

Depth Sensor Node Enclosure Assembly

Learn how to assemble an Open-Storm sensor node with a depth sensor.

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TOOLS:

- Soldering Workstation (1)
- Lead-Free Solder (1)
- Phillips #3 Screwdriver (1)
- Heat Shrink Tubing Assortment (1)
- Heat Shrink Gun (1)
- Flush Cutter (1)
- Wire Stripper (1)
- 6-in-1 Screwdriver (1)
- Large Needle Nose Pliers (1)
- PSOC Programmer (1)
- USB to TTL Serial Converter (1)
- Voltmeter (1)
- USB Power Supply (1)

PARTS:

- Enclosure (1)
- Depth Sensor (1)
- Microcontroller board (1)
- Twilio Cellular Modem (1)
- Solar Panel (1)
- Solar Panel Frame (1)
- 3.7V Lithium Ion Battery (1)
- Antenna (1)
- Jumper pins (2)
- Solar Panel Nuts (4)
- Solar Panel Screws (4)
- Waterproof Cable Gland Connector (1)
- GPS (1)
- Standoffs (8)
- SuperSIM (1)
- Lock (1)
- Battery (1)
- Foam for Securing Battery (1)
- Cable Ties (Battery & Solar Panel) (2)
- Solar Panel Extension Wire (1)

• Worm-Drive Clamp for Firm Hose and Tube 316 Stainless Steel, 5/16" Band Width, 7/32"- 5/8" Clamp ID Range (1)

- Node ID Sticker (1)
- Enclosure to Board screws (1)
- 8GB MicroSD Card (1)
- Depth Sensor MB7950 Mounting Hardware (1)
- Black, red, white wire (1)
- Moisture-Seal Heat-Shrink Tubing 2:1
 0.25" diameter heat shrink tubing (4 ft) (1)
- Moisture-Seal Heat-Shrink Tubing 2:1 Shrink Ratio, 0.19" ID Before Shrinking, 4 Feet Long (1)

• TERM BLK 3P SIDE ENT 2.54MM PCB (1)

• 5-Wire Terminal Block Plug (3.5 mm) (1)

• 2-Wire Terminal Block Plug (3.5 mm) (1)

Step 1 — Running Node Builder Web App



- open Anaconda Navigator
- launch Spyder
- click 'Open File' and select "node_builder.py" under "\Documents\anvil"
- click the 'Run' button
- visit this link to get started: Node Builder

Step 2 — Outside Structure



- Obtain a solar panel with the appropriate metal plate.
- Obtain the correctly bend metal plate.
- (i) The enclosure is the box where the sensor board, and wires are kept to protect from the environment.
- Obtain the enclosure with the predrilled holes.

Step 3 — Extending the Solar Panel Wire



- Obtain the solar panel extension cable
- Obtain heat-shrink tubing and place it around the cable
- Cover the connection between the solar panel wire and the extension cable with the heat-shrink tubing. Then, use a heat gun to shrink the tubing, creating a water-tight seal around the connection

Step 4 — Preparing Solar Panel Wire



- Trim the solar panel extension wire so there is approximately 20 inches of wire from the connection point
- Strip the wires as shown in the image
- Twist the ends of the wires

Step 5 — Attaching The Solar Panel



- Attach the solar panel onto the metal plate.
- Using screws and a screw driver, screw the solar panel into these holes. Now that the solar panel is attached to the metal plate, attach the metal plate onto the lid of the enclosure
 - Note: the tall side of the metal plate should be on the same side of the enclosure as the holes for the ultrasonic sensor and cable glands.
- The screws and nuts should be screwed in this matter in the holes on the sides of the box lid (meaning the nut is on the outside)

Step 6 — Adding The Velcro



- Obtain velcro
- Add velcro with soft side inside the enclosure in the following places

Step 7 — Solar Panel Wire



(i) Now we need to insert the red extension wire from the solar panel into the enclosure box

- Obtain a cable gland
- Screw the cable gland into the wall of the enclosure, through the small hole, as shown
- Place an o-ring between the cable gland and outer-wall of the enclosure
- Insert the solar panel extension wire into the cable gland as shown, leaving approximately 8 inches
 of wire inside the enclosure

Step 8 — Solar Panel Wire Pt. 2



- Obtain a plugable header and ensure the ends of the wires are twisted
- Screw the wires into the plugable header as shown in the picture
- (i) Note: hand tight is just right.

Step 9 — Depth Sensor Assembly



- Solder a 3-prong terminal block to the ground, power, and data (#5) through-holes on the depth sensor
- For organization, bind three wires (red, white, and black) with a small piece of shrink wrap
- Connect the wires as shown in the picture (black to ground, red to power, white for data)

Step 10 — Depth Sensor Installation



- Assemble the depth sensor by adding the o-rings, and the connective wires in the order pictured, leaving the nut ring to the side
- Note that the connective wires connect the depth sensor to the sensor node board. Remember, red wire is responsible for power, black is for ground, and white is for data
- Place the depth sensor through the larger hole, and secure it firmly by tightening the nut ring
 Make sure the nut ring is tightened securely as it will keep the enclosure water-tight

Step 11 — Attaching GPS and Antenna to Modem



- Obtain the cell module (modem), GPS, and antenna
- Insert Super SIM card into cell module
- Attach the GPS to the connection shown (grey wire)
- Attach the antenna to the connection shown (black wire)

Step 12 — Adding Velcro to GPS and Antenna



 Attach rough-sided velcro on the antenna and GPS as shown in the picture.

Step 13 — Adding Velcro and Block Plug to Battery



- Obtain velcro and lithium ion 3.7V battery. Attach rough side of velcro on battery
 Be very careful not to short the battery by touching the two wires together.
- Obtain a block plug.
- Twist the wires of the battery so they fit nicely in the plugable-header block
- Screw the wires into the block plug
- (i) Note: hand tight is just right.

Step 14 — Preparing Battery for Enclosure



- Obtain one battery, 4 zip ties, foam, and a pair of scissors
- Cut out two battery-sized pieces of foam
- Sandwich the battery between the two pieces of foam and secure it using the zip-ties. Connect the zip-ties to make two extra long zip-ties

Step 15 — Adding Standoffs and Battery to Enclosure



- Obtain eight 1.5-inch long standoffs. Screw the standoffs together as shown, to make four 3-inch long standoffs
- Screw the standoffs into the enclosure
- Insert battery into the enclosure. Make sure the wire is on the sensor-side of the enclosure

Step 16 — Connecting Jumpers, SD card, and Modem on Sensor Node Board



- Obtain Open-Storm board and place 4 jumpers in the spots shown
- Insert microSD card into board
- Attach the cellular module onto the sensor node board in the appropriate place

Step 17 — Connecting Sensors, Solar Panel to Node Board



- Put the board on top of the standoffs in the enclosure, and screw it in using a screw driver
- Connect the depth sensor wire as shown
- Connect the solar panel wire to the board as shown
- Connect the battery wire to the board as shown

Step 18 — Securing Antenna, GPS, and Battery



 Attach the antenna, and the GPS on the velcro to the closest wall on the inside of the enclosure

Step 19 — Applying Open-Storm and Node ID stickers



- apply the open-storm sticker to the side of the enclosure as shown
- apply the unique node ID sticker to the two spots shown
- print a label with the unique node ID that appears on the sticker using the label maker
- apply the label to the board as shown

Step 20 — Securing the Solar Panel Wire



- Fold wire over itself so that the portion above the hose clamp won't have slack when the black wire section is pressed against the inside of the panel
- Obtain a hose clamp, and secure the red part of the wire to the black section using a drill fitted with the drill bit
- Wrap a zip tie around the wire as shown.
- Use a second zip tie to connect the ends of the first one

Step 21 — Securing the Solar Panel Wire-continued



- Use a clamp to tighten the zip tie
- Position each zip tie head as shown while tightening
- Clip excess zip tie as close as possible

Step 22 — Adjusting Solar Charger Potentiometer



- Obtain USB power supply, plug into a laptop, and set output to 5.9V
- Check the voltage with a voltmeter (you may have to set the power supply to ~5.8V for the voltmeter to read 5.9V)
- Plug in the green terminal block from the power supply into the Open-Storm board solar port.
- Confirm the solar charge LED is off.
- Plug in a dead battery to the battery port. This step will not work with a charged battery
- CAREFULLY turn the silver potentiometer next to the charge controller IC with a small flathead screw driver until the charge light turns on.
- Although the screw has a phillip screw head, using a phillip screwdriver may damage the potentiometer. The hole in the center is too shallow for most screwdrivers. It is easier to use a flathead screwdriver!
- Resource: 1. How to Select MPP Voltage on a Solar Charge Controller 2. Sunny Buddy Solar Charger V13 Hookup Guide

Step 23 — Preparing Lock



- obtain a master lock and a pair of scissors
- cut the lock and key out of the packaging
- set the lock to the default combination, 0-0-0-0, open the lock
- put the key into the lock and twist clockwise 90 degrees
- while the key is still twisted, set the combo to 2-2-4-5
- remove the key, and the lock is ready to go

Step 24 — Preparing Node Handle pt. 1



- obtain the materials in the quantities shown
- screw the U-bracket onto one of the 8" strut channels, using one of the 1/2" hex bolts and the 1/2" strut channel nut
- attach the remaining 8" strut channel piece to the U-bracket, using two 1/2" hex bolts and two 1/2" hex nuts
- be sure not to center the strut channel you are attaching the the U-bracket, instead make one side of the U-bracket flush with end of the strut channel (as shown)

Step 25 — Preparing Node Handle pt. 2



 insert the two 5/16" strut channel nuts into the back of the horizontal strut channel as shown

Step 26 — Preparing Node Handle pt. 3



- attach the winged strut channel bracket to the 8" telespar using the remaining two hex bolts and hex nuts
- when tightening the hex nuts, ensure the edge of the nut points directly outwards (as shown), or else the struct channel piece will not slide inside
- confirm the T-shaped strut channel piece slides into the telespar, and the handle is now finished

Step 27 — Adding Reinforcement Rails



- Attach the reinforcement rails to the back of the node using two 5/16" hex bolts, two 5/16" hex bolts, and two 5/16" 1.25" OD washers. Insert the bolts the bottom two holes of the node enclosure, using the bottom holes of the rails as shown in the image.
- Line up the top holes of the rails with the top node enclosure holes and then tighten the bottom bolts.

Step 28 — Attaching Enclosure to Handle



- screw the node enclosure onto the strut channel using the two 5/16" hex bolts and two 5/16"
 1.5"OD washers. Be sure to put bolts through the reinforcement rails.
- (i) removing the T-shaped strut channel piece from the telespar makes this step easier
- slide the T-shaped piece back into the telespar

Step 29 — Finishing Touches



- this is what the node should look like on the inside
 - (i) make sure the battery is plugged in
- attach the lock to the outside of the enclosure
- return to <u>Node Builder</u> for instructions on how to drop off the node at the testing rack