Smart Construction Edge Advanced Manual

Smart Construction
Promotion Division

KOMATSU

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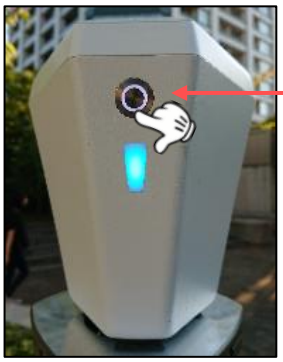
Basics

01

■1-1 How to operate Edgebox



■ 1. Turn on Edgebox
Press power button twice and hold for few seconds

Battery light indicator

White :
Operating w/o charger

Yellow flashing:
Battery low (~25%)

Green:
Fully Charged

Solid yellow:
Charging

Status indicator

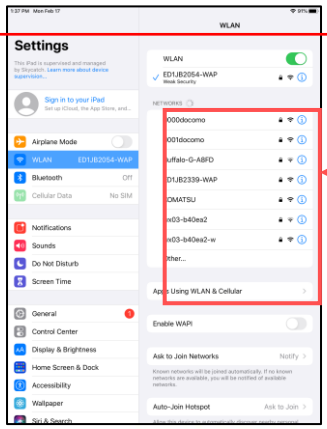
Green solid:
Ready

Green flash:
RTK broadcasting

Red:
Critical error or battery is very low (~10%)

■1-2 How to connect iPad to Edgebox

Edgebox is controlled by iPad app. Connect your iPad to Edgebox WIFI network.



■ 2 . Open “Setting” on iPad

■ 3 . Connect to WIFI name with Edgebox serial

■ 4 . Password “**edge1-ap**”

3D Mapping

02

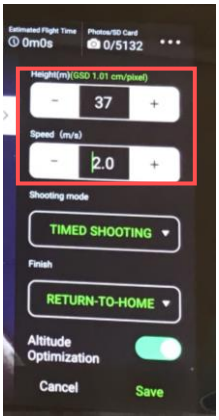
■ 2-1 Mission planning (Phantom 4 RTK)

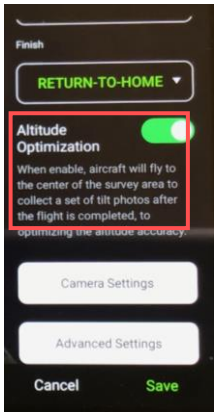
■ 1. Open GS RTK app on tablet.
■ 2. Select “Plan”

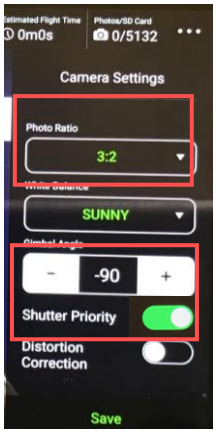
■ 3. Select “2D Photogrammetry” plan

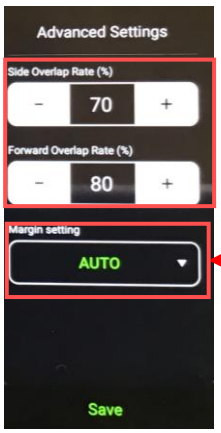
■ 4. Create polygon for flight are.

! For better image coverage, please plan your mission to cover capturing are within the flight paths. “Auto margin setting recommended“









■ 5. Other settings

For most optimized output, please refer to the below detail settings for the mission planning.

Planning mode	2D Photogrammetry
Ratio	3:2
Altitude optimization	ON
Gimbal Angle	-90
Shutter priority	OFF
Altitude	37m (GSD 1cm/pix)
Side overlap	70%
Front overlap	80%

■ Save after mission is created

How Edgebox should be set up depends on how the site localization is performed either RTK with base station or network RTK.

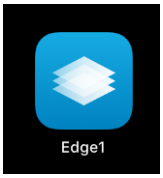
[Localization with Base station]

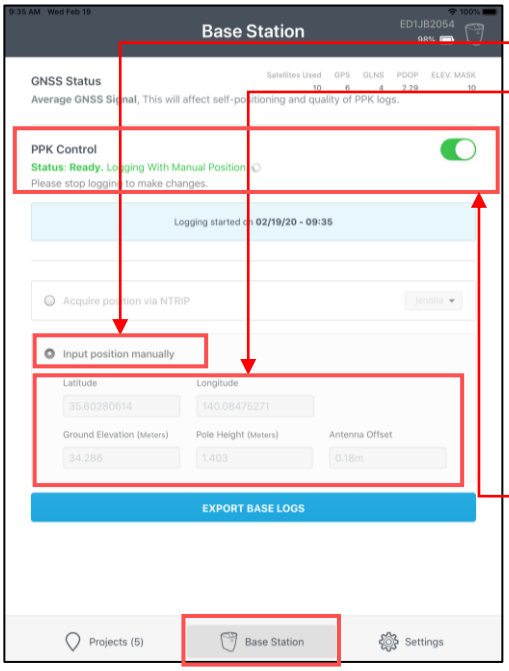
■2-2 Set up Edgebox

■ 1. Place Edgebox on base point

When you set up base station at the control point, place center and level to the control point and measure base height.

■2-3 Start logging on Edgebox





■ 1. Launch Edge 1 app

■ 2. Go to “Base Station” menu

■ 3. Select “Input position manually”

■ 4. Enter base point coordinates

Latitude and Longitude: WGS84 in DD(decimal scale)
Ground Elevation: Ellipsoidal height of base point.
Pole height: base point to bottom of Edgebox in Meter

Please use coordinates based on localization. See Reference section in this chapter for how to confirm on Link1 app

Antenna offset is automatically added

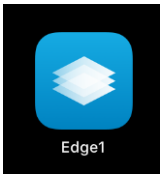
■ 5. Start base logging and wait until status is “Ready”

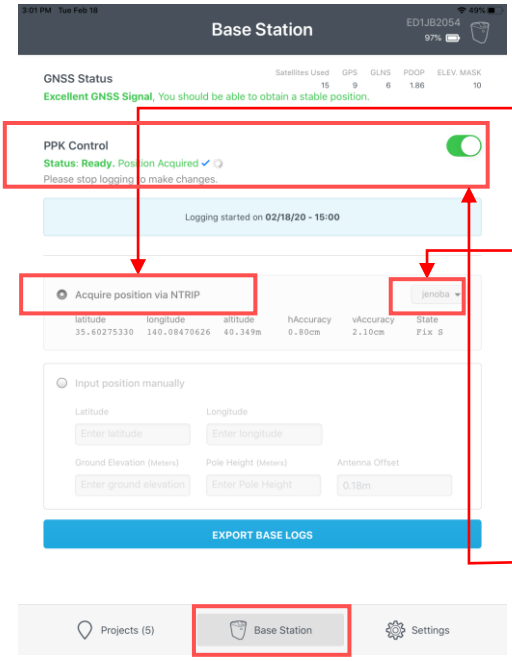
[Localization using network RTK]

■2-2-1 Set up Edgebox

- 1. Set up Edgebox in arbitrary location with open sky. No precise leveling is required.

■2-3-1 Start logging PPK correction data





- 1. Launch Edge 1 app
- 2. Go to “Base Station” menu
- 3. Select “Acquire position via NTRIP”
- 4. Select RTK account

! NTRIP RTK account needs to be registered in Setting menu prior to logging.
See “4-1 Set up Ntrip RTK account” for how to setup.

- 5. Start base logging and wait until status is “Ready”

■ 2-4 Prepare drone

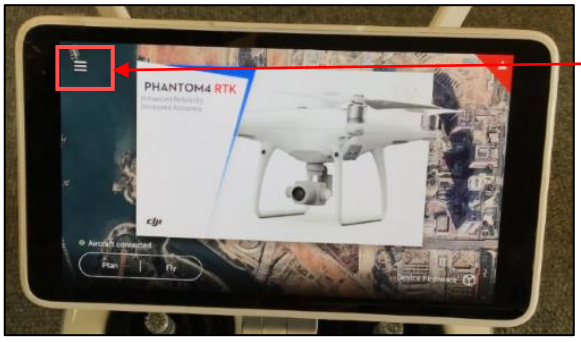
■ 1. Prepare DJI Phantom4 RTK

■ 2. Turn on the controller and drone

! Make sure drone stand by at least 5 min after boot up to acquire enough satellite information.

Reference for DJI Phantm4RTK Quick Guide
https://dl.djicdn.com/downloads/phantom_4_rtk/20181015/For_UK_AU_Phantom_4_RTK_Quick_Start_Guide_v1.2.pdf

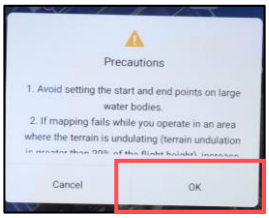
■ 2-5 Open flight mission and fly

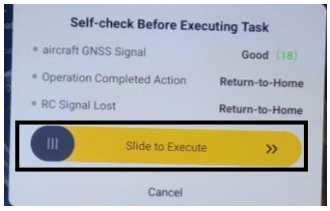


■ 1. Open a flight mission from mission list
For mission creation instruction, see step 2-1" Mission planning (Phantom 4 RTK)"

■ 2. Check drone status

■ 3. When you are ready for flight, press "Invoke" then "Start"





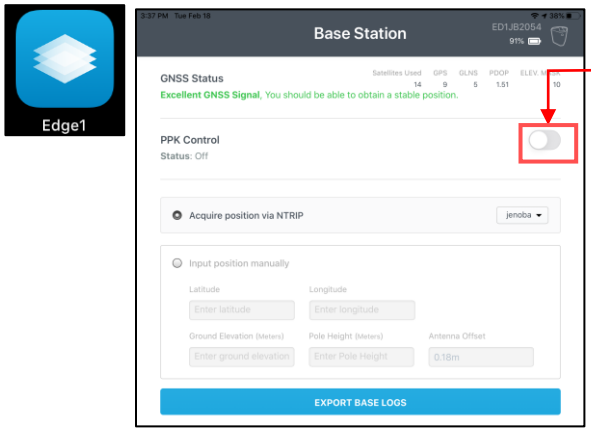
■ 4. Press OK

■ 5. Slide to right to Execute the mission

! Please use fully charged battery for flight

! Drone fly at set altitude FROM take off point. Check for any obstacles in flight are before take off.

■ 2-6 Turn off drone and PPK logging



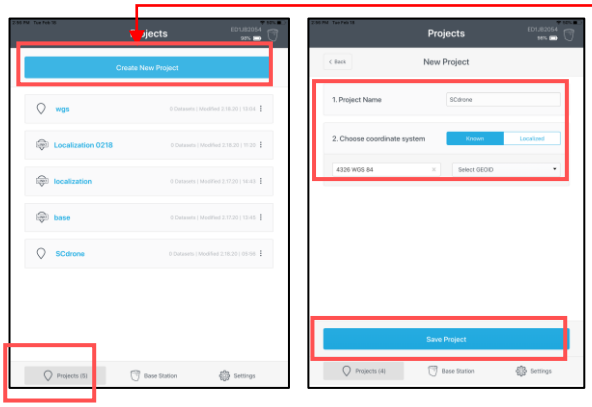
■ 1. Once the drone landed, turn off the drone and remote controller first for safety and proper data processing purpose

■ 2. Open Edge1 app on iPad and turn off the PPK data logging

! Data processing may fail if PPK logging is stopped before drone is turn off.

■ 2-7 Create Project in WGS84 (for LANDLOG upload)

! *For LANDLOG upload, process data MUST be in WGS84 coordinates*



■ 1. To create a new project, “Create project” for the first time

■ 2. Set project information
- Project name
- Project coordinate：Known
- EPSG code：4326 WGS84
  ! You need to confirm by tap candidate as you enter code
- Geoid：none

■ 3. Save project

To process data in local coordinate, you can process data in localized project created by Link1 app or importing localization file

■ 2-7-1 Create Project with Localization

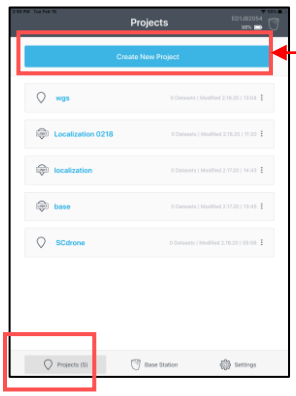
To process data in local coordinate, you can process data in localized project created by Link1 app or importing localization file.

■ 1. Create CSV file (.csv) according to the sample format below and save the file in the folder named “*localization*” in root directory of external storage

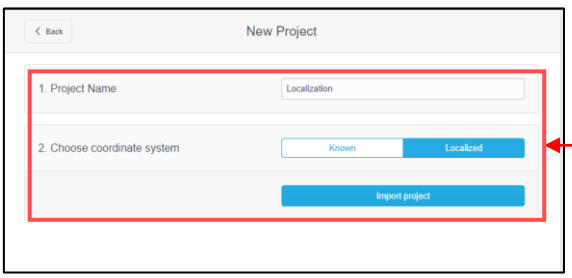
name	n(m)	e(m)	z(m)	lat(dms)	lon(dms)	alt(m)
A	-44037.874	22778.714	3.847	35.36101518	140.05050450	31.636
B	-44045.091	22784.730	3.851	35.36099169	140.05052837	31.650
C	-44040.093	22842.649	3.260	35.36100744	140.05075853	31.064
D	-44164.200	22697.367	3.904	35.36060590	140.05018000	31.704

name	n(m)	e(m)	z(m)	lat(dd)	lon(dd)	alt(m)
A	-44037.874	22778.714	3.847	35.36101518	140.05050450	31.636
B	-44045.091	22784.730	3.851	35.36099169	140.05052840	31.650
C	-44040.093	22842.649	3.260	35.36100744	140.05075850	31.064
D	-44164.200	22697.367	3.904	35.36060590	140.05018000	31.704

! If you performed localization with Link1 app, project can be easily transferred.



■ 1. To create a new project, “Create project” In Edge1 app.



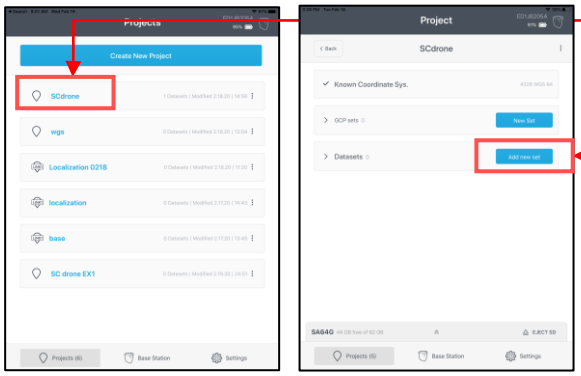
■ 2. Enter the name

■ 3. Select Localization

■ 4. Import csv from external storage

Note: CSV file must be either format and saved in folder named “localization”

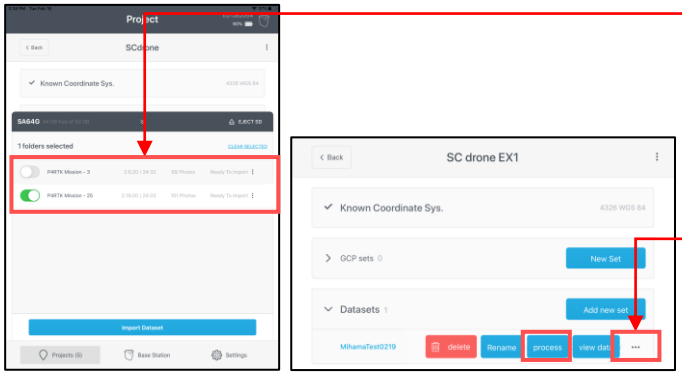
■ 2-8 Process data



■ 1. Select a project for data process

■ 2. insert micro SD from drone

■ 3. “Add new set”

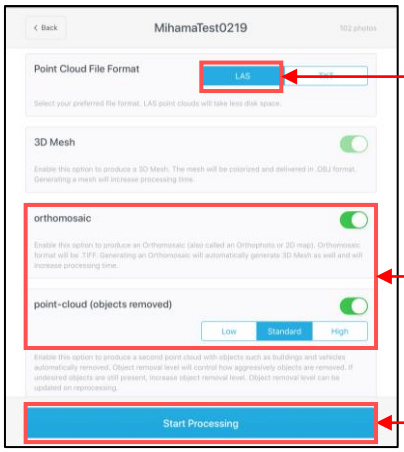


■ 4. Select flight data and import

! If a mission contains multiple flights, you need to select them all and merge upon import

■ 5. tap “・・・” to open menu

■ 6. “Process”



■ 7. Select LAS format

! Mandatory for LANDLOG upload

■ 8. Turn on additional output

>Ortho mosaic ON

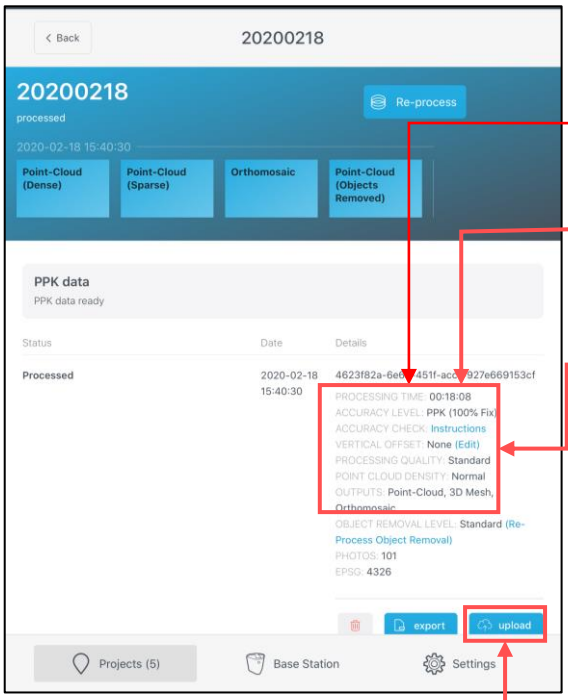
(3D-Mesh is automatically enabled with ortho)

>Object removal ON

*Default setting is *Standard*

■ 9. Start Processing

■ 2-9 Data upload



■ 1. Confirm accuracy level of PPK
PPK100% is recommended

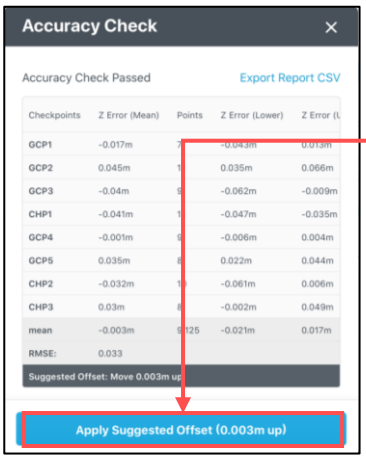
! Accuracy level of below PPK100% process may contain sub-optimal accuracy data.

■ 2. Confirm outputs to be uploaded

■ 3. You can run vertical accuracy check with “checkpoints.csv” and perform average offset.

**Sample csv format is in Reference section*

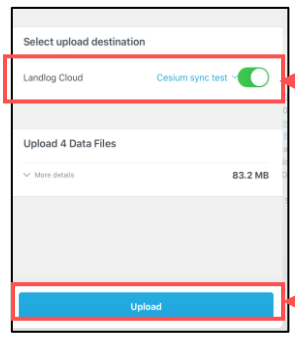
When you insert external storage having “checkpoints.csv” to Edgebox, “Run Check” menu will be appeared in column of accuracy check.



Tap “Apply Suggested Offset”, if you accept the offset value

■ 4. Tap “upload”

■ 5. Log into LANDLOG with your ID (if not logged in)



■ 5. Turn ON “Landlog Cloud” and select a LANDLOG project you have access to.

! If you don’t see the project, you need to join the project before upload

■ 6. Tap “Upload”

■How to check Latitude, Longitude and Altitude information(Link1 app)

[If setup at the base point of the site]

1. Open the project which is used to broadcast RTK correction to perform localization.

2. Go to “Edit” from Base position in the project.

[If setup at the localized control point]

1. Open the localization project.

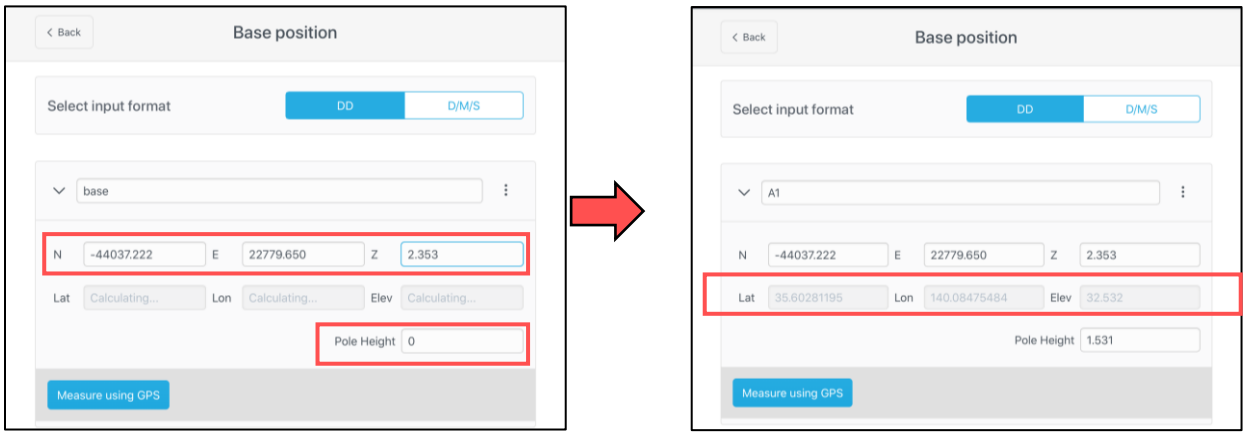
2. Go to “View Data” to view coordinates of control points in localization.

[If setup at the control point which is not included in localization]

1. Open the localization project.

2. Go to “Edit” on “Base position”

3. Add point by entering N, E, Z coordinates and pole height. Edgebox will calculates corresponding Lat, Lon, Alt according to localization parameters.



■ Checkpoints file import format sample

Checkpoints file should be called "checkpoints.csv" and saved in root directory of micro SD or USB drive.

Lat and Lon in dms (Degrees, Minutes, Seconds) format

Name	lat(dms)	lon(dms)	z(m)
Ch0	N20 44 43.3234	W103 30 49.8112	1641.568
ch1	N20 44 43.7957	W103 30 49.6614	1641.42
ch2	N20 44 44.2196	W103 30 49.5423	1641.215

Lat and Lon in DD (Decimal scale) format

Name	lat(dd)	lon(dd)	z(m)
ch0	20.74536571	-103.51383753	1641.568
ch1	20.74549709	-103.51379427	1641.42
ch2	20.74561292	-103.51376181	1641.215

**Latitude and Longitude value should have 8 digits*

Local coordinates

Name	N(ft)	E(ft)	Z(ft)
E2	2654.961	-248610	743.4383
E5	2748.694	-248862	743.353
E8	2792.559	-249076	753.1529

Units of checkpoints in local coordinate systems

■ In case you observe sub optimal accuracy

Please check the following for possible cause;

1. Status of Post Processing
   ▶PPK(Fix100%) is achieved
   ⇒If not, please consider to change Edgebox location for better satellite reception.

Example) Poor Sky view, High voltage power line, Interference during logging, Incorrect turn ON/OFF timing of drone etc

2. Check the setting

Frequent mistake
- ▶VRS positioning used while localization done with base station
- ▶Incorrect coordinate setting (wrong EPSG code used)
- ▶Input mistake for coordinates such as pole height, coordinate value itself.

3. Site conditions
- ▶Drone flown too high(Poor image resolution)
- ▶Lighting conditions(Not enough lighting by sunset, shadowed area)
- ▶Site contains extensive area which has less tie point such as water, snow, concrete surface etc.

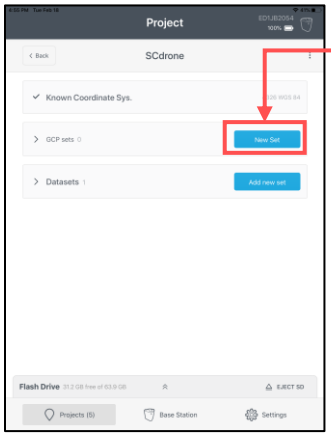
4. Accuracy check tool
- ▶Please utilize accuracy check and offset tool with surveyed ground coordinates within point cloud area accordingly.

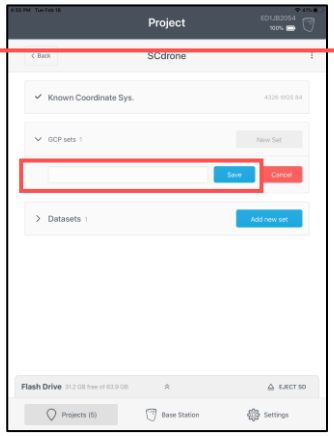
■ 2-10 Add GCP points

You can process your drone data with GCP marker placed in your flight are to improve data accuracy.
GCP coordinates can be added to the project by

1) Import GCP from CSV
2) Add manually
3) Aero point

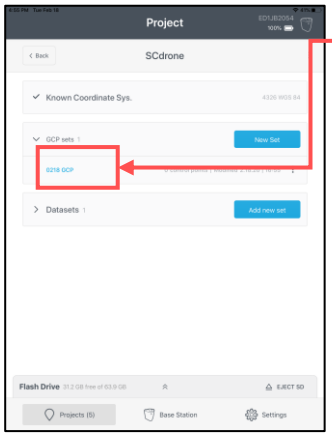
! If you measured GCP points and are processing drone data in the same project created in Link1 app, GCP coordinates are automatically synced.





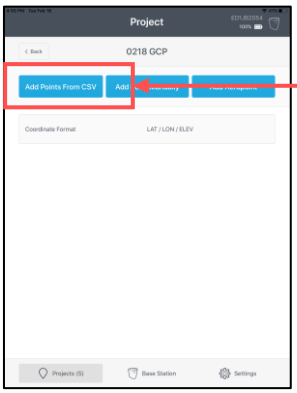
■ 1. Open the project in Edge1 app and go to “New Set” at GCP sets

■ 2. Enter name and save



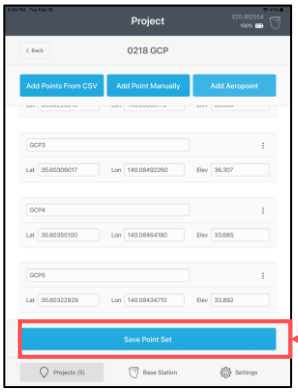
■ 3. Tap GCP set name

■ 2-10-1 Add GCP by CSV Import



■ 1. Create CSV file with GCP point according to sample format and save in the folder “**points**” in top level of external storage.

■ 2. Insert external storage with CSV file and “Add Points From CSV”



■ 3. Select file to import

■ 4. Confirm the GCP points imported and “Save Point Set” to save

! You will see caution if minimum there is value are below required decimal digits.”0” can be often missed.

<CSV format sample>
Coordinates of GCP have to match with project coordinates.

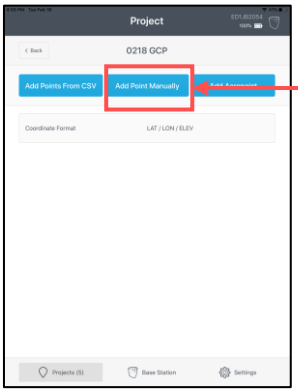
WGS84(Decimal scale)

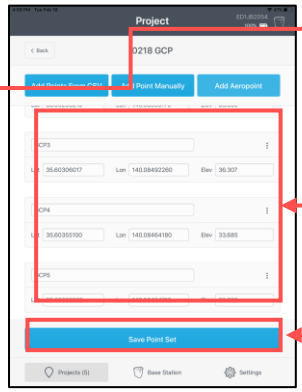
name	lat	lon	alt
GCP1	35.60272096	140.0849327	34.586
GCP2	35.60293315	140.0853317	33.655
GCP3	35.60306017	140.0849226	36.307
GCP4	35.60355100	140.0846418	33.685
GCP5	35.60322929	140.0843470	33.892

Local coordinates

name	n	e	z
GCP1	-44047.283	22795.049	4.146
GCP2	-44023.651	22831.134	3.212
GCP3	-44009.654	22794.038	5.867
GCP4	-43955.266	22768.452	3.246
GCP5	-43991.024	22741.838	3.455

■ 2-10-2 Add GCP manually



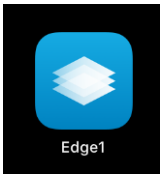


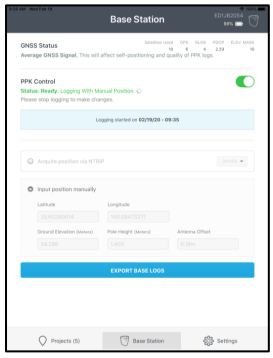
■ 1. “Add Point Manually”

■ 2. Input GCP point coordinates

■ 3. “Save Point Set” to save

■ 2-10-3 Add GCP by Aeropoint



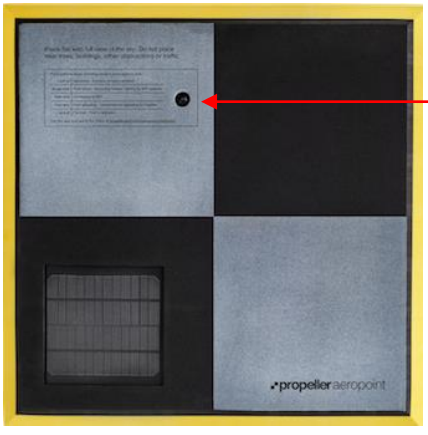


■ 1. Set up Edgebox (Refer 2-2)

■ 2. Start PPK logging on Edge1 app (Refer 2-3)

! You can start PPK logging while it broadcasts RTK-correction data.

! This log will process both drone and Aeropoint data



Press twice and hold to turn on. LED turns RED flashing when it turns on.

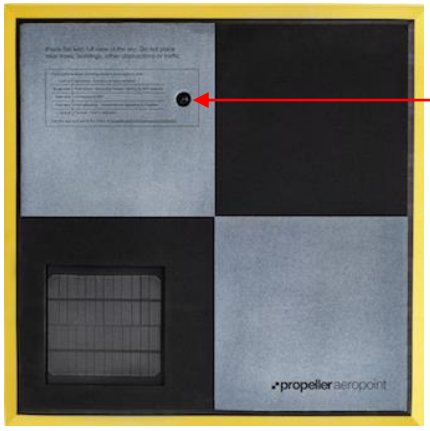
■ 3. Place and turn on all Aero points in the field.

! Aeropoint must be turned on **AFTER** Edgebox starts logging

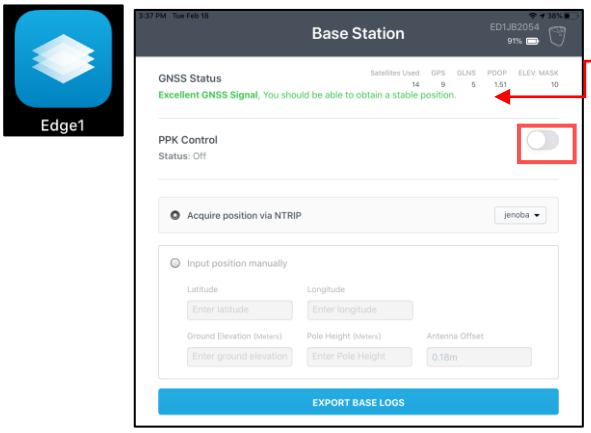
! Aeropoint must be set on a flat and open sky area for good satellite reception

3D Mapping

- 4. Fly a drone mission. (Refer 2-5)
- 5. Leave Aeropoints and Edgebox at least 45 minutes to acquire enough amount of GNSS log data.



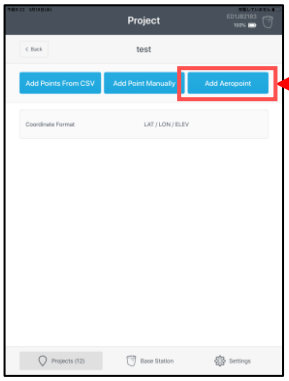
- 6. Turn off Aeropoint logging after drone flights.
  - ! (1) Press the button only once.
    (2) LED turns 30-sec-interval blinking which means it turns to WiFi search mode.
- 7. Collect Aeropoints and bring them closer to the Edgebox.
  - ! Make sure LED is in 30-sec-interval blinking before you pick it up.

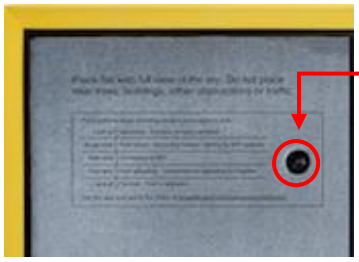


- 8. Turn off PPK logging on Edgebox. (Refer 2-6)
  - ! Make sure to stop PPK logging AFTER LED of all Aeropoints turned in 30-sec-interval blinking

- 9. Insert USB WiFi dongle into Edgebox. Aeropoints will connect to Edgebox automatically.

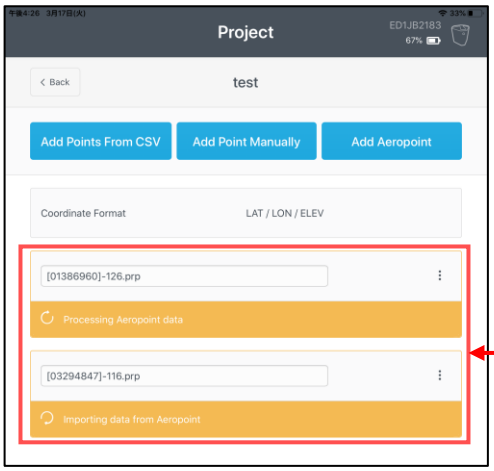
3D Mapping



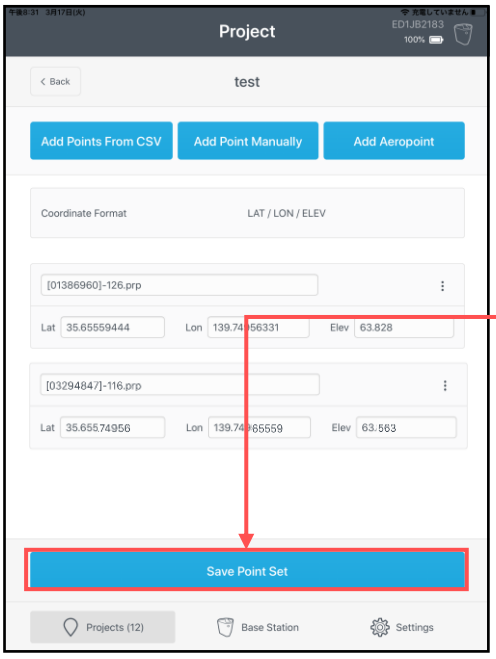


- 10. Select Add Aeropoint menu
- 11. Aeropoint LED turns to;
  - (0) 30-sec blink : Searching WiFi
  - (1) Slow blink : Connecting WiFi
  - (2) Fast blink : Uploading the data
  - (3) Turns off : Finished uploading

! If the LED remains in 30-sec blinking, try restarting Edge1 App.
Do NOT touch the LED button. It will restart the position acquisition, which erases the accumulated data.

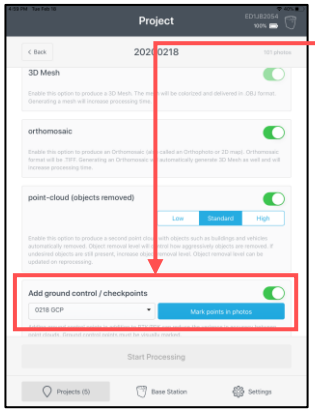


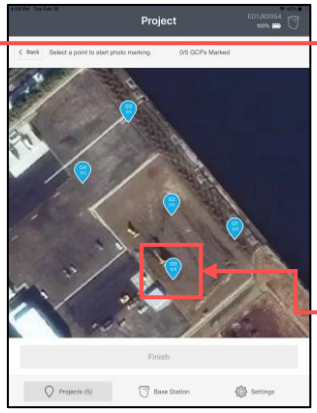
- 12. iPad shows ID and the progress while uploading the data to Edgebox automatically.



- 13. If the upload completes, tap Save Point Set. (Aeropoint LED turns off)

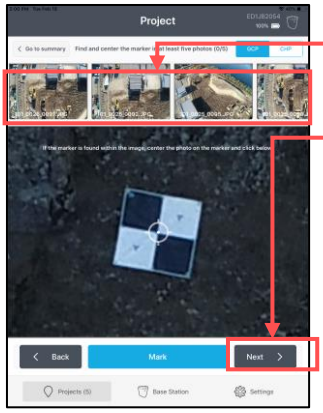
■ 2-11 Process with GCP

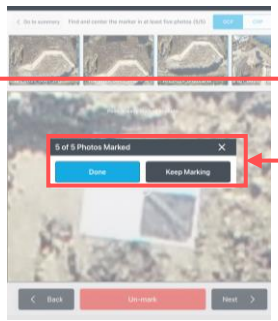




■ 1. Upon data processing, turn on “Add ground control/checkpoints” and select GCP set registered.

■ 2. Tap “Mark points in photos”
■ 3. You will see the GCP on map
■ 4. Tap a GCP to start marking

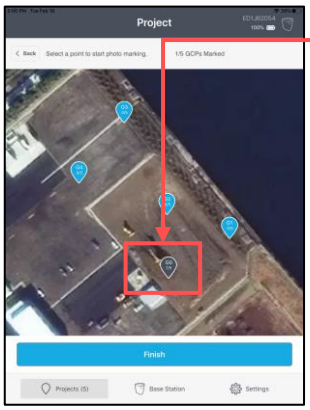




■ 5. Photos around the selected GCP will be displayed.
■ 6. Mark the center of the GCP and go to next photo.

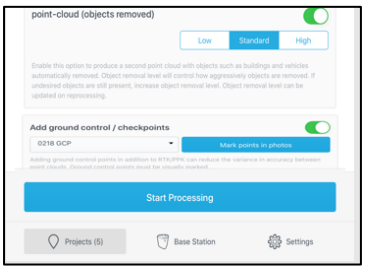
■ 7. Minimum 5 marking/GCP required

! Please keep marking and mark all the photos with the GCP



■ 8. Marked GCP becomes gray

■ 9. Repeat for the rest of GCP and “Finish”



■ 10. Start Processing the data
■ 11. Refer 2-9 for “Data upload”

Base Station

03

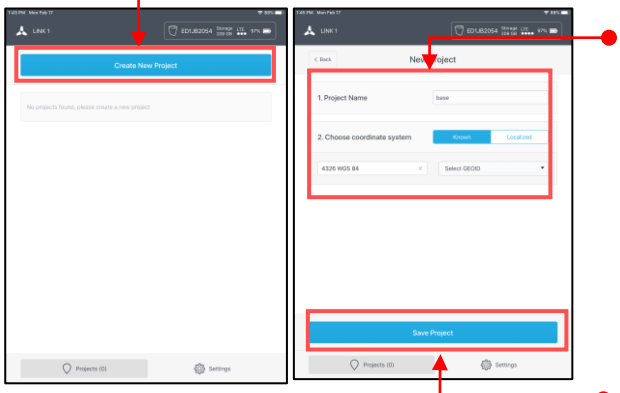
■3-1 Set up Edgebox

■ 1. Place Edgebox

! If you set up base station at the control point, place center and level to the control point and measure base height.

■3-2 Create Base point

■ 1. Launch Link1 app



■ 2. Create New Project

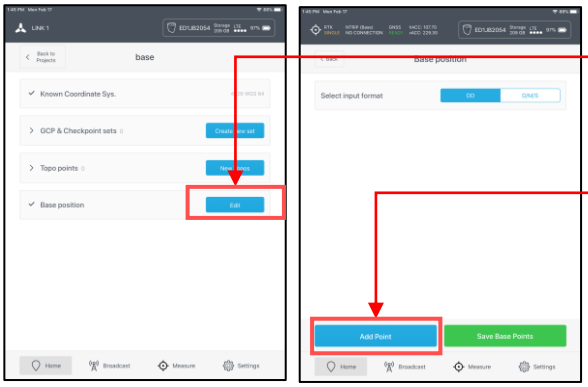
■ 3. Set project information

- Project name
- Project coordinate：Known
- EPSG code：4326 WGS84

! You need to confirm by tap candidate as you enter code

- Geoid：none

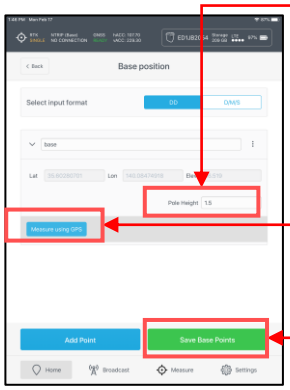
■ 5. Save by “Save Project”



■ 6. Open the save project and open “Edit” for Base station

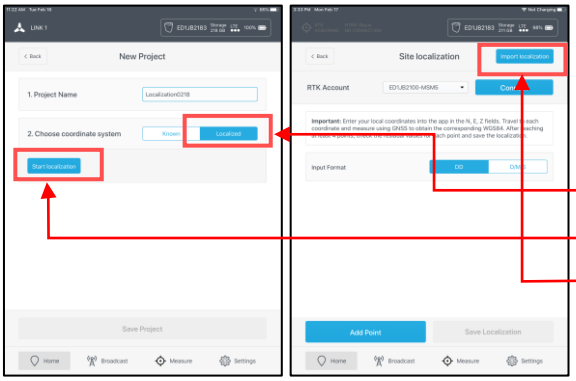
■ 7. “Add Point” to add Base point

Base Station



- 8. Input pole height from base point
- 9. “Measure” to obtain the base position
- 10. “Save Base Points” to save

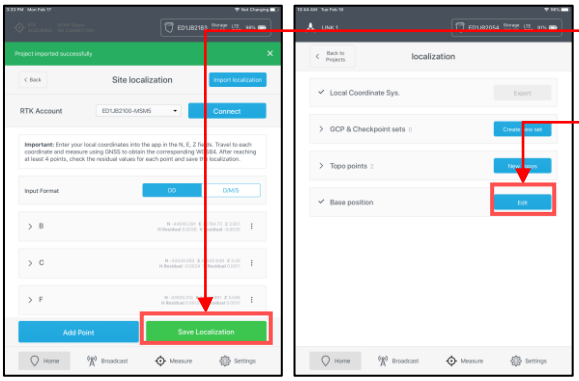
3-2-1 Create base point from localization



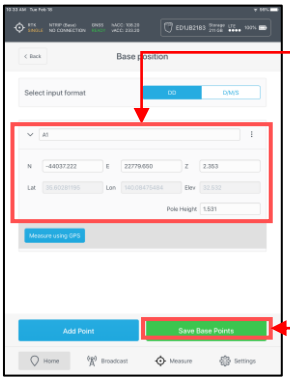
If you set up on control point and would like to obtain position from its coordinate, create project based on localization following below steps

- 1. Select “localized”
- 2. “Start localization”
- 3. Import localization csv file

**Sample file format is in Reference section*

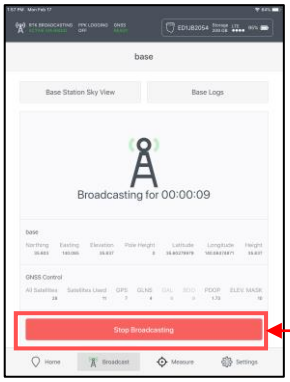


- 4. “Save imported localization”
- 5. Edit base station



- 6. Enter the control point coordinate and pole height in (m). WGS84 value for base point will be calculated according to localization
- 7. Save Base Point

■ 3-3 Broadcast RTK stream



- 1. Go to “Broadcast” menu from project
- 2. Select base point or localized control points from the project Edgebox is placed
- 3. Enter pole height
- 4. Choose Broadcast method
  a) External radio (under develop)
  b) Ntrip server
  *LTE connection required
- 5. Start Broadcast RTK
- 6. Tap “Stop Broadcasting” to stop broadcasting

<Edgebox Ntrip account information>

iMC excavators, iMC dozers, GNSS rovers compatible with RTCM 3.x can connect Edgebox RTK stream using below account information.

Account name: *Any* **Edge serial recommended*
Host: *rtcmsv.smartconstruction-cloud.komatsu*
Port: *2101*
Mount: *MSM5 *see below for available mount point*
Username: *Serial of Edgebox (base station)* **for example ED1JB2054*
Password: *Komatsu-Smacon2020*

Please use below name as mount point depending on RTK stream you like to receive.
*“**MSM5**”: RTCM3.2 (MSM5) with GPS, GLONASS, BeiDou and Galileo*
*“**RTCM30**”: RTCM3.0 with GPS and GLONASS*

■ Localization import format sample

1) If you perform localization using Edgebox as rover, you can directly import the localization file from the folder named "***link1_projects***" which automatically created when localization file is exported to external storage device.

2) If localization is done with other than Edgebox, please create csv file using below format and save in the folder with name "***link1_projects***" created under the root directory of external storage.
Edgebox look for the csv file inside of folder "link1_projects".

Lat and Lon in dms (Degrees, Minutes, Seconds) format

name	n(m)	e(m)	z(m)	lat(dms)	lon(dms)	alt(m)
A	-44037.874	22778.714	3.847	35.36101518	140.05050450	31.636
B	-44045.091	22784.730	3.851	35.36099169	140.05052837	31.650
C	-44040.093	22842.649	3.260	35.36100744	140.05075853	31.064
D	-44164.200	22697.367	3.904	35.36060590	140.05018000	31.704

Lat and Lon in DD (Decimal scale) format

name	n(m)	e(m)	z(m)	lat(dd)	lon(dd)	alt(m)
A	-44037.874	22778.714	3.847	35.36101518	140.05050450	31.636
B	-44045.091	22784.730	3.851	35.36099169	140.05052840	31.650
C	-44040.093	22842.649	3.260	35.36100744	140.05075850	31.064
D	-44164.200	22697.367	3.904	35.36060590	140.05018000	31.704

❗ Lat, Lon requires at least 8 decimal number

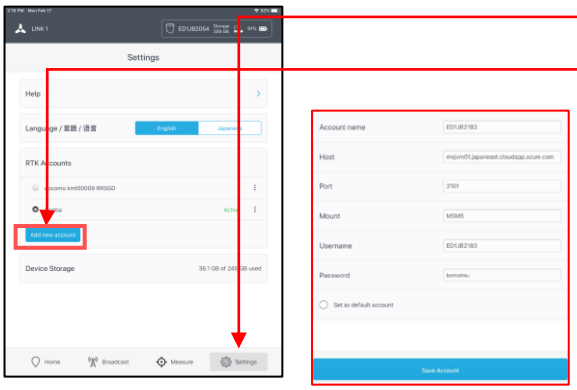
❗ N(x), E(y), Z requires at least 3 decimal number

Rover

04

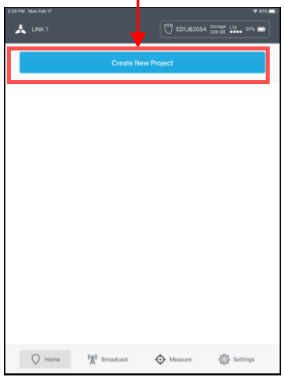
■ 4-1 Set up Ntrip RTK account

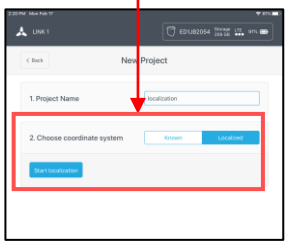
Edgebox as a rover, you can perform localization



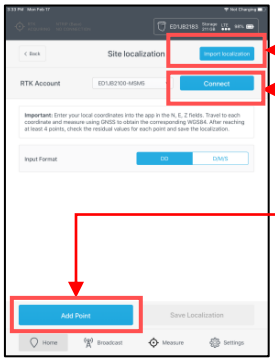
- 1. Go to “Setting”
- 2. “Add new account” to add RTK account
- 3. Enter Edgebox Ntrip RTK account information.

■ 4-2 Perform localization

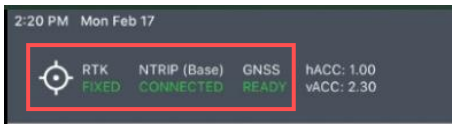




- 1. Create New Project
- 2. Select “Localized”, then “Start Localization”



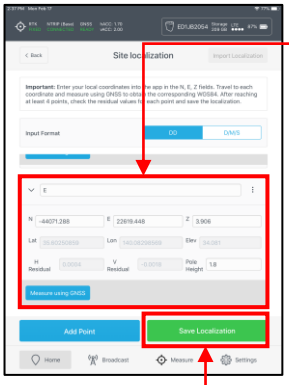
- 4. Select and connect to RTK account and confirm RTK fix established before starting to shoot.



- 5. “Add point” to add coordinates manually
- 5-1. “Import localization” csv file in folder named*“link1_projects”*

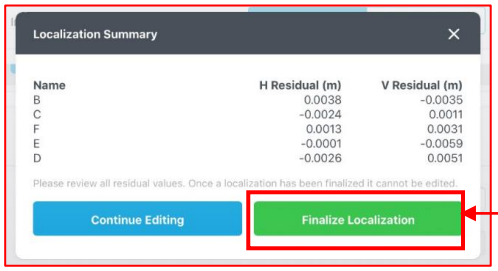
<csv format example>

name	n(m)	e(m)	z(m)
A	-44037.874	22778.714	3.847
B	-44045.091	22784.732	3.851
C	-44040.093	22842.649	3.261
D	-44164.212	22697.367	3.904



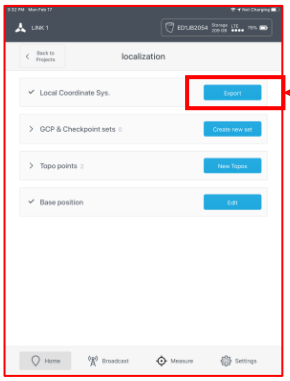
- 6. After N,E,Z of control points and pole height are entered, measure the control points.

- 7. You can save after at least 4 control points are localized.



- 8. Confirm the summary of localization before save and reshoot as needed.

! Note that you can not edit localization unless you export and import localization as a new project



- 9. Localization result can only be reviewed and exported as csv file and saved under folder named “link1_projects” created in external drive inserted

! When you are converting localization csv file to another format (TP3, GC3 etc.), please note that Latitude and Longitude values in export localization file are in DD(decimal scale).
You may need to convert to DMS(Degree, Minutes, Second) for your system.
See Reference “Localization file exported from Edgebox” for more detail.

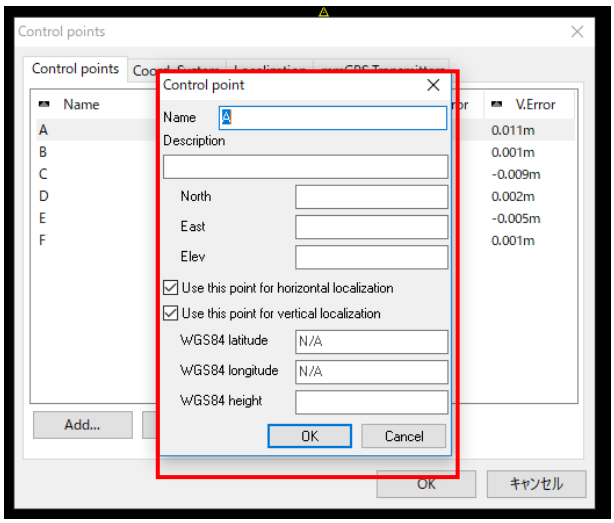
■ *Localization file exported from Edgebox*

Localization file exported from Edgebox contains Latitude and Longitude values in decimal scale(DD).
Convert to Degree, Minutes, Second values as necessary to create GC3 files.

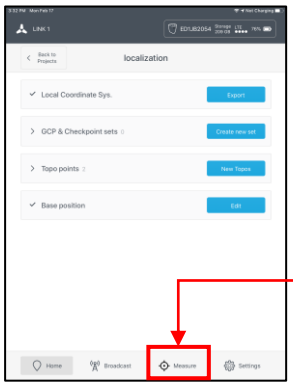
name	lat(dd)	lon(dd)	alt	n	e	z
A	35.60280077	140.08474111	38.677	-44037.874	22778.714	3.847
B	35.60273547	140.08480729	38.676	-44045.091	22784.730	3.851
C	35.60277929	140.08544653	38.110	-44040.093	22842.649	3.260
D	35.60166394	140.08383971	38.715	-44164.200	22697.367	3.904

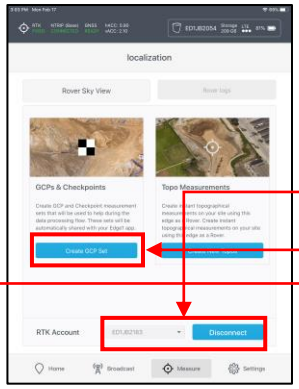
>For Topcon as example, convert Lat, Lon from DD to DMS and copy and paste to control point values to create TP3 or GC3 file.

name	lat(dms)	lon(dms)	alt	n	e	z
A	35.3610082	140.05050670	38.677	-44037.874	22778.714	3.847
B	35.3609847	140.05053060	38.676	-44045.091	22784.730	3.851
C	35.3610005	140.05076070	38.110	-44040.093	22842.649	3.260
D	35.360599	140.05018220	38.715	-44164.200	22697.367	3.904



■ 4-3. Measure GCP



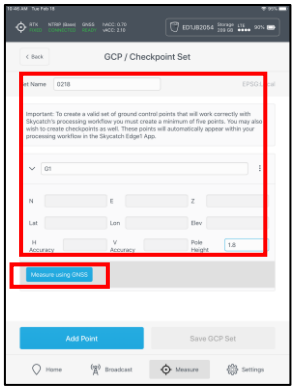


■ 1. Open the project you would like to measure and save the GCP points

■ 2. Connect Egebox to RTK stream

■ 3. Go to “Measure” option

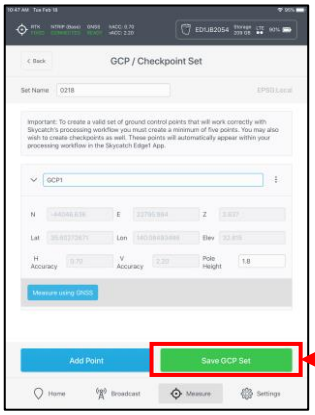
■ 4. Create GCP Set



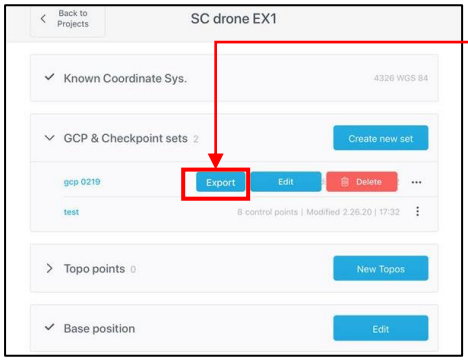
■ 5. Enter the set name for GCP set

■ 6. Enter Name of point
■ 7. Enter Pole height of Edgebox
■ 8. “Measure using GNSS” to measure the GCP point

Edgebox will measure the GCP coordinate according to the coordinate system of the project.



■ 9. When you complete measuring GCP sets, you can hit “Save GCP Set” to save



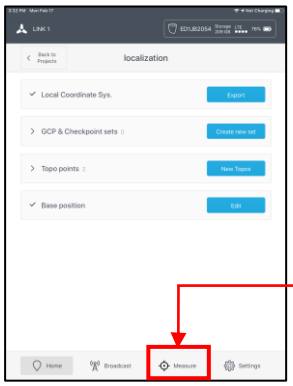
■ 10.You can Export the GCP points file to external storage.

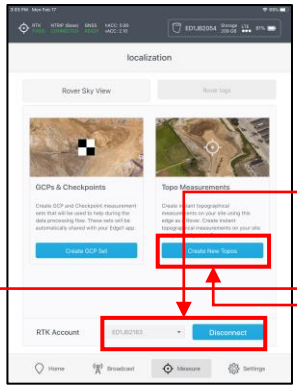
Exported GCP file

name	type	lat	lon	alt	n	e	z
GCP1	CP	35.60272096	140.0849327	34.586	-44047.283	22795.049	4.146
GCP2	CP	35.60293315	140.0853317	33.655	-44023.651	22831.134	3.212
GCP3	CP	35.60306017	140.0849226	36.307	-44009.654	22794.038	5.867
GCP4	CP	35.60355100	140.0846418	33.685	-43955.266	22768.452	3.246
GCP5	CP	35.60322929	140.0843470	33.892	-43991.024	22741.838	3.455

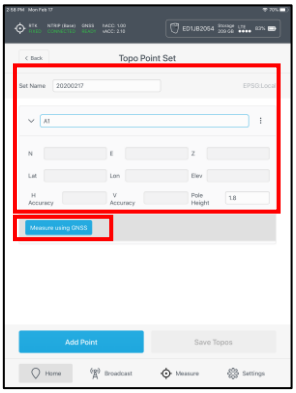
! Note Latitude, Longitude values are in Decimal scale, not Degree, Minutes, Second.

■ 4-4. Measure Topo shots



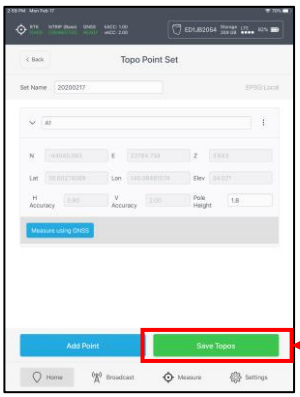


- 1. Open the project you would like to measure and save the Topo points
- 2. Connect Egebox to RTK stream
- 3. Go to “Measure” option
- 4. “Create New Topos”

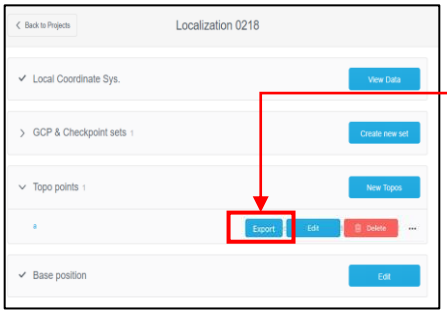


- 5. Enter the set name for Topo set
- 6. Enter Name of point
- 7. Enter Pole height of Edgebox
- 8. “Measure using GNSS” to measure the Topo point

Edgebox will measure the Topo coordinate according to the coordinate system of the project.



- 9. When you complete measuring GCP sets, you can hit “Save GCP Set” to save



■ 10.You can Export the Topo points file to external storage.

Exported Topo file format

name	type	lat	lon	alt	n	e	z
a	CP	35.60274092	140.0848189	34.292	-44045.095	22784.729	3.853

Note Latitude, Longitude values are in Decimal scale, not Degree, Minutes, Second.

Smart Construction Edge
User Manual

Komatsu Ltd

To be edit

[Contact]
Smart Construction Support
TEL : xxx-xxx-xxxx

Revision Record

Date of revision	Version	Revision
Mar/23/2020	00	Released
Mar/30/2020	01	2-3-1 Link to Ntrip account setup added 2-4 Caution added 2-9 LANDLOG login step added

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ver.01