

- **Top-Mount Solar Panels**

  Pull cable to the SC320 Controller and set solar panel over the top of the pole.

  Tighten four set screws.

  Note: In high wind environments, consider using ¼ - 20 through-bolts rather than the supplied set screws.

  Always point solar panels due south. Any amount of shading may result in premature battery failure.

- **Side-Mount Solar Panels**

  Attach solar panel to the pole using two banding straps.

  Drill a small hole for the cable. Seal the hole with silicon after it is pulled.

  Adjust solar panel so that it is co-planar with the top-mount solar panel, or approximately 45 degrees.

**You Will Need:**
- Allen key set
- Electrical tools
- Drill, drill bits
- Band-it tool, banding and clips
- Basic hand tools

Figure 5-E: Install Solar Panels
5.6 Install Polara XAV2-LED Talking Pushbuttons

**You Will Need:**
- 1” Unibit
- Drill with drill bits
- Basic hand tools
- ¼ - 20 tap and tap handle
- Electrical tools

**Wiring Guide:**

<table>
<thead>
<tr>
<th>XAV2-LED Controller Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>To SC320 Controller</td>
</tr>
<tr>
<td>Brown</td>
</tr>
<tr>
<td>Blue</td>
</tr>
<tr>
<td>Orange</td>
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<tr>
<td>Yellow</td>
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<tr>
<td>Red</td>
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<tr>
<td>Black</td>
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<tr>
<td>Button Out 1</td>
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<tr>
<td>PWR+</td>
</tr>
<tr>
<td>BTN</td>
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<tr>
<td>LTS IN 10 – 15V</td>
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<tr>
<td>RTS IN COM</td>
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<td>DC in POS</td>
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<td>DC in NEG</td>
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<td>MUTE</td>
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<td>MIC</td>
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<td>AUD1</td>
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<td>AUD2</td>
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<td>Blue</td>
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<tr>
<td>Red w/Black Stripe</td>
</tr>
<tr>
<td>Blue w/Black Stripe</td>
</tr>
<tr>
<td>To Talking Pushbutton</td>
</tr>
</tbody>
</table>

**Figure 5-F: Install the XAV-LED2 Talking Pushbutton and Controller**
5.7 Install Polara Bulldog Pushbuttons

Process:
- Drill the 7/8" hole exactly where the pushbutton will mount.
- Hold the bracket in place and mark the location for the two ¼ - 20 holes.
- Drill and tap the holes.
- Run the cable from the controller to the 7/8 hole and pass it through the bracket.
- Terminate it at the pushbutton using spade terminations (supplied).
- Attach the bracket to the pole.
- Attach the pushbutton to the bracket
- Attach the sign plate to the bracket

You Will Need:
- 1" Unibit
- Drill with drill bits
- Basic hand tools
- ¼ - 20 tap and tap handle
- Electrical tools

Figure 5-G: Install Polara Bulldog Pushbutton
This section describes how to cut trenches and holes in the roadway for installing IRWLs. First lay out the system by painting the roadway with downward-spraying paint. Refer to engineering plans if applicable. Refer to Figure 6-A.

- Mark all trenches and IRWL holes with downward spraying paint. Use the provided template to spray on the IRWL hole rectangles.
- Always optimize the LEADING EDGE of the crosswalk to the drivers perspective. See the diagrams below.
- On curved approaches, take special consideration to point the IRWLs toward oncoming traffic.
- IRWL holes are large enough to point the lights 10 degrees left or right without cutting them at an angle.

If you have questions regarding your installation layout, call Spot Devices at 888.520.008 for expert advice.

Figure 6-A: Layout Guidelines
6.1 Cut the Trenches

Cut the trenches first, followed by the IRWL holes. There are two common techniques for this:

1. Use a walk-behind road saw with a thin (1/8”) asphalt diamond blade to make two cuts along the sides of the trenches. Mark the blade at 3.5” to ensure the proper depth.

2. Use a small to medium sized demolition hammer equipped with a 1” chisel tip to remove the contents of the trench. This is the preferred method.

Alternatively:

1. Use a stack of blades 1” wide to cut the trench. This method requires a very powerful saw and creates a large amount of mud and slurry.

6.2 Cut the IRWL Holes

Either a walk-behind saw or a handheld road saw can be used for this step. It is critical that a 14” diameter blade be used to cut out the IRWL holes. A 14” diameter blade makes the lengthwise cuts with a single plunge at the perfect depth. Refer to Figure 6-B.

After cutting the holes, chip out the contents using a demolition hammer. When chipping, maintain the curvature of the plunge cuts; the bottom of the hole does not need to be flat. Over chipping increases the amount of epoxy required.

Figure 6-B: Cutting the IRWL Hole
6.3 Clean the Cuts

It is critical that all cuts be clean and dry before installing the IRWLs. Moisture or residual grit can weaken the epoxy by more than 50%. Flush all cuts with fresh water and use suction to collect the waste. A pressure washer is ideal for this step.

After flushing, dry the cuts by blowing them out with high pressure air. Ensure that the cuts are *fully dry* before continuing.
7 Install System Cables, IRWLs in the Roadway

This section describes how to set the IRWLs and system cables into the roadway, test the system and complete the roadwork by sealing the devices permanently in place.

7.1 Install Cables and IRWLs

1. Excavate and expose the conduit stub-outs.

2. Use duct tape to mask all the cuts in the roadway. This creates a better finished look.

3. Pull all non-IRWL cables first. Cables that connect to pushbuttons, beacons and other devices on the opposite side of the street from the SC320 Controller pass through the roadway underneath the IRWLs. Pull the other ends of these cables into the SC320 Controller. Ensure that there is enough slack to reach their destinations.

4. Pull the 12/4 SO Lead-In cables through the stub-outs and to the first light in each line. These are easily identified by the female plug on one end of the cable. Pull the other end of these cables into the SC320 Controller.

5. Attach the provided hang bars to the IRWL anchors using the provided self-tapping screws. The anchors are made from aluminum, DO NOT over tighten. See Figure 7-A.

6. Place the IRWLs into their respective holes. The lights have arrows on them; point all arrows AWAY FROM THE CROSSWALK. Ensure that the
lights do not touch the bottom of the hole; they should suspend from the hang bars.

7. Connect first IRWL to the Lead-In cable by mating the plugs together. These waterproof plugs have alignment dots. Align the dots and plug the ends together. While pressing, squeeze the female plug between its alignment dots to release a built-up pocket of air. Ensure that the plugs seat fully. See Figure 7-B. Place a small amount of electrical tape over the plugs once they are mated.

![Figure 7-B: Properly Seating the Plugs](image)

8. Plug the rest of the lights together using the female-ended interconnect cables. Place a small amount of electrical tape over each connection. At the end of each line, attach a dummy plug to the last light. Refer to Figure 4-A.

9. Tie off the extra slack in the interconnect cables using the supplied zip ties. Ensure all slack is tucked safely into the trench and no cable is within 1” of grade. Refer to Figure 7-C.

![Figure 7-C: Tying Cables with Zip Ties](image)

10. Point all of the lights to their desired angles. Remember that a light can rotate in its hole up to 10 degrees in either direction.
7.2 Test the IRWLs for Operation

It is critical that the lights be tested just prior to pouring the epoxy. Once the epoxy is set the lights are permanently set into the roadway.

1. Refer to the Site-Specific wiring diagram for your installation. This can be found in the document sleeve on the door of the SC320. This diagram details how each device is terminated to the SC320 Controller.

2. Strip the ends of each Lead-In cable and crimp on the supplied female quick-disconnect terminations. Attach these cables to the SC320 PCA as indicated by the wiring diagram. Figure 7-D shows an example of a wiring diagram.

Attention

Each SC320 system is unique. Always attach the IRWL cables exactly as indicated by the Site-Specific wiring diagram.
3. Attach power to the system.

a. For solar-powered systems, install the 12V, 105Ahr battery as shown in Figure 7-E. First attach the positive lug to the red wire, followed by the negative lug to the black wire. Tighten the lugs snugly with a wrench or socket. (The solar panel does not need to be attached yet.)

b. For AC-powered systems, route AC power cables (with power removed from the source) into the SC320 Controller. Attach the supplied NEMA ML-2 female AC plug to the hot, ground and neutral conductors. Insert the NEMA plug into the AC Input Plug shown in Figure 7-F.
4. Turn on system power. Locate the Power Switch and set it to the ON position. The Status Indicator LED should flash rapidly, and then go dark for up to one minute. Following this it should begin to flash a slow, steady pulse. When this occurs, the system is ready to activate.

5. Press the small Activate Pushbutton located on the SC320 PCA. See either Figure 7-E or 7-F. This activates the IRWLs for a duration set by the duration dials. These dials come pre-set with time period determined during the sales process.

6. Verify that:
   a. All IRWLs light.
   b. All IRWLs are pointed in the correct direction.
   c. IRWLs are the correct color (amber or red).

7. Remove power from the system.
Installation Tip:

If only half of the roadway can be installed at one time, plug in only the lights that are to be installed in the first phase. Plug interconnect cables into the last lights of each line and lay them in the trenches for protection. Place a dam in the trench on top of this interconnect cable so that epoxy does not flow into the open lane. Rags make excellent dams for the epoxy. This way lights can be plugged into the exposed interconnect cable when installing the 2nd lane.

7.3 Seal Cables, IRWLs with Liquid Conduit Epoxy

1. Seal the conduit stub-outs with duct seal so that no epoxy flows into them.

2. Only one bucket of Liquid Conduit should be mixed at a time. Do not mix a second bucket until the first has been used. Open a bucket of Liquid Conduit and remove its contents.

3. Pour in the large bag of sand and the liquid component “A”. Mix thoroughly with a plug-in drill and paint-mixing bit. Mix for one minute.

4. Add liquid component “B” and mix for an additional minute, until the mixture is uniform. Once part “B” is added the Liquid Conduit begins to set. *Working time is approximately 10-12 minutes, but may be less on hot days.*

5. Pour the epoxy directly into the trenches and around the IRWLs. Pour until the fluid is within 1/16” of grade. Work the Liquid Conduit around using plastic trowels. Mix additional buckets as needed.

6. The small bag of sand labeled “topping sand” can be applied to the Liquid Conduit to improve appearance and traction. This is an optional step. If desired, apply the sand when the Liquid Conduit is nearly firm and still tacky.

7. Allow the Liquid Conduit to cure until the lights do not move and the material is no longer tacky. Cure time is 30-40 minutes, depending on temperature. Extremely cold temperatures may extend this time significantly. If shorter times are needed, add the provided ZIP accelerant to part “B” of the Liquid Conduit Epoxy. See Figure 7-G.
Figure 7-G: Zip Accelerant

8. Remove and dispose of hang bars and plastic coverings. Remove the duct tape from the roadway.

9. Use an angle grinder equipped with a diamond-cup grinding wheel to smooth any excess material around the IRWLs. If possible do this step the following day after the material has fully hardened. See Figure 7-H.

Attention

This step is critical and should not be skipped. Any protrusion of Liquid Conduit in front of the IRWLs will block light output and reduce the effectiveness of the system.

Figure 7-H: Grinding the IRWLs Flush
8 Prepare the System for Operation

This section describes how to make all electrical terminations and test the SC320 system. Each SC320 system is unique and ships with a Site-Specific-Wiring Diagram. This diagram can be found inside the door of the SC320 Controller. Use this diagram as a guide when terminating devices to the SC320 Controller.

Attention

The Site-Specific Wiring Diagram is the ONLY document that indicates proper wiring of the system. Attaching devices to the SC320 Controller in a different manner may result in failed operation and/or damage to components.

Refer to Figures 8-A and 8-B. Figure 8-A shows a sample wiring diagram for an SC320 system. Figure 8-B overviews the SC320 PCA features and components. The wiring diagram dictates where on the SC320 PCA a given device should attach. Always turn system power off before making or breaking any connections.

Figure 8-A: Sample SC320 Wiring Diagram
8.1 Connect Flashing Devices

Ensure that the SC320 Power Switch is in the off position. Beacons, LED signs, RRFBs and IRWLs attach to Device Channels 4 - 7 on the SC320 PCA. Crimp the supplied female quick-disconnect terminations onto the conductors and attach them as indicated on the Site-Specific Wiring Diagram.

Bidirectional IRWLs typically attach to a single channel and use a device splitter PCA. If so first attach the conductors to the splitter and then attach the splitter to the PCA. Ensure the correct polarity.
8.2 Connect Solar Panels

SC320 Controllers employ one or two solar panels. Both of these panels plug into the Solar Input connections on the PCA. If two solar panels are to be attached then a small splitter is provided.

The Charge Indicator LED lights green when the solar panels are properly attached and exposed to sunlight. If this LED does not light, the solar panel conductor polarity may be reversed.

8.3 Connect Polara™ Bulldog Pushbuttons

*For systems without Wireless Activation*

Refer to Figure 8-C. Connect the pushbutton conductors to Activation Inputs 0 – 3, as indicated by the Site-Specific Wiring Diagram.

*For systems with Wireless Activation*

Refer to Figure 8-C. Crimp the supplied male quick disconnect terminations onto the pushbutton conductors, and attach them to the wireless pushbutton dongle.

![Figure 8-C: Terminate Polara™ Bulldog Pushbuttons](image-url)
8.4 Connect Polara™ XAV-LED2 Talking Pushbutton

*For systems without Wireless Activation*

Refer to Figure 8-D. Connect the blue and brown “button out” conductors to Activation Inputs 0 – 3, as indicated by the Site-Specific Wiring Diagram.

*For systems with Wireless Activation*

Refer to Figure 8-D. Crimp the supplied male quick disconnect terminations onto the blue and brown “button out” conductors, and attach them to the wireless pushbutton dongle.

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For Systems WITH Wireless Activation

Follow Site-Specific Wiring Diagram when terminating the red, black, orange and yellow conductors.

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XAV2-LED Controller Connections

To SC320 Controller

- Brown
- Blue
- Orange
- Yellow
- Red
- Black

To Talking Pushbutton

- Red
- Black
- Orange
- Yellow
- Brown
- Red w/Black Stripe
- Blue w/Black Stripe

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Figure 8-D: Connect XAV-LED2 Pushbuttons
8.5 Power on and Test the System

If not already done, install the battery for solar-powered systems or route AC power for AC-powered systems. Section 7.2 describes this process.

Turn on the SC320 Power switch and wait until the red Status Indicator LED assumes a slow, steady pulse. This may take up to one minute.

System Checklist

- First activate the system from the small Activate Pushbutton located on the PCA. Ensure that all IRWLs, beacons, RRFBs and other peripheral devices function properly.
- Activate the system from each pushbutton (if equipped) in the system to ensure that they operate properly.
- Ensure that talking pushbuttons are audible and their LEDs flash when activated.
- Ensure that the Charge Indicator LED is lit green when the solar panels are in direct or diffused sunlight.
- Locate the GPS/Cellular Modem shown in Figure 8-E. Ensure that the indicator LEDs on the modem flash properly. It may take several minutes for both LEDs to come online.

If any of the previous items do not function properly, contact Spot Devices Customer Support.

Figure 8-E: Modem Indicator LEDs
8.6 Wireless Activation Option

If so equipped, SC320 Controllers communicate with wirelessly. It is critical that all controllers in a system be set to the same frequency channel. There are 10 frequency channels to choose from, selectable from a small dial on the top right portion of the PCA. See Figure 8-B. All SC320 Controllers ship with the frequency dial set to channel 0.

Attention

Controllers that are not supposed to activate one another may do so if they are closer than 2500 feet apart and set to the same frequency channel.

To avoid accidental cross-system activation, make sure that each system uses a separate frequency channel.

8.7 Controller Dials and Flash Duration

SC320 Controllers activate for a period of time that is set by the controller dials. Refer to Figure 8-B. At shipment these dials are pre-set to a duration determined by the customer. These dials can be disabled and controlled via the Spot Devices secure website if desired. For more information, refer to the SIMA Admin Console Users Guide.

8.8 Initiate Calendar Operation

Many SC320 systems are activated via an internet-based calendar. Please refer to the separate manual, SIMA Admin Console Users Guide, to set up and initiate a calendar for operation.