

PHASE**ONE**  
IMAGING BEYOND IMAGINATION

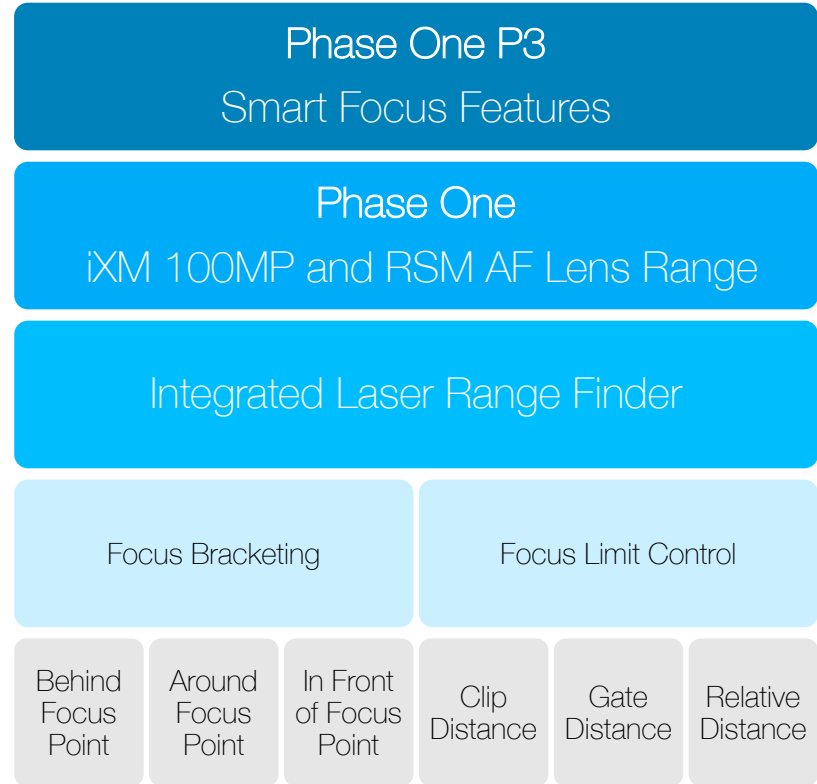
# Phase One P3 – Smart Focus

Phase One's Smart Focus is purpose built for the inspection of complex high volume industrial assets such as wind turbines or power towers.

The Smart Focus Features addresses key challenges where contrast based focus fails to deliver robust and consistent results. The superior performance is delivered by:

- Increasing focusing robustness in low contrast environments
- Increasing focusing consistency when complex assets with small surface area

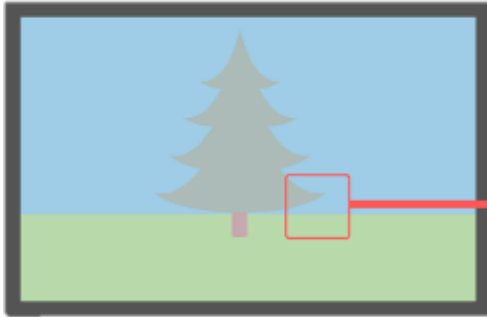
All are based on the P3's 100Mp medium format sensor, high quality AF lens range and the integrated laser based focusing system



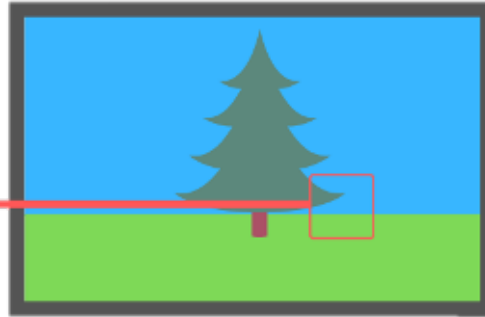
# Phase One P3 – Smart Focus Features

## Consistent and Robust Focus Point

Out of Focus – Low Contrast



In Focus – High Contrast



### What is Contrast

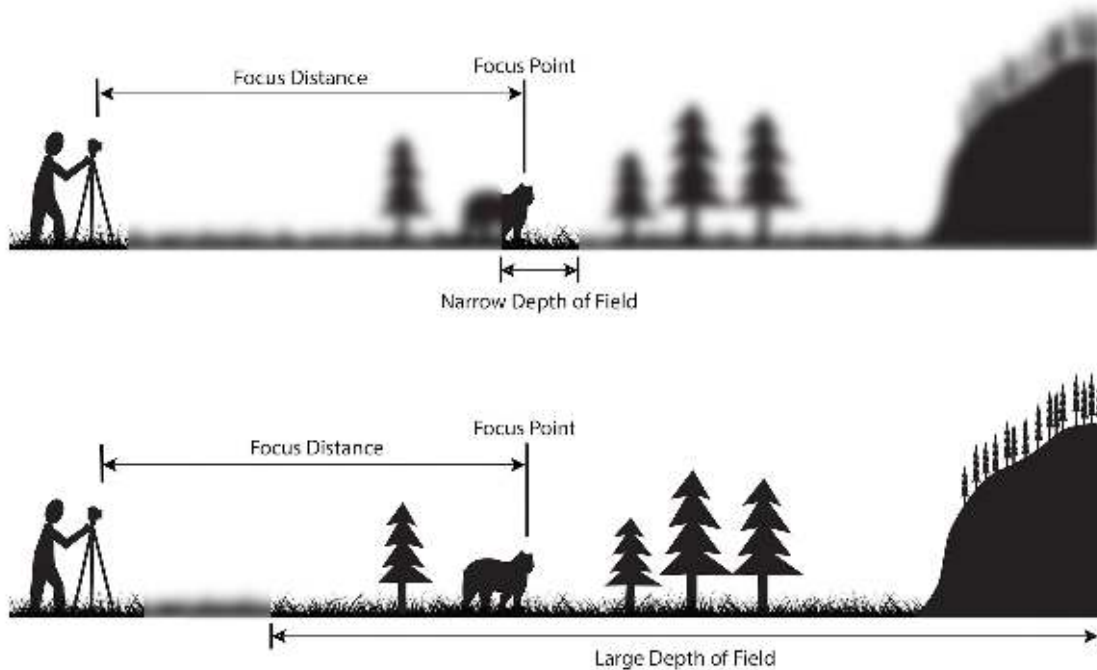
- Contrast is the difference in luminance or colour that makes an object (or its representation in an image or display) distinguishable. In visual perception of the real world, contrast is determined by the difference in the colour and brightness of the object and other objects within the same field of view.

### Challenge of Contrast within inspections

- To ensure that the camera focus on the right object and have full control of the focus point in a low contrast environments

# Phase One P3 – Smart Focus Features

## Depth Of Field



### What is Depth of Field

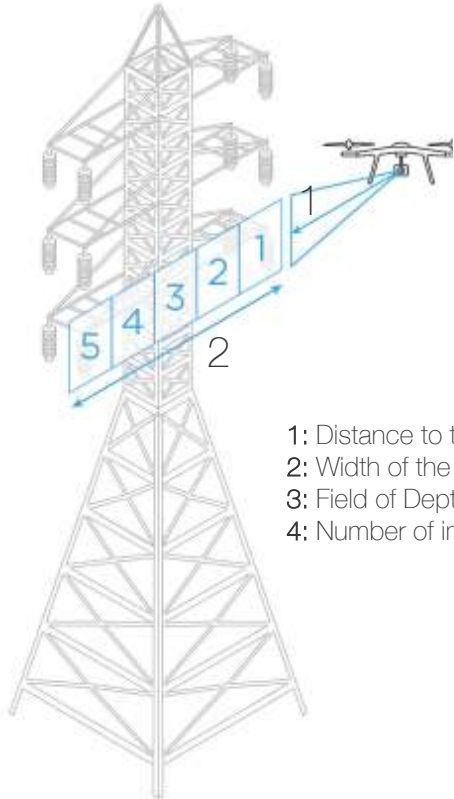
- The depth of field (DoF) is the distance between the nearest and the furthest objects that are in acceptably sharp focus in an image captured with a camera.

### Challenge of DoF within inspections

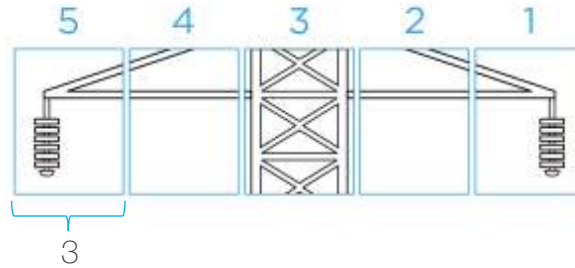
- The challenge for an inspection system is to capture the full Depth of Field (DoF) if this exceeds the DoF of a single image

# Phase One P3 – Smart Focus Features

## Advanced Focusing Feature: Focus Bracketing



4: Image sequence with changing focus distance



- 1: Distance to the object – Measured with the P3's laser range finder
- 2: Width of the asset – Provided by the asset owner
- 3: Field of Depth (FoD) - Calculated
- 4: Number of images required to capture the full depth of view - Calculated

### Why use Focus Bracketing

- To get more effective flight time as the operator only position the UAV once per image sequence
- To Increase consistency regardless of the skill level of the pilot. This makes it easier to scale the inspection operations
- To Increase automatization as the need for a human in loop for quality assurance is reduced

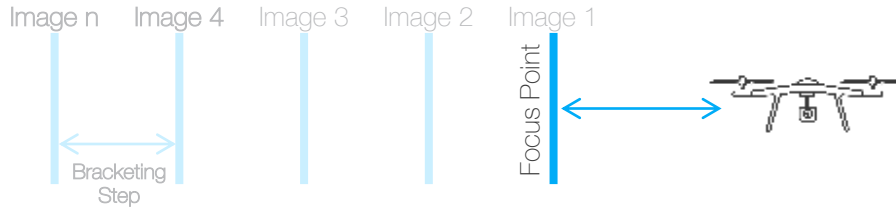
### When to use Focus Bracketing

- When you need to inspect many deep and complex assets with many details in areas that are remote or inaccessible making reflying very costly

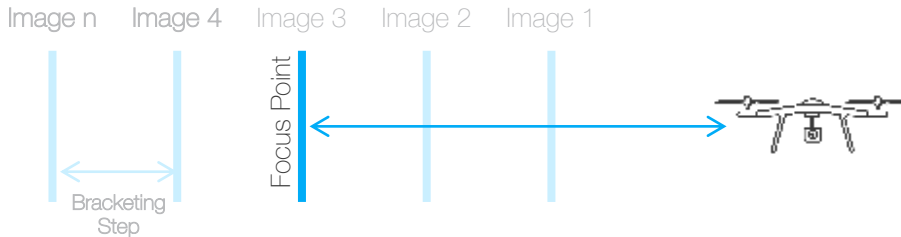
# Phase One P3 – Smart Focus Features

## Focus Bracketing Modes

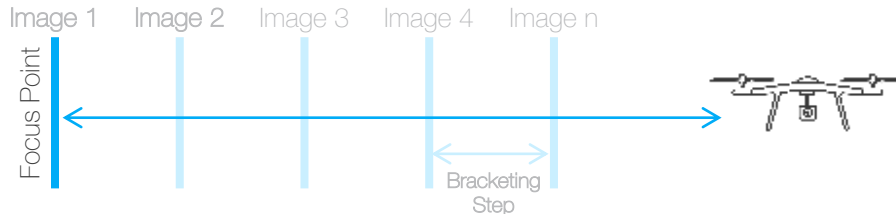
### Behind Focus Point



### Around Focus Point



### In front of Focus Point



### Behind Focus Point

- The focus distance is changed after each trigger moving backwards (away from the UAV) as defined in the Bracketing settings.

### Around Focus Point

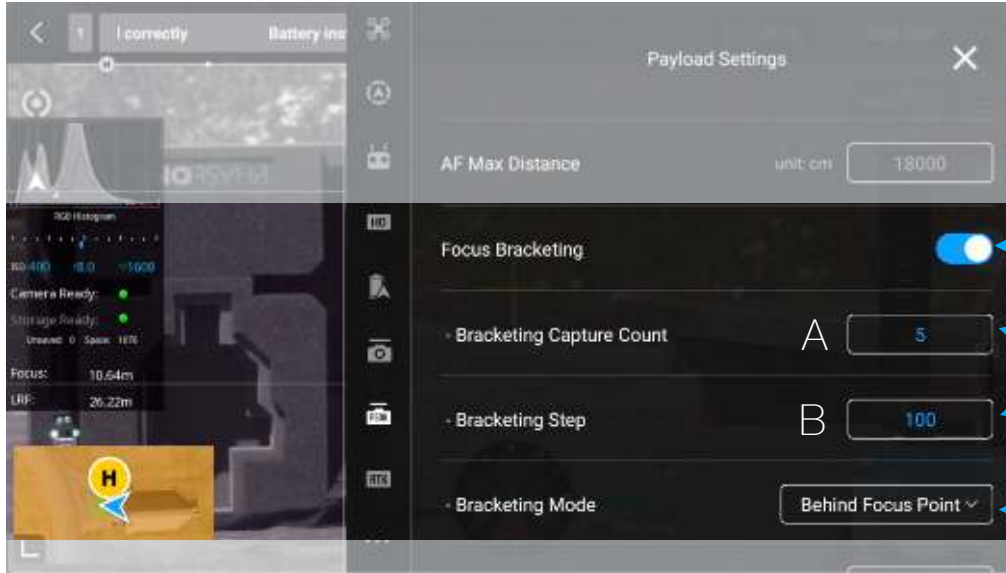
- This bracketing mode takes out in the focus point being in the middle of the object. The Images will be captured as in 'Behind Focus Point' by moving back relative to the UAV.

### In Front of Focus Point

- Here the focus starts from the back of and move forward towards the UAV as defined in the Bracketing Settings

# Phase One P3 – Smart Focus Features

## Focus Bracketing – Implementation in DJI Pilot App



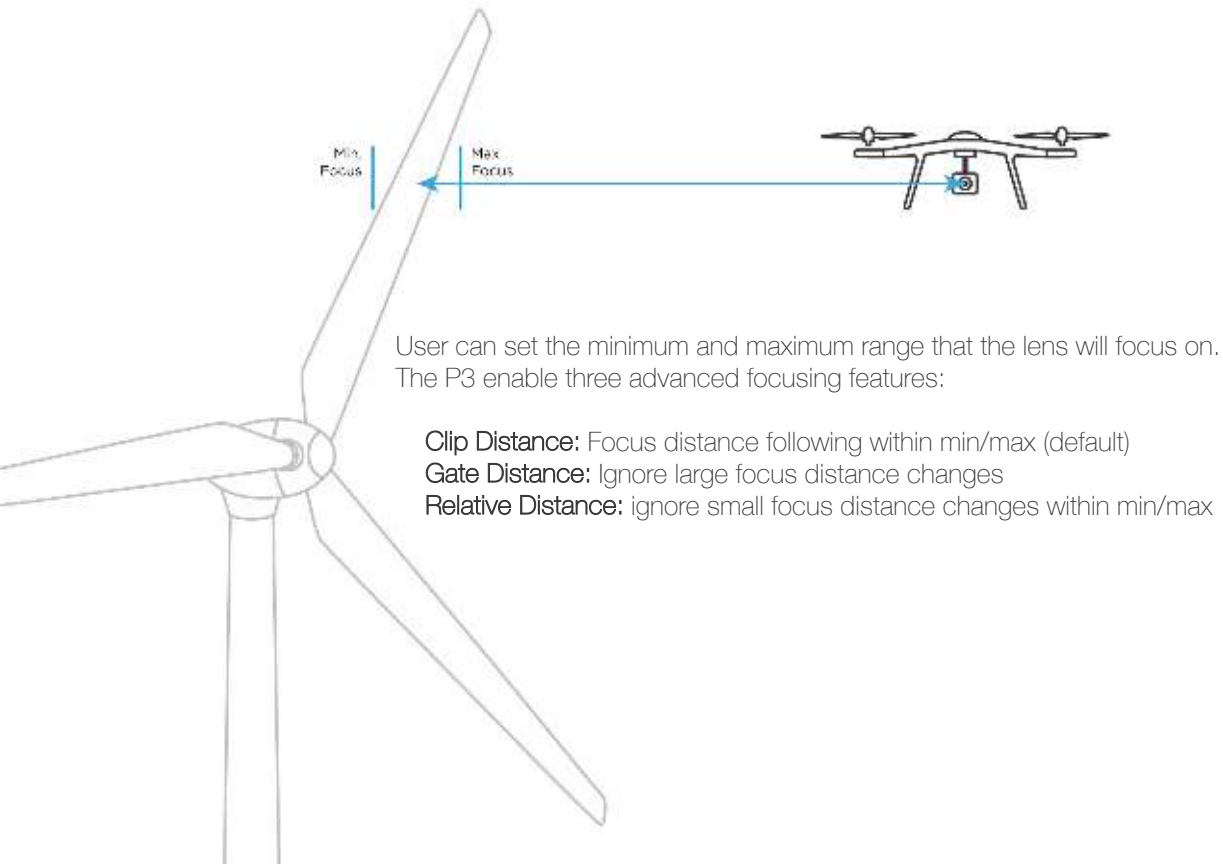
Enables and disables the focus bracketing feature

Set the number of pictures and bracketing steps in the sequence. Use the calculator to find this based on your mission data

- Select the bracketing mode:
- Behind focus point: The laser range finder is used to indicate the closest point of the asset and the focus bracketing stack will then move away from the UAV
  - Around focus point: The laser range finder is used to indicate the centre of the assets. The focus will then be moved away from and towards the UAV
  - In front of focus point: The laser range finder is used to indicate the furthest point of the asset and the focus bracketing stack will then move forwards the UAV

# Phase One P3 – Smart Focus Features

## Advanced Focusing Feature: Focus Limit Control



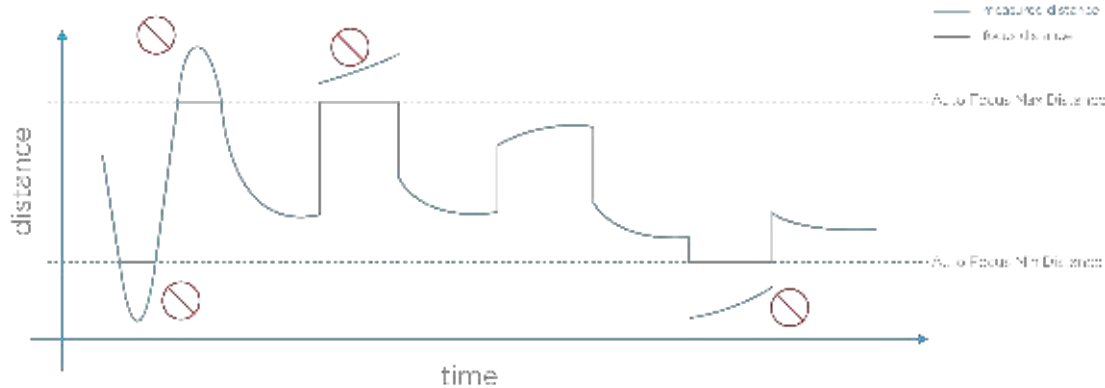
### Why use Advanced Focusing with Min / Max settings

- To reduce the chance of images being out of focus even in complex low contrast environments
- To facilitate enhanced mission automatization with mission planning software
- To make it easier for new pilots to capture high quality data
- To increase output consistency
- To reduce the chance of needing to reflly mission – especially in inaccessible or remote locations



# Phase One P3 – Smart Focus Features

Clip Distance: Lens focus distance follows within min/max



## How Clip Distance works

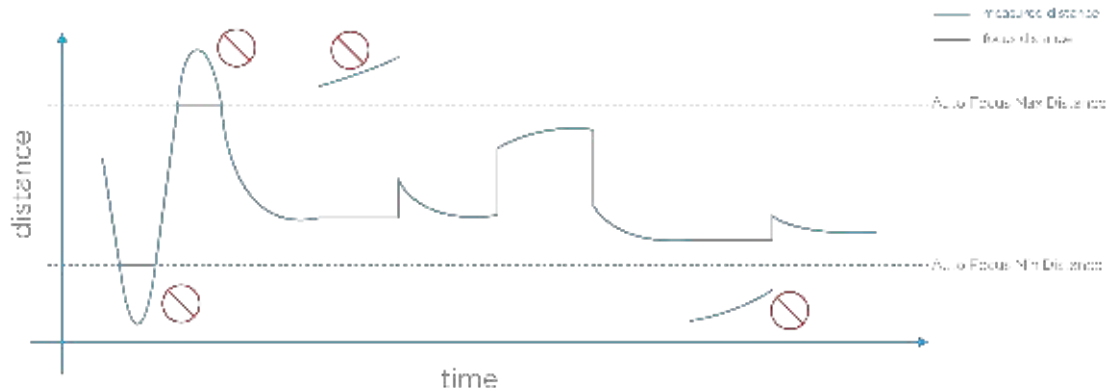
- The user set the min and max focus distance. This is the default mode when using advanced min / max focusing

## Example(s) of when to use Clip Distance

- When inspecting large assets where the chance of the Laser Range Finder missing the target is low such as building façade.

# Phase One P3 – Smart Focus Features

## Gate Distance - Ignore large focus distance changes



### How Gate Distance focus works

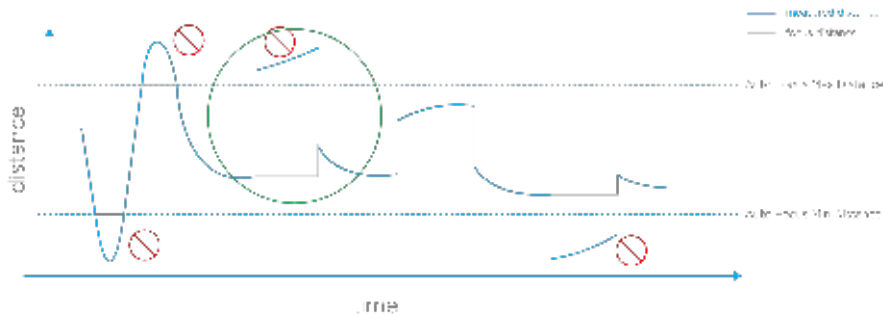
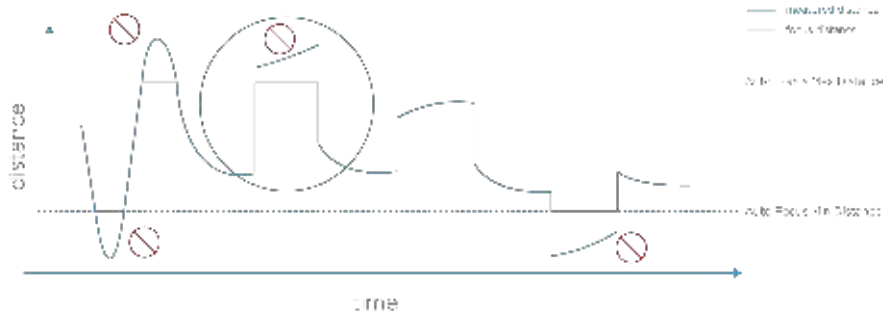
- The user set the min and max focus distance. If the laser range finder measures a distance outside the min / max range the lens focus settings will remain constant until a range inside the focus min / max range is measured.

### Example(s) of when to use Gate Distance

- When capturing medium sized objects like a wind turbine blade and external factors such as wind makes it difficult to keep the laser range finder stable on the desired Focus Point

# Phase One P3 – Smart Focus Features

## Clip Distance vs. Gate Distance



Clip  
Distance

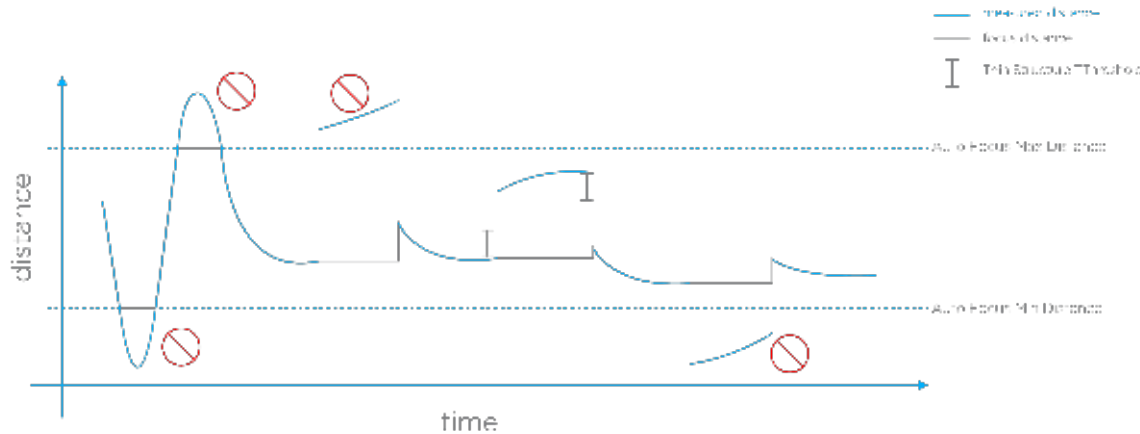
Gate  
Distance

### Clip Distance vs. Gate Distance

- **Clip Distance sets** the lens focus range **to** min or max if a range is measure **outside** min / max
- **Gate Distance leaves** the lens focus range if a range is measured **outside** min / max until a range within focus limits is measured

# Phase One P3 – Smart Focus Features

## Relative Distance - Ignore range changes outside a user defined Relative focus Threshold



### How Gate Distance works

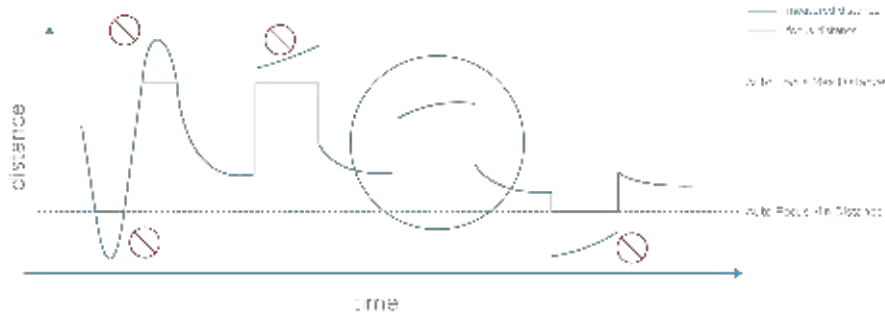
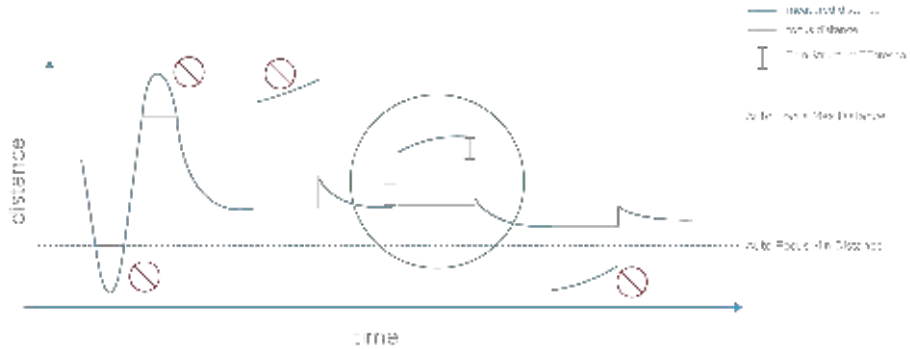
- Even if the laser range finder measure a range inside the user defined min / max focus distance but still a significant change compared to the focusing outset the lens focus range will not change.

### Example(s) of when to use Gate Distance

- When you need to capture thin complex structures such as a power tower

# Phase One P3 – Smart Focus Features

## Gate Distance vs. Relative Distance



### Gate Distance vs. Gate Distance

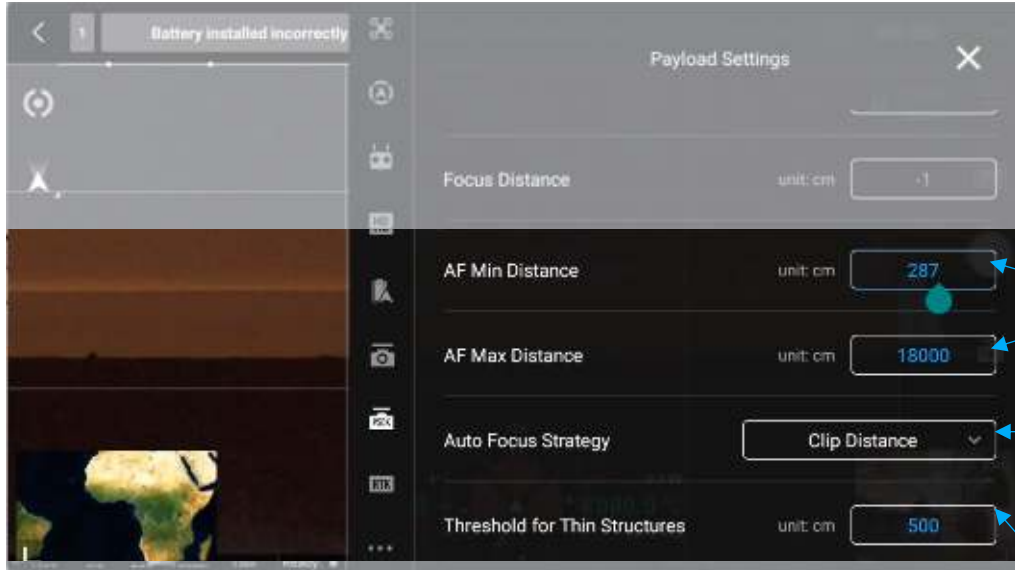
- **Gate Distance** leaves the lens focus range if a range is measured **outside** min / max
- **Relative Distance** leaves the lens focus range if a range is suddenly measured **inside** the min / max range

Gate  
Distance

Relative  
Distance

# Phase One P3 – Smart Focus Features

## Focus Limit Control – Implementation in DJI Pilot App



Sets the maximum distance of the autofocus.

Select the Focus Limit Control Mode

- Clip Distance (Default)
- Gate Distance
- Relative Distance

Acceptable change in distance, changes in range outside this threshold will be ignored. Only applicable for Relative Distance