

WORKING WITH THE TRIUMPH-LS

HOW TO

**Set Up the Radio,
Base and Rover**



in less than 15 minutes

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Working with the Triumph-LS

How to Connect with 3G

Preface



Before beginning this *How To*, you should have already familiarized yourself with, and have previously created (2) Setups on the LS; one for the Triumph-2 (T2) as RTK Base; the other for the Triumph-LS (LS) as RTK Rover. You should have also beforehand transferred the RTK Base Setup via Bluetooth from the LS onto the T2. If you haven't done that yet, you will want to read: ***Remote Setup UHF Base.***

Also, note that in this example and its related photographs, I'm using a 2-meter fixed height GPS pole for both the radio mast and the T2 just as a matter of convenience and for keeping consistent HIs. You could also use a regular surveying tripod as the mounting bracket that comes standard on the radio, clips very easily onto the tripod. The LS is on a bipod for a similar reason of convenience, steadying the shot and for freeing up my hands. If we were going to do topo, I'd opt for the monopod as that is lighter, the exactness of the shot isn't as critical and the length of shot shorter.

What's In The Kit (in these photos)



Battery Kit

12-volt battery

Power cable
(14-578121-01 REV.2)

The bag itself - The Triumph-VS Soft Carrying Case - an amazingly perfect match for it all. Inside the bag, all fit neat and snug. All of the radio, base and rover gear needed for doing RTK is shown above, including the 12-volt battery kit (separate bag on far left).

Rover

Triumph-LS

Antenna (unknown part number)

1/4"x20 to 5/8"x11 adapter (10-590293-01)

* Note: if you plan to use the monopod instead of a bipod, you won't need the adapter as the monopod has the smaller male connector.

Radio

4-watt radio (HPT404BT) with my call sign taped onto it. * Note: Your kit may contain a different radio.

2.5 dB, TNC Antenna (30-050503-02) <- **MAKE SURE THE ANTENNA IS ON THE RADIO BEFORE POWERING THE RADIO!!!**

15-pin Serial to SAE pigtail (14-578157-01 REV.1)

Seen in my photos; custom field bracket for radio - see Appendix B for design specs. Not shown is the Standard Mounting bracket (10-587302-21)

Base

Triumph-2 - ain't it *cunnin'*?

1/4"x20 to 5/8"x11 adapter (10-590293-01)



Other items in the kit: FCC License - this should be kept with the radio; Small hand held compass. If you plan on participating in NGS's **GPSONBM** campaign and sharing your OPUS submissions, you'll need to be mindful of orienting the receiver in accordance with its orientation used during NGS's antenna calibration procedure - see appendix; (2) 6' SAE power extension cables, this fits quite nicely in the T2-LS field bag though it specifically only pertains to the radio and its associated battery kit; *Blinky LED Cheat Sheet* - see Appendix C.

* Note: All devices with batteries when they arrived included their respective chargers, but they're not shown in these photos nor have I bothered enumerating them.



With regard to the first item, I asked Javad *how close is too close* when it comes to setting up the radio and here is his response:

Hello Kelly,

There is no hard rule. The effect depends on the power of the transmitter. Vertical or horizontal separation is the same. The further you are the effect is less. For 1 watt stay away a few feet. For 45 watt, stay away 20 feet. The further the better.

Regards,

Javad

In regards to the second point, I asked Vladimir Zhukov this question: "What is the most practicable range of the communication between the T2 and the HPT404BT (shown in this example) afforded through Bluetooth?" and his answer:

Hi Kelly,

Up to 50 ft (~15 m) is the practicable range of the communication between TRIUMPH-2 and HPT401BT/HPT404BT.

Actually in the field they keep reliable connection up to 130 ft (~40 m).

So, > 130 ft is too far.

Regards,

Vlad

The last bit, the height or elevation of the antenna has two things relevant for you to consider; 1) power and 2) viewshed. If you have the base RTK kit, it comes with (2) 6' SAE extension cords (14-578102-01 REV.2) and the battery kit power cable (14-578121-01 REV.2) comfortably adds another 5' or so plus the 1' pigtail. That's about a maximum of 18' between the 12-volt battery and the radio that's permissible.

The viewshed may take some study beforehand. An excellent program that may already be in the surveyor's tool kit (or should be) is *Global Mapper* which allows the user to easily determine line of sight from your DTM, LiDAR, or other elevation data; viewshed even has its own icon! There is also ESRI software, but I'm unfamiliar how it works for viewshed analysis.

Finally, if you don't have an FCC license for your radio, you really need to read Mark Silver's excellent article that appeared in the January 2014 issue of *The American Surveyor*: "**Sailing with the Pirate Surveyors**," which you can read here: http://www.amerisurv.com/PDF/TheAmericanSurveyor_Silver-PirateSurveyors_Jan2014.pdf

Once the radio is all setup - and make sure the antenna is connected to the radio - turn on the radio by plugging it into the battery cable.

Refer to Appendix A for an explanation of the blinking LED lights.

Find your control point

As you begin your setup, it is presumed that you have previously done your recon, have found the optimal location for your RTK Base; i.e., as much sky as possible, as your base's corrections will otherwise be curtailed if it's unable to receive signals from the same Space Vehicles (SVs) that your RTK Rover is able receive. Ideally, your base should be able to see all healthy SVs.



Set up your radio

Knowing where your RTK base is going to eventually be set up to maximize satellite reception is the first step in setting up your radio. Other criteria for your radio's location will be predicated on 1) mitigating the electromagnetic effects of the radio's transmissions on the GNSS receiver, 2) the practicable range of the Bluetooth connection between the RTK base and the radio and lastly 3) the higher the antenna, the further the line of sight distances will be allowed which is one element effecting the range of the rover while still receiving corrections.



One important thing to note that is particular to only the Triumph-2 (and not the Triumph-LS): There is a distinction when using a 2-meter fixed-height pole and recording the HI as there are actually (2) choices and NGS has distinguished them apart by naming them *JAVTRIUMPH_2* and *JAVTRIUMPH_2A*. The only difference between these two antenna models is where NGS has assigned the ARP; the former at the bottom of the T2 unit and the latter at the bottom of the 1/4"x20 to 5/8"x11 adapter (10-590293-01). This means for the exact same setup the HI for the antenna model *JAVTRIUMPH_2* would be 2.025m and 2.0m for the antenna model *JAVTRIUMPH_2A*.

Set up your base

Here's a great example of how important it is to keep your softwares and firmwares up to date because the cool features aren't ready as of this writing which will facilitate wireless file transfers between the T2 and the PC. As soon as they are ready it will be announced (and much celebrated!). Of course the automatic update feature of the Triumph-LS will help you stay current even when you forget

I only mention this ahead of this part of the discussion because it will come into play particularly while we're still in the *beta phase*; i.e., little to point in recording 4 hours of data on the T2 if it is intended for an immediate OPUS submission / solution. That said, and if you're not in a hurry, there's "up to" 2GB of storage which means many such OPUS sessions could be logged on the T2 before you run out of storage space for your data.

Once the base is set up, power on the T2 and if recording data, be sure to press the record button.

Refer to Appendix A for an explanation of the Blinking LED lights.



Also worth noting, if you're not using a 2-meter fixed-height pole, and instead will be measuring the slant height for your HI, the little green triangle marks are

where on the T2 (and LS) that you are to measure when entering slant height values in the J-Field interface.

For your convenience, the NGS diagrams are included in Appendix of this document. Please refer to the *NGS Antenna Calibration* webpage for additional information.



Set up your rover

At this point should have pretty much gotten everything prepared and all that's left for you to do is get the rover connected to the monopod (or bipod), turn it on and confirm your communications between the rover and the base.

From the Home screen, tap on the UHF icon to bring up the Radio Status screen. Look for your received signal strength indicator (RSSI) value. It is a measurement of the power present in a received radio signal. You should also see your Received, Lost values being updated. Failing to see those two indicators likely means that the two Setups that had been created earlier; 1) for the Base and 2) for the Rover need to be reviewed and then

make any changes to them so that the communications settings on both receivers are the identical. If necessary, transfer the changed Base Setup to the T2 using the Setup Remote utility as covered in the *Remote Setup UHF Base*.

Parameter	Value	Parameter	Value
UHF RX	RTK - JPS	Region	ALL
Sent	--	Output Power	1000(30) mW(dBm)
Station ID	0	Frequency	461.02500 MHz
Distance	N/A	Protocol	JAVAD
LQ	100.0%	Modulation	DQPSK
Delay	0 sec	Ch. Bandwidth	12.5 KHz
Received, Lost	5973, 7	FEC	On
RSSI	Excellent(-41 dBm)	Scrambling	255
BER	0E-0	Antenna	Internal
UHF State	ready, none	FCC ID	WJ4LMR400

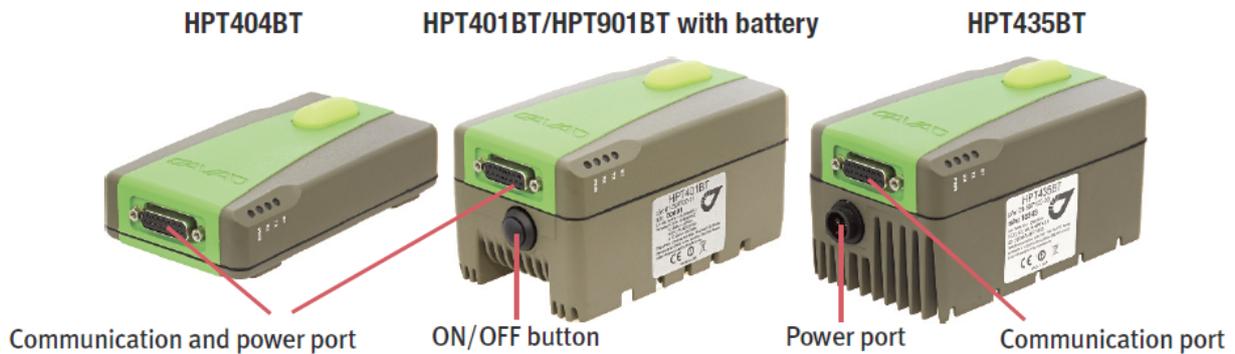
Appendix A

LED Blinky Light Cheat Sheet



The bottom 1/4-20" thread connector allows mounting TRIUMPH-2 on the monopole, install 1/4-20" to 5/8-11" adapter to mount TRIUMPH-2 on the pole.

To operate TRIUMPH-2 as RTK base station it could be equipped with Bluetooth® capable external radio like either one of three UHF 406.1-470 MHz radio transceivers: 35W HPT435BT, 4W HPT404BT, 1W HPT401BT or license free frequency hopping 902-928 MHz 1 W HPT901BT radio transceiver.



WARNING! To avoid serious damage of the equipment, do not use the radio without the antenna.

TRIUMPH-2 communicates with radio via Bluetooth wireless link. Up to 50 ft (~15 m) is the practicable range of the communication between TRIUMPH-2 and HPT401BT/HPT404BT. Actually in the field they keep reliable connection up to 130 ft (~40 m). TRIUMPH-2 and radio are paired at the factory, so they automatically connect together after power applied.

To turn ON the radio without the internal battery, connect the external power using the cable included to the kit. To turn ON the radio with the internal battery, either connect the external power or press and hold the power button for more than 5 seconds to operate from the battery. To charge the internal battery, connect the external power.

External radio status indication:

Function	Color	Description
PWR	Green	Radio with internal battery: Solid - external power is connected, battery charger is off. Blinking every 1 second - external power is connected, the battery is being charged Blinking every 4 seconds - external power is not connected, internal battery is being used as power source Blinking every 0.5 second - external power is not connected, the battery is near to full discharge OFF - external power is not connected.
		Radio without internal battery: Solid - external power is connected OFF - external power is not connected
RX	Green	ON - radio receives data
TX	Green	ON - radio transmits data
BT	Blue	OFF - Bluetooth® is OFF; Solid blue - Bluetooth® is ON; Blinking if radio receives or transmits data over Bluetooth®



To **turn ON** the receiver press the power button. To turn OFF the receiver, press and hold the power button until LEDs are off and then release the button.

The **MinPad** is the receiver's minimum interface used to display and control data input and output.

Function	Symbol	Green	Yellow	Red	OFF
BATTERY ¹		Full	Half	Almost empty	OFF/No power
WLAN		Connected	Initialization	Error	Not Active
SATELLITES ²		8 or more	5 to 7	Less than 5	No Satellite
POSITION		Fixed/Diff/OK (Base)	Float/No-Diff	No Position	Receiver OFF
RECORDING ³		Recording	Less than 10 min memory left	Memory Full	Not Active

1. Blinking every 1 sec according to the battery means receiver is ON without external power. LED solid according to the battery means external power is connected.

2. Effective number of satellites are total number of satellites tracked minus the number of non-GPS systems tracked. For example if 8 GPS and 5 GLONASS are tracked the effective number of satellites is 12.

3. RECORDING LED blinks on each recording.

Function	Symbol	Blue	Yellow	Red	OFF
BLUETOOTH		Connected	Searching	No connection	Not Active



The record button starts/stops data recording.

Power port is used to connect the receiver to an external power source and to charge the batteries. Input voltage: +10...16 VDC.

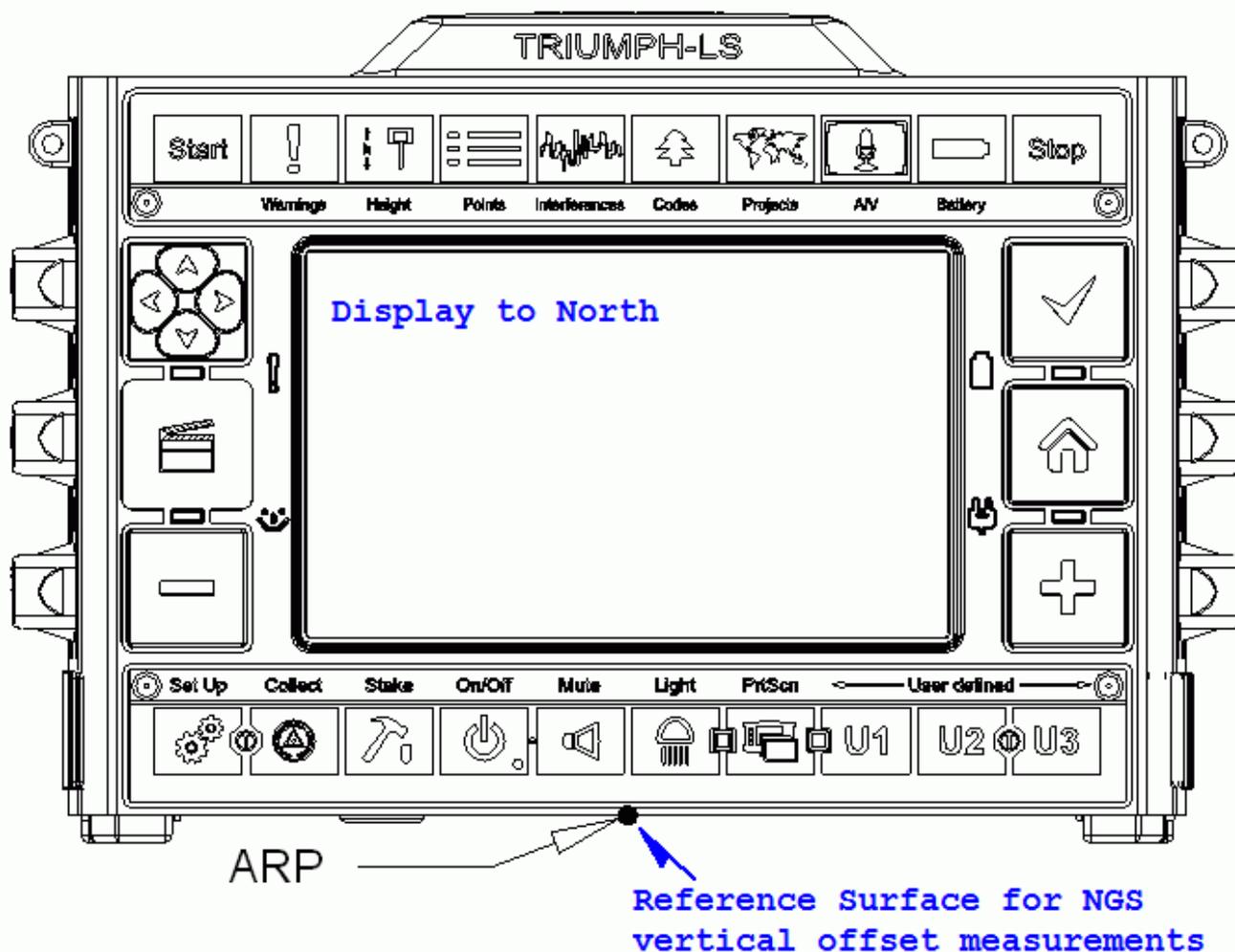
USB port is used for high-speed data transfer and communication between the receiver and an external device.

Revision 1.3 from May 28, 2014

Appendix B

NGS Ant Cal Diagrams for LS & T2

JAVTRIUMPH_LS+NONE



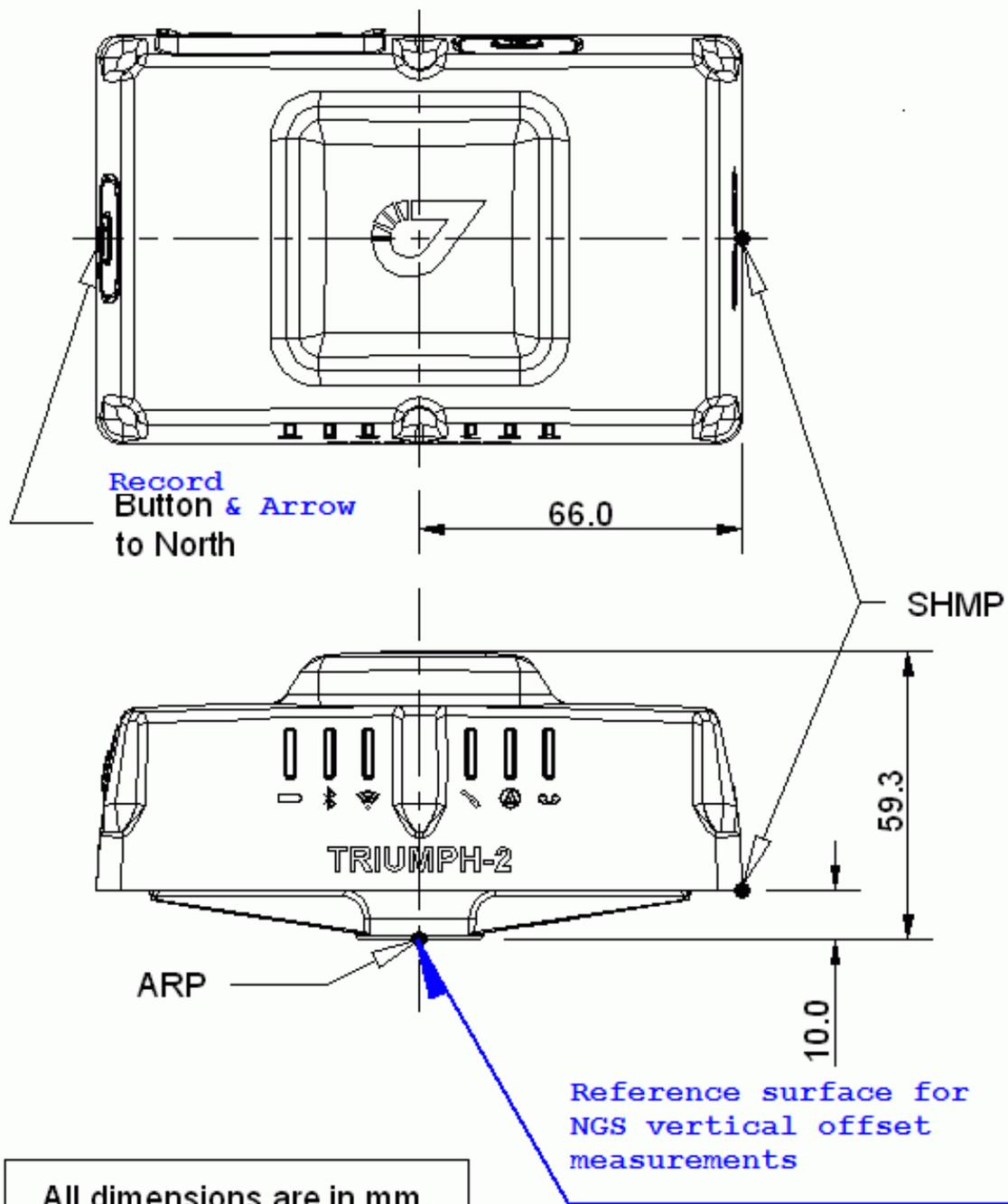
Model Name: JAVAD TRIUMPH-LS

Antenna Code: JAVTRIUMPH_LS

The receiver was mounted using a pole adapter
(P/N 10-590293-01) 1/4-20 to 5/8-11.

Height of the adaptor is 25mm from the bottom of the
adaptor to the ARP.

JAVTRIUMPH_2+NONE



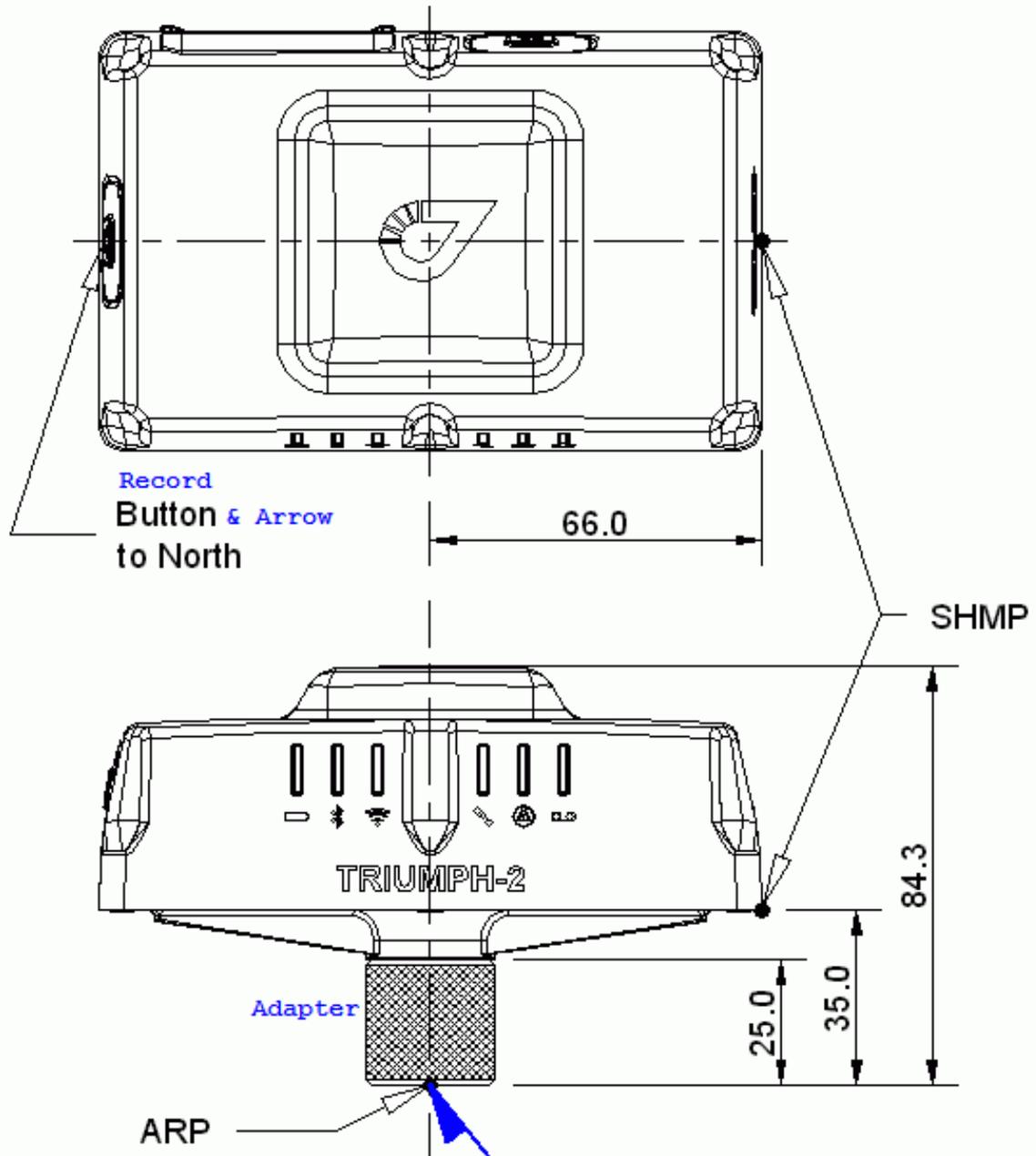
All dimensions are in mm.

ARP - Antenna Reference Point
SHMP - Slant Height Measurement Point

Model Name: JAVAD TRIUMPH-2 with Adapter

Antenna Code: JAVTRIUMPH_2A

JAVTRIUMPH_2A+NONE



All dimensions are in mm.

Reference surface for NGS
vertical offset measurements

ARP - Antenna Reference Point
SHMP - Slant Height Measurement Point

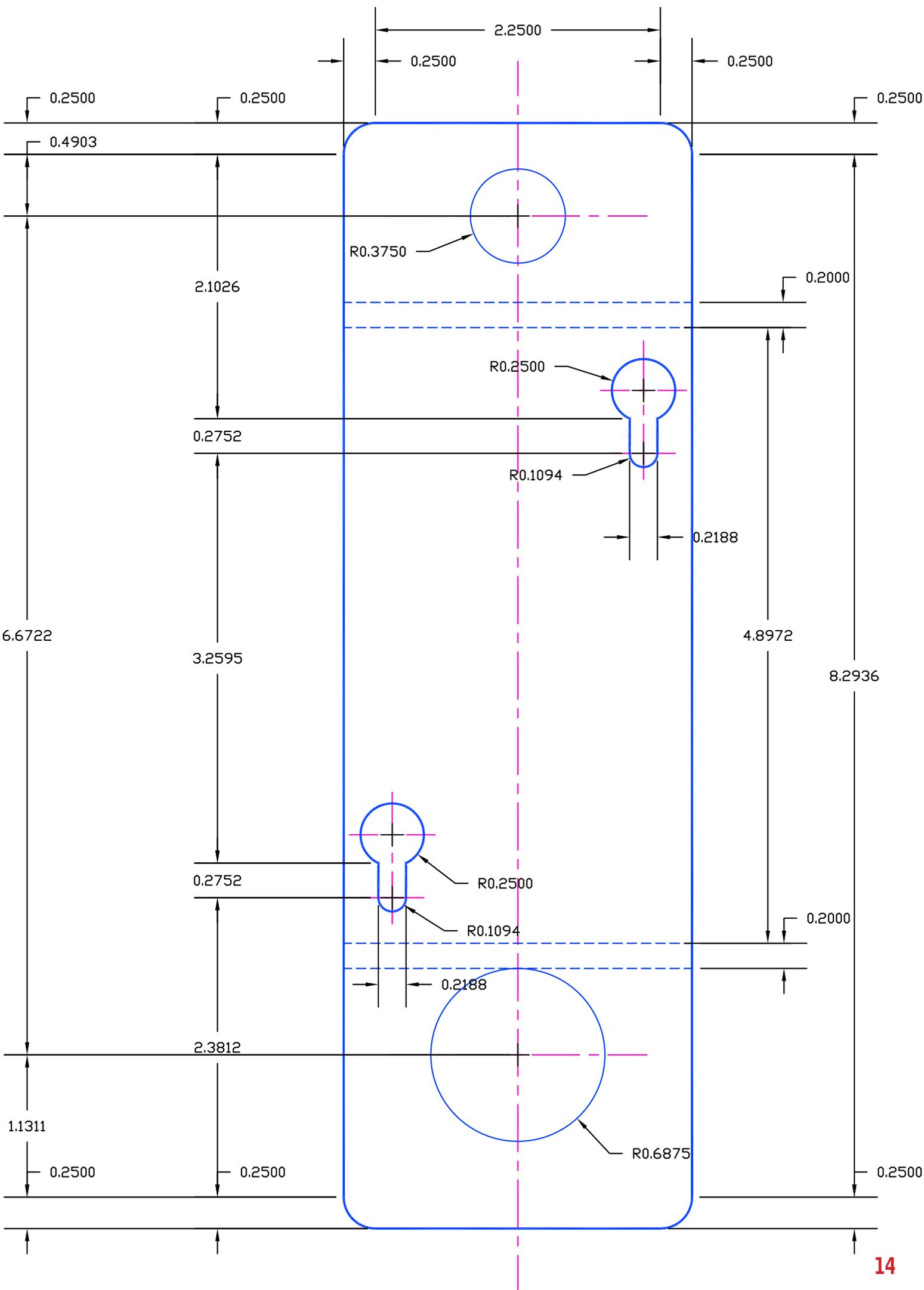
Appendix C

Alternative Mounting Bracket



The standard mounting bracket for the radio works great for the standard surveying tripod, but how to get the antenna higher? The first idea was to buy an antenna cable, but then another idea, just raise the radio. So one of the first things I did was design an alternative bracket that works with any 1 1/4" O.D. pole like the 2-meter fixed-height poles.

Feel free to use the design. Materials for what I made were: (2) M6-1.0 x 12mm hex-head bolts - note these are metric which replace the (2) Phillips head screws on the back of the radio acting as studs.





The bracket itself is made from a 6mm thick Sintra, a closed-cell PVC board used in the signage industry and works like a dream with ordinary woodworking tools.

There are (2) 90° - V-grooves routed about 4mm deep between the pairs of dashed lines on the drawing above.

One of the neat features of this material is that it allows for heat shaping. Practice your routing and heat shaping with a mini torch on scrap. Once bent and after it cools, PVC cement, the watery thin stuff, works great to weld the routed edges together.

The little cable c-clips I made from 1 1/4" PVC pipe sliced into rings and then Dremeled out about a 90° section.

The radio with the two studs on the back just slips into the two slots of the bracket. The top of bracket rests on the top of the pole and for a little security, a 5/8" nut keeps it snugged up to the pole.

After further reading, best practices indicates that a 4-meter mast like is shown here should be guyed at the 3 meter mark with stays at 45° radially spaced at 120°.





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