Bee assembly instructions

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Preliminary requirements

Required conditions

Table 1 Required conditions

Action/Condition	Data module/Technical publication
None	

Support equipment

Table 2 Support equipment

Name	Identification/Reference	Quantity	Remarks
Torx and hex drivers		6	
Pair of pliers		1	
Soft mat		1	
Brass heat insert assembly tool		1	
Soldering iron: JBC CDB soldering station with the following tips: 4.8mm chisel tip (C245-908), 1.2mm chisel tip (C245-906), 1mm round tip (C245-403), set to 350ºC, unless noted otherwise		1	
Threadlock		5	
JST-GH crimp tool		1	

Consumables, materials and expendables

Table 3 Consumables, materials and expendables

Name	Identification/Reference	Quantity	Remarks
Assembly gloves			
Super glue		1	
Solder: 0.5mm and 1.2mm Sn95/Ag4/Cu1 (TSC KRISTALL 400, 810004 and 810007), or equivalent		1	

Spares

Table 4 Spares

Name	Identification/Reference	Quantity	Remarks
None			

Safety conditions

None

Procedure

1 Top fuselage assembly

1.1 O-ring cord assembly

1.1.1 Insert the main seal component into the seal groove on the top fuselage and ensure good fit as the seal is inserted.

1.1.2 Upon reaching the end of the groove, cut o-ring to length.

1.1.3 Monitor if there is any water ingress through the fuselage split line and behind the front camera hatch.

1.2 Motors assembly

1.2.1 Make sure to use previously tested motors according to the motor configuration document.

1.2.2 Bend motor cables 90° to prepare for routing.

1.2.3 The motors are to be installed in the following layout (see the Fig 1).

Applicable to: All **BEE-A-00-00-00-00A-720A-D**
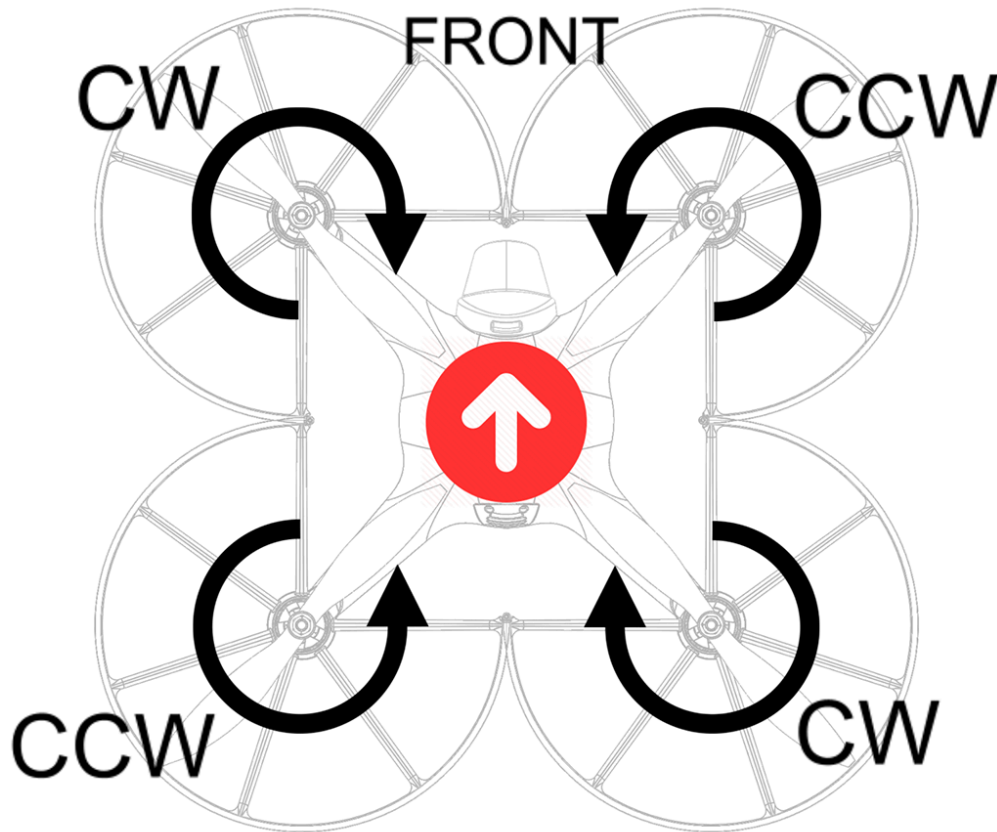
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Fig 1 Motors layout

1.2.4   Route motor cables through fuselage opening. First try pushing them through the hole, and afterwards push and gently pull cables from the other side.

1.2.5   Secure motor in place with 4 M3x6 bolts & threadlock.

Note

Leave cables free, they will be secured in place once beepower board is installed. Do not fully tighten bolts completely to allow for any position/alignment adjustment. Once all of them are inside, secure them properly with 0.55 Nm of torque.

1.2.6   Repeat for other 3 drone arms, monitor water ingress through motor cable.

1.3   Pogo pin sub-assembly

1.3.1   Machine a 45° ~1mm chamfer on the pogo pins as shown below. The width of the chamfer can be measured with a set of calipers or a ruler, and should be ~1.4mm wide.

1.3.2   Strip about 5 mm from one side of the wire, apply a bit of a flux and pretin. Solder the wire to the pogo pin.

Note

Pogo pin would heat up significantly - leave it to cool down. Make sure the wire is soldered straight, use pliers if necessary to bend the wire in the base.

1.4   Pogo pin mount assembly

1.4.1   Feed the square x-section washer to the pogo pin wire, and push against the pogo pin.

1.4.2   Feed the wire into the pogo pin holder and out through the wire exit feature. You may want to bend the cable slightly as shown below and use tweezers. Then push the pogo pin into the pogo pin holder until the washer is compressed.

1.4.3   Strip and pre-tin the free end.

1.4.4   Assemble the pogo pin mount into the fuselage using the keyed feature and route the red wire.

1.4.5   Upon assembly, confirm that the pogo pin holder is keyed correctly and that the red wire exits the opening feature freely and with no issues.

1.4.6   Repeat for other 3 drone arms.

1.5   Fan sub-assembly

1.5.1   Cut the fan wires to length (35mm measured as shown) and prepare fan with GH connector according to the Fig 2.
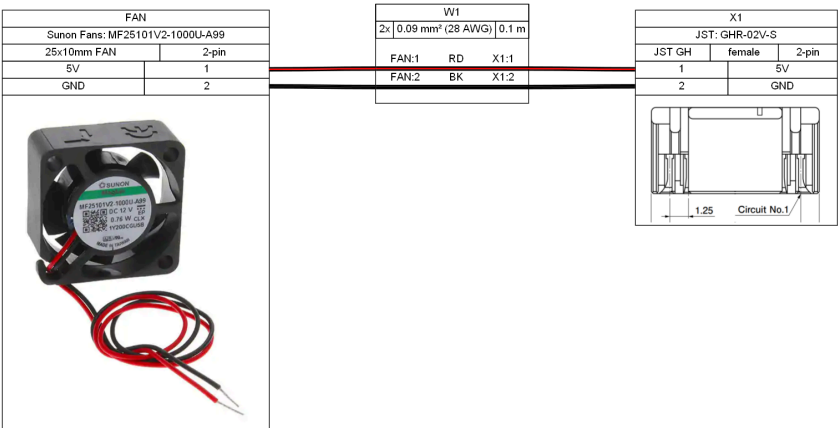
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Fig 2 Fan preparation diagram

1.6 Fan and fan cover assembly

1.6.1   Insert fan cover by sliding the air duct into the fuselage duct opening.

1.6.2   Ensure the mounting holes of the fan cover are aligned with the holes on the fuselage.

1.6.3   Insert the M2x16 bolts through the fan cover and fuselage.

1.6.4   Insert the fan in position with right orientation (sticker towards the outside) and secure with the nyloc nuts with 0.3 Nm.

1.7 Main electronics sub-assembly

1.7.1   Make sure to use the beepower board which is previously configured and tested according to the HRN-BEE-POWER-AI.

1.7.2   Insert rubber isolators on rubber isolator brackets by inserting half of it and gently push the other half inside. Rubber seal insert tool may be helpful but **DO NOT** use sharp tools with rubber isolators!

1.7.3   Attach the flight controller isolator mounts 476-1001-B (with isolators) to the beePower board with the M2.63x8mm self-tapping screws (0.55 Nm of torque). Make sure they are correctly centered and in the right four holes.

1.7.4   Ensure SD card is present in the preassembled beesmart.

1.7.5   Attach flex cable on the beesmart board and secure it using 2 x M2x3 bolts (use threadlock and 0.25 Nm torque).

1.7.6   Place beesmart on beepower board (align "front" arrow on beeSmart and beepower boards) and secure beeSmart with rubber isolators. Make sure the isolators are properly assembled in the respective mounts and board holes - the isolator "lips" must be in-and-over the holes, with no obstructions. Confirm correct assembly by rotating the isolator around its axis and ensuring there is no obstruction to this motion in both ends of the isolator.

1.7.7   Route the flex cable through the cutout in beepower board (see next illustrations).

1.7.8   Connect the flex cable by click pressing it on the connector located on the bottom side of the beepower board.Secure it using 2 x M2x3 bolts with 0.25 Nm torque. Make sure the flex cable is bending as shown.

1.8 Assemble the top fuselage

1.8.1   Place main electronics sub-assembly using "front" arrow for orientation onto the fuselage sub-assembly.

1.8.2   Guide the motor and pogo pin cables through the cutouts on the guiding tab.

1.8.3   Solder the motor and charging cables to the beepower board. Motor wires are interchangeable (use the location with the least stress), while the power wire from the pogo pin has to be soldered at the right beepower board's pad.

1.8.4   Insert upper battery holder with the wire features pointing forward towards the camera hatch opening and secure in place (press fit).

1.8.5   Connect the fan connector to the beepower board.

2   Bottom fuselage assembly

2.1   Seal & heat insert

2.1.1   Place sub-assembly upside down.

2.1.2   Camera hatch insert

2.1.2.1   Screw the M2x3 bolt all the way in the M2 insert.

2.1.2.2   Prepare adhesive and add it to the cavity. It shouldn't fill the cavity completely but it should be sufficient enough - when insert is placed it needs to cause some adhesive to overflow.

2.1.2.3   Place previously prepared insert with bolt into the cavity and use clamps to hold it in place all the way in. Make sure the insert-bolt is properly leveled.

2.1.2.4   Leave it to dry for about 30 minutes. Unclamp and unscrew the bolt. Adhesive should be cured but still not completely hard, so remove (scratch) excess adhesive which overflew. Leave everything to dry for at least a couple of hours (preferably overnight) before intended use.

2.1.3   Prepare o-ring with Super Lube.

2.1.4   Insert O-ring seal, using rubber seal insert tool.

2.1.5   Cowl holding inserts

2.1.5.1   Place the M2.5 insert in the provided place on the fuselage. Make sure to place "the top" (wider side) of the insert facing towards the cowl.

2.1.5.2   Screw the M2x10 bolt from the cowl side all the way and fix the insert thightly. You may need to press and hold the insert with tweezers or similar tool. Repeat steps 1 and 2 for all four inserts.

2.1.5.3   Prepare adhesive and fill the cavity around the insert from all sides. You might need to use some pointy tool to properly fill the whole cavity. Repeat this for other 3 inserts.

2.1.5.4   Leave it to dry for about 30 minutes. Unscrew the bolt. Leave everything to dry for at least a couple of hours (preferably overnight) before intended use.

2.2   Heat sink & radio module

2.2.1   Remove the protective paper from the back of the heat sink.

2.2.2   Insert heat sink in place by holding it onsides. Fins go along the vertical axis.

2.2.3   Connect antennae on beeLink board if not already present. Remove connector protectors from the antennas and connect them both by press clicking to the beelink board.

2.2.4   Position beelink in place as shown.

2.2.5   Secure with 4 self-tapping screws with 0.35 Nm torque.

2.2.6   Peel paper from antennae backs. Place antennae in cut-out positions on the bottom fuselage and secure by applying pressure onto fuselage (adhesive back).

2.2.7   Guide antenna wires and put a bit of silicone on 4 places as shown below. Make sure the wires

are touching the fuselage around points where silicone is applied.

2.3   Power button

2.3.1   Solder JST-GH connector on power button according to the Fig 3. Make sure you heat shrink each wire and afterwards altogether. Measured from the base of the button housing, the heat shrinked (fixed) cable length should not exceed 12mm. Once assembled, do a button test using appropriate usb cable.
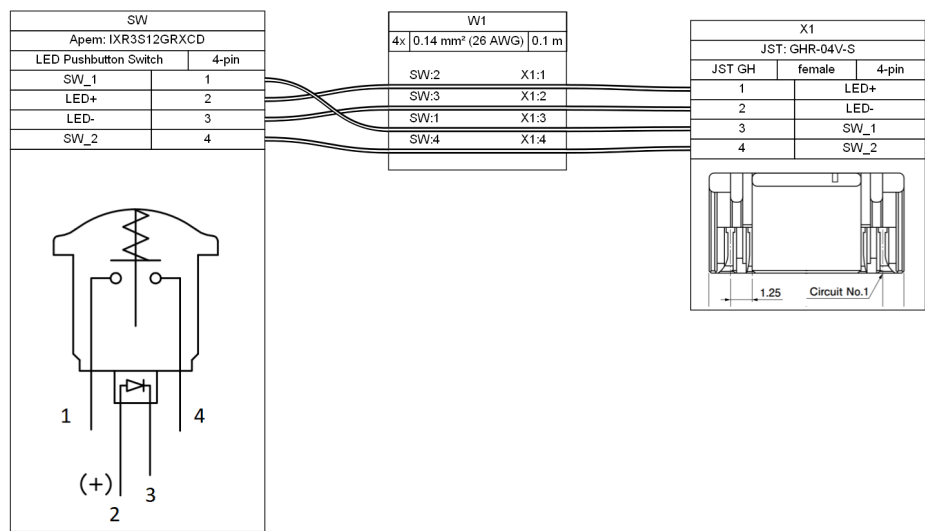
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Fig 3 Wiring diagram

2.3.2   Insert power button making sure that the seal is in place and the button is oriented according to the fuselage cutout.

2.3.3   Tighten the securing nut with approximately 0.55 Nm of torque.

3   Cowl assembly

3.1   Landing camera sub-assembly

3.1.1   Follow the HRN-BEE-LAND-AI-0060-1

3.2   Sonar sub-assembly

3.2.1   Follow the HRN-BEE-SAFE-AI-0060-1

3.3 IR screen & landing camera mount

3.3.1 Prepare landing camera mount with the following O-rings: 2 x 9262K649 (1.5mm, ID 29mm, OD 32mm) 1 x 9262K194 (1mm, ID 21.5mm, OD 23.5mm).

3.3.2 Make sure landing screen is clean.

3.3.3 Insert IR screen in cowl screen feature using gloves.

3.3.4 Place landing camera mount in cowl by matching the mounting holes.

3.3.5 Insert M1.91X10 self-tappers and fasten in place 0.35 Nm.

3.4 Beeland board

3.4.1 Ensure that the o-ring placed on the top of the landing camera mount has not been displaced during assembly.

3.4.2 Remove lens protecting cover.

3.4.3 Slide Bee Land board into Cowl - tilt board to clear the front sonar funnel. **Extremely important:** Rotate the beeland board in the right orientation! "Fly me this way" sign from the beeland board should point away from the cowl clocking feature.

3.4.4 Fasten four M1.91X10 self-tappers and fasten in place 0.40 Nm.

3.5 Sonar sensors

3.5.1 Place cowl on a flat surface.

3.5.2 Fold the connector side of the sonar sensor sub-assembly 3 times according the Fig 4.
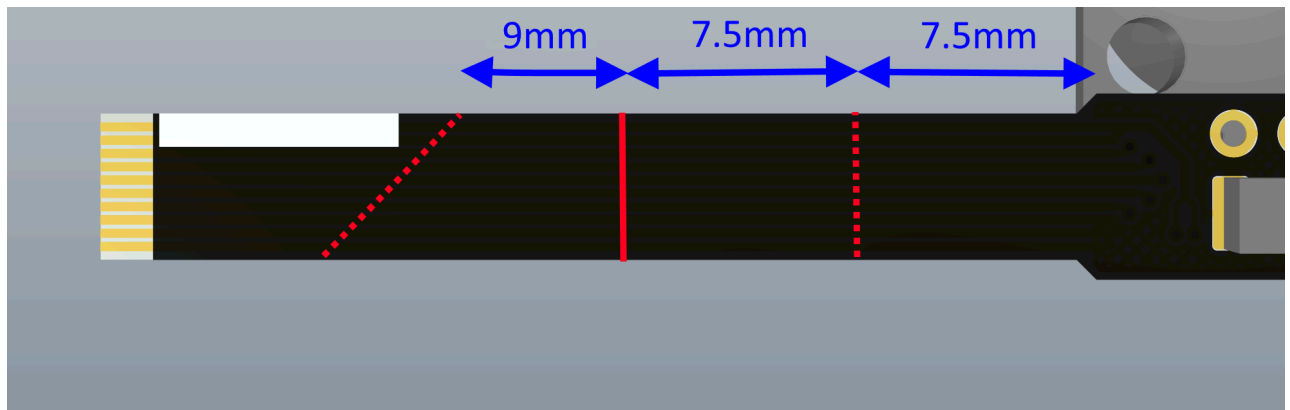
ICN-BEE-A-000000-0-00000-00014-A-001-01

Fig 4 Folding pattern

3.5.3 Place sonar sensors inside cowl. Align rear sensor with rear funnel by aligning the connector to the connector location on the board.Put them in matching funnels but without clicking the bayonet clips.

3.5.4 Double check if the orientation is right and insert each one using the bayonet clips to secure in place.

Note

For 3d printed drones there might be some support leftovers in between bayonet features. Make sure you remove it before inserting sonars, otherwise you may break the bayonet feature by applying too much force.

3.5.5   Plug the flat flex connector into the landing camera board, ensuring the white mark on the connector lines up with the white mark on the landing camera board.

3.6   Lower battery holder

3.6.1   Assemble the beesplit board on the lower battery holder as shown above and secure with self tapping screws.

3.6.2   Attach one end of the 4 pin GH cable to the beeLand board.

3.6.3   Attach the other end 4 pin GH cable to the beesplit board's bottom facing connector.

3.6.4   Align the lower battery holder with the cowl, ensuring the beeSplit board is on the left side when the cowl is facing forwards.

3.6.5   Secure the lower battery holder to the cowl using 4 self tapping screws, making sure it's aligned to the cowl.

3.7   Sonar rings & membranes

3.7.1   Take a gore membrane from the spool and place it on a flat surface such that the adhesive side is up (not touching the surface). Center a sonar ring over the membrane and press the membrane. Make sure the adhesive surface has received enough pressure to be considered glued.

3.7.2   Insert ring and membrane sub-assembly into cowl features, using clocking features.

3.7.3   Ensure ring is flush with a-surface of the cowl.

3.7.4   Repeat steps for other three instances.

4   Front camera hatch

4.1   Front camera sub-assembly

4.1.1   Insert the camera hatch seal 1.6mm-1 into the seal groove. Have previously configured and focused camera ready according to:

a. Standard resolution camera HRN-BEE-IMX385-AI-0060-1

b. High resolution camera link

4.2   Heat inserts

4.2.1   Prepare soldering iron with the correct tip at 350ºC.

4.2.2   Insert heat inserts using heat, ensure they advance straight.

4.2.3   Top face of the inserts must be flush with the top face of the boss.

4.3 Front screen

4.3.1   Place screen on hatch feature using clean gloves.

4.3.2   Insert and press fit front screen ring and check there is no play on screen.

4.3.3   Clamp down using the jig.

4.3.4   Add epoxy glue around the perimeter on the rear side of the ring, ensuring no glue has gone onto the screen (use masking tape over ring opening to avoid glue spilling onto the glass).

4.3.5   Leave the hatch to dry for 10 minutes.

4.4 SD card board

4.4.1   Install the SD card into the beecamSD board.

4.4.2   Plug the flex cable into the beecamSD board.

4.4.3   Slide the beecamSD board in place.

4.4.4   Insert and tighten securing bolt.

4.5 Front camera installation

4.5.1   Remove lens protective plastic and visually inspect if the lens is clean. Use lens cleaning tool if necessary.

4.5.2   Visually inspect the front glass for fingerprints and dirt. Clean if necessary with glass cleaner tool.

4.5.3   Bend the sd card flat cable such that it directs to the right below the ring opening.

4.5.4   Guide the lens through the ring and place the sensor board in place. Screw the sensor board with 4 m2x8x3 standoffs into the previously screwed standoffs. Flat cable should stick on the side.

4.5.5   Place the processing board in place and screw it in with 4 m2x6 bolts.

4.5.6   Bend the flat cable and insert it in the connector. Make sure the orientation is right and to lock the connector.

4.6 Front camera cabling

4.6.1   Make cable according to the Fig 5. W1 and W3 should be 85mm and W2 (snapshot trigger) 95mm long.
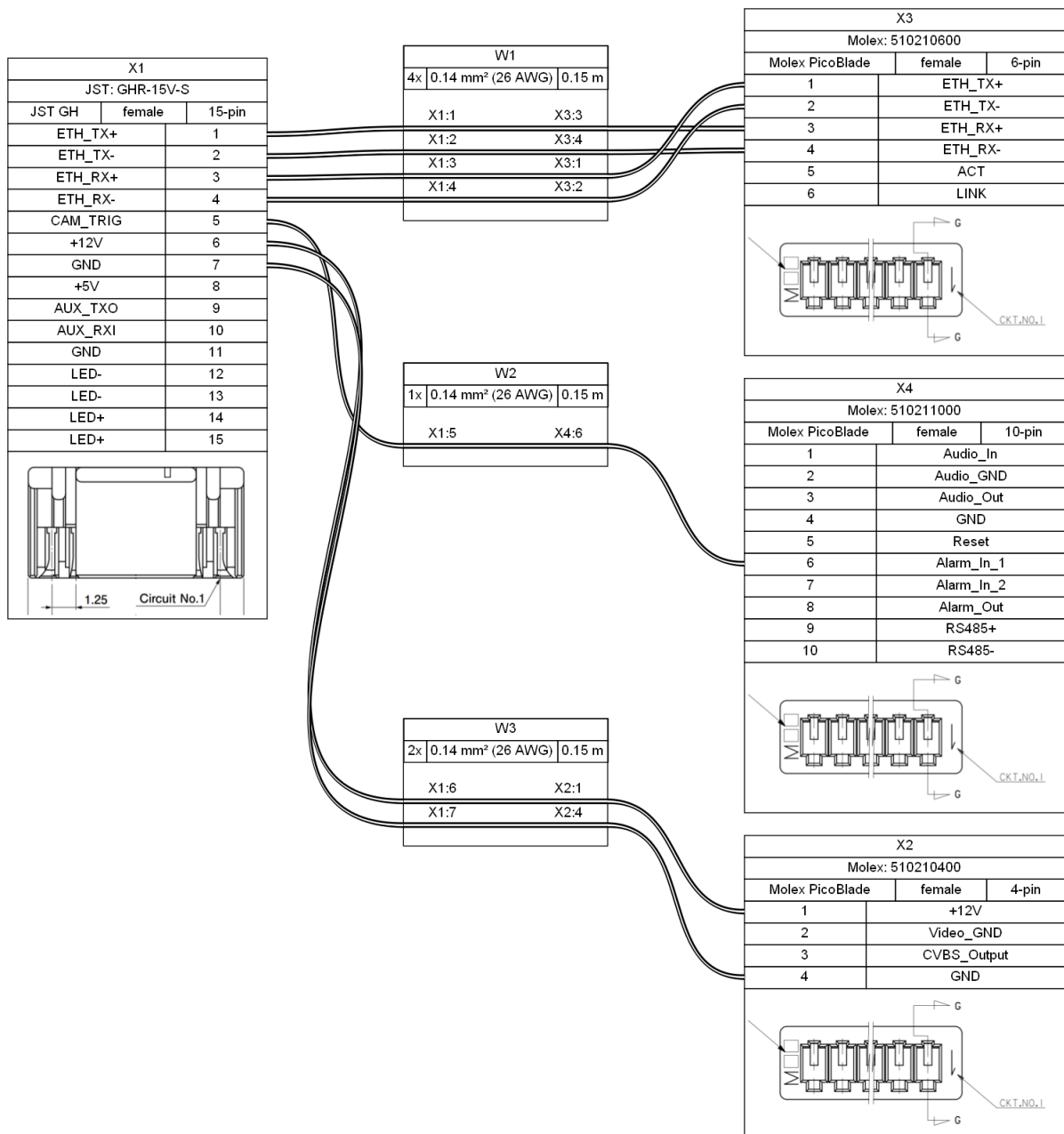
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Fig 5 Wiring diagram

4.6.2   Put some epoxy on the molex wires where they enter the connector (to prevent them fall out).

4.6.3   When glue is dried, connect molex connectors.

5   Master assembly

5.1   Connect the jst-gh 4pin 60mm - radio eth, jst-gh 9pin 60mm - radio, and twisted jst-gh 4pin 160mm - i2c to the correct beepower sockets.

5.2   Place bottom fuselage over and guide wires away from the perimeter.

5.3   Connect jst-gh 9pin radio side and push wires to free up space for the battery. Afterwards

connect jst-gh 4pin radio lan.

5.4   Connect jst-gh 9pin power button.

5.5   Make sure two parts are correctly aligned, and gently start pressing two parts together. Especially check whether the pogo pins are coming out properly with no obstruction. Apply necessary force to exercise the snapping features.

5.6   Secure two halves using twelve 2.63x14 self-tapping screws with 0.65 Nm of torque (three per drone arm). While screwing, keep pressing two parts together. Apply some down force on screw and avoid sudden speed changes while screwing.

5.7   Connect the power cable to the beepower P1V1-1.

5.8   TBD - foam for better adhesion.

5.9   Place the fuselage upside down and put the battery in the battery holder. Battery cables should point (stick out) to the camera hatch opening. Guide the power cables through the features.

5.10   Put the cowl above the fuselage and using clocking feature align it correctly.

5.11   Secure cowl to fuselage with four 2.63x14 self-tapping screws with 1.0 Nm of torque. While screwing, keep pressing two parts together. Apply some down force on screw and avoid sudden speed changes while screwing.

5.12   Connect the camera. Make sure the fuselage plastic is guided between camera hatch "rails". Snap the hatch in and secure it with m2x6 bolt.

5.13   Follow the Configuration document to finalize setup.

5.14   Set the registration.

5.15   Place the propeller guard on the attachment point and lock it by rotating it clockwise to the final position. Repeat the procedure for all four guards.

5.16   Secure adjacent propeller guards with four m2.26x12 thread forming screws with XY Nm of torque.

5.17   Secure propeller guards to the fuselage using four machine m2.5x12 bolts. Screw with required torque of XY Nm.

5.18   Put the propeller adapters on all motor shafts.

5.19   Place propellers on the motors. Make sure the propeller orientation is correct. Use adequate thread and color lock nuts to secure propellers in place. You may want to wear protective gloves to avoid hand cuts.

Requirements after job completion

Required conditions

Table 5 Required conditions

Action/Condition	Data module/Technical publication
None	