Task Sheet

Trimble Groundworks Boot Camp 2019

Machine Measure Up

Learning Objective

This station will cover the following topics regarding Trimble Groundworks Machine Control System:

- ❑ Measure up machine
- ❑ Enter measure up values into Groundworks software

Equipment

- ❑ Tape measure
- ❑ Square or 4’ level

Introduction

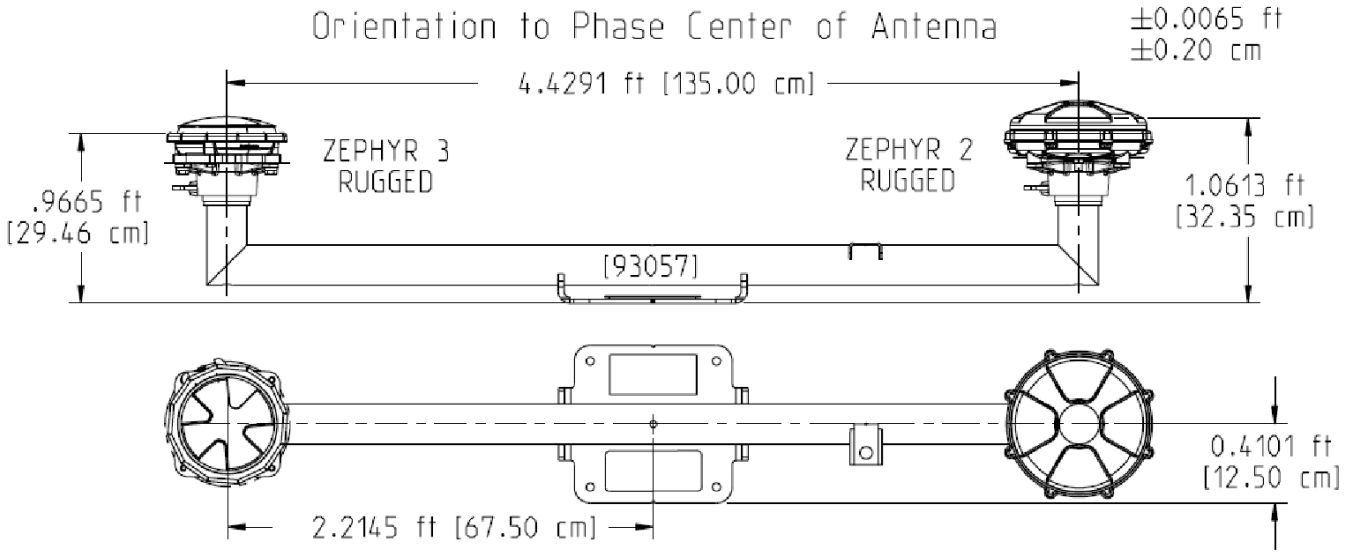
The measure up uses various offsets to calculate the horizontal/vertical position of the tool in relation the GNSS antennas. Trimble recommends starting with the machine placed on level ground with the machine and boom aligned parallel with the tracks and the mast plumb. Move the machine as necessary to find each measure up item.

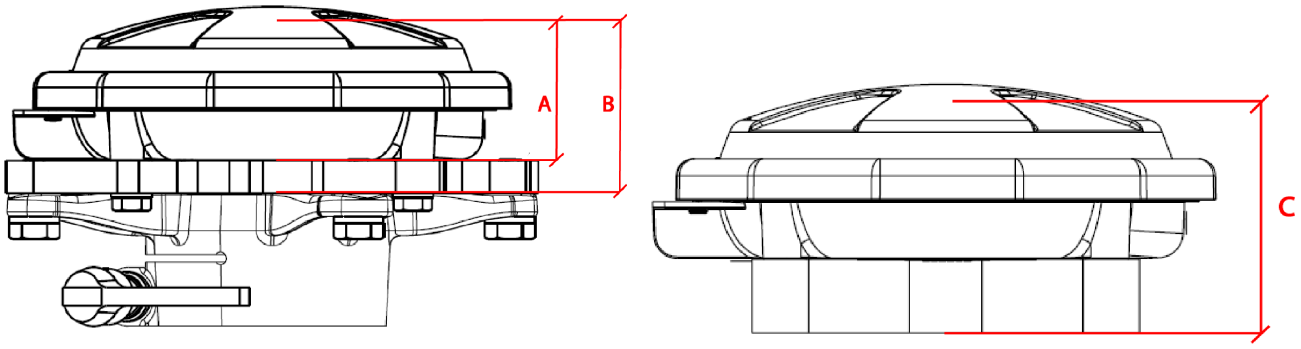
The “front” of the machine must be identified before entering measure up values to designate where each item is in relation to the reference point. The front of the machine used in the Groundworks software is not always the actual front of the machine as defined by the Operator/Machine OEM. The front of the machine is used by Groundworks software to display map views and when calibrating sensor locations and it must remain consistent.

Note: Simple way to determine front of machine is ask the Operator which direction he would expect to move the machine if the bull’s-eye view navigation was pointing up on screen.

GNSS antenna offsets

Use the following diagrams to assist with finding measure up values:



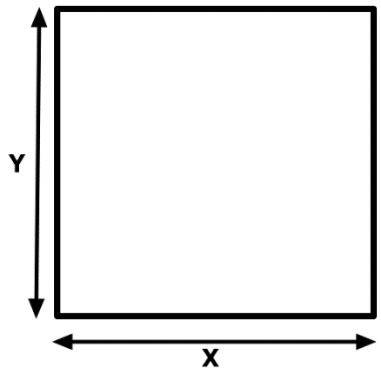


Label	Zephyr 3 Rugged Antenna	APC offset (m)	APC offset (ft.)
A	Bottom of antenna mount	0.0589	0.1932
B	Bottom of 4-hole bracket	0.0716	0.2349
C	Bottom of 5/8” bracket	0.0843	0.2766

Step 1: Horizontal GNSS measurements

This task sheet uses the center of the mast as the *horizontal reference point* and uses the tool offsets to offset the tool from the center of the mast.

1. Measure the outer dimensions of the mast to find the distance from the outside to the center of the mast.



Mast X = _____ /2 = _____ = Center of mast X offset

Mast Y = _____ / 2 = _____ = Center of mast Y offset

2. Measure the horizontal distance that the Heading antenna is in front or behind center of mast. Take the distance from center of Heading antenna to side of mast, add center of mast Y offset to find [A1], then circle correct location:
   [A1] Heading Antenna = _____ In Front / Behind

3. Measure the horizontal distance that the Heading antenna is to the left or right side of center of mast. Take the distance from center of Heading antenna to side of mast, add center of mast X offset to find [A2], then circle correct location:
   [A2] Heading Antenna = _____ Left / Right

4. Measure the horizontal distance that the Moving Base antenna is in front or behind center of mast. Take the distance from center of Heading antenna to side of mast, add center of mast Y offset to find [A5], then circle correct location:
   [A5] Moving Base Antenna = _____ In Front / Behind

5. Measure the horizontal distance that the Heading antenna is to the left or right side of center of mast. Take the distance from center of Moving Base antenna to side of mast, add center of mast X offset to find [A6], then circle correct location:
   [A6] Moving Base Antenna = _____ Left / Right

6. Measure the horizontal distance that the tool is in front or behind center of mast. Take the distance from center of tool to side of mast, add center of mast Y offset to find [F1], then circle correct location:
   [F1] Tool Offset = _____ Left / Right

7. Measure the horizontal distance that the tool is to the left or right side of center of mast. Take the distance from center of tool to side of mast, add center of mast X offset to find [F2], then circle correct location:
   [F2] Tool Offset = _____ Left / Right

Step 2: Vertical GNSS measurements

The *vertical reference position* is the position the tool is in when the M18 proximity switch is in the center of the trigger plate for automatic depth sensor reset. This task sheet assumes that M18 proximity sensor is mounted on mast and trigger plate is mounted on tool.

1. Measure the vertical distance from the Heading APC to the bottom of tool when in the *vertical reference position*. To simplify this measurement, combine these 2 measurements to find [B2]:
    a. Measure distance from Heading APC to center of the trigger plate = _____
    b. Measure distance from center of M18 proximity switch to bottom of tool = _____

    [B2] Tool Height Offset = _____
    Note: Use positive value if Heading APC is above bottom of tool when in *vertical reference position*.

2. Measure the vertical distance from the Heading APC to the mast foot:
    [B3] Mast Height = _____
    Note: This value is always positive.

3. Measure the vertical distance from the Heading APC to the location where the mast pivots:
    [A7] Heading APC from Mast Pivot = _____
    Note: Use a positive value if Heading APC is above the mast pivot. This measurement is for graphics only.

Step 3: Machine body and tool measurements

The machine body measurements are taken from the center of boom pin and are used to display the machine properly in graphics. They are used to define the outer extents of the machine body which can be important if avoidance zones will be used.

1. Measure the horizontal distance that the machine center of rotation is in front or behind boom pin and circle the correct location:

    [D1] Center of Rotation = _____ In Front / Behind

2. Measure the horizontal distance that the machine center of rotation is to the left or right side of boom pin and circle the correct location:
    [D2] Center of Rotation = _____ Left / Right

3. Measure the horizontal distance that the rear of machine body is in front or behind boom pin and circle the correct location:

    [D3] Distance to Rear of Body = _____ In Front / Behind

4. Measure the horizontal distance that the front of machine body is in front or behind boom pin and circle the correct location:

    [D4] Distance to Front of Body = _____ In Front / Behind

5. Measure the horizontal distance that the left side of machine body is to the left or right side of boom pin and circle the correct location:

[D5] Distance to Left of Body = _____ Left / Right

6. Measure the horizontal distance that the right side of machine body is to the left or right side of boom pin and circle the correct location:
   [D6] Distance to Right of Body = _____ Left / Right

7. Measure the vertical distance between the boom pin and the top of the Operator cab:
   [D7] Distance to Top of Machine = _____
   Note: Use a positive value if the top of the machine is above the boom pin.

8. Measure the vertical distance between the boom pin and the bottom of tracks:
   [D8] Distance to Bottom of Machine = _____
   Note: This value is always negative.

9. Measure the horizontal distance from the boom pin to the location the mast pivots while the boom is fully extended.
   [E2] Boom Length = _____

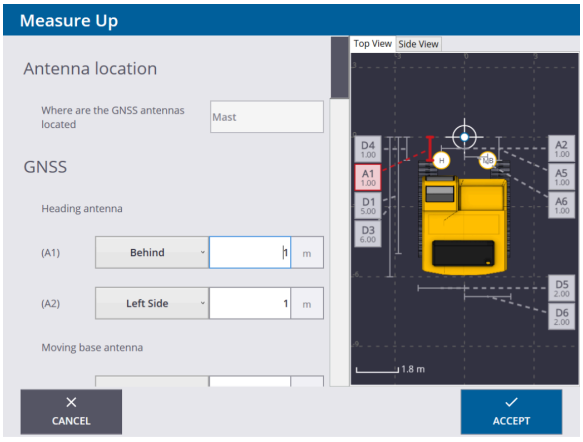
10. Measure the drill bit diameter (mm/inches).
    Drill bit diameter = _____

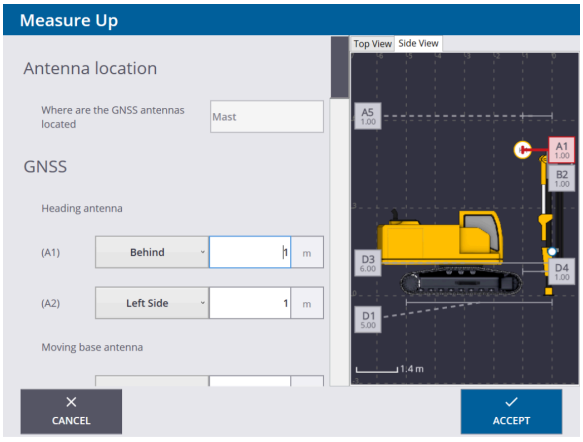
    Note: The drill bit diameter measurement is used for plan view graphics, but more importantly it is stored in as-built data which will show up in Trimble Business Center Drill Hole Quality Report.

Step 4: Enter measure up values into Groundworks software

The Measure Up menu is located in the Settings of the Groundworks software. To enter the measure up values:

1. Tap ☰.
2. Select **Settings / Measure Up**.
3. Enter the appropriate values for each item making sure that you select the correct option when asked if the value is **In Front/Behind/Left Side/Right Side**.
4. Tap **Top View** or **Side View** options to see how the current measure up values are being applied.





Tip: The active item is highlighted in red in the Top View and/or Side View preview. Some items do not appear in both views.

5. Tap **ACCEPT** to save the changes.

Questions

1. What feature relies on the machine body measurements?

   _____

2. What is the [B3] Mast Height measurement used for?

   _____

3. Which GNSS antenna is measured from when doing vertical measurements?

   _____