GROUND DATA TERMINAL 4X4

USER MANUAL

Revision: 1.0
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APPROVAL

Name	Signature	Date
COMPILED BY: [redacted] Mechanical Engineer	[redacted]	10. October 2022
CHECKED BY: [redacted] Flight Operations	[redacted]	5. November 2022
APPROVED BY [redacted] Development Director	[redacted]	10. November 2022

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RECORD OF REVISION

Revision No.	Content	Date
1.0	First release	10.11.2022

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1 SAFETY

The information that follows, together with local site regulations, should be studied by personnel concerned with the operation or maintenance of the equipment, to ensure awareness of potential hazards.

Switch off supplies before removing covers or disconnecting any RF cables, and before inspecting damaged cables or antennas.

Avoid standing in front of high gain antennas (such as a dish) and never look into the open end of a waveguide or cable where strong RF power may be present.

Users are strongly recommended to return any equipment that requires RF servicing to Threod Systems OÜ.

CAUTION

This system contains MOS devices. Electro-Static Discharge (ESD) precautions should be employed to prevent accidental damage. Never touch the pins of an open connector.

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2 WARNINGS, CAUTIONS AND NOTES

UAVs of any kind are dangerous and can cause serious injury. Please read, understand and follow the cautions and instructions.

Throughout the manual warnings and cautions are used to highlight various important procedures. They are defined as:

⚠ WARNING

AN OPERATING PROCEDURE, INSPECTION, REPAIR OR MAINTENANCE PRACTICE, WHICH IF NOT CORRECTLY FOLLOWED, COULD RESULT IN PERSONAL INJURY, OR LOSS OF LIFE.

CAUTION

AN OPERATING PROCEDURE, INSPECTION, REPAIR OR MAINTENANCE PRACTICE, WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE OR DESTRUCTION OF EQUIPMENT.

NOTICE

An operating procedure, inspection, repair or maintenance condition, etc., which is deemed essential to highlight.

3 GROUND DATA TERMINAL 4X4 (GDT)

3.1 GDT 4X4 SET

Figure 1 - GDT 4x4 Set

#	Part #	Part Description	Qty
	116469	**GDT 4x4 Set**	**1**
1	116927	Case with foams	1
2	105970	Cable pouch	1
3	117031	Tripod with adapter and net	1
4	116955	Radio module	1
5	103486	Battery	1 (2[1])
6	104528	Power adapter	1 (2[2])
7	117825	Y-Cable with DC-to-DC converter	1
8	116568	Ethernet/RJ45, 3m	1
9	103472	Ethernet Extension Cable, 15m	1
10	117379	Ethernet Extension Cable, 20m	(1[3])
11	110288	Omni Antenna, 2.5 dBi,	4
12	117380	Omni Antenna, 6 dBi	(2[4])
13	116946	Magnetic mount	1
14	117781	Contact cleaner	1
15	117926	GDT4x4 manual	1
16	117925	GDT4x4 packing list	1

Notes:
1 - Optional second battery
2 - Optional second charger
3 - Optional 20m ethernet cable
4 - Optional 6 dBi antennas

Ground Data Terminal 4x4 (GDT 4x4) consists of highly capable radio transmitter, battery, cables, mounting and a case. GDT 4x4 can be used in two configurations. If four short antennas are used, then the range of the radio is up to 30km with the azimuth range of 360° and maximum elevation of 78°. If four long antennas are used, then the range of the radio is up to 40km with the azimuth range of 360° and maximum elevation of 30°. Optimal results are obtained by using two short and two long antennas. Directly above the radio is a minor blind spot where the transmission may be lost (green area).

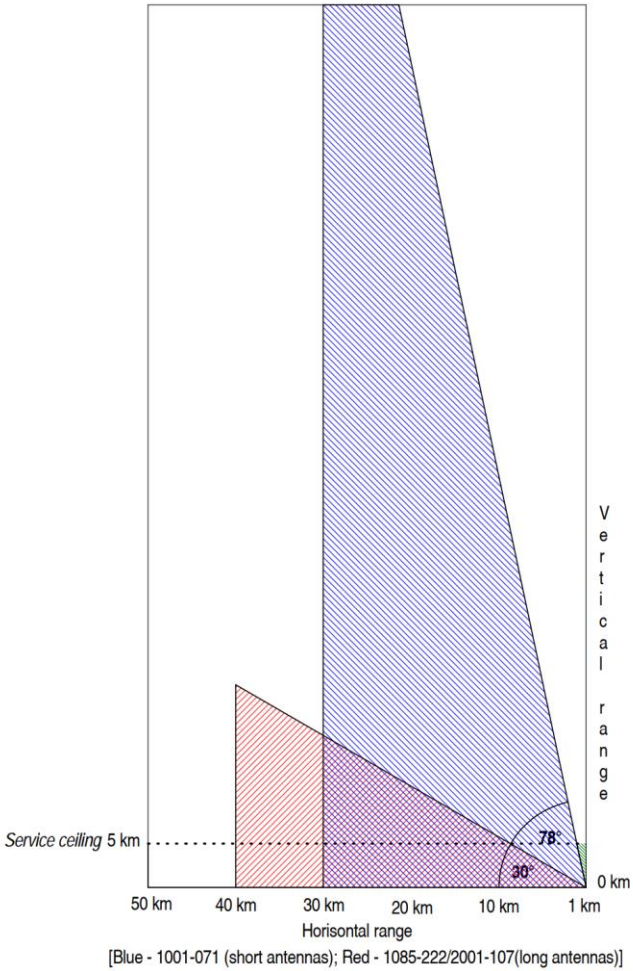


Figure 2 - Radiation chart

3.2 GDT 4X4 PARTS

3.2.1 Rugged case with foam

The rugged case (1) is impact resistant and waterproof case with custom made foam protection for sensitive equipment.

Weight (full)	8.7 kg
Dimension (outer)	L: 687 mm W:528 mm H: 276 mm
Temp range	-30°C to 90°C
IP code	IP67

3.2.2 Cable pouch

The cable pouch (2) is a standard Tasmanian Tiger dump pouch which is intended for packaging the ethernet; ethernet extension and Dc to DC cables.

Figure 3 - Cable pouch

3.2.3 Tripod

Tripod (3) is a Manfrotto MT055XPRO3 tripod which has a modified Manfrotto 625 adapter installed. The tripod is used to mount and level radio system. Other mounts are available upon request. The mount uses a click-on mechanism and can be opened using two levers.

There is a net placed on the tripod for placing the battery and cabling. Battery and cabling should always be placed on the net for extra weight and stability. Additionally, to protect battery and cabling against moisture and other weather elements.

Parameter	Value
Weight	2.5 kg
Max. top load	9 kg
Max. height	1.7 m
Folded length	0.61 m

Figure 4 - Tripod with modified adapter and net

There are also cable straps placed on the legs of the tripod to strap primary cable (Y-cable with DC-to-DC converter). The primary cable should always be strapped onto the tripod to lower strain on the cable.

Figure 5 - Tripod cable strap

3.2.4 Radio Module

The radio module (4) is a Silvus Streamcaster 4400E MIMO (Multiple input, multiple output) radio with a custom mount. It has four threaded RF connectors, a channel knob and three data connectors (PRI, PTT, AUX). The GDT4x4 set uses only the PRI connector which is a combined connector for data link and power to the unit. Always keep the connector covers on when the radio is not being used.

When radio is not in use, the switch must be in the off ("0") position. The Radio is turned on by selecting a channel. If the radio is turned on and "Z" position on switch is selected, then after 30 seconds all the data on radio is deleted. Data can only be restored by a Threod Systems technician.

Parameter	Value
Weight	1.35 kg
Dimensions	L:125 mm W:133 mm H: 74 mm
Encryption standard	AES-256
Input voltage	9-20 VDC
Input power	Up to 100 W
Output power (TX)	Up to 20 W

Figure 6 - GDT 4x4 radio module

3.2.5 Battery

The battery (5) is a Li-ion BB-2590 battery with a Pass-Thru Charger head module. The battery head acts as an UPS module. When no external power source is connected, the power is supplied from the battery. When external power source is connected, the battery header will charge the battery and power the device simultaneously. The charger has a LED indicator for battery level and an ON/OFF switch. Battery is powered on by pressing ON/OFF switch for 5 seconds. Additional 1 second push shows the battery charge level.

Parameter	**Value**
Weight	5.7 kg
Dimension	L:151 mm W:81 mm H: 187 mm
Charging voltage	24V
Max. output voltage	33.6 V
Input connector	SAE 2 Pin
Output connector	Lemo FGG.2K
Capacity	10.3 Ah at 24V
Operating Temperature	-20°C to +60°C
Recommended Storage Temperature	-40°C to +40°C
ON/OFF switch	Press and hold 5 sec. for power on/off; press for state of charger indication
MIL standard	MIL-PRF-32052/1

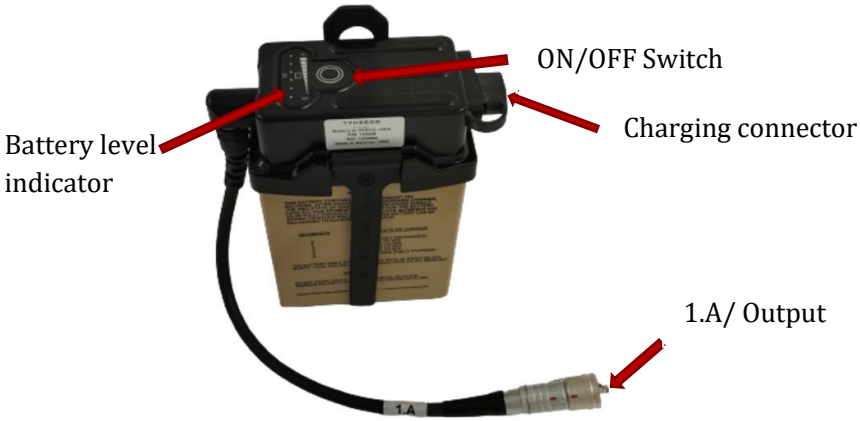


Figure 7 - Battery

3.2.6 Battery charger

The battery charger (6) is a 100-240 V charger with a SAE 2 Pin output connector.

Parameter	Value
Weight	0.9 kg
Dimensions	L:173 mm W:70 mm H: 35 mm
Input	AC 100 to 240 V
Output	DC 24 V 6.67 A

Figure 8 - Battery charging adapter

3.2.7 Y-Cable with DC-to-DC converter

The Y-Cable (7) is used to transfer data and power to the radio. The single end of the cable connects to the PRI output of the radio. The Y end of the cable connects to the battery and to the ethernet cable that goes into the GCS computer. Different plugs are used to remove the possibility of incorrect connection.

There is a DC-to-DC converter placed on battery cable. The converter converts incoming voltage to stable 12.9V. As there are batteries with different voltages used with GDT sets, this provides protection against using too high voltage on the 4x4 radio.

Parameter	Value
Length	1.8 m
Weight	0.12 kg
PRI connector	PRI - SC-PRICBL-F-6H
Battery connector	2.A - Lemo PHG.2K
Data connector	2.B - Lemo FGG.2K

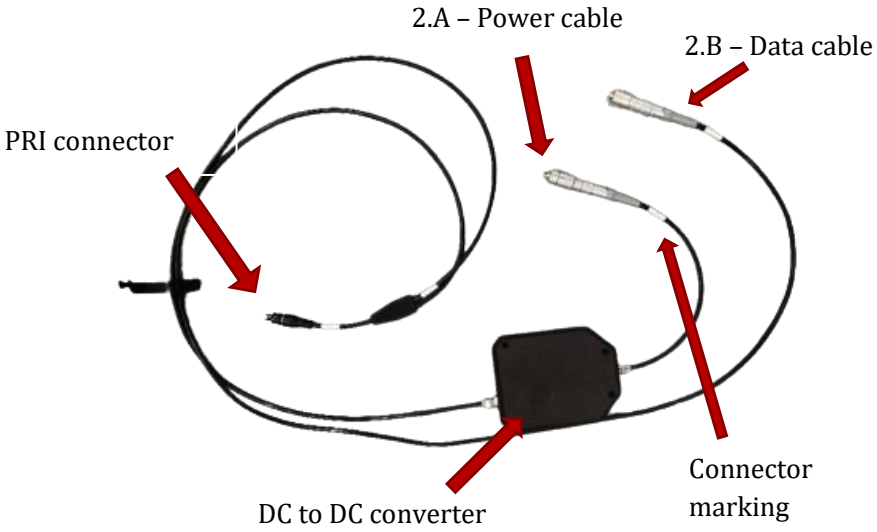


Figure 9 - Y-Cable with DC-to-DC converter

CAUTION

Align the red dots on plugs and sockets or you may damage the connection.

3.2.8 Ethernet/RJ45 cable

The Ethernet cable (8) is used for data transfer between radio and GCS computer. One end of the cable connects to the Y-harness and the other into the Ethernet/RJ45 socket on the GCS computer.

Parameter	Value
Length	3 m
Weight	0.32 kg
Data connector	5.B - Lemo PHG.2K
GCS connector	RJ45/Ethernet

Figure 10 – Ethernet/data cable

CAUTION

Align the red dots on plugs and sockets or you may damage the connection.

3.2.9 Ethernet Extension Cable

The extension cable (9,10) is used for extending the connection between the Y-cable and Ethernet cable. The cable extends only ethernet so that it cannot be used to extend the battery cable. Upon request, it is possible to add 20m data/power extension cable to the set.

Parameter	Value
Length	15 m
Weight	1,72 kg
Y-harness connector	3.B - Lemo PHG.2K
GCS connector	4.B - Lemo FGG.2K

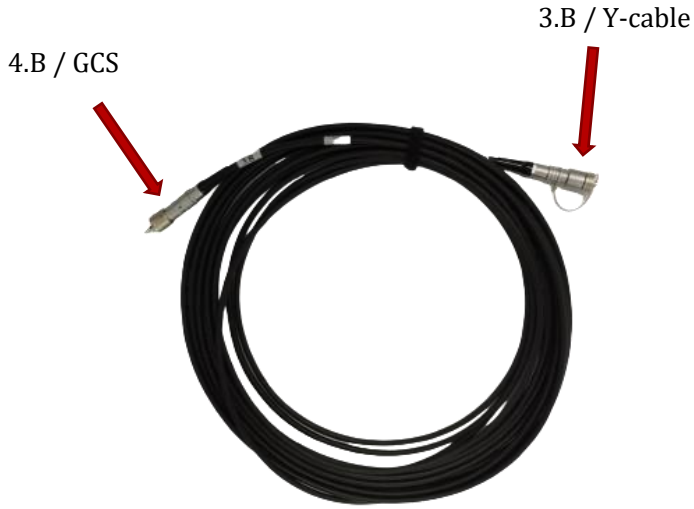


Figure 11 - Ethernet/RJ45 extension cable

CAUTION

Align the red dots on plugs and sockets or you may damage the connection.

3.2.10 Omni-directional Antennas

The radio module uses four 2.5 dB omni-directional antennas (11). The antennas use RF threaded connectors which can be screwed onto the radio. As per request, it is possible to use two 6 dBi antennas (12) in addition to two 2.5 dBi antennas. Four 2.5 dBi antennas provide good data link at higher altitudes. Two 6 dBi antennas with two 2.5 dBi antennas provide better longitudinal data link. The position of the antennas on the radio is not fixed.

Parameter	**Value**
2.5 dBi Antenna	
Weight	4x 63 g
Dimensions	L:200 mm D:14.3 mm
Frequency range	2.1-2.5 & 4.4-5.9 GHz

Parameter	**Value**
6 dBi Antenna	
Weight	2x 125 g
Dimensions	L:470 mm D:20.62 mm
Frequency range	2.2-2.5 GHz

Figure 12 - 2.5 dBi and 6 dBi antennas

CAUTION

Do not turn radio on without antennas connected.

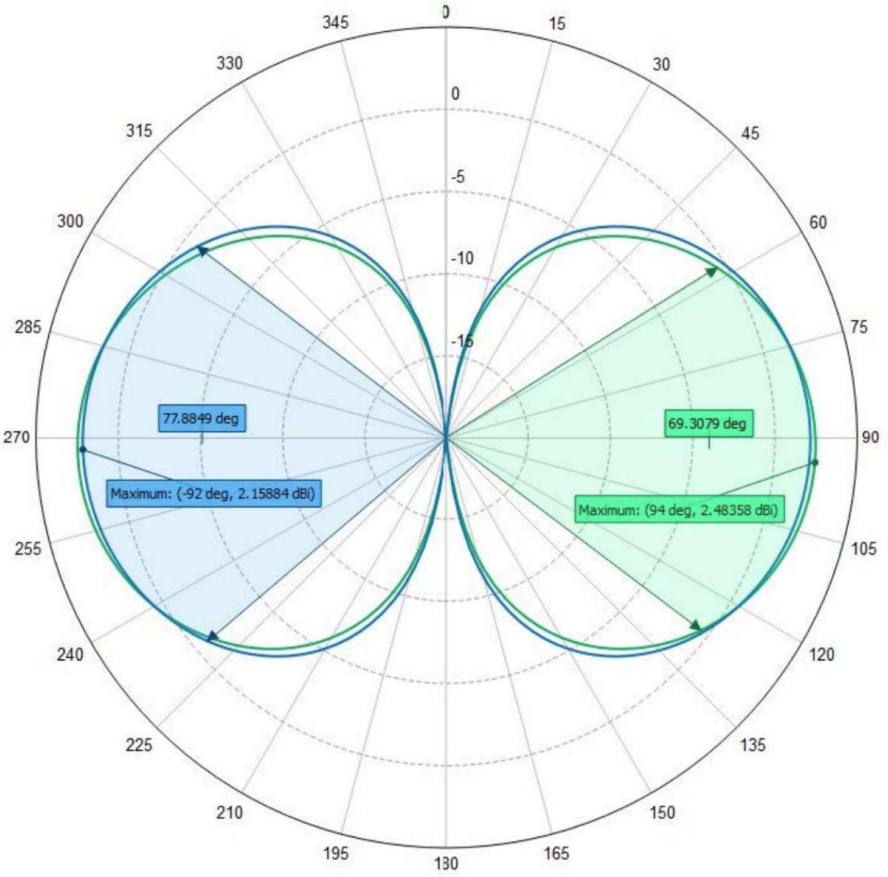


Figure 13 - Elevation pattern for 1001-071 (2.5dBi); Blue - S band; Green - C band

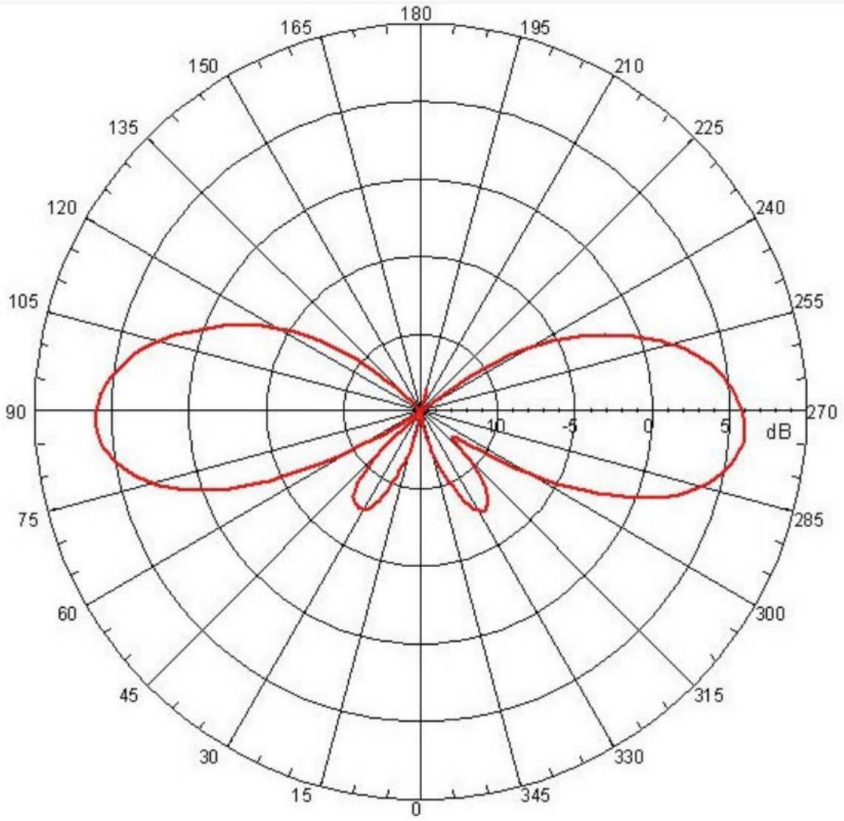


Figure 14 - Elevation pattern for 1085-222/2001-107 (6dBi)

3.2.11 Magnetic Mount

The magnetic mount (13) can be screwed onto the bottom of the radio module. It provides a possibility to mount the radio onto a metallic surface instead of a tripod. The radio should be placed in a horizontal position when the magnetic mount is used. It is not recommended to drive while the radio is mounted onto a car with the magnetic adapter.

Parameter	Value
Weight	0.1 kg
Dimensions	D: 66 mm H:24 mm
Thread	M6 (L:15 mm)
Pull force	180 N / 18 kg

Figure 16 - Radio with magnetic mount installed

3.2.12 Contact cleaner

Contact cleaner (14) is for cleaning and lubricating the radio and the cable connectors. Mechanical cleaning is not recommended.

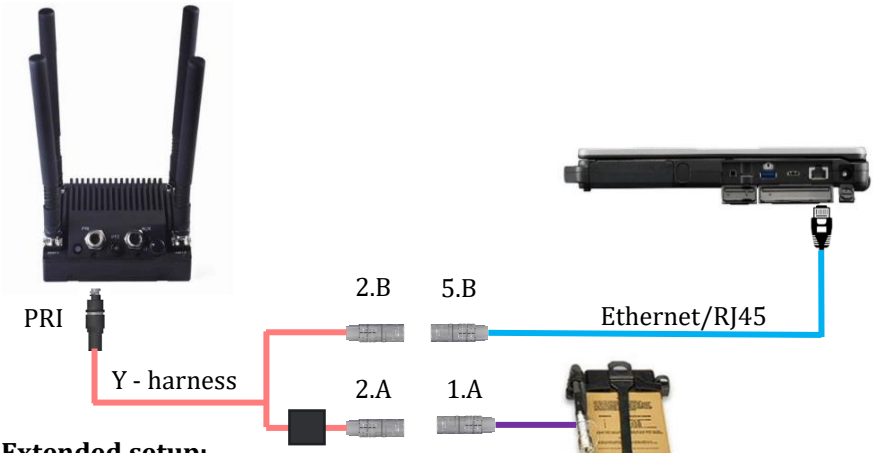
Parameter	Value
Weight	0.3 kg
Dimensions	D: 53 mm H:175 mm
Volume	200 ml

Figure 17 – Contact cleaner/lubricant

4 GDT 4X4 ASSEMBLY

4.1 SETUP SCHEMATICS

Standard setup:



Extended setup:

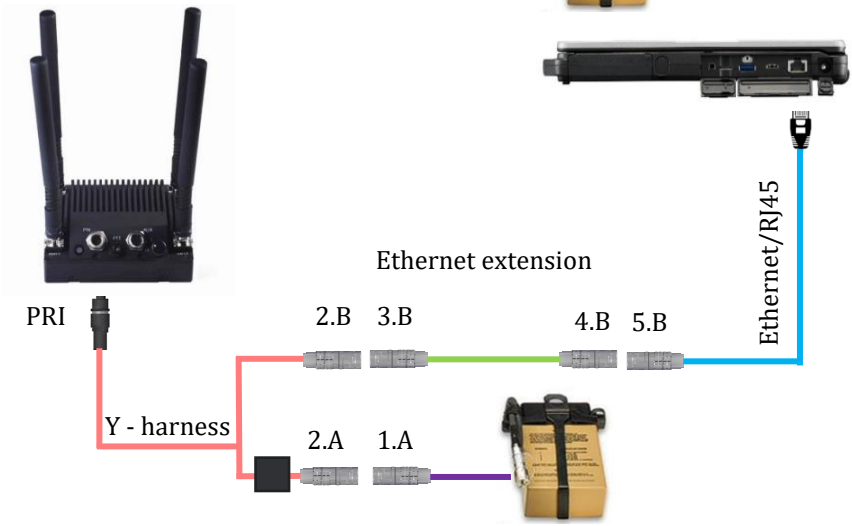


Figure 18 - Setup schematics

4.2 ASSEMBLY INSTRUCTIONS

Set up the tripod on stable ground.

Figure 19 - Assembled tripod

Adjust it into level.

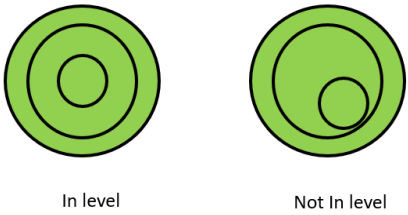


Figure 20 - Levelling

NOTICE

When the tripod is not in level, you may get weaker signal strength or lose communication between UAV and the tracker at longer ranges.

1. Lock the radio module on a tripod. Ensure it is locked tightly.
2. Remove the connector covers and screw in the four antennas. Ensure they are in a vertical position.
3. Place Y-cable and battery securely onto the net.
4. Connect the single end of Y-cable with the radio's primary connector (PRI). Use the red indication on the cables for correct cable alignment prior to connection.
5. Use the cable strap to strap the cable onto the tripod. Make sure it is tight and the PRI cable is not under tension.

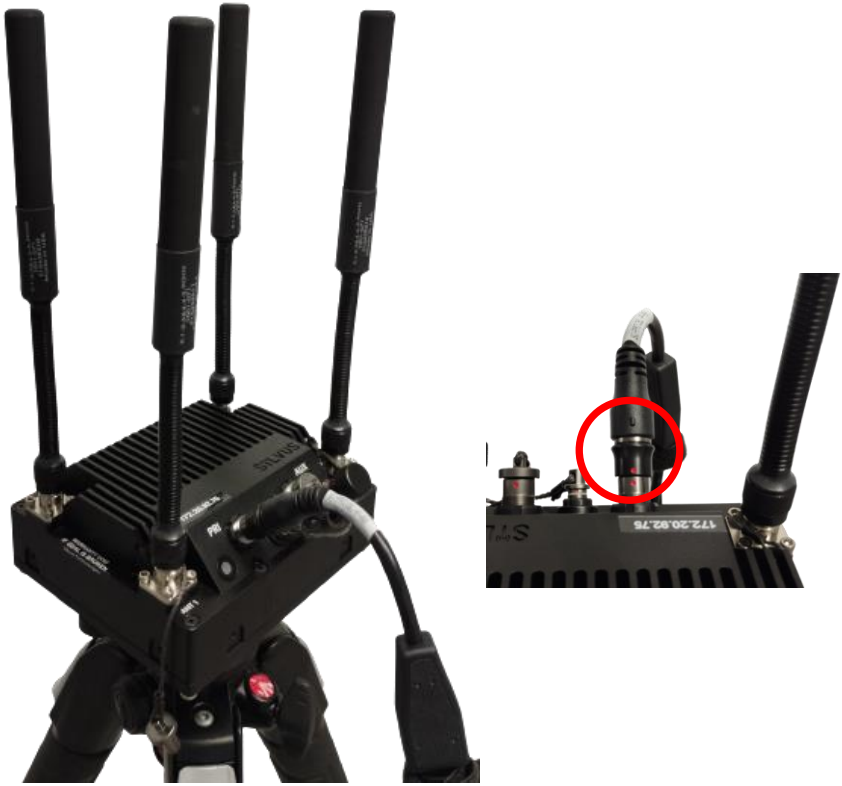


Figure 21 - Radio with antennas and data cable installed

6. Check that the battery is powered off, by pressing the ON/OFF button for 1 second on top of the battery header. Connect the battery (1.A-2. A). Ensure to align the red dots on the connectors and mate the dust caps with each other to prevent any contamination getting inside during operations.

Figure 22 - Power & data cable connected to battery.

7. Connect the ethernet/RJ45 or extension cable to the Y cable (3.B-2.B) end. Ensure to align the red dots on the connectors and mate the dust caps with each other to prevent any contamination getting inside during operations.

Figure 23 - Power & comm cable connected to ethernet extension cable.

⚠ CAUTION

Ensure to connect the cables correctly or it may damage the pins.

8. Connect the ethernet/RJ45 cable to the RJ45 port on the GCS computer.

Figure 24 - Ethernet input on GCS computer

9. Power on the battery by pressing the ON/OFF button for five seconds. The charge indicators will illuminate after the battery has been switched on.
10. Turn the channel knob to choose the correct preprogrammed channel. As per standard, the main preprogrammed channel is no 1.

Figure 25 - Channel knob

4.3 ASSEMBLY CHECK-LIST

#	GDT 4x4 ASSEMBLY	Check
1	Set up tripod on secure surface	☐
2	Lock radio module onto the tripod	☐
3	Mount antennas	☐
4	Place the Y-cable and battery securely on the net	☐
5	Connect Y-cable to radio	☐
6	Strap the Y-cable to the tripod	☐
7	Connect Y-cable to the battery	☐
8	Connect ethernet cable/extension cable to Y-cable	☐
9	Connect ethernet cable/extension cable to GCS computer	☐
10	Turn on battery	☐
11	Choose channel on radio/turn radio on	☐

5 DISASSEMBLY

⚠ CAUTION

Before disassembling, power off the battery as it may damage the equipment.

Disassemble the unit in the reverse order. Before packing check that the cables are without any damage and the connectors are clean.

6 CONNECTION

Connection with aircraft is created in the Ground Control Station (GCS). This is described in GCS software manual.

For access into radio, find IP address from radio module.

Figure 26 - IP address location

Type the same IP address into your web browser in the GCS.

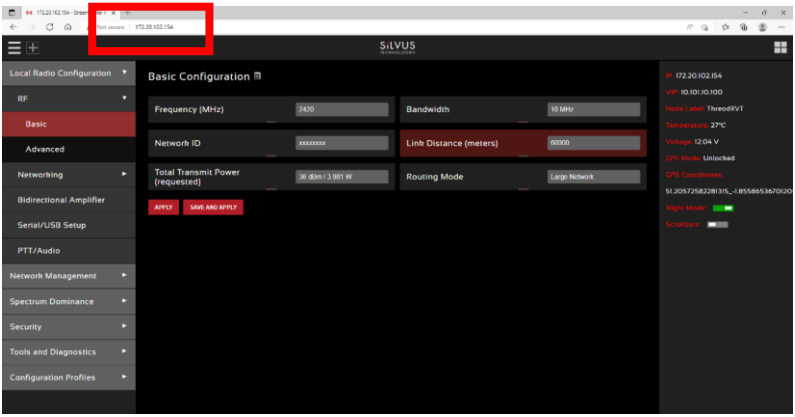


Figure 27 - Browser interface

7 MAINTENANCE

	Each use	Monthly	Yearly
Charge battery	x	x	x
Check contacts	x	x	x
Dry the equipment	x	x	x
Clean contacts with contact cleaner		x	x
Update radio and GDT firmware			x

7.1 CHARGE THE BATTERY

The BB-2590 battery can be charged using the provided battery charger which connects directly to the battery header of the BB-2590 battery and takes in 220VAC. While charging, the system can also be operated as the battery header acts as an UPS module providing external power to the system and charges the battery.

The batteries are Lithium-Ion batteries with a protective circuitry that prevents them from excessive discharge. When the battery's output voltage per cell drops to a certain threshold value, the battery will switch off and will need servicing by Threod Systems. For this reason, the batteries must be periodically charged even if not used. The batteries have a charge indicator (per each cell in the battery) and user should not leave batteries with minimum charge (below two LED bars) for more than two weeks without re-charging them.

7.2 DRY EQUIPMENT

After each use in a rainy, snowy, or humid environment, the case, along with the equipment should be dried before storage.

7.3 CHECK AND CLEAN CONTACTS

Before and after each use of the equipment, the user should ensure that all the contacts, especially radio modules pogo-pin connectors, are clean and that there is no moisture or particles inside them. In case there is any contamination in the connectors, the user should clean the connectors thoroughly with the supplied contact cleaner.

The user should clean all the contacts and equipment generally before storing it for longer periods and periodically during normal operations (once a month).

7.4 UPDATE RADIO FIRMWARE

The GDT software on the radio firmware will require updating periodically. This is not performed by the user, but by Threod Systems technician.

NOTES