Small Automated Sampler Design and Construction Manual

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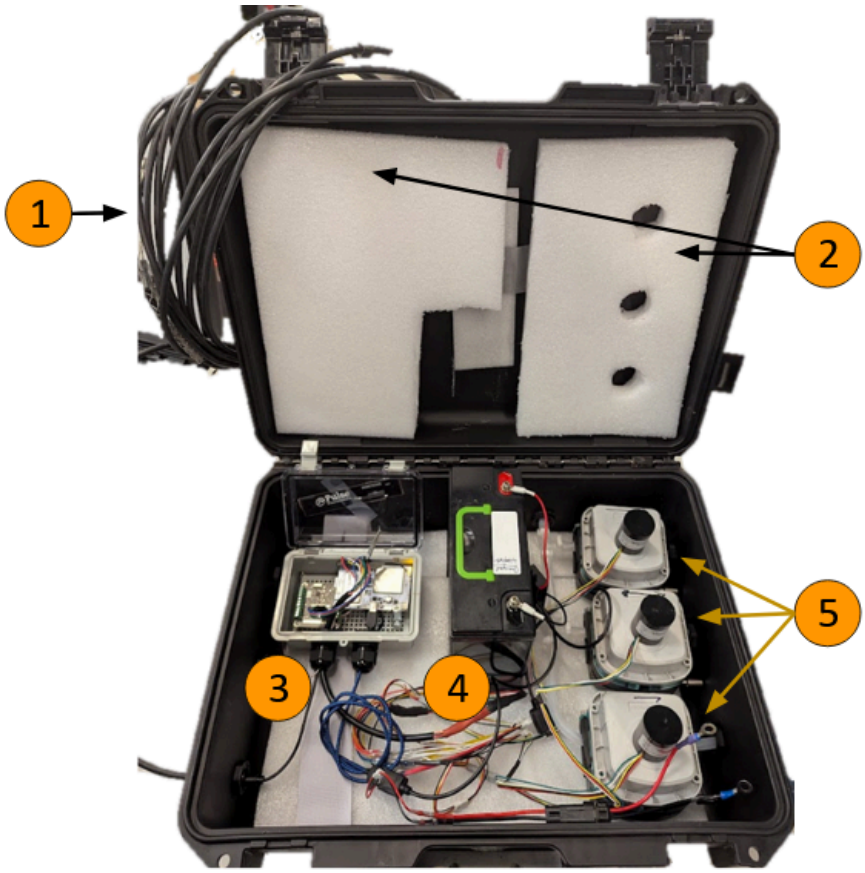
CRediT Authorship
Kayli - Conceptualization, Methodology, Writing - Original draft
Don - Conceptualization, Software, Methodology, Writing - review and editing
Lorenzo - Software
Mark Eliot - Conceptualization, Software
Kelly - Conceptualization, Writing - review and editing, Funding acquisition

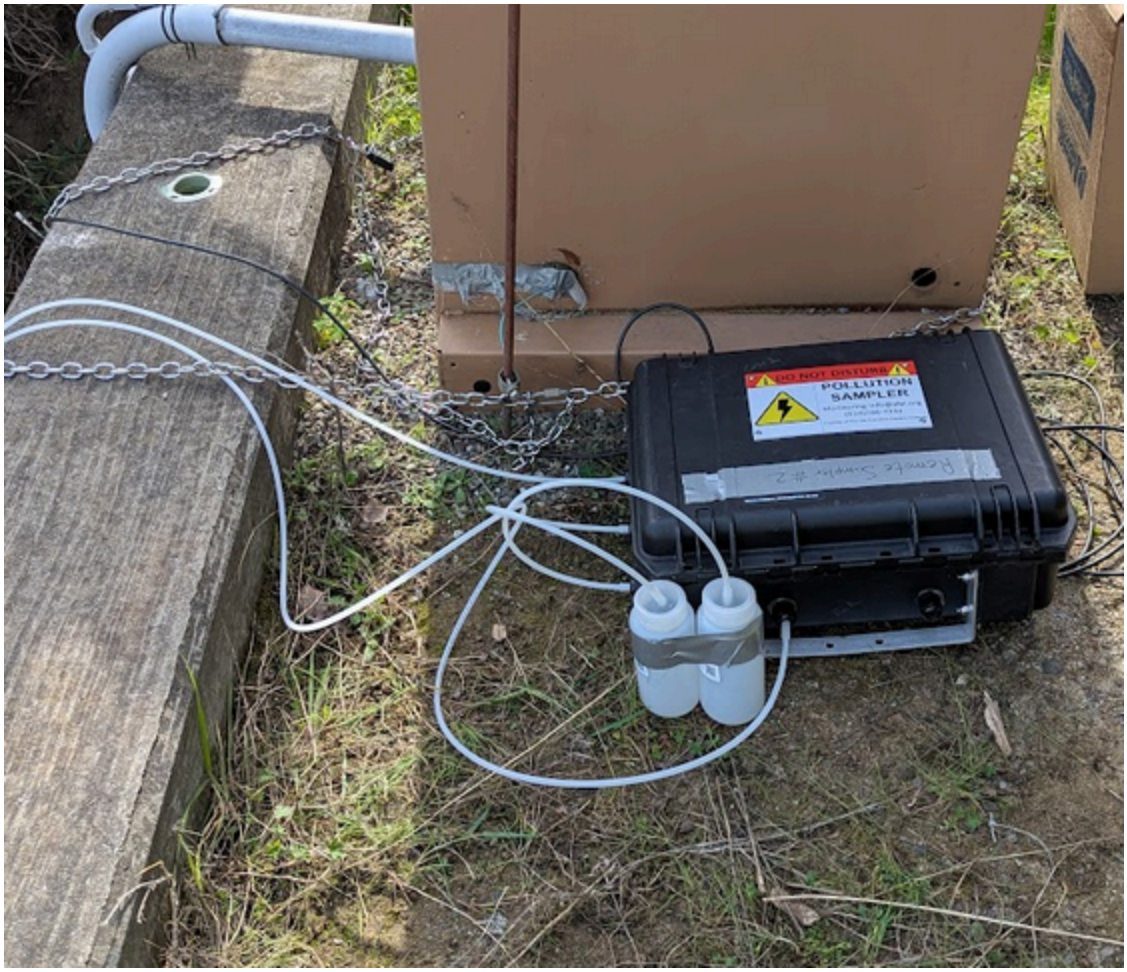
SFEI Contribution Number: 1288

This manual details the design and construction of the SFEI small automated water sampler. It includes two main parts: Remote Sampler Setup (this section, covering sampler housing, structure attachments, and pumps) and Omega Board and Housing Construction (next section, covering the computer control board, its housing, and wiring) will outline the steps for configuring the remote sampler for deployment setup.



Example of the Small Automated Remote Sampler internal setup and pump orientation.

1. CTD Sensor
2. Padding/pump holders
3. Sampler computer and housing
4. 12V Lithium-Ion battery (fully charged)
5. 3 Koemor peristaltic Pumps



Example of the small automated remote sampler in the field with sample bottles and tubing attachments.

Pelican Case Cable Gland Installation

In order to allow the components that need to be kept waterproof access to the water being sampled outside of the Pelican Case, we must drill holes into the Pelican case. These holes will be filled with the cable glands, which will help to prevent water intrusion, but the water resistance may be reduced.

Due to pricing, finding an alternative off-brand waterproof case may be preferable.

Equipment

Equipment Name	Quantity	Website Link
Pelican™ iM2400 Storm Case™ - No foam	1	https://www.buycasesforless.com/p-11668-pelican-im2400-storm-case.aspx

*NPT Plastic Cable Gland 1/2 Knockout Box 25PCS Waterproof IP68 6-12mm Nylon Plastic Black Electrical Cord Grips Kit With Gasket	8	https://www.amazon.com/Waterproof-Adjustable-Locknut-Diameter-Junction/dp/B09VPCDGJT/ref=cm_cr_arp_d_product_top?ie=UTF8&th=1
Silicone Sealant	1 tube	https://www.homedepot.com/p/GE-Supreme-Silicone-Caulk-2-8-oz-KandB-Sealant-White-2974791/330885479
Step drill set	3/16”-⅞” step drill	https://neikotools.com/products/neiko-10169a-step-drill-bit-set-and-automatic-center-punch-5-piece-41-sae-sizes-total-1-8-1-3-8-titanium-high-speed-steel-unibit-stepper-cone-drill-bit-two-flute-step-down-bits?_pos=3&_sid=1e9e306de&_ss=r
5 Piece NPT Thread Forming Taps	1/2" Tap	https://www.amazon.com/dp/B085T4RP4C/?coliid=I396U49YYUG7JP&colid=HR38FGHUHIC&ref_=list_c_wl_lv_cv_lig_dp_it&th=1
Crescent wrench	1	
Power Drill		

*Note for the plastic cable glands. On Amazon, many sellers show these as having full threads and full backings. However, after purchase, many have shown up with short threads and backings that are half the size. The short threaded cable glands will not work and will fall apart during use.

Layout and Description0

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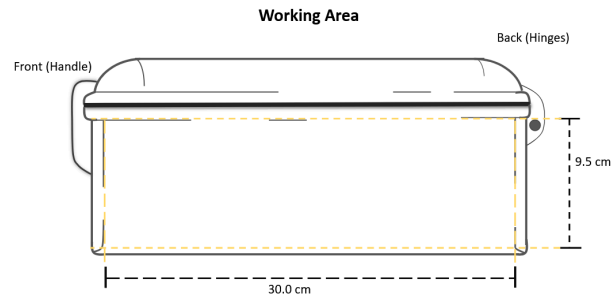
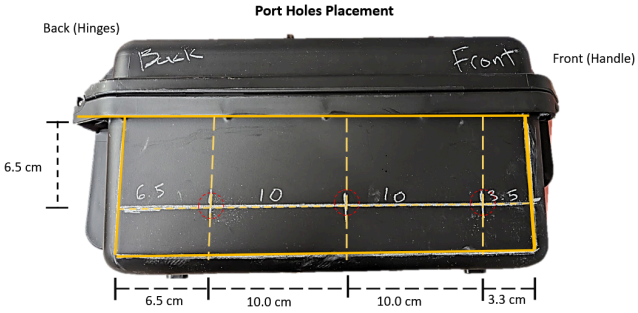
Because you will be drilling and working with silicone sealant, make sure to wear eye protection and work in a well-ventilated area.

Equipment Layout	**Description**

	Label the front and back of the pelican case. Outline the working area on the sides of the case, which is the entire flat area, height = 9.5cm, and width = 30cm.
	Draw a horizontal line 6.5cm from the top of the working area. From the back of the case, draw a vertical line at 6.5cm from the back of the case. Another vertical line 10cm from the previous line, another vertical line 10cm from the previous line. You should have 3.5cm from the final line and the edge of the working area closest to the front handles.
	Repeat the above pattern on the opposite side. Use a drill punch to punch divots in the areas that will be drilled. These punches will help to guide the drill bit.
	On the back of the Pelican case, draw vertical lines that are lined up with the first notch, closest to the raised parts on the back of the case. Draw a horizontal line 6.5cm from the hinge. Use the punch to guide the drill for these holes as well.

	Use the step drill and drill a hole to the 3/16”-⅞” size. Use the 1/2" thread-forming tap to create threads for each hole. Line up the tap and use a crescent wrench to slowly carve in the threads.
	Removing the flat backing from a cable gland. evenly cover the threads with a thin layer of silicone sealant.
	Slowly screw in the cable gland into a hole in the case. Make sure the silicone sealant doesn’t clump in one area and is evenly distributed around the cable gland. Screw the cable gland until its rubber gasket is flush with the box. Repeat this for all 8 cable glands and holes. Let dry in a well-ventilated space for 24-48 hours to ensure the silicone sealant has completely cured.

Conduit Mounting Structure

This section describes how to construct the attachment structure for the 10ft conduct to the case.

Equipment

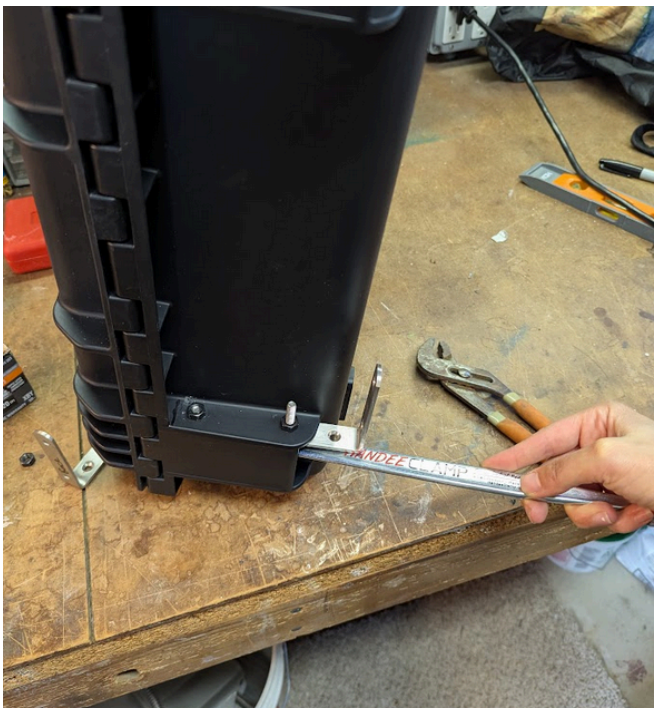
Equipment Name	Quantity	Website Link
Pelican™ iM2400 Storm Case™ - No foam	1	https://www.buycasesforless.com/p-11668-pelican-im2400-storm-case.aspx
Stainless Steel L-Bracket 5”x3”	4	
M5-0.8x35mm Stainless Steel Pan Head Phillips Drive Machine Screw 2-Pieces	8	https://www.homedepot.com/p/Everbilt-M5-0-8x35mm-Stainless-Steel-Pan-Head-Phillips-Drive-Machine-Screw-2-Pieces-863508/323369836
5/16 in. Stainless Steel Flat Washer	8	https://www.homedepot.com/p/Everbilt-5-16-in-Stainless-Steel-Flat-Washer-5-Pack-800351/204276463
Stainless Metric Hex Nut (M5-0.80)	12	https://www.homedepot.com/p/Hillman-Stainless-Metric-Hex-Nut-M5-0-80-4045/204801180https://www.homedepot.com/p/Hillman-Stainless-Metric-Hex-Nut-M5-0-80-4045/204801180
M5-0.8 x 20 mm Internal Hex Flat-Head Cap Screw (12-Pack)	8	https://www.homedepot.com/p/Hillman-M5-0-8-x-20-mm-Internal-Hex-Flat-Head-Cap-Screw-12-Pack-44525/204794979
1 in. x 3 ft. - 1/8 in. Thick Aluminum Flat Bar	1	https://www.homedepot.com/p/Everbilt-1-in-x-3-ft-1-8-in-Thick-Aluminum-Flat-Bar-6205/332735165
Adjustable Clamps	2	https://www.homedepot.com/p/DEWALT-6-in-100-lbs-Trigger-Clamp-with-2-43-in-Throat-Depth-DWHT83139/204389199
Benchtop Drill Press	1	(if available) The alternative is hand-tool power drill
Carbide Multi-Material Drill Percussion Bit Set (7-Piece)	1 - set	www.homedepot.com/p/Milwaukee-SHOCKWAVE-Carbide-Multi-Material-Drill-Percussion-Bit-Set-

		7-Piece-48-20-8899/321505937
Miter saw or hand saw	1	
Adjustable Crescent wrenches		Full set
Handee Clamp	1	https://www.handeeclamp.com/shop
Bench-mounted vice clamp	1	https://www.homedepot.com/p/Wilton-CBV-100-Super-Junior-4-in-Vise-with-Clamp-On-Swivel-Base-63247/306224214
Full coverage eye protection	1	https://www.homedepot.com/p/DEWALT-Safety-Goggles-Concealer-with-Clear-Anti-Fog-Lens-DPG82-11C/202220499
Work gloves	1 set	
Sharpie/pencil		
Ruler/Right-angle	1	

Layout and Description

Set up the benchtop drill press in a flat, stable area. It may need to be mounted to a table using either mounting screws or the adjustable clamps to help with stability. Make sure full eye protection is worn while metal is being drilled. Metal shavings can easily get into the eyes and cause major damage. If using a miter saw or hand saw, also wear eye protection and work gloves.

Equipment Layout	**Description**
	Turn the pelican case over to look at the back hinges. Using the ruler or right angle, mark where the defined “top of the back is, right under the hinges. Line up the L-bracket along this “top” line and the back hinges protrusion on the box. Use the right-angle to ensure the bracket is level. Using a pencil or sharpie, mark the top and bottom holes of the bracket. Use a screw-tap to help define the drill sites.

	Use a ¼” drill bit and hand drill to drill the bracket holes. Use the handee-clamp to place the Stainless Steel Pan Head Phillips screws. The L-bracket can go on the interior or exterior of the hinge area. With the handee clamp holding the screws in place. Cap the screws with a washer and hex bolt. M5-0.8 x 20 mm Internal Hex Flat-Head Cap Screw, washer, and hex-bolts.
	Measure the space between the hinge areas where the L-brackets will go, and measure out that length on the 1 in. x 3 ft. - 1/8 in. Thick Aluminum Flat Bar. After the first L-bracket is installed, temporarily affix the aluminum bar to the L-bracket using the adjustable clamps. Use the aluminum flat bar to guide where to place the second L-bracket and ensure the flat bar placement will be flat. Repeat the previous sets for the second backside, L-bracket placement.
	With the clamps, hold the measured length of the 1 in. x 3 ft. - 1/8 in. Thick Aluminum Flat Bar over the attached L-brackets. Mark with a sharpie where the attachment holes for the brackets are on the flat bar. Use the benchtop drill press and clamps to drill the aluminum flat bar. Use an appropriate carbide drill bit from the set to drill out the holes. Use the adjustable clamps to hold the flat bar in place on the benchtop drill press. Secure in place using the

	On the front side of the Pelican case, use the L-bracket to mark where the single-hole placement is. This should be just below the lip of the case, similar to the back. Use the second hole of the L-bracket to see where the hole will be placed. Mark with a sharpie or pencil and drill using a ¼” drill bit and a hand power drill.
	With the handee clamp, secure the M5-0.8x35mm Stainless Steel Pan Head Phillips screw on the inside of the case with a stainless steel washer. Secure in place with the stainless steel hex bolt and L-bracket. Cut a piece of the aluminum flat bar to fit between the two L-brackets using the miter or hand saw. Use the aluminum flat-bar to find where to place the next L-bracket and ensure the holes are correct. Follow the previous steps to see where to place the holes to secure the flat bar in place.

Sign and indicators attachment to the Pelican Case

Sometimes you need to put signage on the case to indicate what it does and who it belongs to. Signage can vary depending on the organization and what the equipment will be used for. Heavy-duty outdoor materials should be used for the signs.

Equipment

Equipment Name	Quantity	Website Link
Sign	1	
#8-32 x 3/4 in. Stainless Steel Combo Round Head Machine Screw	4	https://www.homedepot.com/p/Everbilt-8-32-x-3-4-in-Stainless-Steel-Combo-Round-Head-Machine-Screw-5-Pack-828351/317479121
7/16 in. Stainless Steel Flat Washer	4	https://www.homedepot.com/p/Everbilt-7-16-in-Stainless-Steel-Flat-Washer-12-Pack-826911/317479528?MERCH=REC-_-fbt_test-_-317479121-_-2-_-n/a-_-n/a-_-n/a-_-n/a-_-n/a
#8-32 Stainless Steel Machine Screw Nut	4	https://www.homedepot.com/p/Everbilt-8-32-Stainless-Steel-Machine-Screw-Nut-4-per-Pack-826221/317478849?MERCH=REC-_-fbt_test-_-317479528-_-5-_-n/a-_-n/a-_-n/a-_-n/a-_-n/a
Silicone Sealant	1 tube	https://www.homedepot.com/p/GE-Supreme-Silicone-Caulk-2-8-oz-KandB-Sealant-White-2974791/330885479
Nitrile gloves		
Drill bit set		
Work gloves		
Benchtop drill press		
Safety glasses		

Layout and Description

Equipment Layout	Description

	Using the benchtop drill press and a small drill bit that can accommodate the #8-32 x 3/4 in. Stainless Steel Combo Round Head Machine Screw, drill holes into the corner of the sign. Larger signs should use at least 4 drill holes, while smaller signs may use just two. Orient your sign on the front of the pelican case and use a Sharpie to mark the four sign holes. Drill the marked locations on the pelican case with a hand drill.
	Place the #8-32 x 3/4 in. Stainless Steel Combo Round Head Machine Screw through the holes on the front of the case. On the interior side, cap the screws with the washers and screw nuts. Cover the interior screw, washer, and nut with a thick layer of silicone sealant to prevent water intrusion. Make sure the entire washer and nut are covered. Wear nitrile gloves when spreading the sealant.

Case Interior Setup and Padding

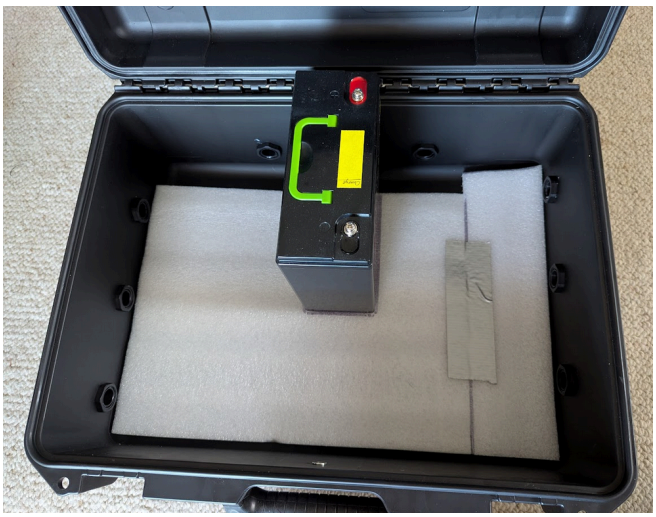
Setting up the interior of the case and positioning the padding is the final step in the sampler-building process. The foam used here is effective at holding all the equipment in place and cushioning the internal equipment from the effects of impacts. However, any type of foam can be used, or if you have another system to hold the equipment in place, that can be used in its place.

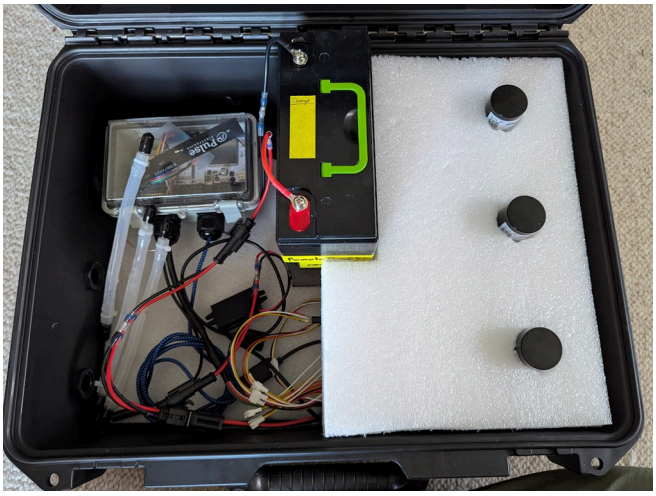
Equipment

Equipment Name	Quantity	Website Link

Pelican™ iM2400 Storm Case™ - No foam	1	https://www.buycasesforless.com/p-11668-pelican-im2400-storm-case.aspx
Foam	½” and 1-1.5” Thick	This foam was grabbed from other boxes, packages, etc.
Retractable safety knife	1	https://www.homedepot.com/p/Stanley-6-in-Classic-Retractable-Utility-Knife-10-099/100000053

Layout and Description

Equipment Layout	Description
	Grab a completed, empty Pelican case. Get the ½” foam and fit it to the bottom of the case. As you can see in the photo, two foam pieces were used. Use what you can and make it work. No need to tape or glue the foam to the bottom of the case. It should be removable in case the foam gets damp.
	Place the battery and take and draw its outline on the bottom case foam. With the retractable safety knife, cut the battery outline out. The batter will sit on the bottom of the case.

	Place your pumps, battery, and Omega board housing and wiring in the case. Arrange the equipment in the positions they will be for deployments. Add as few or as many pumps as you want. Make sure everything fits well.
	Cut holes out of the foam for the pump tops as well as space for the battery.

	Repeat this process for the other side. Add a piece of ½” foam above the battery to make sure it doesn’t move around at all. Close the case up and do a shake test. If you hear things moving around in the case, you may need to refit the foam.

This concludes the Remote Sampler Setup. These samplers are now ready for deployment and whatever else you want to do with them.

Omega Board and Housing Construction

This portion of the manual will outline the construction of the Omega board housing and electronics mounting board, its wiring components, the housing step-up, and parts needed for a complete Omega board sampler. This manual will be broken into sections based on part and wiring assembly for an easily digestible step-by-step construction.

Omega board housing construction

The housing for the Omega board and the Dr. Liu SDI-12 UART Adapter, plus all the wiring, should be as waterproof as possible. The Junction box listed in the equipment section has a lot of features that make it a good choice for the sampler. The clear lid allows us to see inside the box and confirm that the equipment lights are running. It also includes cable glands that allow wires to connect through the box but still maintain their waterproof integrity.

The size of the box can be changed. The 5.9” x 3.9” x 2.8” box fits both boards and wiring, but it is very tight. If you think a larger box might be better based on a modification to the overall system, I would suggest the 5.9" x 5.9" x 3.5" box or the 7.9" x 3.9" x 2.8" box. The box still needs to fit in the sampler with all the pumps, batteries, and wiring.

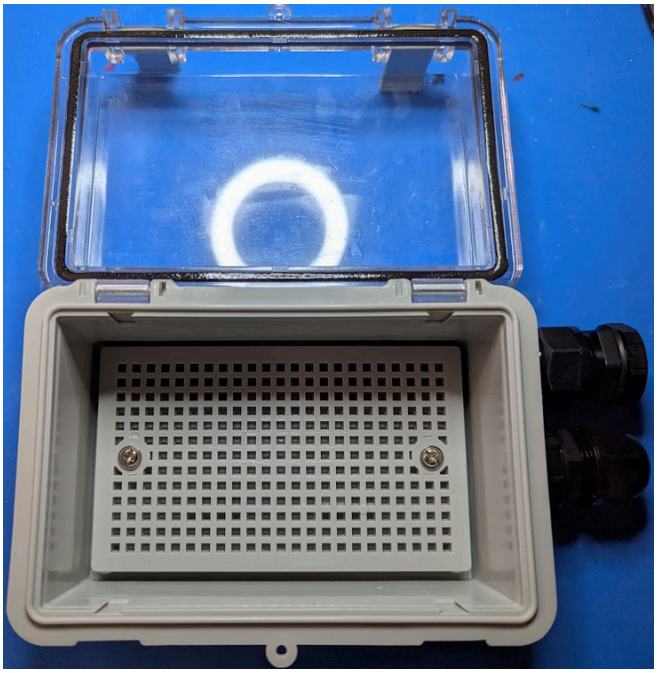
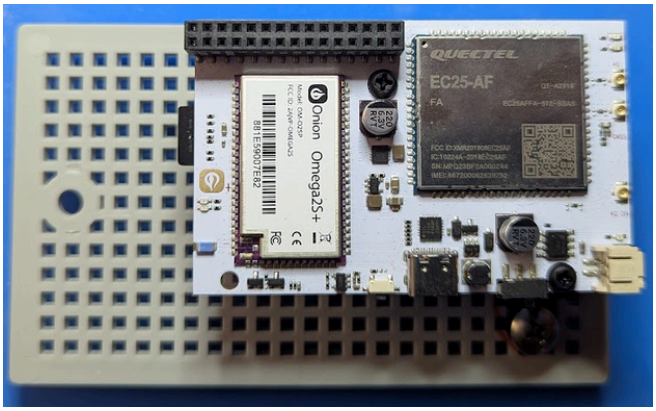
You will need equipment such as step drills, a standard drill bit kit, a screwdriver, needle-nose pliers, and a power drill for this process.

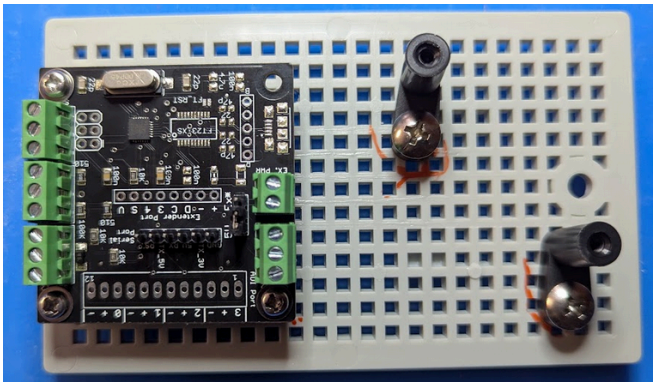
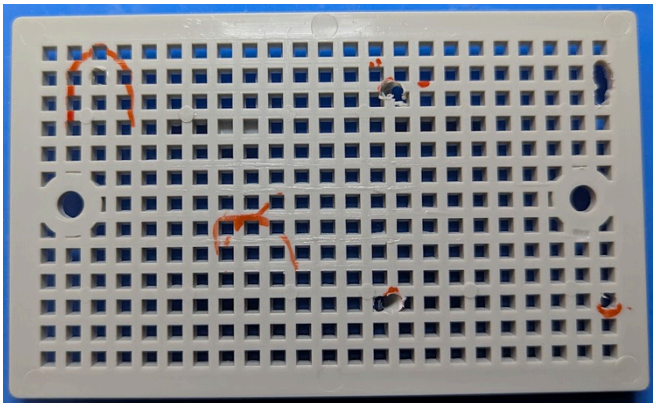
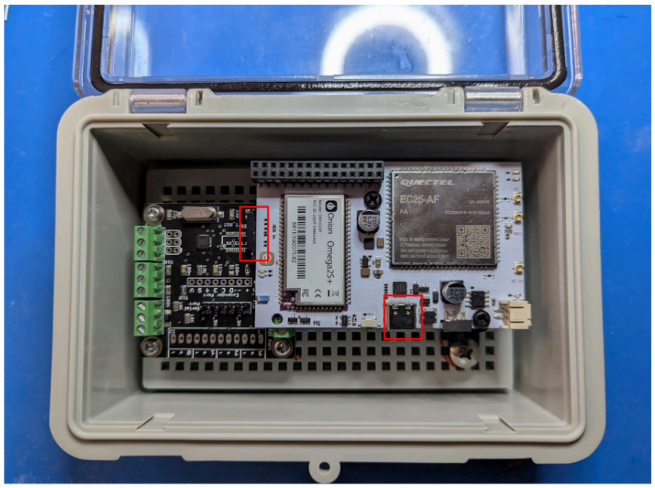
Equipment

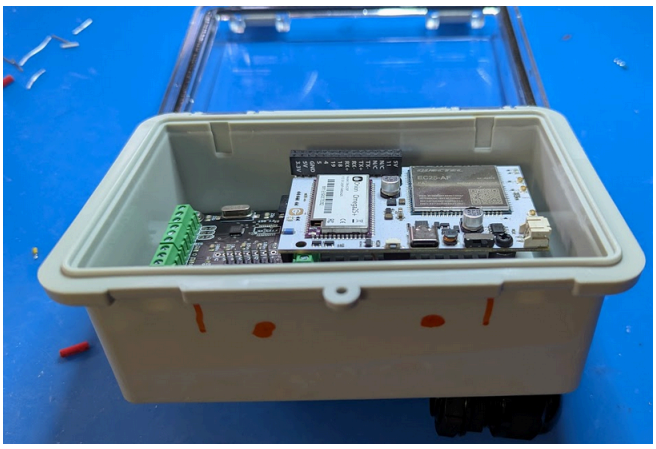
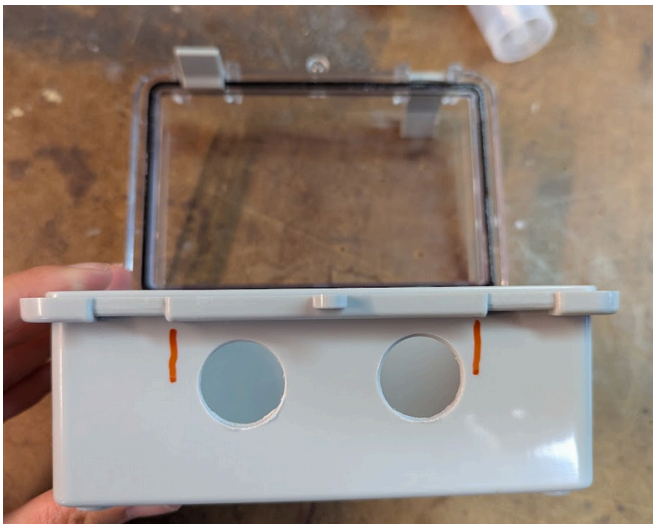
Equipment Name	Quantity	Website Link
Junction Box IP65 Waterproof ABS Plastic Enclosure Hinged PC Clear Cover Electrical Project Box with Mounting Plate, Wall Brackets, Cable Glands 5.9" x 3.9" x 2.8"(150 * 100 * 70)	1	https://www.amazon.com/HoHaing-Waterproof-Enclosure-Cover-Electrical/dp/B0BY8XXZ2T/ref=sr_1_39?dib=eyJ2IjoiMSJ9.Fupe1QZ1HyakqQhZntNVglesyEfvf8gJsS35pOcLwYI4LOlssqPU1UpXQ1kEVXmQm3sMLDC5Nloa3beaM-DdjplcMHRPLGNKBPrUj7Cjv3-hsR_4UaIlz1qvEOYTxt1t20RMRGfWVM9LdmAwxGffo4b8lVCwBmjDllNVwKad7xm2DbnwkJ2EK0EyNcdrGP7g2cJPAgqdRd3uHqXDDqCE7QX63gEpryH8ohUhjEOpfrSzzrW4oCFp-gLZ47ojsBYOwWS_WBYzot3nAsVKxQ7DGZ66bgTOdvtXOlGJTOZdKtK4e0BhP92nIcjqINltUXyl

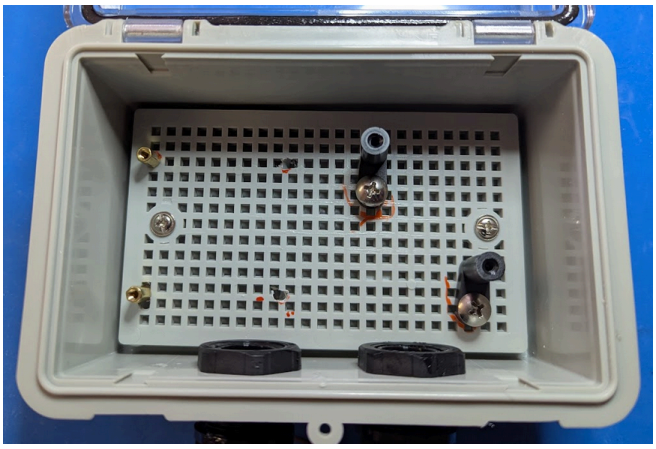
		P1gu-ZiE_nqgiiKx47nvlu-u0V4y0dQiKgrio3G8XdGMtnzqaktj59Ubq4e_9__mlZaDdSAQ_PKCjPatcdoyVdrOBPAGa32TIlyehIlkvoWJBwQO2YRv12nCb-6RFMDg.-NMLg3o9yz9MzDgZ9hexN-ycG9tRQfkVjObfCpda6QE&dib_tag=se&keywords=pcb%2Benclosure&qid=1734544591&sr=8-39&th=1
Silicone Sealant	1 tube	https://www.homedepot.com/p/GE-Supreme-Silicone-Caulk-2-8-oz-KandB-Sealant-White-2974791/330885479
Mounting Hardwear	Various	https://www.amazon.com/Swpeet-Standoffs-Mounting-Hardware-Insulated/dp/B0BZGPP6WP/ref=sr_1_4?dib=eyJ2IjoiMSJ9.AhE2fUNJ6NThoZz-veYiF51FYiWbC-QV4MLopI6ts-LS93u9W178wXoM1X22DKugqd5SUNULTHN7nbtLI3ROHmWOoHi6KL5sbZbHKIUSKakl4_FRj2cBi2MMgyQOrxgd2pMsosr7HDxjUa7Kk4dzOJW7d1X2wt28nIA0pv6cOt0xTju3qHV6aAfx0e5-GHExG4PLB7wtRg75gUnSmWavXKpEQChfJU9AB3ByGOnaKvo.qqNS2VypReBHV-XU61q9B-kETCOS7WIbtZMgN9kEVsg&dib_tag=se&keywords=circuit+board+mount&qid=1750794215&sr=8-4
Step drill set	Can be reused	https://neikotools.com/products/neiko-10169a-step-drill-bit-set-and-automatic-center-punch-5-piece-41-sae-sizes-total-1-8-1-3-8-titanium-high-speed-steel-unibit-stepper-cone-drill-bit-two-flute-step-down-bits?_pos=3&_sid=1e9e306de&_ss=r

Connections and Layout

Equipment Layout	Description
	Get the Junction Box IP65 Waterproof ABS Plastic Enclosure out of its plastic wrap and check to make sure the rubber seal is intact, and it has two cable glands.
	Using the footed mounting hardware, place the Omega board so that the serial port is closest to the box's hinge. There should be a little bit of room around the edges closest to the wall of the box. Screw in the feet to the mounting plate. You may need to mark the foot on the inside of the board. There is no need for a third mounting foot.

	Attach the mounting hardware to the SDI-12 UART Adapter. Leave the mounting feet from the Omega board to get an idea of where to place the SDI-12 UART Adapter. The ADI Port of the SDI-12 UART Adapter should be facing the feet. Place the SDI-12 UART Adapter so the rows of ports are to the other wall of the box. Mark where the SDI-12 UART Adapter mounting hardware will be on the mounting board.
	With a small drill bit and a power drill, drill out the marked areas on the mounting board where the SDI-12 UART Adapter mounting hardware will go. The mounting feet for the Omega board should not need to be drilled. You may need to move the drill around to get the hole big enough or in the right place. Make sure to clean the board of any loose debris.
	Mount the SDI-12 UART Adapter first on the mounting board. Use the needle-nose pliers to screw in the mounting feet to the back of the mounting board. Place the Omega on its two mounting feet. Note where the Micro SD card port is and make sure that the card can be easily removed. Also, not where the USB-C power port is. Make sure this port has some distance from the box wall.

	Close the box and mark where the clamps fall. Use a cable gland, rest the gland edge on the top edge of the box, and mark the center of the gland with a marker. Repeat on the other side. Do not overlap the gland with the box clamps, or the box will not seal properly.
	Use the 3/16”-⅞” step drill from the step drill set to drill a 13/16” hole where the cable gland marks were. Use a tap to mark the center of the holes and help guide the drill bit. Once the holes are bored, make sure the edges are flat. Excess plastic may need to be cut away using a box cutter from the outside and inside of the box. Check to make sure the holes are large enough for the cable glands.
	Take the backing off the cable glands. Around the threads, smear a good amount of silicone sealant over all sides. Place the threads into the outside of one of the holes in the junction box and slowly screw the gland in, making sure the sealant is evenly distributed around the hole, until you reach the rubber gasket. On the inside of the junction box, reattach and slowly tighten the cable gland backing.

	Repeat the process for the other cable gland.
	Reinstall the junction box mounting plate. Remove the boards to access the mounting plate screw holes. Leave the Omega board and SDI-12 UART Adapter Connection mounting feet when reattaching the junction box mounting plate.

This concludes the Omega Board housing construction section. The installation of the SDI-12 UART Adapter Connection Board and the Omega Board and their components will be addressed in their respective sections.

The Omega Board Connections

DrLIU SDI-12 UART Adapter connections

The Dr. Liu SDI-12 UART Adapter connects the CTD-sensor output information to the Omega board. The following steps will go through the equipment, setup, and quantity for a single sampler.

You will need equipment such as a soldering iron, a miniature flathead screwdriver, and wire cutters to construct the equipment.

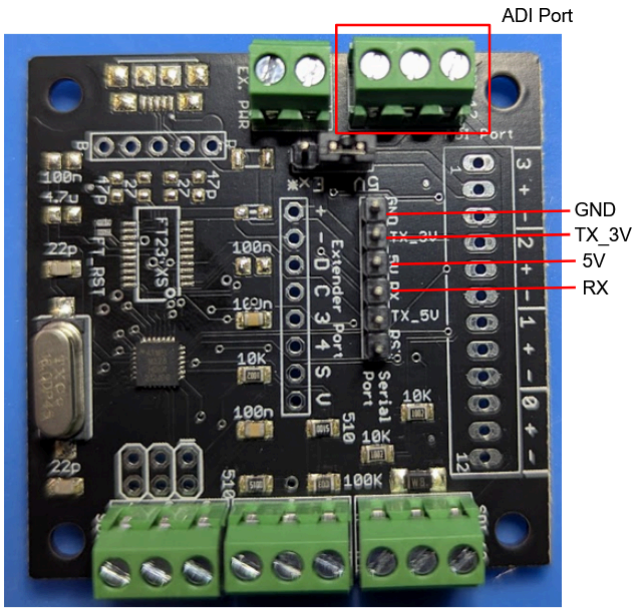
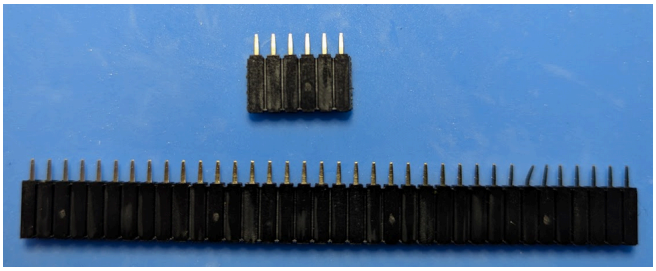
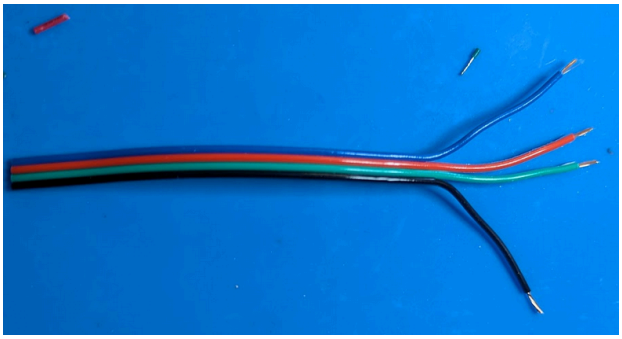
Equipment

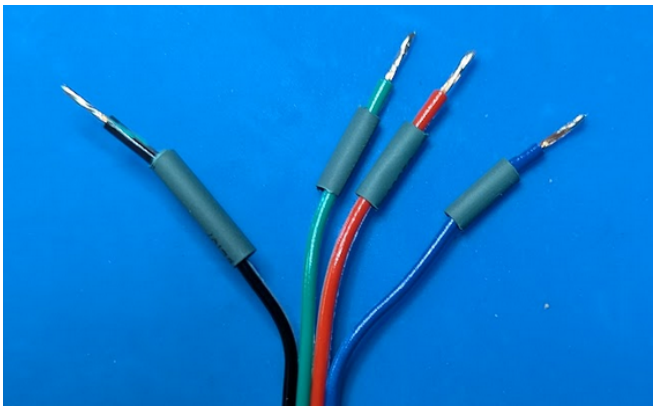
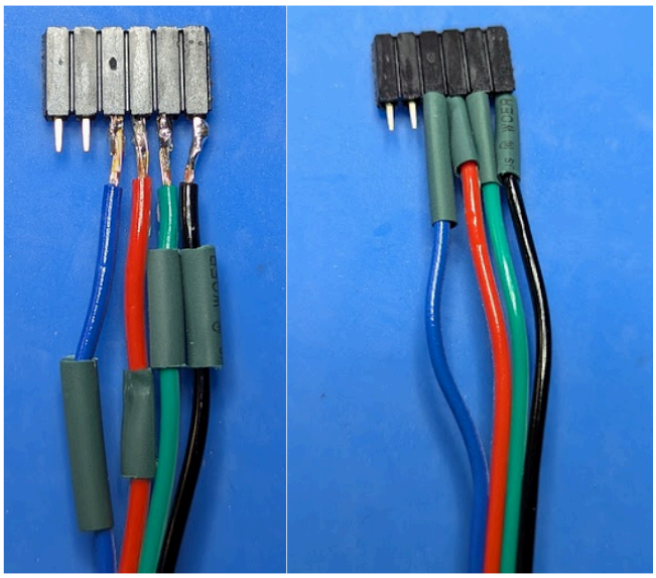
Equipment Name	Quantity	Website Link
SDI-12 UART adapter	1	https://liudr.square.site/product/sdi-12-uart-adapter/52?cs=true&cst=custom
Female Stereo Jack Adapter	1	https://bit.ly/43Q8FLe
4-PIN RGB Extension Connector Wire Cable Cord	4-5 in	https://www.ebay.com/itm/234595813096
2.54mm 28pcs 1x42pin Hand Breakaway Female Pin Headers Connector	6 pins	amzn.to/4jVcrJr
Heat Shrink	Various	https://www.amazon.com/dp/B07TYBPBJP/ref=sspa_dk_detail_6?psc=1&pd_rd_i=B07TYBPBJP&pd_rd_w=Mc0sN&content-id=amzn1.sym.953c7d66-4120-4d22-a777-f19dbfa69309&pf_rd_p=953c7d66-4120-4d22-a777-f19dbfa69309&pf_rd_r=JTFZSJHRAQT2M5SP4G64&pd_rd_wg=BNhRn&pd_rd_r=0eb555dc-7bd1-49dd-9800-27b1849fdb19&sp_csd=d2lkZ2V0TmFtZT1zcF9kZXRhaWwy

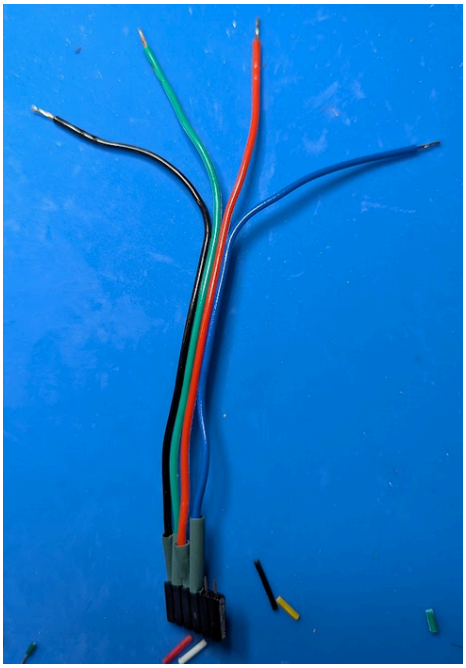
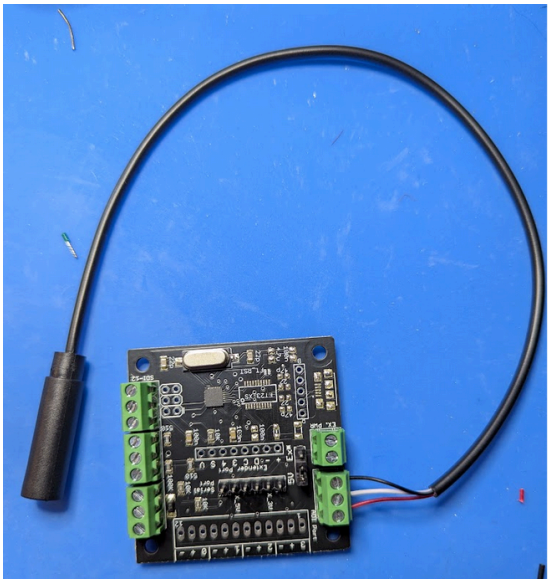
The Dr. Liu SDI-12 UART adapter can be set up before connecting the 4-PIN RGB extension connector to the main Omega board circuit.

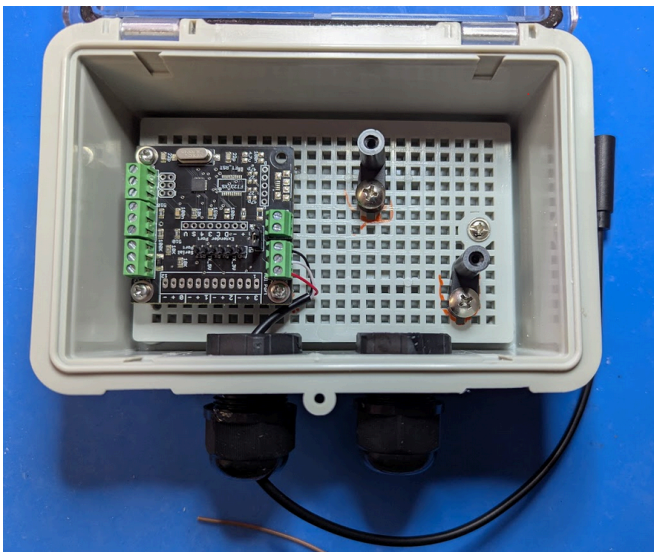
Connections and Layout

Equipment Layout	Description

	Detach the DrLiu SDI-12 UART adapter from its packaging. Note the features and orientation of the board shown in the photo to the left. On the Serial port, the four connections (GND, TX_3V, 5V, RX) will be used to connect to the Omega Board with the CTD Sensor information. The ADI port will connect the Female Stereo Jack Adaptor for the CTD sensor.
	Cut around 5in of the 4-PIN RGB Extension Connector Wire Cable Cord.
	Clip 6-pins from the 2.54mm 28pcs 1x42pin Hand Breakaway Female Pin Headers Connector. This can be done with a wire cutter.
	Using a wire cutter, clip the webbing between the wires of the 4-PIN RGB Extension Connector Wire Cable Cord. Carefully peel the wires apart around 1.5in. With the wire cutters, cut a small portion of the sheath off the wire ends.

	Make sure the wiring at the ends of the wires is tight and solder the tips of the exposed wires. Cut up one of the smaller diameter heat shrinks into four pieces and place those onto each of the wires.
	On the 6-pin female connector pins, note which pin will connect with the GND pin on the SDI-12 UART adapter. Solder the black wire to where the GND pin will connect. Solder the rest of the wires to the subsequent pins in their original color order. Slide the cut pieces of heat shrink over the soldered pins to ensure none of the wires are touching.

	On the other end of the 4-PIN RGB Extension Connector Wire Cable Cord, carefully cut and pull the wires apart, around 2in.
	Carefully strip around 3mm of sheath from the Female Stereo Jack Adapter, black, white, and red wires. With a miniature flat-head screwdriver, loosen the screws for the ADI Port. Starting with the black wire, insert the wire into the port nearest the EX. PWR port. Tighten the screw until the wire does not move. Work down the ADI Port with the subsequent wires being white, followed by red. Ensure that the sheath covers the wire at the port entrance. The Jack Adapter wires are very small if you accidentally cut one. Strip the wire back around 5mm. Resolder the wire tips.

	Carefully so as not to disturb the female stereo jack wiring, install the SDI-12 UART adapter with the female stereo jack attachment. Slowly pull the female stereo jack attachment head through the cable gland closest to the SDI-12 UART adapter. Do not pull the cable super tight; there should be some slack in the wiring.

This concludes the SDI-12 UART adapter installation section. Be careful moving the female stereo jack attachment around until the cable gland is tightened. This will occur in the Omega LTE Board and connections section.

Omega2 LTE Board and Connections

The Omega board connects the SDI-12 UART adapter with the pumps and battery. This is the main hub for input processing and programming.

You will need a soldering iron, heat gun, needle-nose pliers, and wire cutters to complete the construction.

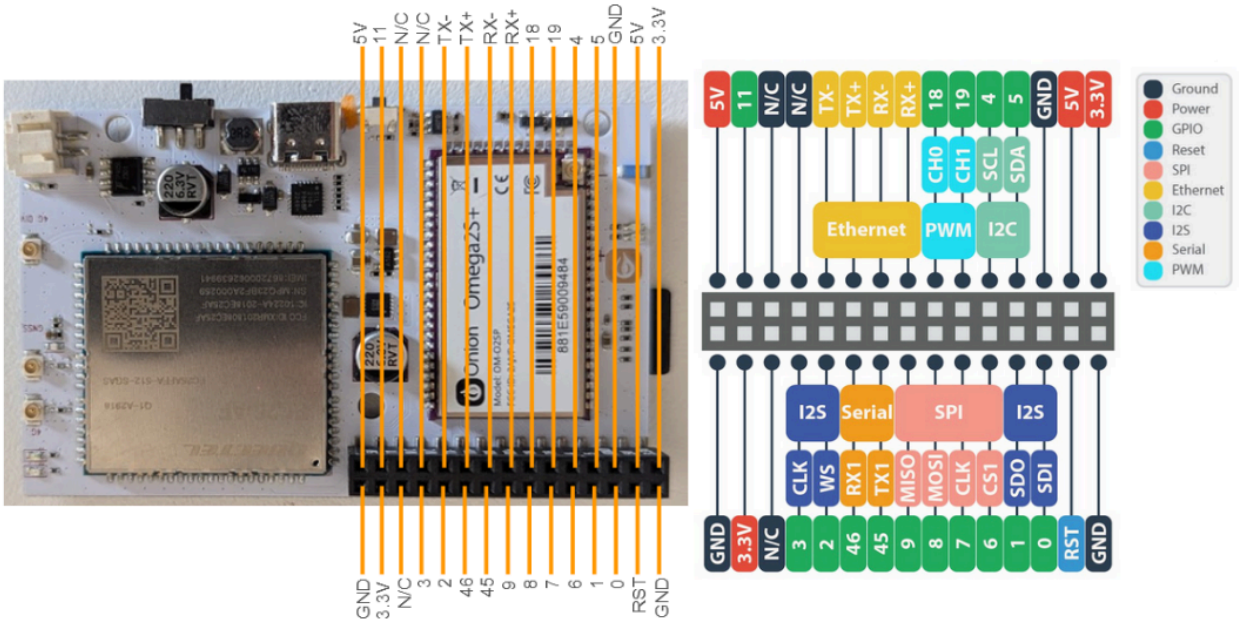
Equipment

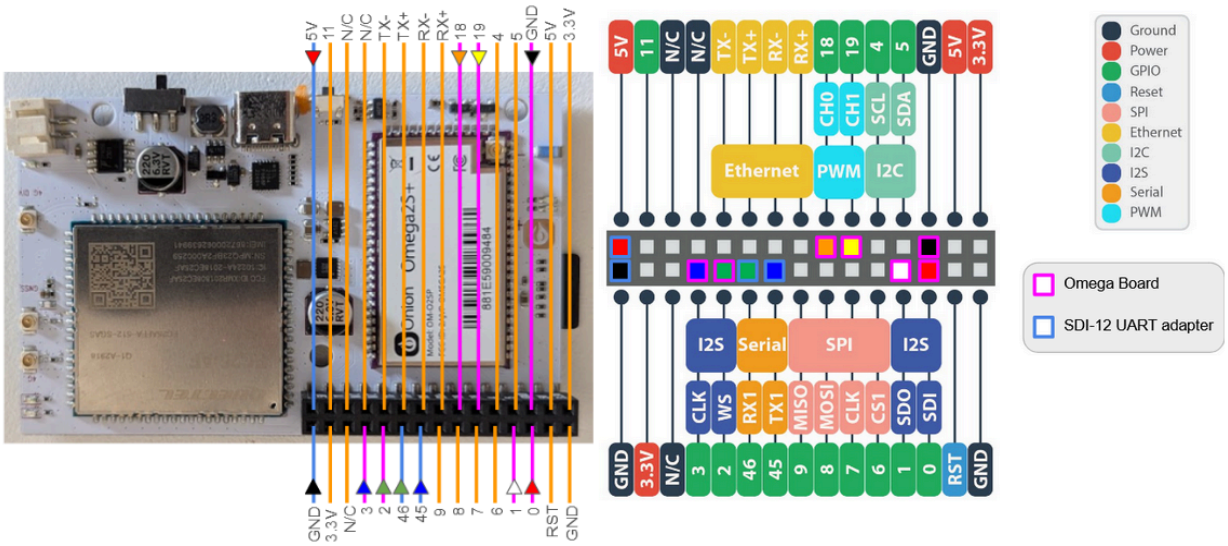
Equipment Name	Quantity	Website name
Omega2 LTE North American Model	1	https://onion.io/omega2-lte/
LTE Antennas Ant Int 0.698-3.6GHz	1	https://www.mouser.com/ProductDetail/Pulse-Electronics/W3907BD0100?qs=0lSvoLzn4L%252B2SIO18gQxdw%3D%3D
SIM Card	1	https://shop.1nce.com/en?_gl=1*16hhwfr*_gcl_au*Mjg3NjI3MDA5LjE3MzYzNTgwMzYuMTI0MzY0ODgyMS4xNzM2MzU5NTEwLjE3MzYzNTk3Nzg.

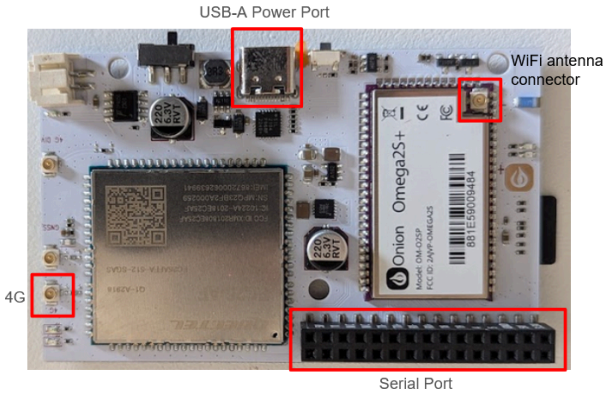
Micro SD Card	1	https://www.amazon.com/dp/B09WW69YRD/?coliid=I3HMOE0YSOJH33&colid=HR38FGHUHIC&ref_=list_c_wl_lv_cv_lig_dp_it&th=1
Dual Band WiFi 2.4GHz 5GHz Antenna with female cable	1	https://www.amazon.com/Bingfu-Antenna-Wireless-Express-Network/dp/B088GWHNCR/ref=pd_ci_mcx_di_int_sccai_cn_d_sccl_4_4/138-4883206-1737759?pd_rd_w=Xsyl4&content-id=amzn1.sym.751acc83-5c05-42d0-a15e-303622651e1e&pf_rd_p=751acc83-5c05-42d0-a15e-303622651e1e&pf_rd_r=B04WNZ2BF73TF61CW5P0&pd_rd_wg=xXvZO&pd_rd_r=e0a2a6cf-2e09-4321-977b-cf448724aa29&pd_rd_i=B088GWHNCR&psc=1
2PCS U.FL IPEX IPX Male to U.FL IPEX IPX Female Cable 4" /10CM U.fl/IPEX IPX 1.37mm Low-Loss Extension Cable	1 (2” or 4”)	https://www.amazon.com/gp/product/B0C8MGMG7P/ref=ox_sc_saved_image_3?th=1
22-Gauge 8-Conductor Electrical Wire	8-10 in	https://www.amazon.com/Conductor-Electrical-Thermostat-Landscape-Automotive/dp/B0CZL4XGT7/ref=sr_1_21_sspa?crid=3IURCTPTAZ3QI&dib=eyJ2IjoiMSJ9.592iLrWeRjoLHJ_PhGNr9w14zUkUhrqzOHDuhHLTNLkZGW3Ay3GNeS460VUF75H9_NMtIIXw-yCWv3vsNBYT6S8tpjk_rOfiqj4-PLm7Wo4IIoUbd89uwtMM3Y0RSpENETtuzrVCXxkxK2n4zdmd6yF-iE6uADAdMU7P967U0LGIewolLLXJLNn9Am1dE-1D_pGbMoWJOyp9pLu1Aut7BwAWcpOQJvvqf2LxtLIZmnZQB_7z8PwL5EI0eoEb6xv8VMtUJxos9WCQ9QDW8wANrKQ2vto0joKadsTDDrD7dPc.psqO2DixiIdPkXp4ur2EgdtLmDCeuE1UDkrnOa2T4IQ&dib_tag=se&keywords=28%2Bawg%2B8%2Bcore&qid=1736364573&sprefix=28%2Bawg%2B8%2Bcore%2Caps%2C150&sr=8-21-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9tdGY&th=1
USB-C to USB-A charging cable	1	https://www.bestbuy.com/site/insignia-4-usb-a-to-usb-c-charge-and-sync-cable-charcoal/6410815.p?skuId=6410815&intl=nosplash

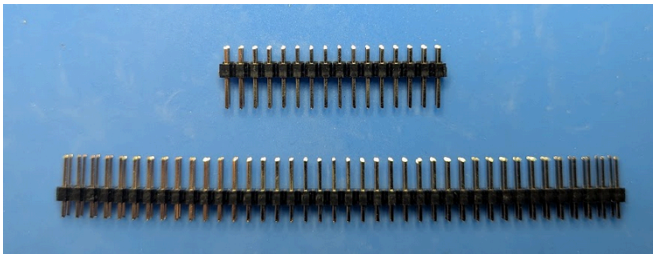
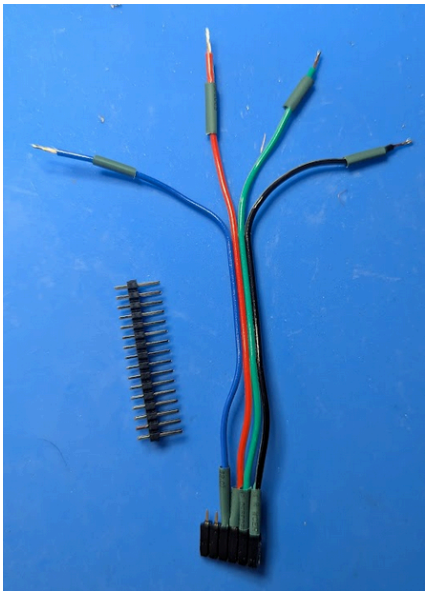
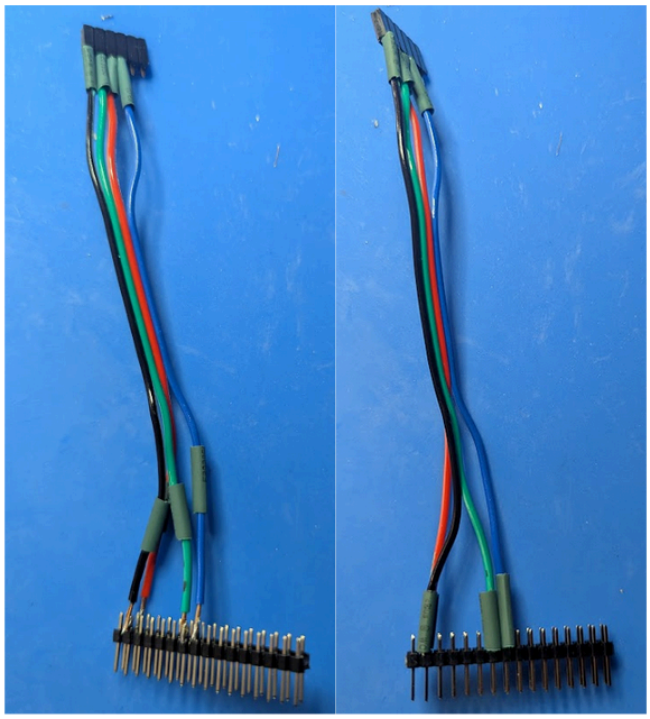
40 Pin 2.54mm Spacing Double Row IDC Male Pin Header Connector Strip	15-16 pins	https://www.amazon.com/Antrader-2-54mm-Spacing-Double-Connector/dp/B07D48Z8PN?th=1
8 PIN Female and Male Connecting Plug with Terminal Connector Wire Cable	1 male connector	https://www.amazon.com/dp/B08H55TNJX/ref=sspa_dk_detail_0?psc=1&pd_rd_i=B08H55TNJX&pd_rd_w=exl2B&content-id=amzn1.sym.8c2f9165-8e93-42a1-8313-73d3809141a2&pf_rd_p=8c2f9165-8e93-42a1-8313-73d3809141a2&pf_rd_r=PJJ230YQ21RT0N01A1E4&pd_rd_wg=IEGVr&pd_rd_r=3af8d6e3-b295-4164-acfa-d9c729e00161&s=hi&sp_csd=d2lkZ2V0TmFtZT1zcF9kZXRhaWw
Heat Shrink	Various	
Solder seal wire connectors	7 AWG 26-24 (white)	https://www.amazon.com/dp/B0B1PVJ226/?coliid=I2AUU1F2NK5DYY&colid=3A1KK5X2Q9J7B&ref_=list_c_wl_lv_ov_lig_dp_it&th=1

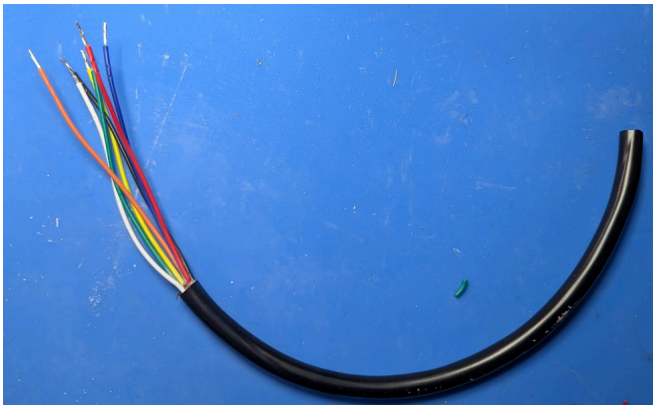
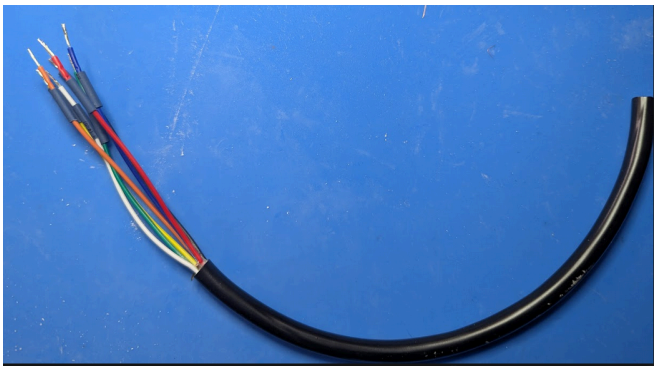
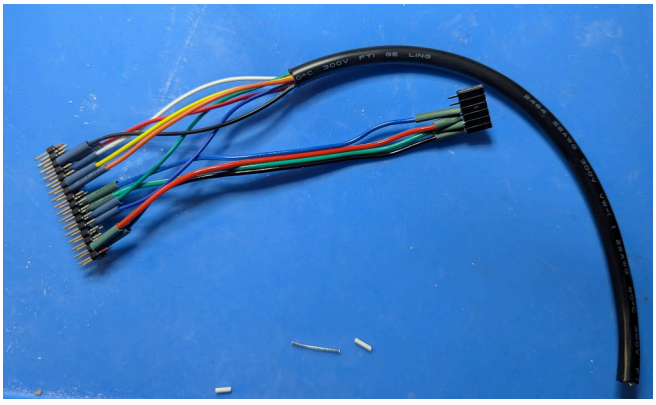
Connections and Layout

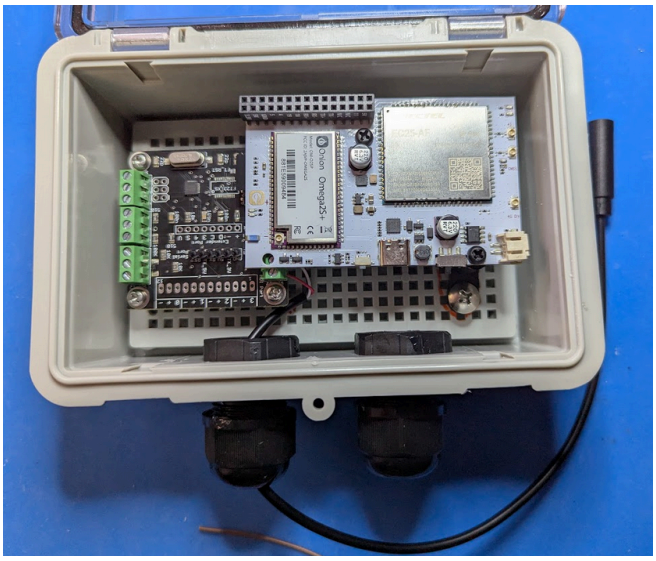
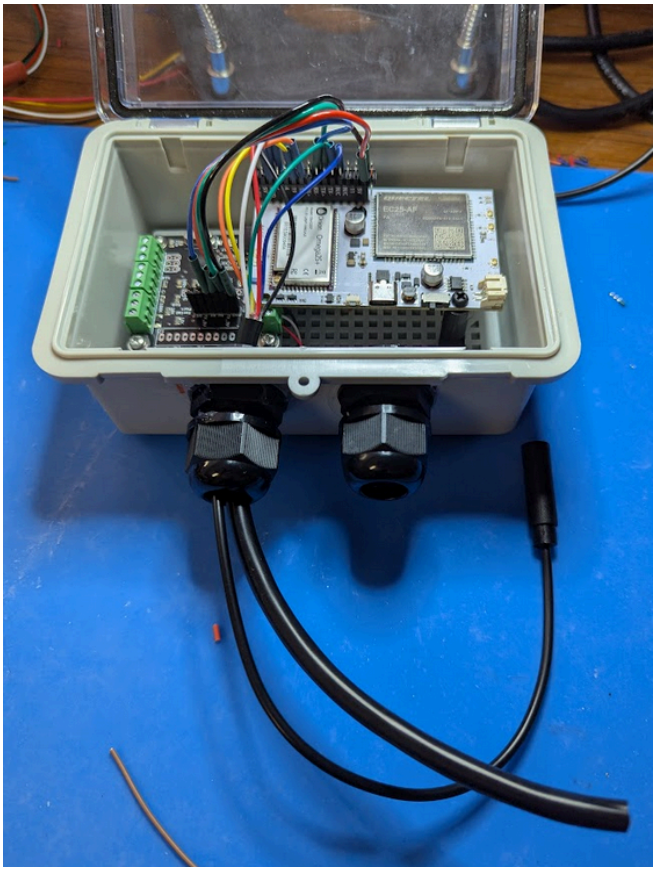


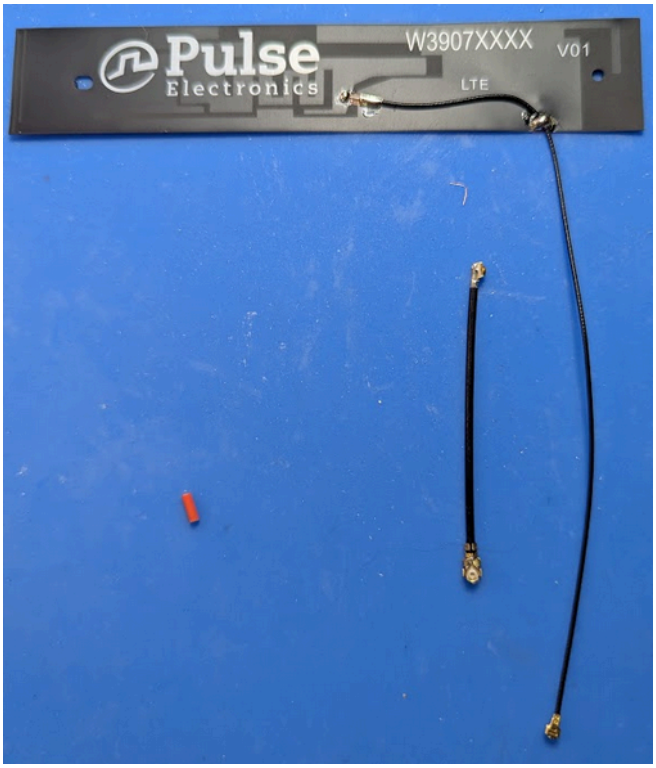


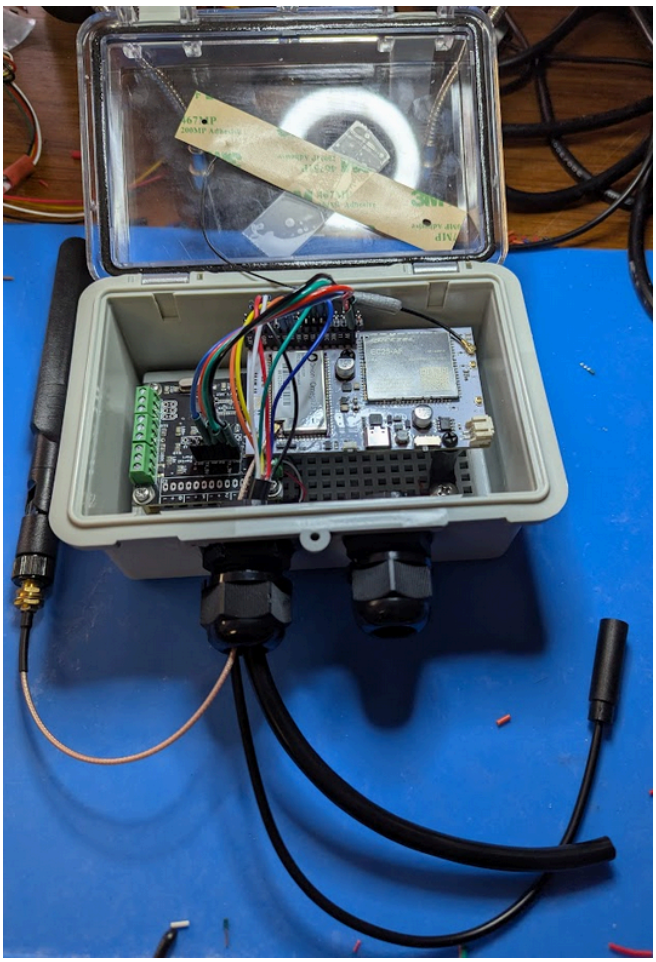
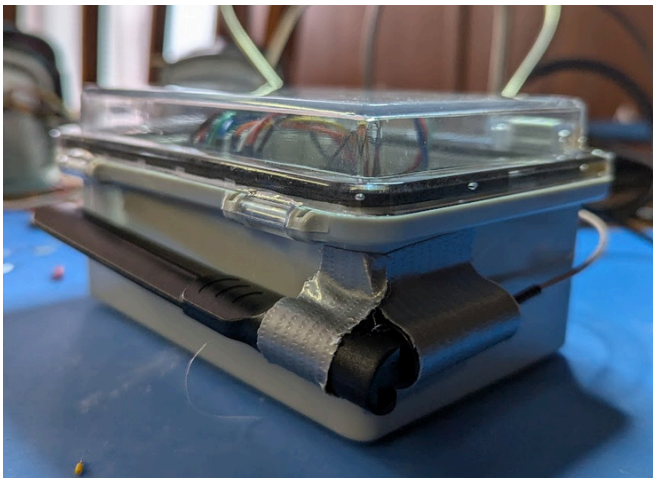
Equipment Layout	Description
	Remove the Omega board from its static-free casing. Note the features of the board outlined in red. For the serial port, the connections are shown in the figures above. The serial port will connect the SDI-12 UART adapter and the CTD sensor to the Omega board.
	On the back side of the Omega Board, insert the SIM Card and the Micro SD Card. Make sure the orientation of both cards is correct.

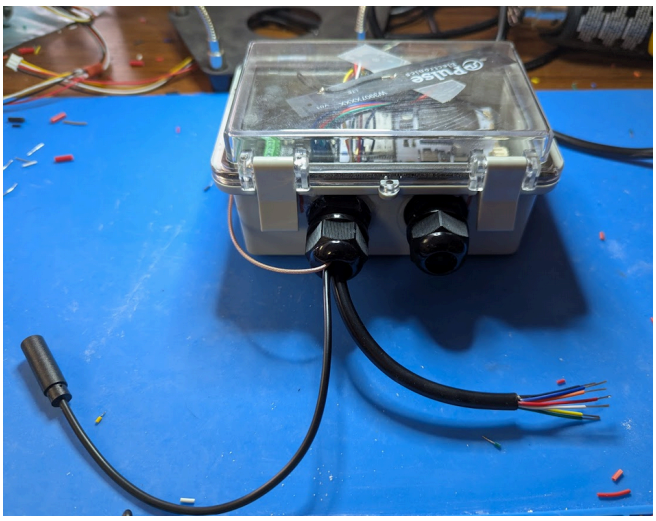
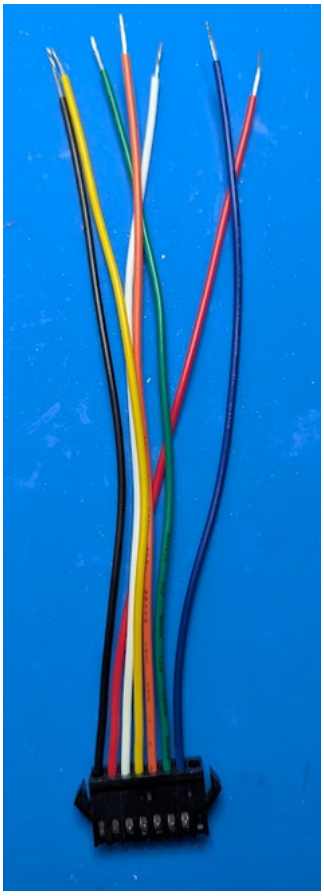
	Using wire cutters, 15-16 pins from a 40-pin 2.54mm Spacing Double Row IDC Male Pin Header Connector Strip. Having extra pins can help to remove the pin header from the serial port.
	Cut a smaller bore piece of heat shrink into four even pieces. Place the heat shrink over the ends of the RGB Extension Connector Wire Cable Cords that were pulled apart in the SDI-12 UART Apator steps. Using a soldering iron, connect the finished 4-PIN RGB Extension Connector Wire Cable Cord from the SDI-12 UART adapter steps to the clipped 2.54mm Spacing Double Row IDC Male Pin Header Connector Strip. Following the diagrams above, starting with the GND wire, mark where to solder the 4-PIN RGB Extension Connector Wire Cable Cord to the 2.54mm Spacing Double Row IDC Male Pin Header Connector Strip.
	Once the 4-PIN RGB Extension Connector Wire Cable Cord is soldered to the correct Pins on the clipped 2.54mm Spacing Double Row IDC Male Pin Header Connector Strip, slide the heat shrink down over the pin heads to sheath the wiring. This will help to prevent the wires from touching and shorting. Do not heat-shrink the cut heat-shrink pieces over the soldered connections. The heat from the heat gun can melt the Pin headers. Also, I prefer to be able to pull back the heat shrink so I can see the soldered connections in case there is an issue, and these need to be checked.

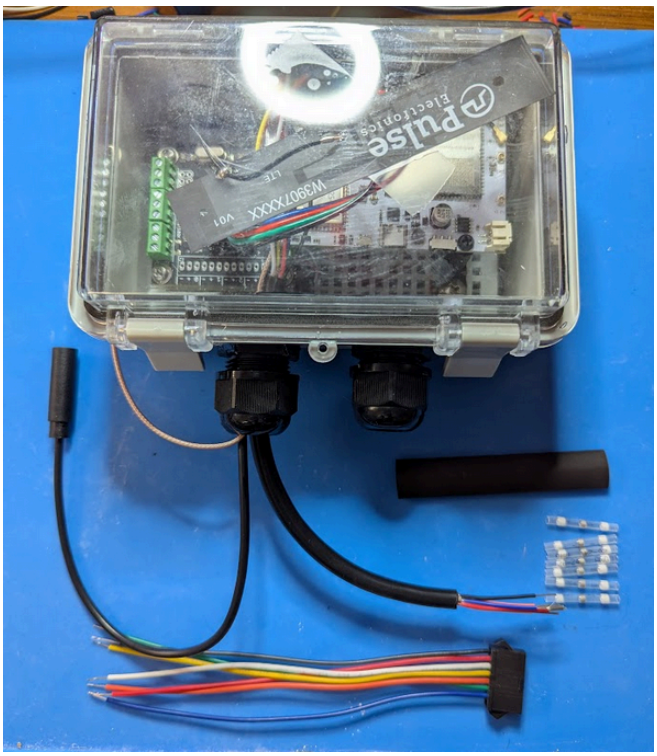
	Cut around 8-10 in of the 22-Gauge 8-Conductor Electrical Wire.
	Carefully strip around 3in of the outer black sheathing from the interior wires. Clip the brown wire completely off; this wire will not be used. Using the wire cutters, strip around 5mm from each wire end. Solder each wire end to prevent stray wires.
	Cut pieces of heat shrink to cover each of the wire ends. Place heat shrink over the wires before soldering.
	Using the Pin-out diagram above, solder the 22-Gauge 8-Conductor Electrical Wires to the 2.54mm Spacing Double Row IDC Male Pin Header Connector Strip, with the 4-PIN RGB Extension Connector Wire Cable Cord from the SDI-12 UART adapter. Slide the heat shrink over the soldered pins, protecting the pins from cross-wiring.

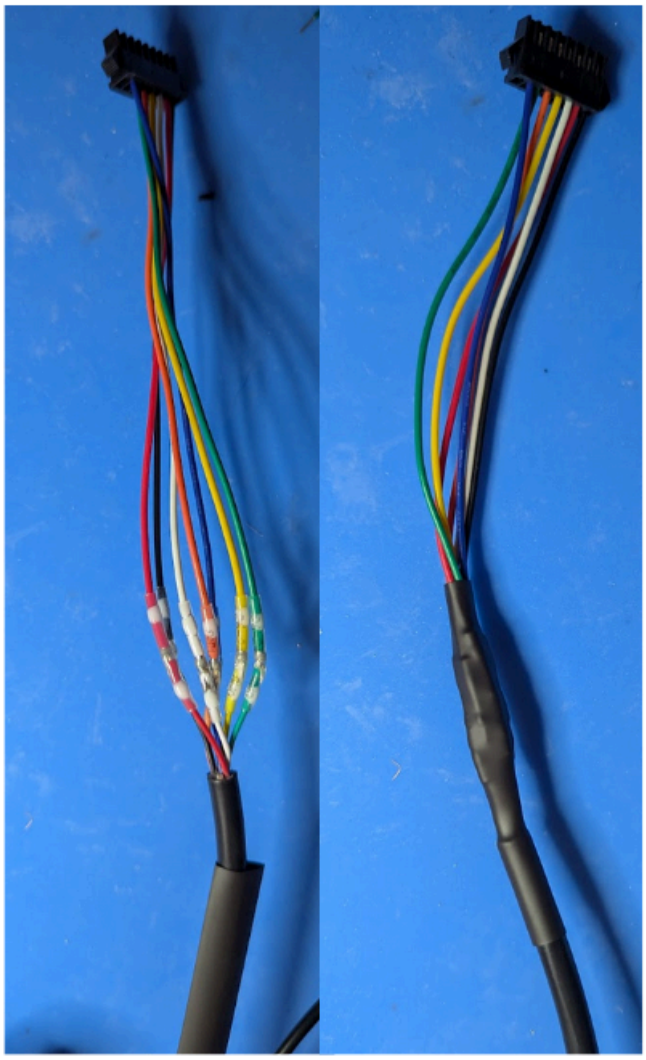
	Install the Omega board onto its mounting feet. The board should fit snugly over the SDI-12 UART Adapter without any vital areas touching. The Micro SD card should be easily accessible. Note the USB-A power port and ensure it is aligned with one of the cable glands.
	Connect the 2.54mm Spacing Double Row IDC Male Pin Header Connector Strip with the 22-Gauge 8-Conductor Electrical Wire and 4-PIN RGB Extension Connector Wire Cable Cord to the Omega board serial port. Make sure the orientation of the header is correct by following the diagrams at the start of this section. Use even pressure to place the Pin Header; you may need to use needle-nose pliers to set the header. Next, connect the 4-PIN RGB Extension Connector Wire Cable Cord header to the SDI-12 UART Adapter's serial port. Make sure the black wire pin aligns with the GND pin. Next, be careful not to move the Female Stereo Jack connector too much. Pull the uncut end of the 22-Gauge 8-Conductor Electrical Wire through the same cable gland.

	The next step is to attach the LTE Antennas Ant Int 0.698-3.6GHz to the Omega board. The connectors for this antenna are very delicate. Use caution when attaching these to the board or the IPX Male to U.FL IPEX IPX Female Cable. The LTE Antennas Ant Int 0.698-3.6GHz can be attached to the board directly, or an IPX Male to U.FL IPEX IPX Female Cable extender can be used to prevent the LTE antenna from disconnecting when opening and closing the junction box lid.

	Tape the LTE Antennas Ant Int 0.698-3.6GHz to the lid of the junction box. Make sure the connection cable is wrapped in an insulating tape and place it behind the pin-head connector in the Omega board serial port. Thread the female head of the Dual Band WiFi 2.4GHz 5GHz Antenna with female cable through the cable gland with the SDI-12 UART adapter and the 22-Gauge 8-Conductor Electrical Wire. Attach the female head of the Dual Band WiFi 2.4GHz 5GHz Antenna to the Wifi antenna connector port on the Omega board. Attach the Dual Band WiFi 2.4GHz 5GHz Antenna to the male head outside of the junction box.
	The Dual Band WiFi 2.4GHz 5GHz Antenna does not need to point in any specific direction when it is deployed. It should be secured in such a way that the cable does not have tension on it that could cause it to break, or the female head becomes detached from the Wifi antenna port on the Omega board. We have been taping the antenna at its elbow to the corner of the junction box using duct tape.

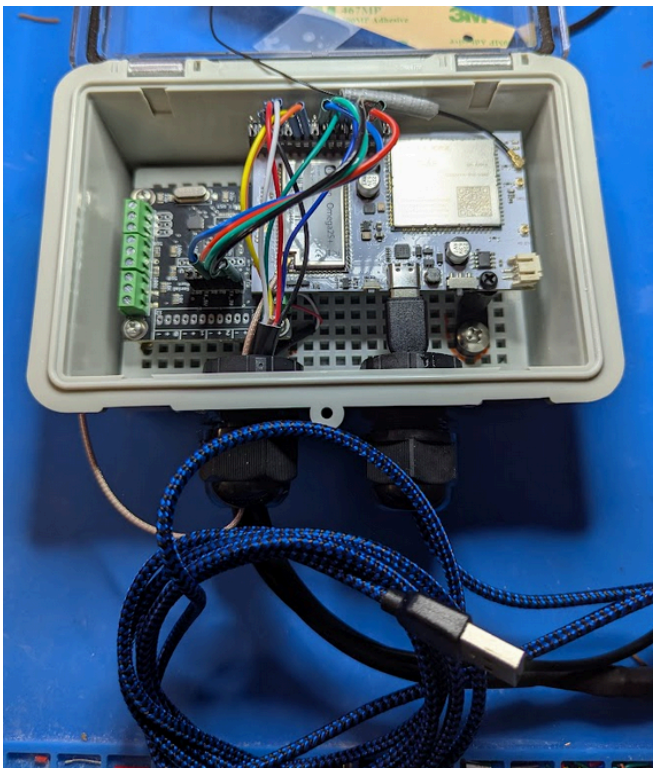
	Using wire cutters, carefully cut the sheath of the 22-Gauge 8-Conductor Electrical Wire coming out of the junction box cable gland. Cut to expose about 1” of wire. Clean the exposed wires, and cut the brown wire completely. With wire cutters, strip around 5mm off the ends of all the wires. Twist the small wires to keep all of the connections tidy.
	Take out a male 8-PIN Connecting Plug with Terminal Connector Wire Cable. Remove the purple wire from the terminal connector. This can be done with a paper clip or by cutting the wire at the terminal connector head. Using wire cutters, strip around 5mm of wire from each wire cable end.

	Place a ⅜”-3/16” heat shrink over the 22-Gauge 8-Conductor Electrical Wire. You will need 7 white Solder seal wire connectors and heat shrink for each wire connection. Connect the male 8-PIN Connecting Plug with Terminal Connector Wire Cable to the 22-Gauge 8-Conductor Electrical exposed wires.



Use the Solder seal wire connectors, heat shrink, to connect each individual wire from the male 8 PIN Connecting Plug with Terminal Connector Wire Cable to the 22-Gauge 8-Conductor Electrical exposed wires. Connect each color wire together. It is best to do one connection at a time with the heat gun on low heat. Avoid pointing the heat gun at the larger heat shrink.

Once all the individual wires are connected with the Solder seal wire connectors, heat-shrink. Wait till all the wiring is cool, then pull over the ⅜”-3/16” heat shrink over the loose connections. This step is optional, but having that extra larger heat shrink holding all the wiring together adds another layer of waterproofing to the connection as well as protecting the wires from getting snagged or pulled out.

	Connect the USB-A side of a USB-C to USB-A charging cable to the USB-A power port on the Omega Board. The mounting fittings of the Omega board may need to be loosened to allow the USB-A cable to connect. Tighten the cable gland to prevent the USB-A to USB-C cable from moving. You may need to put putty or soft tubing in the cable gland to ensure a tight and waterproof fit.

This concludes the Omega2 LTE Board and Connections sections. A note about the Male 8 PIN Connecting Plug with Terminal Connector Wire Cable. This may often be interchangeable with the female 8 PIN Connecting Plug with Terminal Connector Wire Cable. However, you need to keep a strict track of which one you are using for which parts, or you might build two parts where somehow two male terminals are supposed to connect together. I prefer keeping a strict note of which connector head goes to what part, which is why, for the Pump and Board Connector Octopus, all of those connections are female connector terminals.

Pump and Board Connector Octopus

To get the signals from the omega board to the pumps, a connector needs to be made. Since we are going to be connecting up to six pumps, as well as the power and step-down converter, this makes a large, octopus-like structure.

You will need a heat gun and wire cutters to complete the construction.

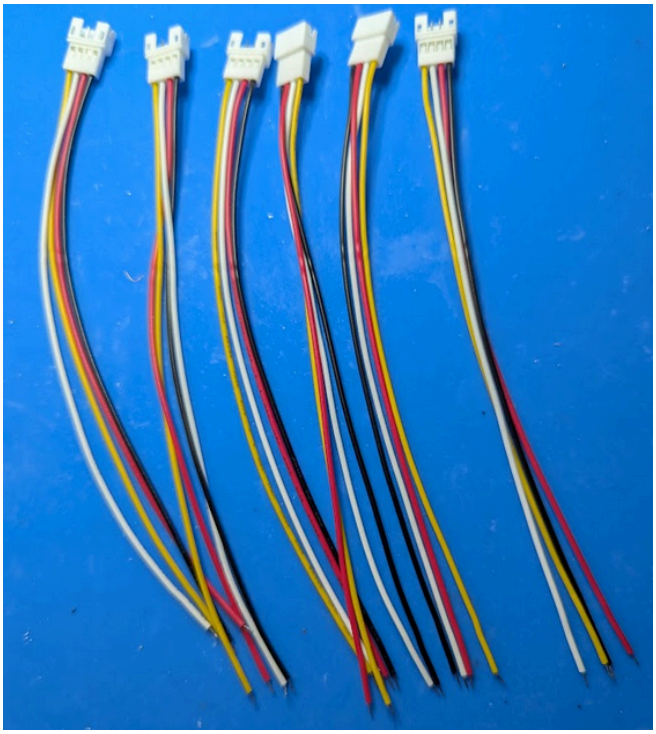
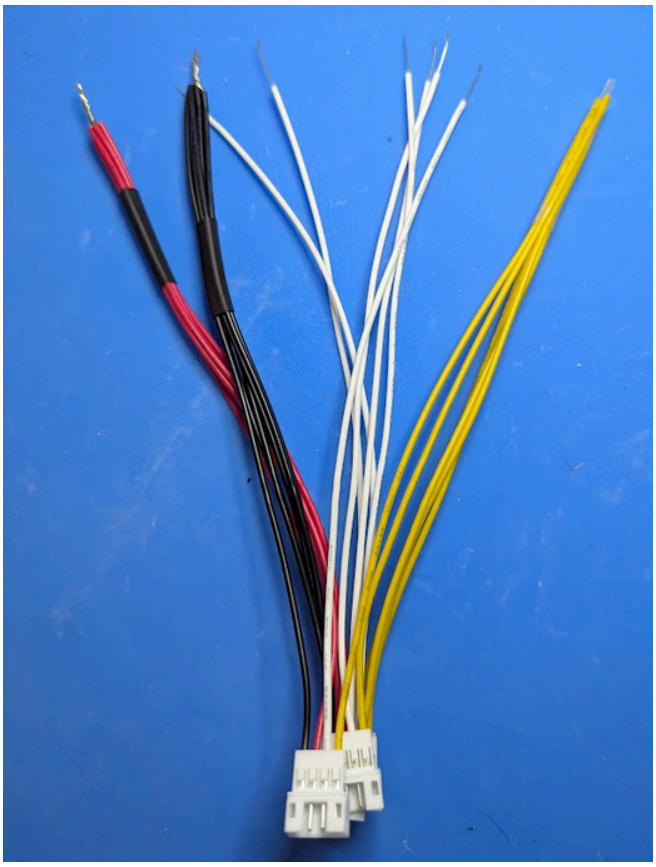
Equipment

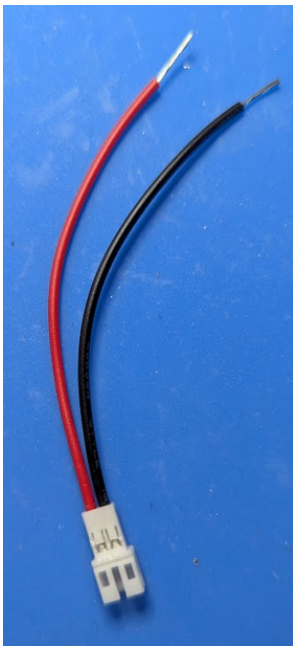
Equipment Name	Quantity	Website name
8 PIN Female and Male Connecting Plug with	1 Female Connector	https://www.amazon.com/dp/B08H55TNJX/ref=sspa_dk_detail_0?psc=1&pd_rd_i=B08H55TNJ

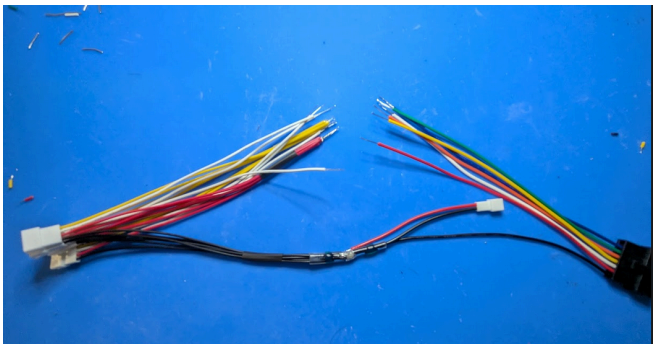
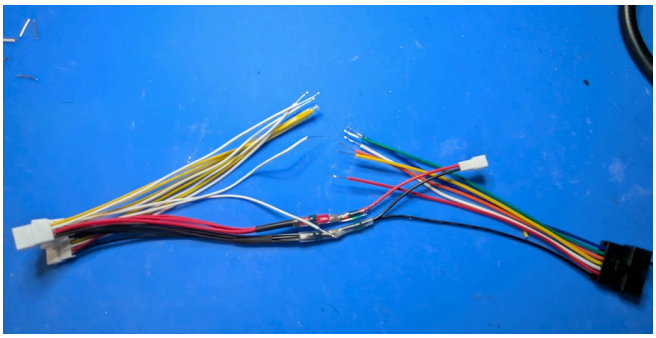
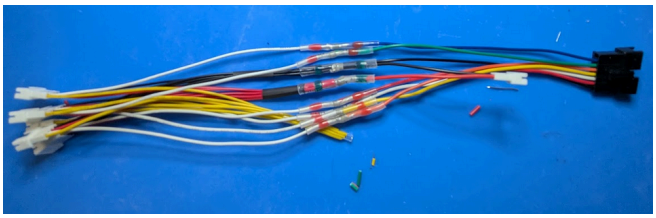
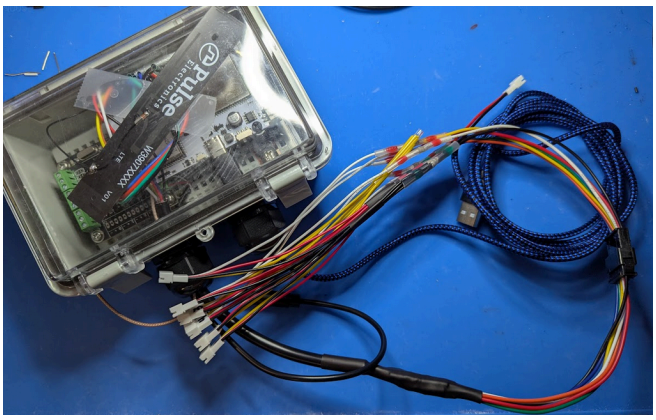
Terminal Connector Wire Cable		X&pd_rd_w=exl2B&content-id=amzn1.sym.8c2f9165-8e93-42a1-8313-73d3809141a2&pf_rd_p=8c2f9165-8e93-42a1-8313-73d3809141a2&pf_rd_r=PJJ230YQ21RT0N01A1E4&pd_rd_wg=IEGVr&pd_rd_r=3af8d6e3-b295-4164-acfa-d9c729e00161&s=hi&sp_csd=d2lkZ2V0TmFtZT1zcF9kZXRhaWw
2.0mm 4PIN Female Male Connecting Plug with 15cm Terminal Connector Wire Cable	6 Female Connecting Plugs	https://www.amazon.com/dp/B081CRLN8B/?coliid=I250ZP3R8FVSD&colid=HR38FGHUHIC&psc=1&ref_=list_c_wl_lv_cv_lig_dp_
JST 2.0 PH 2-Pin Connector	1 Female Connector	https://www.amazon.com/dp/B07V69GRZ2/?coliid=ICHJ7567ZTS3B&colid=3A1KK5X2Q9J7B&ref_=list_c_wl_lv_ov_lig_dp_it&th=1
Solder seal wire connectors	Red and Green	https://www.amazon.com/dp/B0B1PVJ226/?coliid=I2AUU1F2NK5DYY&colid=3A1KK5X2Q9J7B&ref_=list_c_wl_lv_ov_lig_dp_it&th=1
Heat Shrink	Various	

Connections and Layout

Equipment Layout	**Description**

	Prepare six female connector plugs of the 2.0mm 4-PIN Connecting Plug with 15cm Terminal Connector Wire Cable by stripping 6mm of the protective wire sheath from all except the yellow wires. Clip the heads off the yellow wires so no metal wiring is exposed. The yellow wires will not be used at all for the samplers. If you feel it would be better to remove them completely, they can be pulled out using a paper clip or clipped off at the terminal end.
	An optional way to arrange the female 2.0mm 4PIN Connecting Plug with 15cm Terminal Connector Wire Cable is to line up the terminal ends with the yellow wires, then seal those positions by placing a heat shrink over the wire ends. The terminal connectors can also be lined up using the black wires. Twisting all the exposed wires together, then using a piece of heat shrink to hold everything together. Repeat the same process with the red wire. Keep the white wires loose.

	Strip 5-6mm of the wire sheathing off the ends of the female 8-PIN Female and Male Connecting Plug with Terminal Connector Wire Cable.
	Strip 5-6mm of sheathing off the ends of the female JST 2.0 PH 2-Pin Connector.

	Connect the black wires from the female JST 2.0 PH 2-Pin Connector and 8 PIN Female Connecting Plug with Terminal Connector Wire Cable to the bundle of black wires from the female 2.0mm 4PIN Connecting Plug with 15cm Terminal Connector Wire Cable. Use a green Solder seal wire connector and a heat gun on low heat.
	Connect the red wire from the female JST 2.0 PH 2-Pin Connector to the red wire bundle from the female 2.0mm 4-PIN Connecting Plugs with 15cm Terminal Connector Wire Cable. Use a green Solder seal wire connector and a heat gun on low heat. **Do Not connect the red wire from the 8-PIN Female and Male Connecting Plug to the red wire bundle from the female 2.0mm 4-PIN Connector Wire Cables.**
	Starting with the red wire on the 8 PIN Female Connecting Plug with Terminal Connector Wire Cable and a white wire from the terminal at the end of the bundle of the female 2.0mm 4PIN Connecting Plugs. Connect these two wires using a red Solder seal wire connector. Repeat with each wire going down the 8 PIN Female Connecting Plug with Terminal Connector Wire Cable colors from the red wire.
	Connect the female 8 PIN Connecting Plug with Terminal Connector to the male 8 PIN Connecting Plug with Terminal Connector from the Omega Board setup and assembly section.

This concludes the assembly of the Pump and Board Connector Octopus section. Move on to the Power Converter Connector section to connect the power supply to the pumps and Omega board.

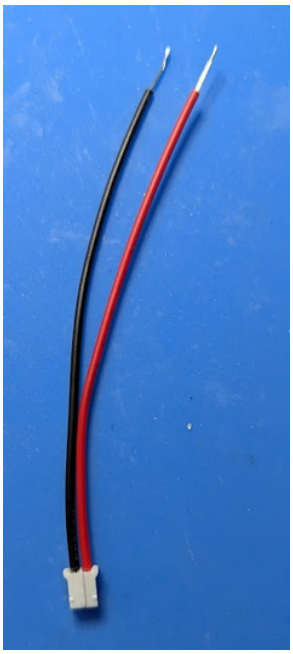
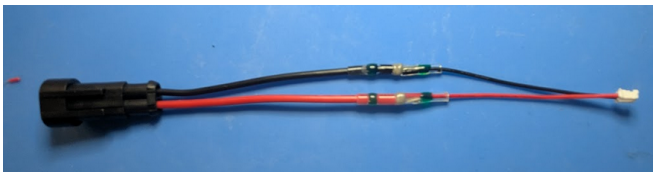
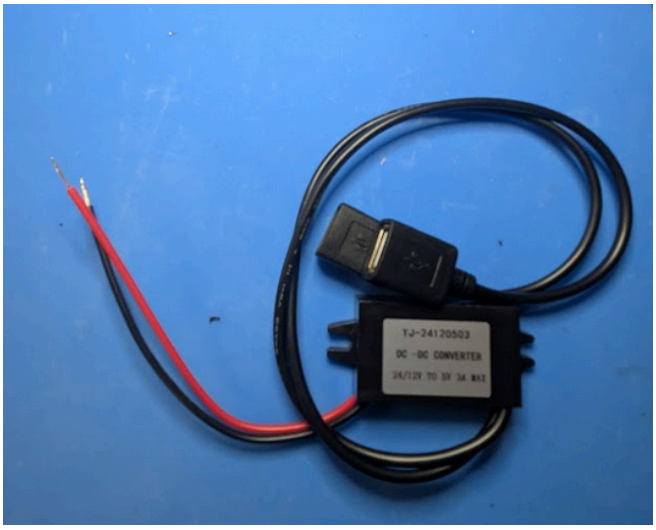
Power Converter Connector

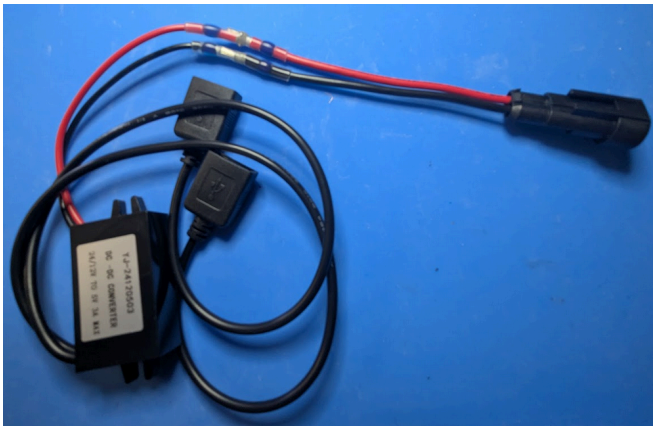
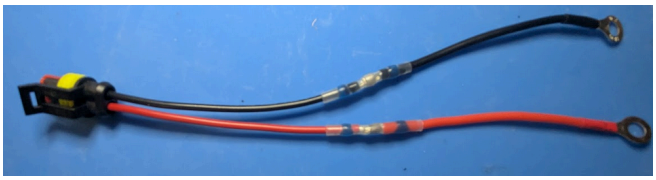
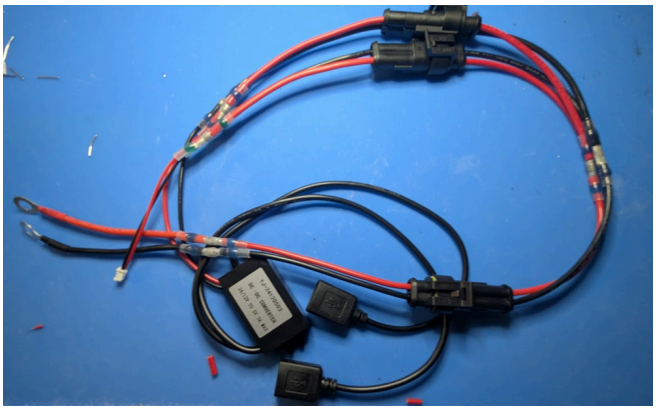
The power converter steps down the 12V from the battery to 5V for the Omega board.

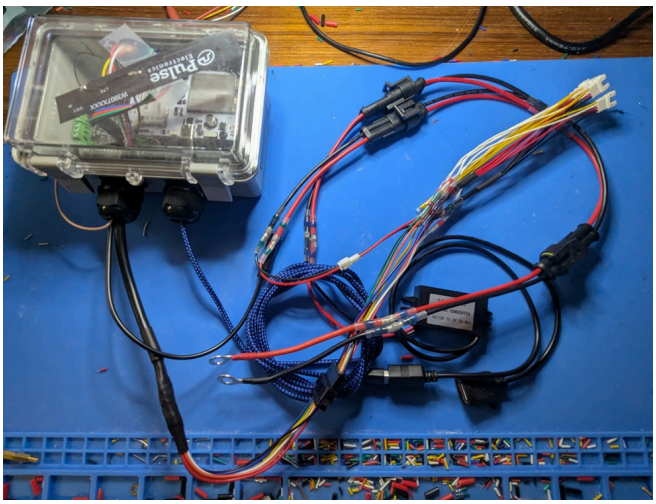
You will need a heat gun, a wire crimper, and wire cutters to complete the construction.

Equipment Name	**Quantity**	**Website name**
2Pin Way 16AWG Waterproof Wire 1.5mm Series Terminal Connector	3 Female Connectors , 2 Male Connectors	https://www.amazon.com/Connector-waterproof-Female-Suitable-Connection/dp/B08579V5ZJ/ref=pd_lpo_d_sccl_2/138-4883206-1737759?pd_rd_w=uWQOW&content-id=amzn1.sym.4c8c52db-06f8-4e42-8e56-912796f2ea6c&pf_rd_p=4c8c52db-06f8-4e42-8e56-912796f2ea6c&pf_rd_r=TD2G0YQA1VAJJBWRXYVF&pd_rd_wg=NX5ko&pd_rd_r=e8f4d6af-0801-4f8c-a481-1e66fa9d2d23&pd_rd_i=B08579V5ZJ&th=1
DC Converter 12v to 5v 3a 15w DC	1	https://www.amazon.com/dp/B08F9QYJV2/ref=sspa_dk_detail_6?pd_rd_i=B08F9QYJV2&pd_rd_w=ea652&content-id=amzn1.sym.953c7d66-4120-4d22-a777-f19dbfa69309&pf_rd_p=953c7d66-4120-4d22-a777-f19dbfa69309&pf_rd_r=FW2NV0HZR8HE6TWKMX7J&pd_rd_wg=TnCsx&pd_rd_r=def7c44f-e39e-427e-ba30-0129c139b205&s=industrial&sp_csd=d2lkZ2V0TmFtZT1zcF9kZXRhaWwy&th=1
JST 2.0 PH 2-Pin Connector	1 male connector	https://www.amazon.com/dp/B07V69GRZ2/?coliid=ICHJ7567ZTS3B&colid=3A1KK5X2Q9J7B&ref_=list_c_wl_lv_ov_lig_dp_it&th=1
Battery connection terminals	2	https://www.homedepot.com/p/Gardner-Bender-100-Piece-Terminal-Kit-TK-806/202518736
Solder seal wire connectors	4 Blue	https://www.amazon.com/dp/B0B1PVJ226/?coliid=I2AUU1F2NK5DYY&colid=3A1KK5X2Q9J7B&ref_=list_c_wl_lv_ov_lig_dp_it&th=1

Connections and Layout

Equipment Layout	Description
	Strip around 5-6mm off the wired ends of the male JST 2.0 PH 2-Pin Connector.
	Using 2 blue Solder seal wire connectors, connect the male JST 2.0 PH 2-Pin Connector to a female 2-Pin Way 16AWG Waterproof Wire 1.5mm Series Terminal Connector with a heat gun.
	Strip around 5-6mm off the wire ends of the DC Converter.

	Using 2 blue Solder seal wire connectors, connect the DC Converter to a female 2-Pin Way 16AWG Waterproof Wire 1.5mm Series Terminal Connector with a heat gun.
	Using 2 blue solder seal wire connectors, connect 2 male 2Pin Way 16AWG Waterproof Wire 1.5mm Series Terminal Connectors to one female 2Pin Way 16AWG Waterproof Wire 1.5mm Series Terminal Connector.
	Using a crimper, connect two Battery connection terminals (size and type to be determined by batteries used for samplers) to the ends of a male 2-Pin Way 16AWG Waterproof Wire 1.5mm Series Terminal Connector. Heat shrink can be used to help keep the battery connection terminals in place.
	Connect the JST 2.0 PH 2-Pin Connector to a female 2-Pin Way 16AWG Waterproof Wire 1.5mm Series Terminal Connector to one of the male connectors. Connect the DC Converter to a female 2-Pin Way 16AWG Waterproof Wire 1.5mm Series Terminal Connector to the other male connector. On the single female connector side, connect the male 2-Pin Way 16AWG Waterproof Wire 1.5mm Series Terminal Connector with the battery connection terminals.

	Connect the USB-A to USB-C cable to the DC Converter USB-C connector port. Connect the female JST 2.0 PH 2-Pin Connector in the Pump and Board Connector Octopus to the male JST 2.0 PH 2-Pin Connector from the power converter setup.

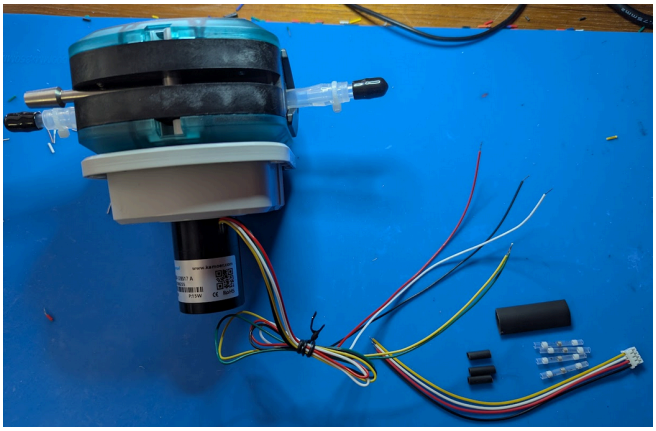
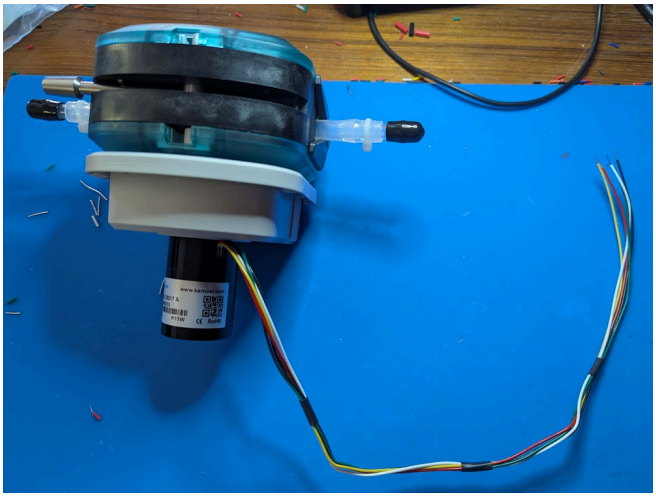
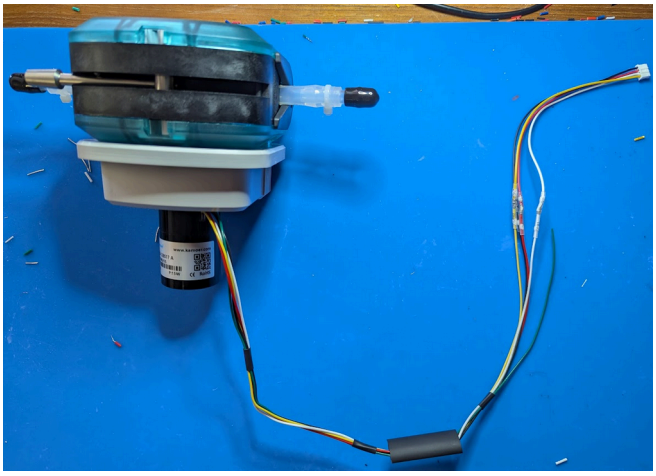
Pump Connections

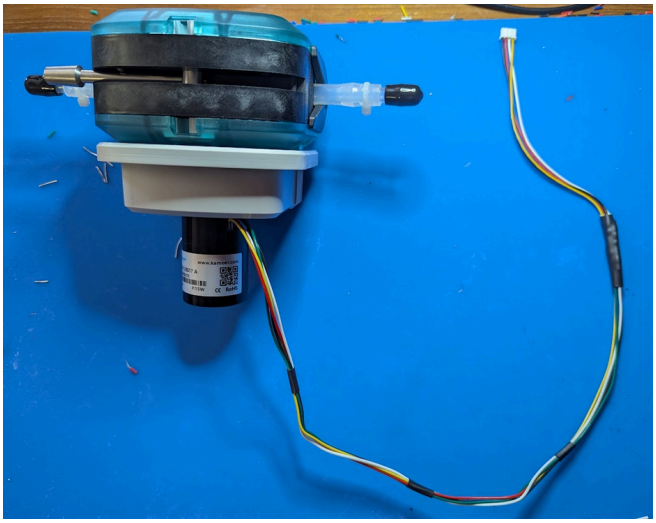
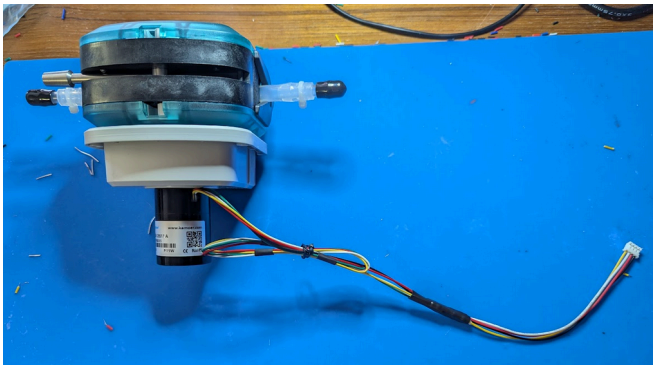
The pumps are powered through the Pump and Board Connector Octopus and are run by the Omegaboard controls.

You will need a heat gun and wire cutters to complete the construction.

Equipment Name	**Quantity**	**Website name**
Kamoer Peristaltic Pump	1	https://www.kamoer.com/us/product/detail.html?id=9007 or https://www.amazon.com/Peristaltic-brushless-Adjustable-Liquid-KPHM600/dp/B09PDS7Z51
2.0mm 4PIN Female Male Connecting Plug with 15cm Terminal Connector Wire Cable	1 male connector cable	https://www.amazon.com/dp/B081CRLN8B/?coliid=I250ZP3R8FVSD&colid=HR38FGHUHIC&psc=1&ref_=list_c_wl_lv_cv_lig_dp_
Solder seal wire connectors	4 white	
Heat shrink	Various	

Connections and Layout

Equipment Layout	Description
	Get the equipment you need together. Cut a larger heat shrink in half. The larger heat shrink needs to fit over the connections for the pump and the male 2.0mm 4PIN Connecting Plug with 15cm Terminal Connector Wire Cable. For the smaller heat shrink, make sure it can fit over all the pump wires bundled together. Cut the smaller heat shrink into three 5mm sections. Untwist the twist tie holding all the pump wires together.
	Slip the three 5mm sections of the smaller heat shrink onto three equal sections of the pump wires. Using low heat, melt the heat shrink onto the three sections. This will help to hold the pump wiring together, keeping it neat and preventing pulling or snagging.
	Before connecting the 4-PIN male terminal cable, place the larger heat shrink on the pump wires. Using the white solder seal wire connectors, attach the 4-PIN male terminal cable to their corresponding colored wires for the pump. Use a heat gun at low heat to seal the solder seal connectors. Cut the head off the green pump wire. The green wire will not be used for this sampler setup. **Note:** The yellow wire is also not going to be used; however, it may be easier to set the connection between the pump wiring and the 4-PIN male terminal cable than to remove the wire. This is your preference;

	the wire just cannot interfere with the sampler connections or cause any problems.
	Slip the larger heatshrink over the connections between the pump and the 2.0mm 4PIN Male Connecting Plug with 15cm Terminal Connector Wire Cable. With the heat gun on low heat, melt the heatshrink around the connectors. Ensure that the green wire head is in the heat shrink.
	Neatly arrange the long pump wiring so that it is folded up. Hold the wiring in that shape using the twist-tie that came with the pump.

This concludes the Omega Board Housing and Construction Manual. Move on to the Remote Sampler Setup Manual for the next steps in the full sampler setup.