Perception Viewer
User Manual

Perception Viewer User Manual

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TOC

Customer Support

Chapter 1 Overview

1.1 Install Perception Viewer ... 6
1.2 Remove Perception Viewer ... 7
1.3 Launch Perception Viewer ... 7
1.4 Perception Viewer versions ... 7

Chapter 2 Devices window

2.1 Add a Device ... 9
2.2 Open/Close a connection ... 10
2.3 Open the Perception Viewer window ... 11
2.4 Change the Communication Parameters of a Device ... 11
2.5 Delete a Device ... 11

Chapter 3 Perception Viewer Window

3.1 Connections Bar ... 12
3.2 Menu ... 12
3.2.1 Status ... 12
3.2.2 Configuration ... 13
3.2.3 Settings ... 13
3.2.4 Device ... 13
3.2.5 Start recording ... 13
3.3 Summary Bar ... 14
3.3.1 Device ... 15
3.3.2 GNSS ... 17

Chapter 4 Status Window

4.1 Camera View ... 19
4.2 Perceived Surroundings view ... 20
4.2.1 Top Down ... 20
4.2.2 Perspective ... 23
4.2.3 Map ... 24

Chapter 5 Configuration Window

5.1 Summary ... 26
5.1.1 Vehicle Reference Point ... 26
5.1.2 Vehicle Coordinate System ... 27
5.1.3 Vehicle Setup ... 27
5.1.4 Base Link ... 27
5.1.5 Cameras ... 28
5.2 Cameras Configuration ... 29
5.2.1 Global Settings ... 31
5.2.2 Camera Settings ... 33
5.2.3 Detect Sensors ... 34

5.2.4 Stereo camera exposure ROI calibration 34
5.2.5 Checkerboard Calibration 35
5.2.6 Checkerboard requirements 39
5.2.7 Checkerboard positioning 46
5.3 Logging Configuration 54

Chapter 6 Settings

6.1 Vehicle Setup 55
6.2 Network Settings – Ethernet 55

Chapter 7 Device

7.1 Details Window 56
7.1.1 ECU Device 56
7.1.2 Debug 57
7.1.3 Camera Connections 57
7.1.4 Current System Status 57
7.1.5 Device Trouble Code History 58
7.1.6 Ports 60
7.1.7 Versions 60
7.2 Export Data 60
7.2.1 Copy to AWS 61
7.2.2 Download 62
7.2.3 Copy to USB 62
7.2.4 Eject USB 62
7.2.5 Remove 62
7.3 Restart 63

Customer Support

NovAtel Knowledge Base

If you have a technical issue, visit the NovAtel Support page at novatel.com/support. Through the Support page, you can contact Customer Support, find papers and tutorials or download current manuals and the latest firmware.

Contact Information

Log a support request with NovAtel Customer Support using one of the following methods:

Log a Case and Search Knowledge:

Website: novatel.com/support

Log a Case, Search Knowledge and View Your Case History: (login access required)

Web Portal: shop.novatel.com/novatelstore/s/contactsupport

E-mail:

perceptionsupport@hexagon.com

Telephone:

U.S. and Canada: 1-800-NOVATEL (1-800-668-2835)

International: +1-403-295-4900

Chapter 1 Overview

Perception Viewer is an application available from NovAtel Application Suite. It is used to visualise Perception data, configure the Perception system and calibrate Perception system cameras.

1.1 Install Perception Viewer

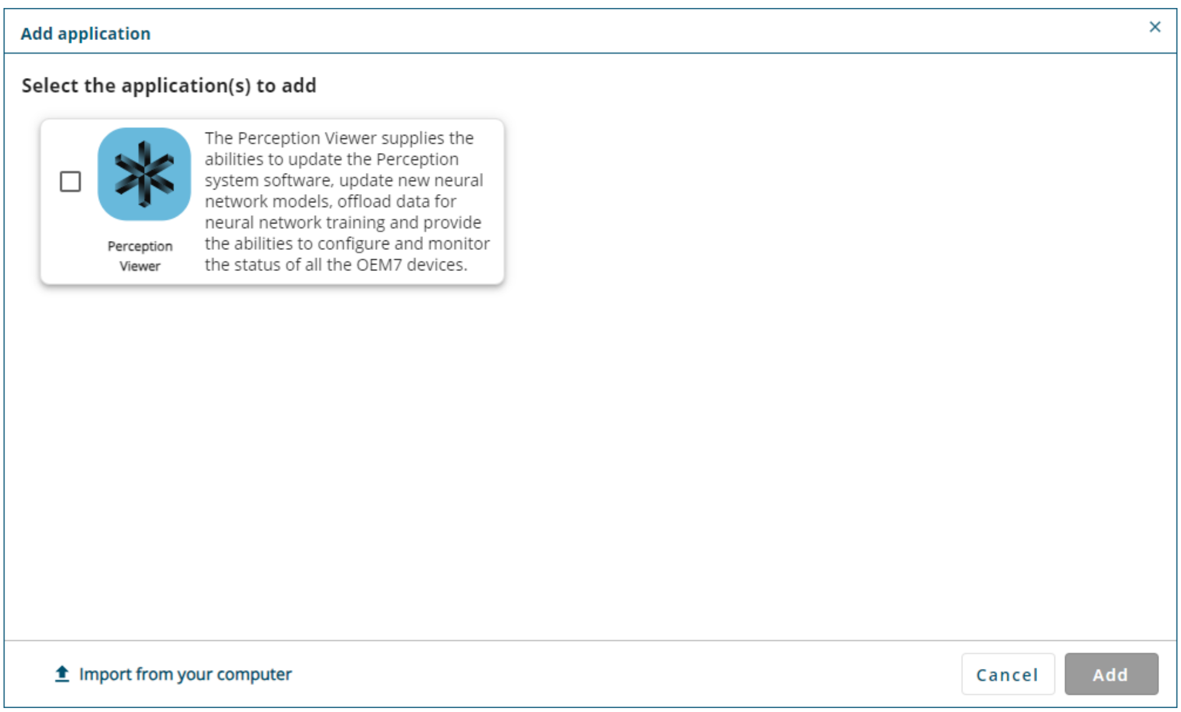
NovAtel Application Suite version 2.7.0 or greater must be installed before installing Perception Viewer. Refer to docs.novatel.com/Tools/Content/ToolsSuite/InstallConnect.htm for information about installing NovAtel Application Suite.

The Perception Viewer application is installed using the **Add Application** button on the NovAtel Application Suite main window.

For most situations, the version of Perception Viewer included with NovAtel Application Suite should be installed. To install the version of Perception Viewer included with NovAtel Application Suite:

1. Open NovAtel Application Suite.
2. Click the **Add application** button.

   The *Add application* window appears.

   A list of applications available is shown. If there are no additional applications currently available, the window will be empty.
3. Select the checkbox for Perception Viewer.
4. Click the **Add** button.

To install a version of Perception Viewer that is not included with NovAtel Application Suite:

1. Download the installation file for the alternate version of Perception Viewer.

   The file will be named **perceptionviewer.zip**.
2. Open NovAtel Application Suite.
3. Click the **Add application** button.

   The *Add application* window appears.
4. Click the **Import from your computer** link.

   The *Open* dialog box appears.
5. Navigate to the folder that contains the Perception Viewer installation file.
6. Select the **perceptionviewer.zip** file and click the **Open** button.
7. When the application has finished installing, click the **Done** button.

If NovAtel Application Suite does not start on an Ubuntu system and no error message is shown

A library required by NovAtel Application Suite is not included in the default Ubuntu 22.04 installation and must installed manually. To install this library, use the following commands:

```
sudo apt-get update
sudo apt-get install -y libfuse2
```

1.2 Remove Perception Viewer

To remove Perception Viewer from NovAtel Application Suite:

1. Open NovAtel Application Suite.
2. Click the **Delete** icon (🗑) on the **Perception Viewer** icon.

   The *Delete Application* dialog box appears.
3. Click the **Delete** button.
4. When the application has finished deleting, click the **Done** button.

1.3 Launch Perception Viewer

To start Perception Viewer:

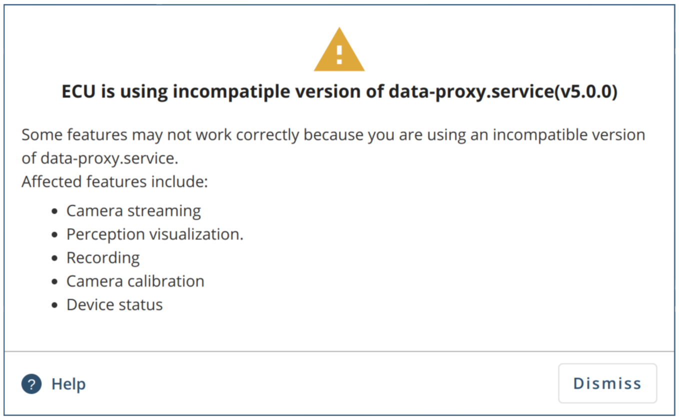
1. Open NovAtel Application Suite.
2. Click the **Perception Viewer** icon on the NovAtel Application Suite welcome window.

1.4 Perception Viewer versions

To ensure the best system performance, use the data_proxy version that is compatible with the Perception Viewer version.

Perception Viewer version	0.1.0	The Perception Viewer version is shown in the bottom right corner of the *Device* window (*Devices window* on page 9).
Compatible data_proxy version	5.1.0	The data_proxy version is shown in the *as-data-proxy* field on the *Versions* window (*Versions* on page 60).

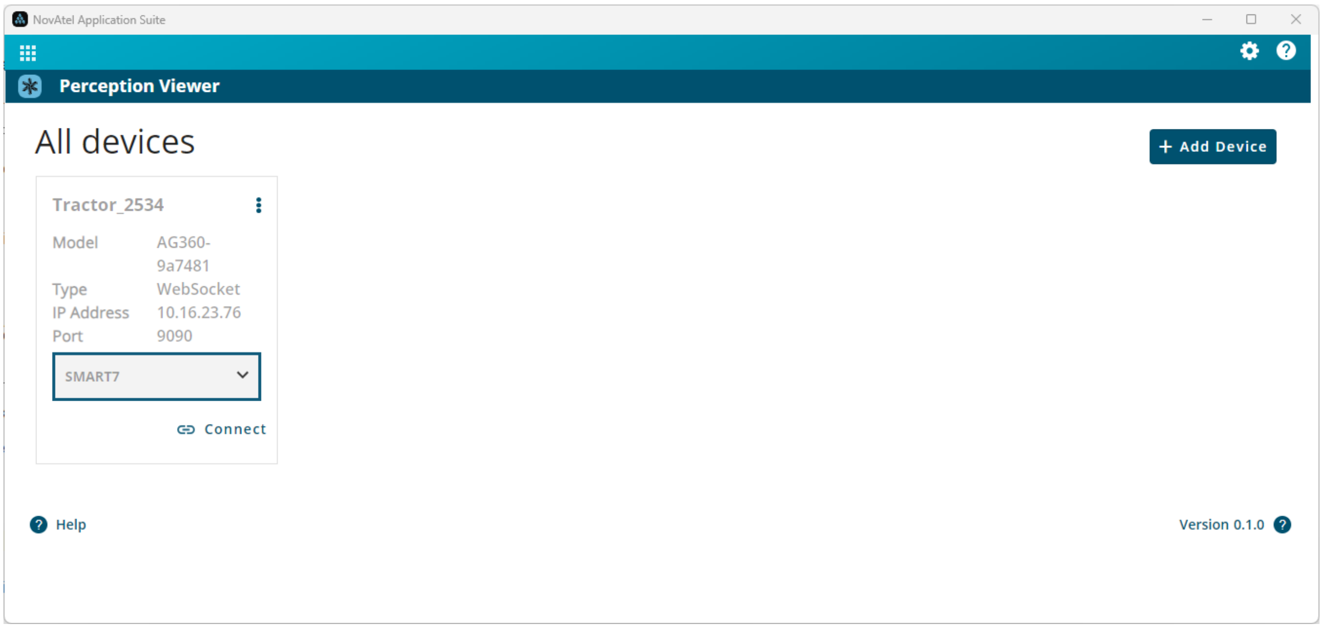
If you are using an incompatible version of the data_proxy, a warning window is shown.



If you have incompatible versions, contact your Sales representative.

Chapter 2 Devices window

Before a *Perception Viewer* session can be started with a Perception system, a Device must be added for the system on the *Devices* window. A Device contains the connection type, and communication parameters used to communicate with the ECU in the Perception system.



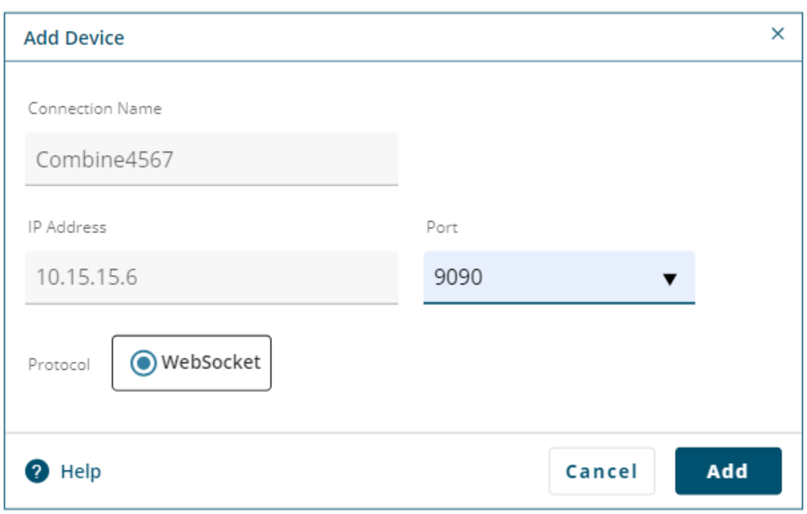
The *Devices* window contains all of the Devices defined in *Perception Viewer*. From this window, Devices can be added, edited and deleted. The Devices are used to start a connection with the Perception system and open the Perception Viewer window for the system.

2.1 Add a Device

To add a Device for a Perception system:

1. Click the **Add Device** button.

   The *Add Device* dialog box opens.



2. In the *Connection Name* box, enter a name for the Device.

   This name is used to identify this Perception system on the *Devices* window and on the Perception Viewer windows. Note that when sorting the entries on the *Devices* window, this is the name by which Perception Viewer sorts the Devices.

3. In the *IP Address* box, enter the IP address of the Perception ECU.

   The default ECU IP address when connected to port PoE3 is 192.168.100.101. For more information about the IP addresses used on the ECU, refer to the *Hexagon Perception System VSV-360 Installation Guide*.

4. In the *Port* box, enter the port used to communicate with the Perception ECU.

   The default port is 9090.

5. Click the option for the protocol used for communication with the data proxy WS server.

   The only supported protocol is WebSocket.

6. Click the **Add** button.

   Perception Viewer attempts to connect to a Perception system at the specified IP address. If the connection is successful, a new Device labelled with the name entered in the *Connection Name* box is added to the *Devices* window.

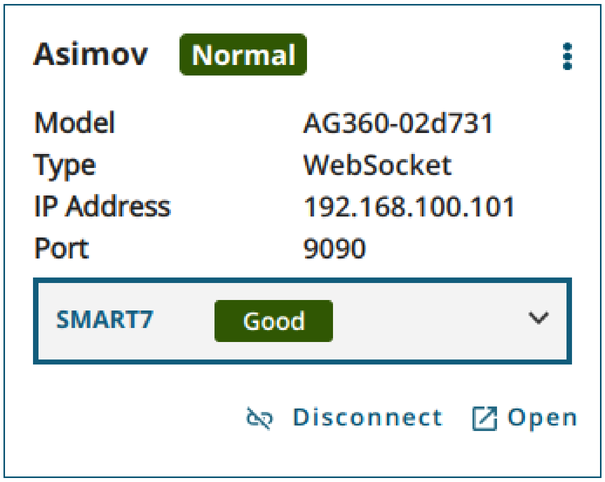
2.2 Open/Close a connection

A connection to the Perception system must be established before Perception Viewer can be used to monitor or configure the Perception system.

To connect to the Perception system:

1. Click the **Connect** button.

   The device box changes to show status information for the Perception system and show the *Disconnect* and *Open* buttons.



   To view information for the GNSS receiver used in the Perception system, click the receiver drop menu.

To close a connection:

1. Click the **Disconnect** button.

   The device box changes to remove the status information and show the *Connect* button.

2.3 Open the Perception Viewer window

When a connection to the Perception system is established, a Perception Viewer session for the Perception system can be opened. To open the Perception Viewer, click the **Open** button.

2.4 Change the Communication Parameters of a Device

To change the communication parameters used to connect to a Perception system:

1. Click the menu button (⋮) on the Device to change.
2. Click **Edit Device**.
3. Change the communication parameters to match the new settings required to connect to the Perception system.

2.5 Delete a Device

To delete a Device:

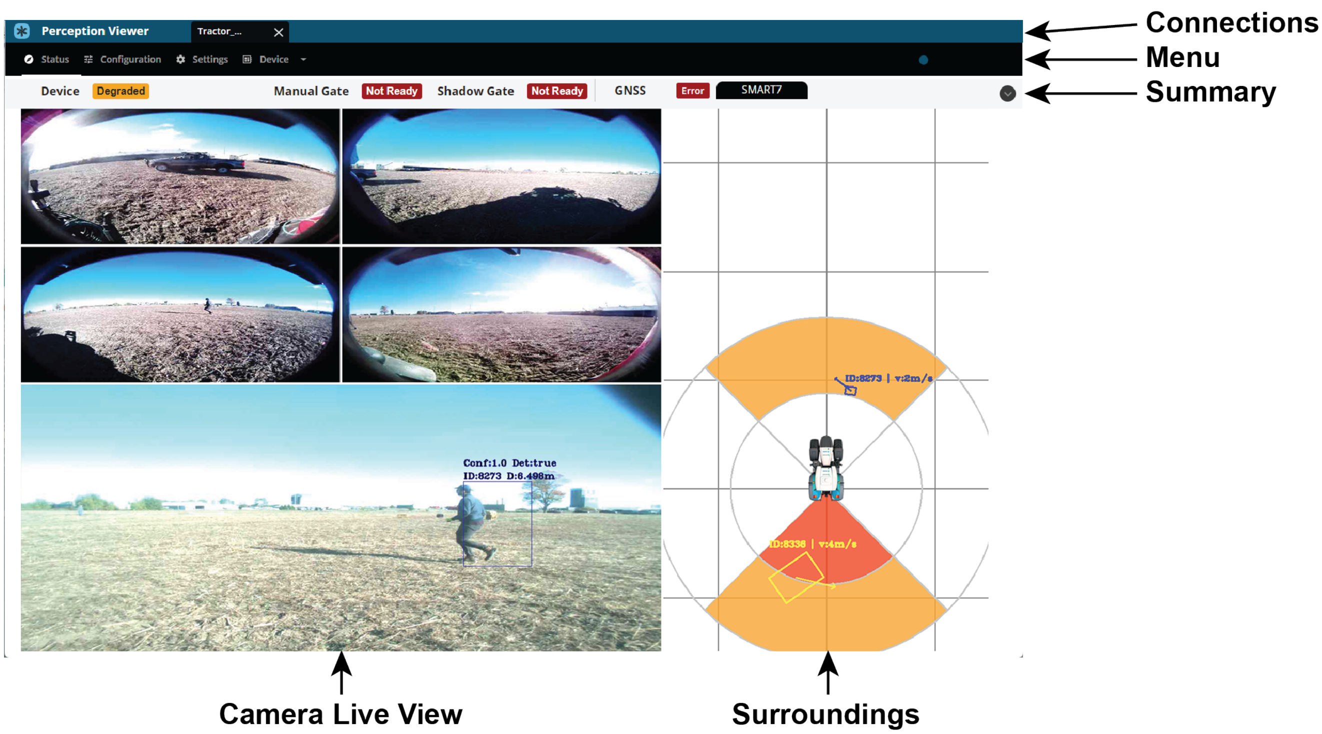
1. Click the menu button (⋮) on the Device to delete.
2. Click **Delete Device**.

   A confirmation dialog box appears.
3. Click the **Yes** button.

> The Delete Device option is not available when Perception Viewer is connected to the Perception system.

Chapter 3 Perception Viewer Window

When a connection to a Perception system is opened, the Perception Viewer window is displayed. From this window, all of the status and configuration information for the Perception system can be accessed.



3.1 Connections Bar

The *Connections* bar appears at the top of all Perception Viewer windows. This bar shows all the Devices to which the computer currently has a connection.

The Device that is currently being viewed is black. To view a different Device, click the tab on the Connections bar for that Device.

To close a connection, click the **X** button on the Device tab.

3.2 Menu

The Menu bar provides access to the features available in Perception Viewer and is available on all Perception Viewer windows.

Click a menu item to access the options available.

3.2.1 Status

Click **Status** to display the *Status* window.

The *Status* window provides access to current camera views and the perceived surroundings of Perception system. The Status window is shown when a connection is opened to a device. See *Status Window* on page 19 for more information.

3.2.2 Configuration

Click **Configuration** to display the *Configuration* window.

The *Configuration* window provides access to camera configuration and calibration. See *Configuration Window* on page 26 for more information.

3.2.3 Settings

Click **Settings** to display the *Settings* window.

The *Settings* window provides access to Ethernet network configuration. See *Settings* on page 55 for more information.

3.2.4 Device

Details

Click **Details** to open the *Details* window.

From the *Details* window you can view information about the Perception system hardware and software. For information about the *Details* window, see *Details Window* on page 56.

Export

Click **Export** to open the *Data* window.

From the *Data* window, you can download data collected on the Perception system. For information about the *Data* window, see *Export Data* on page 60

Restart

Click **Restart** to open the *Restart* window.

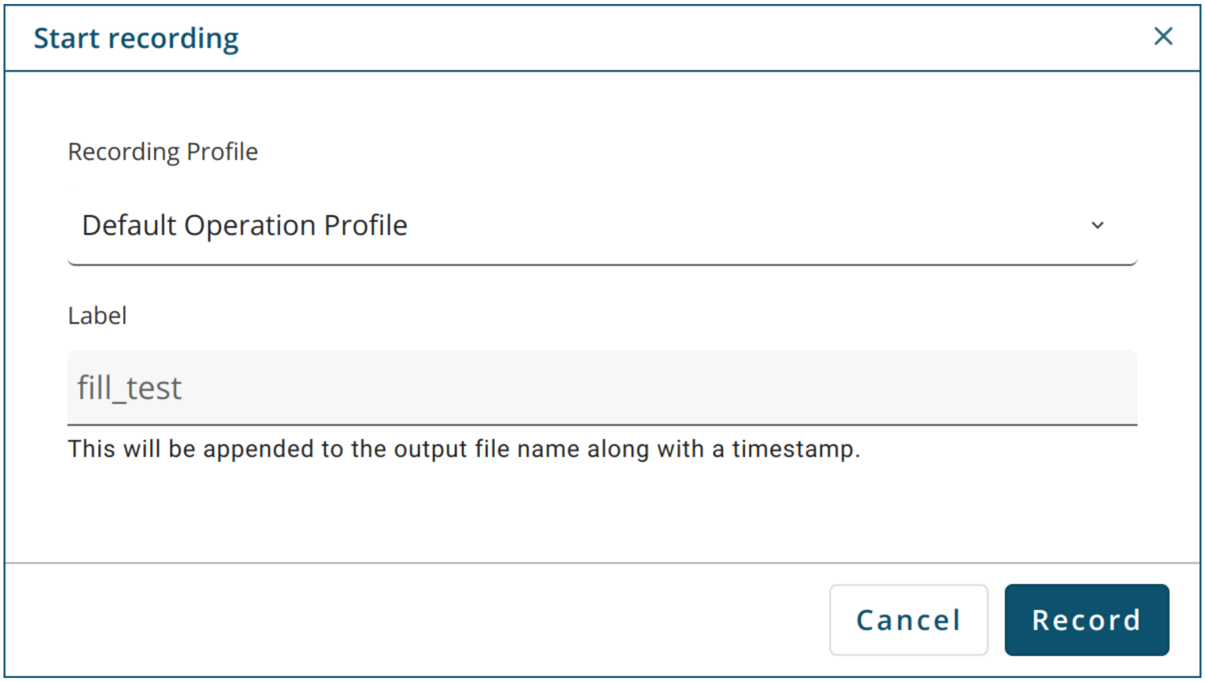
From the *Restart* window, you can restart or shut down the Perception system. For information about the *Restart* window, see *Restart* on page 63.

3.2.5 Start recording

The ECU sensor data and Perception outputs can be recorded and saved on the Perception ECU. To start a recording:

1. Click the **Start recording** button on the right end of the Menu bar.

   The *Start recording* dialog box appears.



2. From the **Recording Profile** drop menu, ensure **Default Operation Profile** is selected.
3. In the **Label** box, enter an identifying name for this recording. The Label will be added to the file name of the recording file.
4. Click the **Record** button.

> If the Perception System is in an error state, a dialog box appears identifying the error. If you want to record data while the system is in an error state, click the **Yes** button.

3.3 Summary Bar

The Summary bar provides status information about the components in the Perception system.

Beside each component is a coloured bar with text that indicates the status of the component.

Table 1: Summary Bar Colour Codes

Colour	Description
Green	The component is functioning and there are no warnings or errors.
Amber	The component is functioning, but there are one or more issues that may require attention.
Red	An issue is preventing the component from functioning properly. The Error state will remain until the situation is resolved.

Table 2: Summary Bar Status Codes

Component	Text	Description
Device	Init	The ECU is initializing.
	Config	The ECU is in configuration mode.
	Validate	The ECU is validating the current configuration.
	Playback	The ECU is operating in playback mode.
	Awaiting	The ECU waiting for the attached sensors.
	Degraded	The ECU is functioning, but there are one or more issues that may require attention.
	Normal	The ECU is functioning normally.
	Error	An issue is preventing the ECU from functioning. The Error state will remain until the situation is resolved.
	Off	The ECU is powered off.
Manual Gate	Ready	The Perception system is ready for recording.
	Not Ready	The Perception system is not in an optimal state for recording.
Shadow Gate	Ready	The Perception system is ready for recording and the vehicle is moving.
	Not Ready	The Perception system is not in an optimal sate for recording or the Perception system is ready for recording but the vehicle is not moving.
GNSS	Normal	The GNSS receiver is functioning and providing positioning information.
	Error	There is an error on the GNSS receiver.

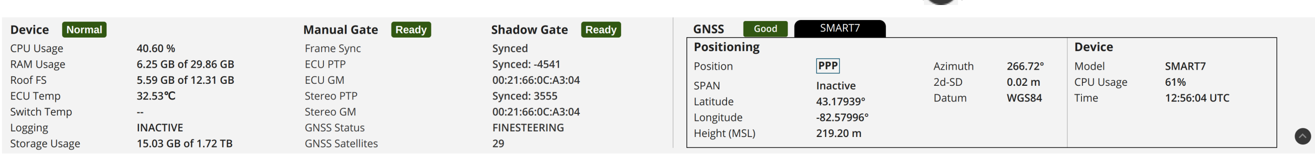
When the Perception system is functioning normally the component statuses are:

- Device = Normal
- Manual Gate = Ready
- Shadow Gate = Ready (or Not Ready if the vehicle is not moving)
- GNSS = Normal

If the any of the components are not *Normal* or *Ready*, see *Current System Status* on page 57 for details.

The GNSS component also has a black bar that indicates the type of GNSS receiver used in the Perception system.

To view details about the status of the components, click the drop menu button ().



3.3.1 Device

This section of the Summary bar shows the status information for the Perception ECU.

CPU Usage

The *CPU Usage* field shows the percentage of ECU computing (CPU) power currently being used.

RAM Usage

The *RAM Usage* field shows the amount of ECU RAM being used compared to the total amount of RAM available.

Roof FS

The *Roof FS* field shows the amount of ECU internal storage used for the Perception system software compared to the total amount storage available for system files.

ECU Temp

The *ECU Temp* field shows the current temperature of the Perception ECU.

Logging

The *Logging* field shows the status of logging to the ECU's internal memory or computer running Perception Viewer.

Storage Usage

The *Storage Usage* field shows the amount of ECU internal storage used for data compared to the total amount of storage available.

Frame Sync

The *Frame Sync* field shows the status of the surround view camera synchronization. When this field shows *Synched*, the surround view cameras are synchronised and will take pictures at the exact same time.

ECU PTP

The *ECU PTP* field shows the Precise Time Protocol status of the ECU. When the ECU is synchronised with a PTP grand master clock, the status is *Synched*.

ECU GM

The *ECU GM* field shows the MAC address of the PTP grand master clock used by the ECU. The GNSS receiver acts as the grandmaster clock when the receiver has a GPS reference time status of FINESTEERING. The GPS reference time status is shown in the *GNSS Status* field.
If the ECU is not synchronised to a PTP grand master clock, this field shows *None*.

Stereo PTP

The *Stereo PTP* field shows the Precise Time Protocol status of the stereo camera. When the stereo camera is synchronised with a PTP grand master clock, the status is *Synched*.

Stereo GM

The *Stereo GM* field shows the MAC address of the PTP grand master clock used by the stereo camera. The GNSS receiver acts as the grandmaster clock when the receiver has a GPS reference time status of FINESTEERING. The GPS reference time status is shown in the *GNSS Status* field. If GNSS receiver is in any status other than FINESTEERING, the ECU acts as the PTP grand master clock for the stereo camera.
If the stereo camera is not synchronised to a PTP grand master clock, this field shows **——-**.

GNSS Status

The *GNSS Status* field shows the GPS reference time status.

GNSS Satellites

The *GNSS Satellites* field shows the number of satellites used in the position solution.

3.3.2 GNSS

This section of the Summary bar shows the status of the GNSS receiver connected to the Perception system.

Position

The *Position* field shows the positioning type used to calculate the position.

This field shows all of the position types configured on the receiver. The position type being used is highlighted with a box.

- **None**

  A position solution has not been calculated.

- **Single**

  A GNSS code based position is being calculated without the use of any correction sources. This is the default positioning type.

- **SBAS**

  A GNSS code based position is being calculated using corrections provided by an SBAS system, such as WAAS.

- **PPP**

  A carrier based position is being calculated using corrections provided by TerraStar.

- **RTK**

  A carrier based position is being calculated using the Real Time Kinematic (RTK) method and the receiver is receiving corrections from a base station.

- **PSR DIFF**

  A GNSS code based position is being calculated using corrections provided by a differential GNSS base station.

SPAN

The SPAN field shows the status of SPAN positioning. SPAN is a GNSS+INS navigation technology that provides a reliable position, velocity and attitude solution.

- **Off**

  The SPAN IMU type is not configured.

- **Inactive**

  The SPAN IMU type is configured and the Inertial Solution Status is any status other than INS_SOLUTION_GOOD.

- **Ready**

  The Inertial Solution Status is INS_SOLUTION_GOOD and the INS position type is any status other than INS positions.

- **Aiding**

  The Inertial Solution Status is INS_SOLUTION_GOOD and the INS position type is any status of INS positions.

Latitude

The *Latitude* field shows the latitude of the calculated position in degrees.

Longitude

The *Longitude* field shows the longitude of the calculated position in degrees.

Height (MSL)

The *Height* field shows the height above mean sea level of the calculated position in metres.

Azimuth

The *Azimuth* field shows the left-handed rotation around the z-axis in degrees clockwise from North. (0° to 359.99°)

This is the inertial azimuth calculated from the IMU gyros and the SPAN filters.

Azimuth is available only if SPAN is active.

2d-SD

The *2d-SD* field shows the horizontal standard deviation of the position.

Datum

The *Datum* field shows the datum in which the Latitude, Longitude and Height are reported. The default is WGS84.

Model

The *Model* field shows the receiver type.

CPU Usage

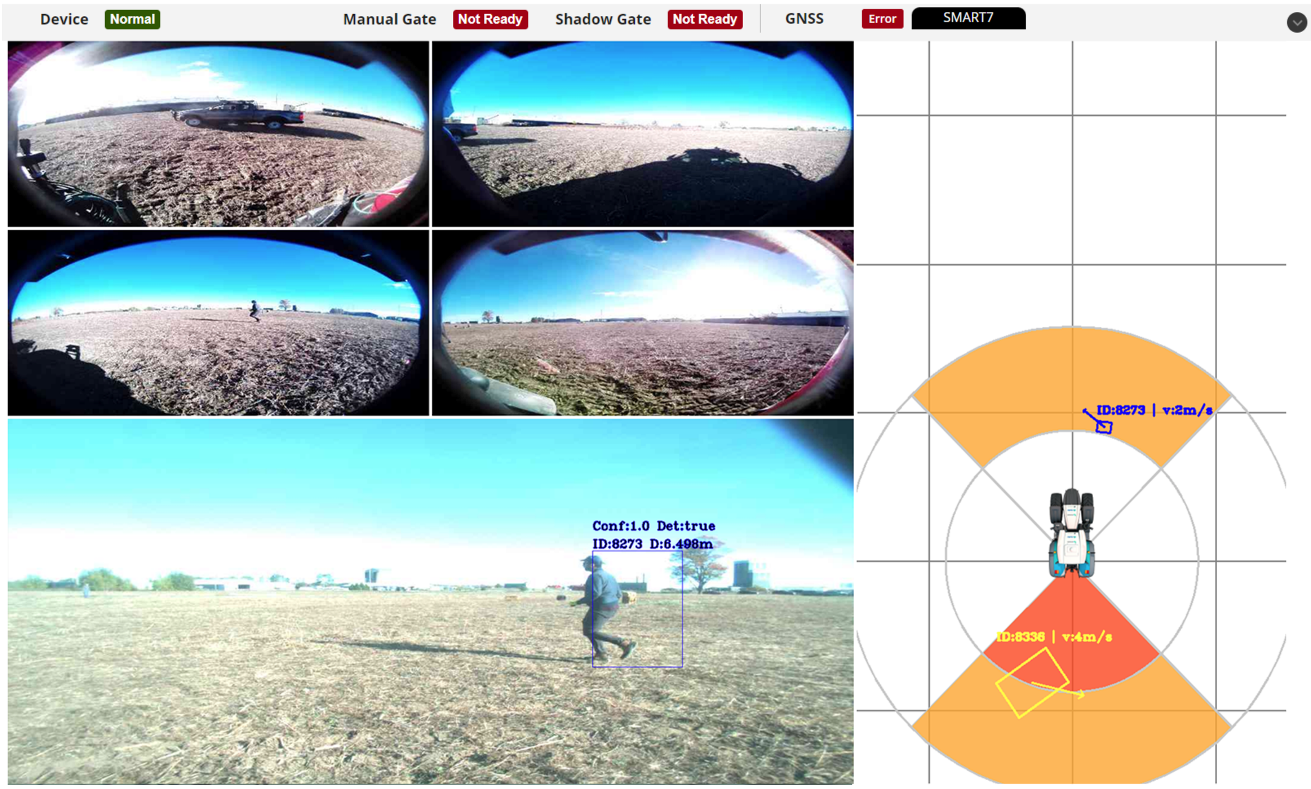
The *CPU Usage* field shows the amount of receiver computing (CPU) power currently being used.

Time

The *Time* field shows the current UTC time.

Chapter 4 Status Window

The *Status* window provides access to current camera views and the perceived surroundings of the Perception system.



4.1 Camera View

The left side of the *Status* window shows the live view of the cameras connected to the Perception system.

When an object is detected by the Perception system, a box is drawn around the object and the object is assigned an ID number. The colour of the box and text indicate the type of object detected. See *Table 3: Detected object colour code* below. If the object moves to another camera view, or can be seen in more than one camera view, the same ID number is used for the object.

Table 3: Detected object colour code

Type of object	Colour of box and text
Pedestrian	Blue
Vehicle	Yellow
Unknown obstacle	Purple

By default all five cameras are shown at 100% magnification.

To change the magnification of a camera image:

1. Move the mouse pointer over the camera image to magnify.

   The tool icons appear on the image.

2. Move the mouse pointer over the **100%** drop down menu ( ).

3. Use the plus (+) or minus (-) buttons to adjust the zoom level.
   Alternately, use the slider to change the zoom level.

When a magnification of a camera is greater than 100%, the portion of the picture being viewed can be changed.

1. Move the mouse pointer over the camera image.

   The tool icons appear on the image.

2. Click the hand icon.
   The mouse pointer changes to a hand icon.

3. Click and drag on the picture to view a different area of the picture.

To change a camera image to full screen:

1. Move mouse pointer over the camera image to change to full screen.

   The tool icons appear on the image.

2. Click the ( ) button.

   The camera image expands to fill the entire *Status* window.

To exit from full screen mode, click the ( ) button.

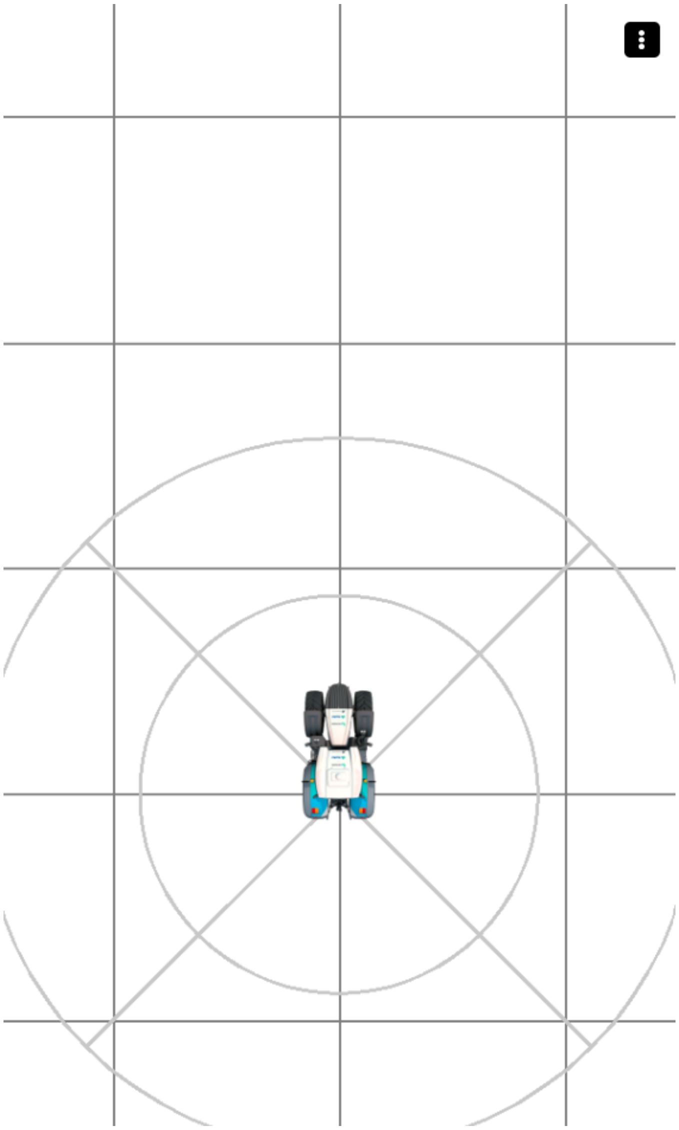
4.2 Perceived Surroundings view

The right side of the *Status* window shows the area around the vehicle and any objects detected by the Perception system.

There are three views available for the *Perceived Surroundings* view. To change the view, click the menu icon ( ), then select one of the views.

4.2.1 Top Down

The *Top Down* view shows a 2D icon of the vehicle and the objects detected by the Perception system. This view is shown from the perspective of directly above the vehicle.

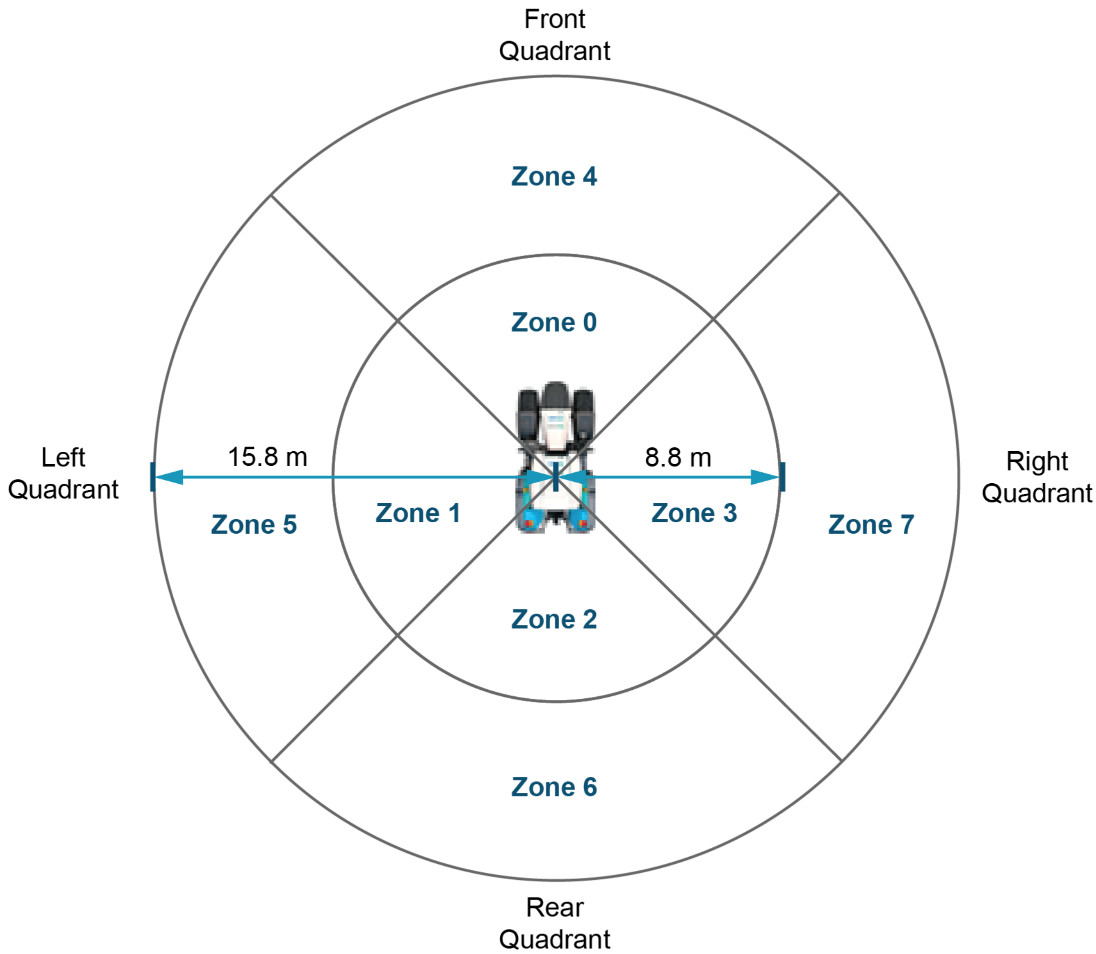


The area around the vehicle is divided into eight zones. These zones are grouped into two regions and four quadrants.

The inner region (Zone 0 to Zone 3) is the circular area closest to the vehicle. By default, the inner region is the area within an 8.8 metre radius of the centre of the vehicle. The outer region (Zone 4 to Zone 7) is the circular area outside of the inner region. By default, outer region is the area between 8.8 metres and 15.8 metres radius from the vehicle.

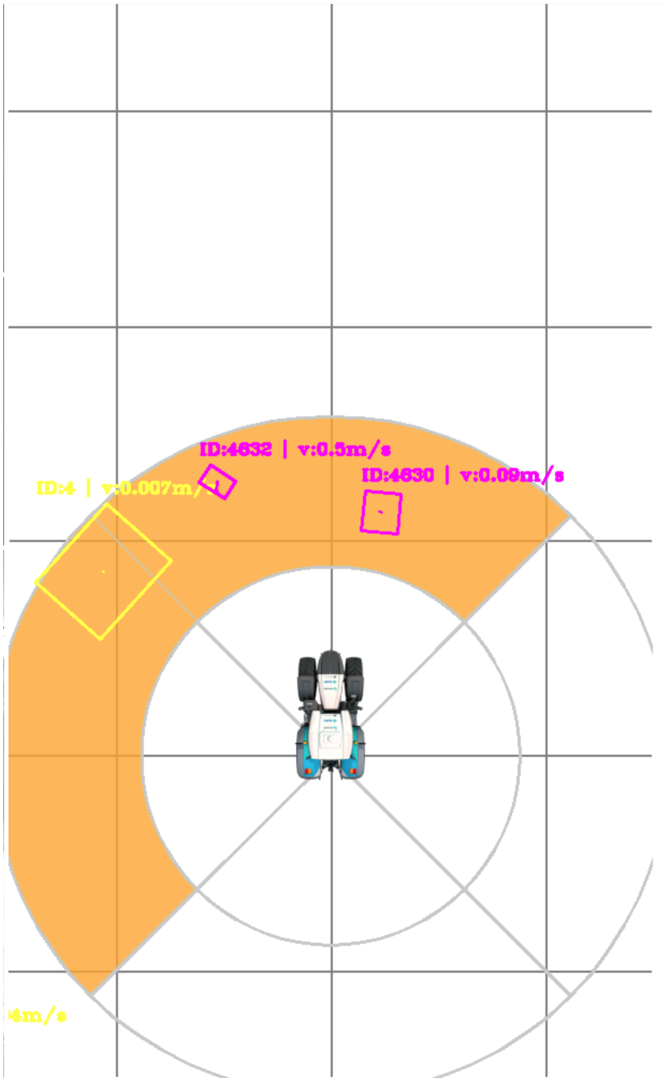
> If required, the radius of the inner region and outer region can be changed. Contact Hexagon Perception support at perceptionsupport@hexagon.com for help changing the radii.

The inner and outer regions are divided into four quadrants: the front quadrant (Zone 0 and Zone 4), the left quadrant (Zone 1 and Zone 5), the rear quadrant (Zone 2 and Zone 6) and the right quadrant (Zone 3 and Zone 7).



When an object is detected, a box is shown in the location of the object and the zones (0 to 7) in which the object was detected are highlighted. In the example below, 6 objects have been detected:

- a vehicle (yellow box with ID 4) is shown in Zones 4 and 5 (outer region, front quadrant; and outer region, left quadrant
- an unknown obstacle (purple box with ID 4632) is shown in Zone 4 (outer region, front quadrant)
- an unknown obstacle (purple box with ID 4630) is shown in Zone 4 (outer region, front quadrant)

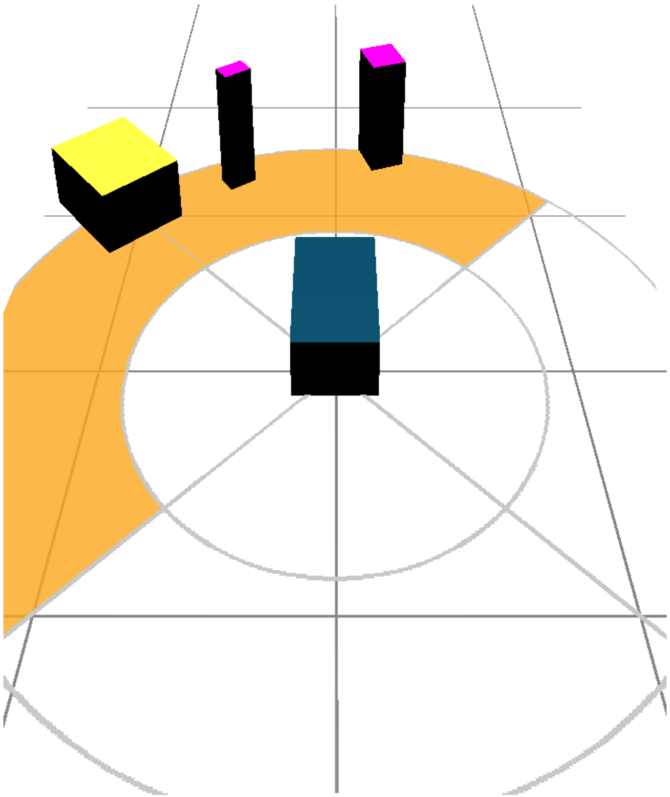


The object boxes displayed are colour coded, scaled to show the detected size and labelled with an ID and velocity. The ID is a unique identifier used to track the object. The ID and colour of the box are the same ID and colour shown on the *Camera View* images. The velocity shown is the ground speed of the object in metres per second. The arrow starting at the centre of the box shows the direction and magnitude of the object velocity.

> When the Perception system does not have a GNSS position, the velocity shown is the velocity of the object relative to the vehicle in metres per second.

4.2.2 Perspective

The *Perspective* view shows a 3D icon of the vehicle and the objects detected by the Perception system. This view is shown from the perspective of behind and above the vehicle.

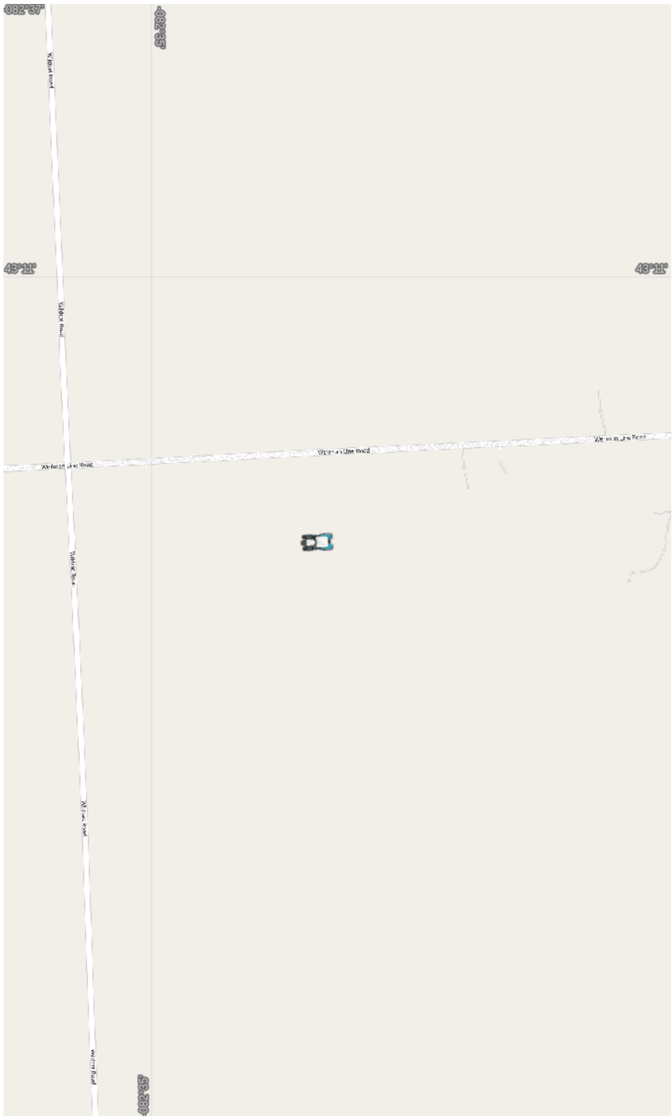


The area around the vehicle is divided into two regions and four quadrants. These regions and quadrants are the same as those shown on the *Top Down* view.

When an object is detected, a 3D box representing the object appears on the *Perspective* view. The object box is colour coded, scaled to show the size of the object and moves to show the object movement relative to the vehicle. The colour of the box is the same colour used on the *Camera View* images.

4.2.3 Map

The *Map* view shows the location of the vehicle on a map.



The *Map* view can be changed using several button available on the *Map* view.

To zoom in on the map, click the Zoom In button ( ).

To zoom the map out, click the Zoom Out button ( ).

> The mouse wheel can also be used to zoom in or out.

To make the *Map* view occupy the entire *Status* window, click the ( ) button .

To return the Map view to default size, click the ( ) button.

To mark a point of interest on the map, click the **Pin** button ( ) and drag the pin to the point of interest on the map.

To remove a point of interest, select the point of interest and click the **Remove Pin** button ( ).

Chapter 5 Configuration Window

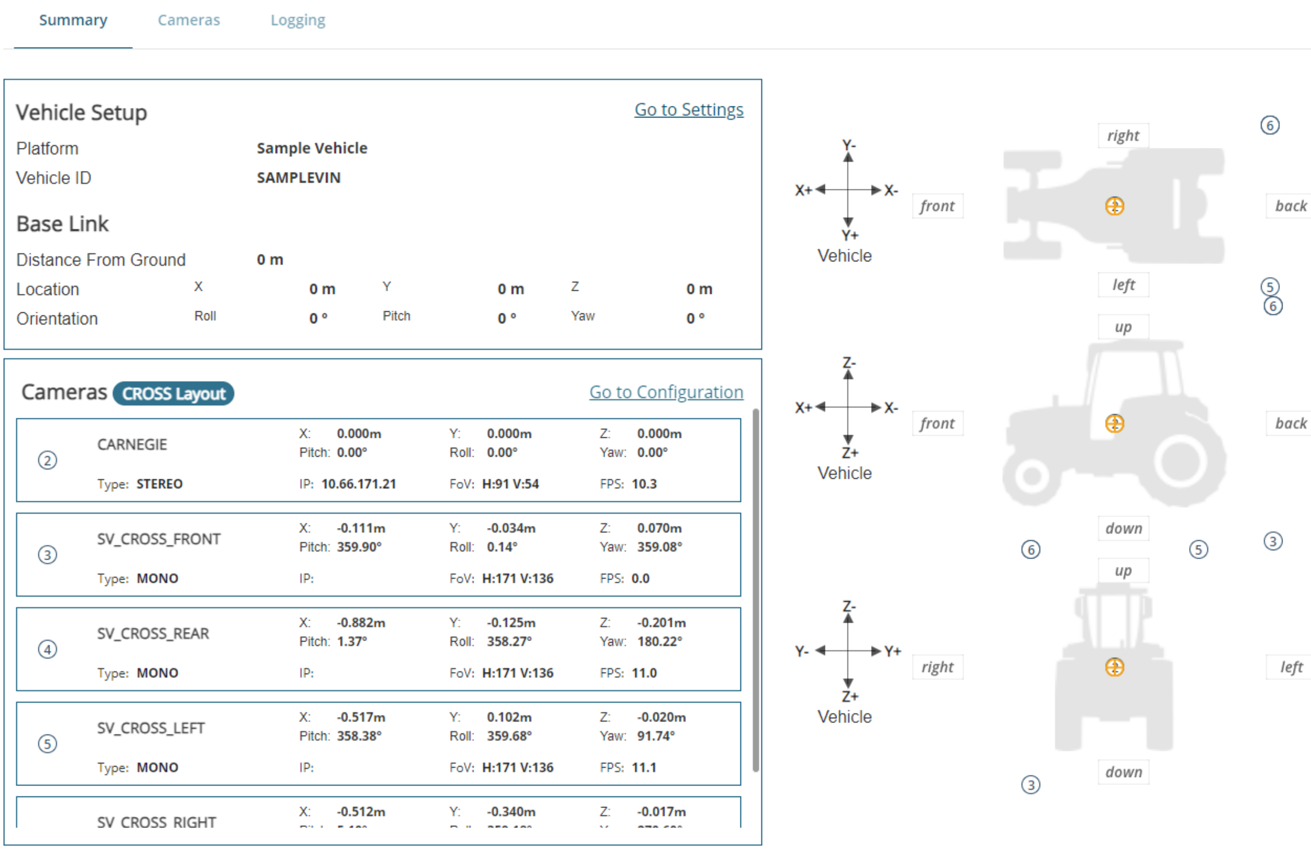
The *Configuration* window has three tabs.

- *Summary* below
- *Cameras Configuration* on page 29
- *Logging Configuration* on page 54

The *Summary* tab is shown by default.

5.1 Summary

The *Summary* tab shows the current configuration of the Perception system components.



5.1.1 Vehicle Reference Point

The Vehicle Reference Point is a precisely defined, fixed and measurable location on the vehicle (e.g., a tractor, combine harvester, or sprayer) that serves as the origin (0,0,0) for all coordinate transformations and sensor data fusion.

It is the physical point from which the vehicle's position, orientation and the relative positions of perceived objects (like crop rows, boundaries, obstacles, or implements) are calculated and referenced in the vehicle's local frame of reference.

The vehicle reference point is shown on the vehicle graphic as a yellow cross inside a circle.

For information about the Vehicle Reference Point, refer to the *Hexagon Perception System VSV-360 Installation Guide*.

5.1.2 Vehicle Coordinate System

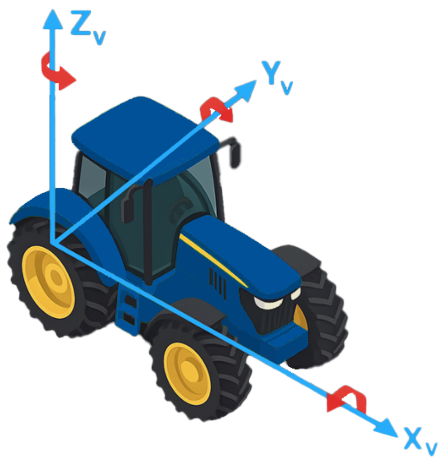
The Vehicle Coordinate System is shown on the *Summary* tab.

The vehicle X axis points forward from the vehicle.

The vehicle Y axis points to the left, as viewed when facing forward.

The vehicle Z axis points up from the ground.

The Vehicle Coordinate System follows the ISO 8855 standard convention for rotation. Each axis is positive in the clockwise direction, when looking in the positive direction of that axis.



5.1.3 Vehicle Setup

The parameters in the *Vehicle Setup* box are used to identify the vehicle on which the Perception system is installed.

Platform

The type of vehicle on which the Perception system is installed..

Vehicle ID

A unique identifier for the vehicle.

To change the Base Link parameters, click the **Go to Settings** link. See *Vehicle Setup* on page 55 for information about changing these parameters.

5.1.4 Base Link

The parameters in the *Base Link* box show the location and orientation of the GNSS receiver.

Distance From Ground

The vertical distance from the ground to the installation location of the GNSS receiver in metres.

Location

The location of the GNSS receiver on the vehicle.

- **X** – The distance along the vehicle X axis (front or back) from the vehicle reference point to the GNSS receiver in metres.
- **Y** – The distance along the vehicle Y axis (left or right) from the vehicle reference point to the GNSS receiver in metres.
- **Z** – The distance along the vehicle Z axis (up or down) from the vehicle reference point to the GNSS receiver in metres.

The distances are measured from the vehicle reference point (centre of vehicle) to the GNSS receiver centre of navigation.

Orientation

The angular difference between the orientation of the GNSS receiver and the X, Y and Z axis of the vehicle.

- **Roll** – The angular rotation of the GNSS receiver around the vehicle X axis in degrees. When the GNSS receiver is installed flat relative to the X axis, the roll is 0°.
- **Pitch** – The angular rotation of the GNSS receiver around the vehicle Y axis in degrees. When the GNSS receiver is installed flat relative to the Y axis, the pitch is 0°.
- **Yaw** – The angular rotation of the GNSS receiver around the vehicle Z axis in degrees. When the forward direction marker on the GNSS receiver is pointing in the direction of travel for the vehicle, the yaw is 0°.

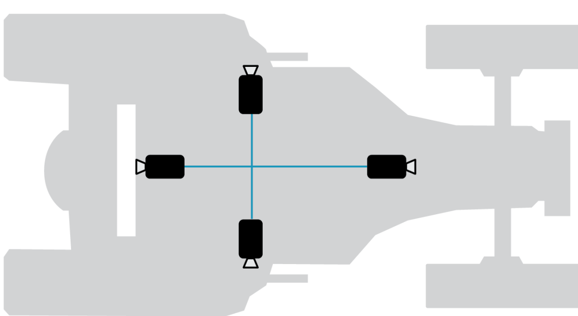
To change the Base Link parameters, click the **Go to Settings** link. See *Vehicle Setup* on page 55 for information about changing these parameters.

5.1.5 Cameras

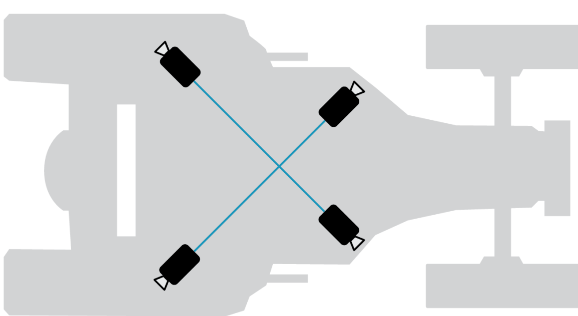
The *Cameras* box shows the current configuration for the cameras on the Perception system.

The button beside the *Cameras* title indicates the layout used for the surround view cameras. The layout can be CROSS or DIAG.

CROSS layout



DIAG layout



Below the *Cameras* title is a status box for each camera. Each status box contains the following fields.

Identifier

This field appears as number inside a circle. This number is used on the vehicle graphic to show the location of the camera on the vehicle.

Name

The name assigned to the camera.

Type

The type of camera. The camera can be stereo or mono.

X

The distance along the vehicle X axis (front or back) from the vehicle reference point to the camera in metres.

Y

The distance along the vehicle Y axis (left or right) from the vehicle reference point to the camera in metres.

Z

The distance along the vehicle Z axis (up or down) from the vehicle reference point to the camera in metres.

Roll

The angular rotation of the camera around the vehicle X axis in degrees. When the camera is installed flat relative to the X axis, the roll is 0°.

Pitch

The angular rotation of the camera around the vehicle Y axis in degrees. When the camera is installed flat relative to the Y axis, the pitch is 0°.

Yaw

The angular rotation of the camera around the vehicle Z axis in degrees. When the camera is pointing in the direction of travel for the vehicle, the yaw is 0°

IP address

The IP address used by the camera.

The *IP address* field contains data only for the stereo camera which is connected to the Perception ECU using Ethernet. This field is blank for the surround view cameras which are connected to the Perception ECU using GMSL.

FoV

The horizontal and vertical Field of View for the camera in degrees.

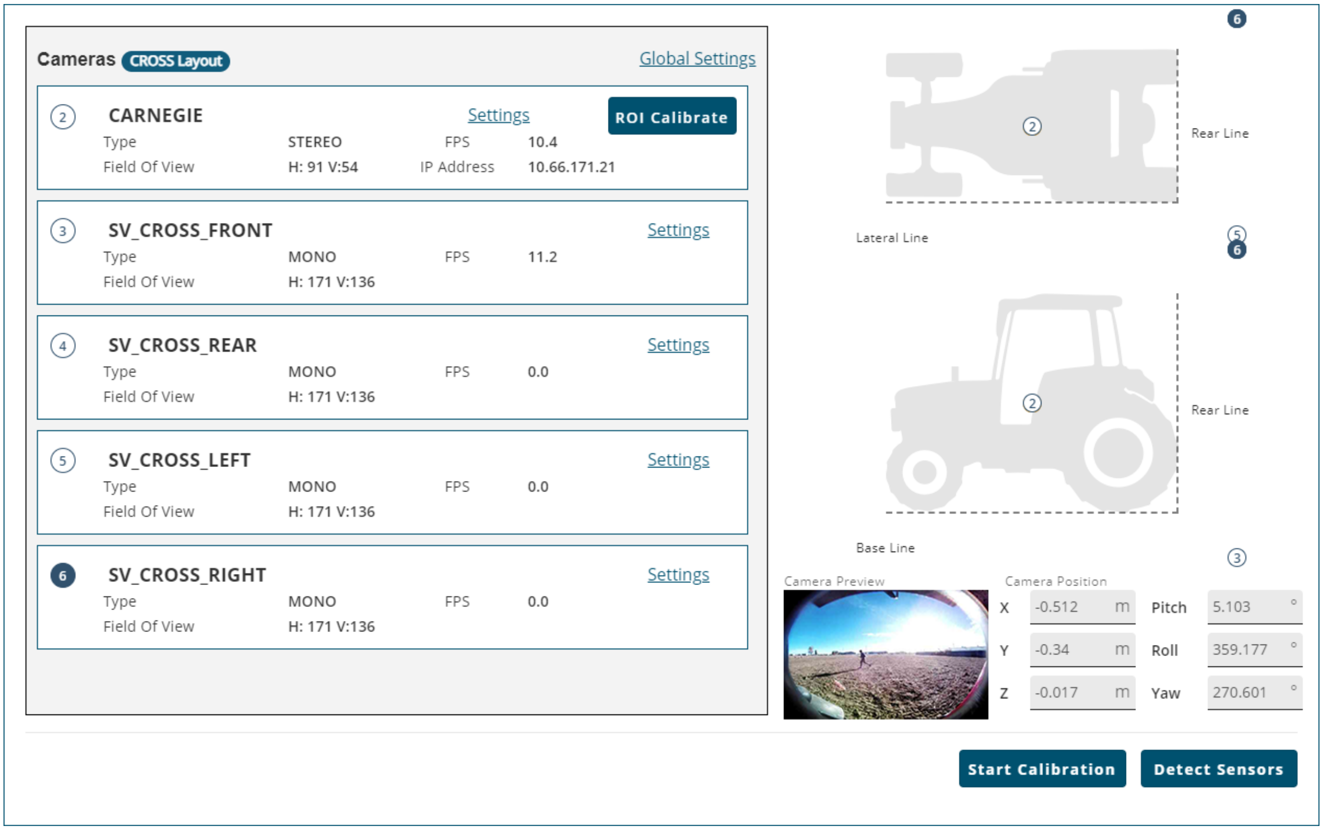
FPS

The number of frames (pictures) the camera captures per second.

To change the configuration of a camera, click the **Go to Configuration** link. See *Cameras Configuration* below for information about configuring cameras.

5.2 Cameras Configuration

The *Cameras* window provides access to the configuration parameters for the Perception system cameras.



The layout of the surround view cameras appears beside the *Cameras* heading. To change the camera layout:

1. Click the **Global Settings** link.

   The *Cameras - Global Settings* dialog box appears. From this dialog box you can change the Camera Layout, FPS and Shadow Mode.

   See *Global Settings* on the next page for information about changing the global settings.

To change the settings for a camera:

1. Click the camera to change.

   The vehicle graphic section updates to show the location information and a live view of the selected camera.

2. Click the **Settings** link for the camera.

   The *Camera Settings* dialog box appears.

   See *Camera Settings* on page 33 for information about changing the camera settings.

To calibrate the cameras:

1. Click the **Start Calibration** button.

   The *Camera Calibration* dialog box appears.

   See *Checkerboard Calibration* on page 35 for information about calibrating the cameras.

To ROI calibrate the stereo camera:

1. Click the **ROI Calibrate** button.

   The *Cameras - Calibration* screen appears.

   See *Stereo camera exposure ROI calibration* on page 34 for information about ROI camera calibration.

To detect information about the components connected the Perception ECU:

1. Click the **Detect Sensors** button.

   The *Update Sensor Config* dialog appears.

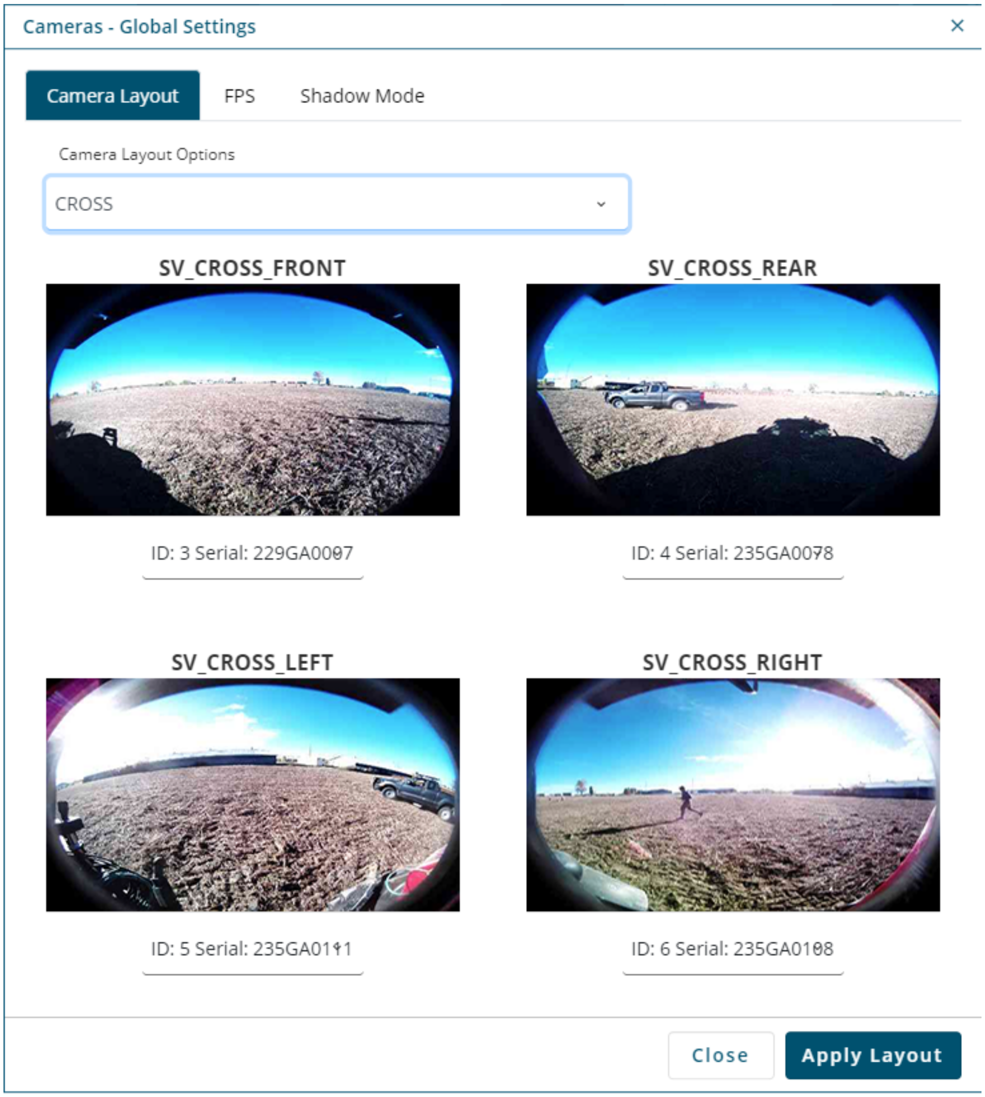
   See *Detect Sensors* on page 34 for information about detecting new cameras.

5.2.1 Global Settings

The *Cameras - Global Settings* window has three tabs that provide access to camera settings for the Perception system cameras.

Camera Layout

The Camera Layout defines the general installation location of the surround view (mono) cameras.



To change the Camera Layout:

1. Click the **Camera Layout Options** menu and select the layout, **CROSS** or **DIAG** that best represents where the surround view cameras are installed on the vehicle.
2. Click the **Apply Layout** button.

   The Perception system reboots.

When you change the Camera Layout, the previous calibration and configuration may no longer apply.
If you encounter any issues with this change, contact Hexagon Perception support at perceptionsupport@hexagon.com for assistance.

Figure 1: CROSS layout

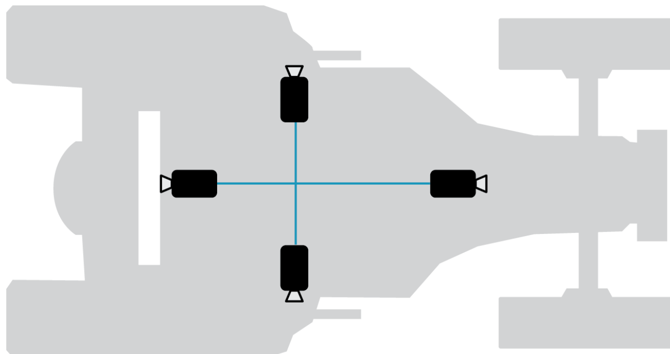
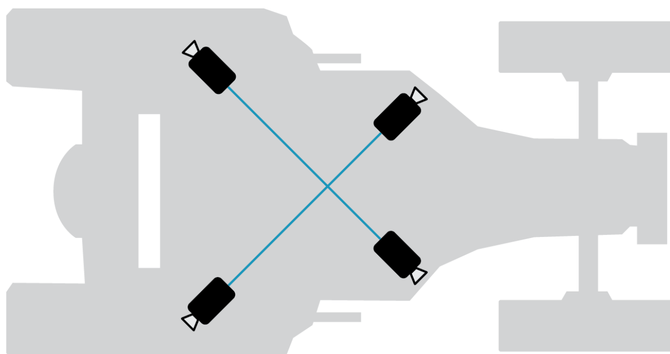


Figure 2: DIAG layout



The graphics above show the general camera locations for a CROSS or DIAG layout. In actual use, the camera locations will vary based on available mounting locations on the vehicle.

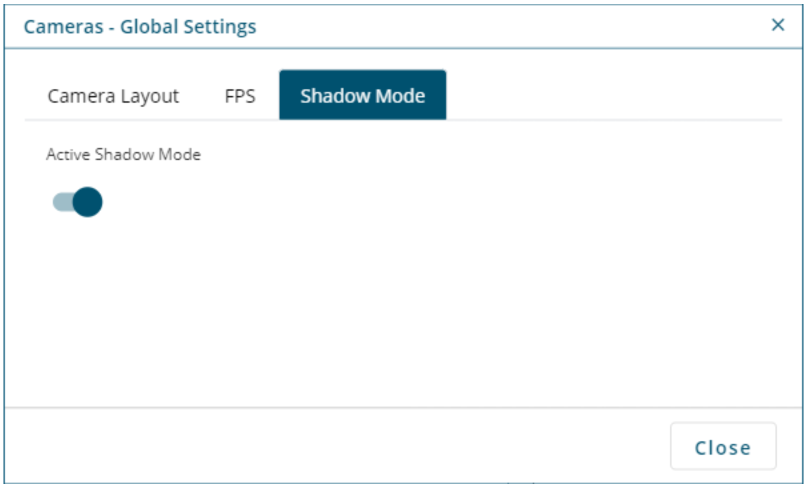
FPS

The *FPS* tab is for internal Hexagon Support use only.

Shadow Mode

Shadow Mode is an automatic recording feature used to generate training data for the Perception system. When Shadow Mode is enabled and the Perception system detects an anomaly, a short recording is made and stored on the ECU.

If the Automatic Data Upload (ADU) feature is enabled, the Perception system will automatically upload these Shadow Mode recordings to AWS.



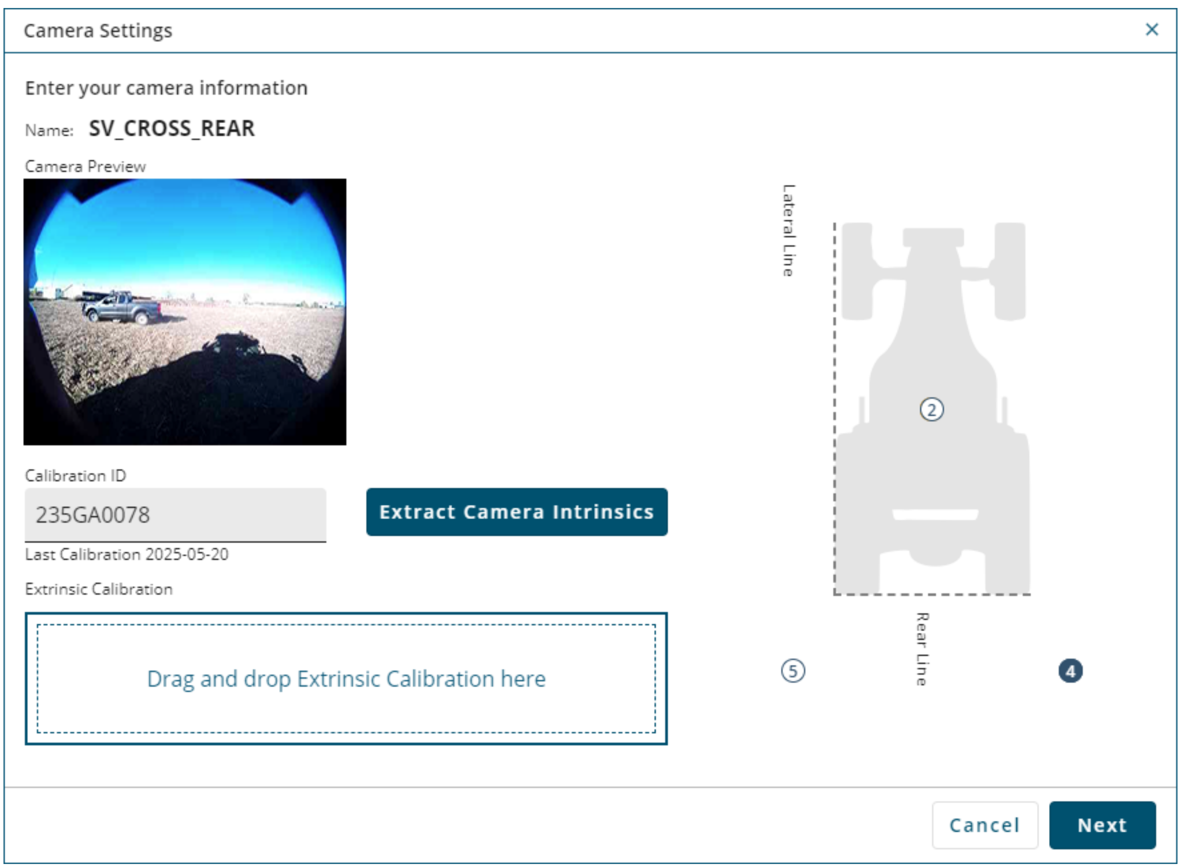
Active Shadow Mode

To enable Active Shadow Mode and allow the Perception system to automatically store recordings on the ECU, set the option button to On ().

To disable Active Shadow Mode and prevent automatic recordings, set the option button to Off ().

5.2.2 Camera Settings

From the *Camera Settings* dialog box, you can view camera information, down load the intrinsic data or load extrinsic calibration data.



Name

The name of the camera.

This name reflects the name of the camera on the *Cameras* configuration page.

The number assigned to the camera on the *Cameras* configuration page is highlighted on the vehicle graphic to shown the camera location.

Camera Preview

The current live view from the camera.

Calibration ID

The serial number of the camera.

Extract Camera Intrinsics

To save the current camera intrinsics:

1. Click the **Extract Camera Intrinsics** button.

   The *Save File* dialog box appears.
2. Navigate to the folder on the Perception Viewer computer in which the file will be stored.
3. Click the **Select Folder** button.

   The data is saved as a JSON file.

Extrinsic Calibration

To load extrinsic calibration data for the camera:

1. Drag and drop the extrinsic data file onto the **Extrinsic Calibration** box.

   Alternately, click the **Extrinsic Calibration** box, select the calibration file and click the **Open** button.
2. Click the **Next** button.
3. Confirm the extrinsic data.
4. Click the **Done** button.

5.2.3 Detect Sensors

The detect sensors process is needed only for new installations or if a sensor is replaced.

To update the extrinsics JSON file with information about the components connected the ECU:

1. Click the **Detect Sensors** button.

   The *Update Sensor Config* dialog box appears. This dialog box compares the information in the Extrinsics.json file and the sensor information detected by the ECU.
2. To update the JSON file with the information detected by the ECU, click the **Apply** button.
   The Perception system reboots.

   To keep the existing JSON file, click the **Close** button.

5.2.4 Stereo camera exposure ROI calibration

The stereo camera dynamically adjusts the light sensitivity level to ensure the best exposure level for the image. In situations where the background light is very bright, this adjustment can make other areas of the image too dark.

The stereo camera exposure ROI (Region Of Interest) calibration is used to define the area of the image the stereo camera uses to adjust the light sensitivity level. This ensures that the area of the image (ROI) important for Perception has the clearest image.

To perform a stereo camera ROI calibration using live image capture mode:

1. Click the **Configuration** menu and then select **Cameras**.
2. Click the **ROI Calibrate** button to start the stereo camera ROI calibration.
3. Click the **Capture Image** button to capture a live stereo camera image.

   A confirmation box appears to confirm a live image was properly captured.
4. Click the **Close** button to close the confirmation box.
5. Click the **Start Calibration** button to start the stereo camera ROI calibration processes.

   The user interface displays a comparison between the current ROI saved in Extrinsic and the new ROI calibration to assist in doing an adjustment of acceptance if needed.
6. Click the **Done** button to load the stereo camera ROI calibration into the ECU.

   Click the **Cancel** button to stop/exit stereo camera ROI calibration.

   Click the **Back** button to go back to the previous step in the stereo camera ROI calibration.
7. Reboot the Perception ECU.

To perform a stereo camera ROI calibration using offline image mode:

1. Click the **Configuration** menu and then select **Cameras**.
2. Click the **ROI Calibrate** button to start the stereo camera ROI calibration.
3. Click the **Upload Image** button to upload an existing stereo camera image (.png).

   A dialog box appears to confirm the image was uploaded successfully.
4. Click the **Close** button to close the confirmation box.
5. Click the **Start Calibration** button to start the stereo camera ROI calibration processes.

   The user interface displays a comparison between the current ROI saved in Extrinsic and the new ROI calibration to assist in doing an adjustment of acceptance if needed.
6. Click the **Done** button to load the stereo camera ROI calibration into the ECU.

   Click the **Cancel** button to stop/exit stereo camera ROI calibration.

   Click the **Back** button to go back to the previous step in the stereo camera ROI calibration.
7. Reboot the Perception ECU.

5.2.5 Checkerboard Calibration

The checkerboard calibration is used to accurately estimate the position of the cameras relative to the vehicle's coordinate system and generate an extrinsic calibration file.

The checkerboard calibration has four general steps which correspond to tabs on the *Cameras - Calibration* window:

- **INPUT** – In this step, the inputs necessary for calibration are entered.
- **MATCHER** – In this step, checkerboard detections/matches are obtained for each camera pair.
- **SOLVER** – In this step, the solver application uses the user inputs and checkerboard matches to output an extrinsics calibration solution.
- **UPDATE** – In this step, the calibration solution is verified and loaded onto the Perception system.

To start a checkerboard calibration:

1. Click the **Configuration** menu and then select **Cameras**.
2. Click the **Start Calibration** button to start the checkerboard calibration.

   A dialog box appears to warn that the Perception application will be stopped during the calibration.
3. Click the **Yes** button to continue.

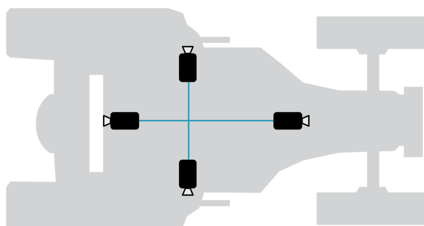
   The *Camera - Calibration* window opens showing the *Input* tab.

Input

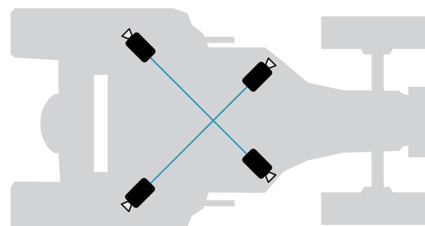
The values on the *Input* tab show the values currently stored on the ECU. The goal of this step is enter all of the information needed to start a calibration.

1. Click the drop menu in the *Camera Layout* section and select camera layout (**CROSS** or **DIAG**) that best matches the surround camera layout on the vehicle.

   CROSS

   DIAG

2. In *Checkerboard* section, enter the parameters for the checkerboard being used for camera calibration.
   a. In the **Rows** box, enter the number of rows on the checkerboard.
   b. In the **Columns** box enter the number of columns on the checkerboard.
   c. In the **Size** box, enter the height of a single square on the checkerboard in metres.
3. In the *Initial Pose* section, enter the location and orientation of the cameras.

   For the stereo camera (STEREO), the values for position and orientation must be measured accurately.

   For the surround view cameras, the values for position and orientation are estimated values. In a CROSS layout, the surround view cameras are labelled FRONT, RIGHT, LEFT and REAR. In DIAG layout, the surround view cameras are labelled FRONT_RIGHT, FRONT_LEFT, REAR_RIGHT and REAR_LEFT.

   > The estimated values can be entered as decimal numbers and must be within 0.5 metres of the actual location of the camera.

   a. In the **X** box for each camera, enter the distance along the vehicle X axis (front or back) from the vehicle reference point to the camera in metres. Forward from the vehicle reference point is a positive value and backwards is a negative value.
   b. In the **Y** box for each camera, enter the distance along the vehicle Y axis (left or right) from the vehicle reference point to the camera in metres. Left from the vehicle reference point is a positive value and right is a negative value.

c. In the **Z** box for each camera, enter the distance along the vehicle Z axis (up or down) from the vehicle reference point to the camera in metres. Down from the vehicle reference point is a positive value and up is a negative value.

d. In the **ROLL** box for each camera, enter the angular rotation of the camera around the vehicle X axis in degrees. When the camera is installed flat relative to the X axis, the roll is 0°.

e. In the **PITCH** box for each camera, enter the angular rotation of the camera around the vehicle Y axis in degrees. When the camera is installed flat relative to the Y axis, the pitch is 0°.

f. In the **YAW** box for each camera, enter the angular rotation of the camera around the vehicle Z axis in degrees. When the camera is pointing in the direction of travel for the vehicle, the yaw is 0°.

4. Click the **Set** button to save the inputs in the ECU.

   A confirmation dialog box appears.

   > If your want to go back to the values previously saved on the ECU, click the **Reload Previous** button.
   > If you would like to delete the values entered in the Input tab, click the **Clear** button.

5. Click the **Yes** button to accept the changes.

   The changes made are saved on the ECU and a check mark is added to the *Input* check box to indicate the Input stage is complete.

6. Continue to the Matcher step.

Matcher

The goal of the Matcher step is to detect the checkerboard positioned around the vehicle and obtain checkerboard matches for each camera pair. See *Checkerboard requirements* on page 39 for the requirements a checkerboard must meet to be used for calibration.

1. Click the **Matcher** tab to move to the *Matcher* screen.
2. Click the **Run** button.

   The **MATCHER RUNNING** box turns green to indicate the Matcher process has started.

   The **RECEIVING DATA** box turns green to indicate that image streams are being received.

3. Position the checkerboard in a location that it is in view of at least two cameras.

   When a checkerboard is detected, the check box beside the camera name turns green.

   See *Checkerboard positioning* on page 46 for information about how to place the checkerboard for best results.

4. The matcher process starts collecting matches for the camera pairs that have detected the checkerboard. The progress of the matching is shown in the *Progress* section.

   When at least 10 matches are collected for the camera pair, the progress bar is all green.

5. Move the checkerboard to a new location so an unmatched camera pair can detect the checkerboard.

   Wait until at least 10 matches are collected for the camera pair.

6. Repeat step 5 until at least 10 matches are collected for all camera pairs.
7. Click the **Stop** button.

   A confirmation dialog box appears.

> The matcher process can be paused before all matches are made by clicking the **Stop** button.
> To resume collecting matches, click the **Run** button.
> To clear the currently collected matches, click the **Clear** button.

8. Click the **Done** button to save the matched pairs.

   A check box is added to the *Matcher* box in the *Calibration Progress* bar.

9. Continue to the Solver step.

Solver

The goal of the Solver step is to use the user inputs and checkerboard matches to output an extrinsics calibration solution.

1. Click the **Solver** tab to move to the *Solver* screen.
2. Click the **Run** button to start the Solver.

   A confirmation dialog appears.

3. Click the **Done** button.

   The status text changes from *Solver Idle* to *In Progress*.

   The fields in the *Status* section update to show the progress of the Solver process.

4. When the Solver process finishes successfully, the Solver process stops and the status text changes to *Finished - Good Solution*. The best solution is saved and a check box is added to the *Solver* box in the *Calibration Progress* bar.

   > The Solver can also stop if the process exceeds the time limit before finding a solution. The status text changes to *Solver Time Out*.
   > Rerun the *Input* and *Matcher* steps to use different inputs and matches for the next solver iteration. Run the Solver step again.

   > The Solver can also stop if a solution is found but the Average Cost is too high. The status text changes to *Finished Check Solution*.
   > Review the extrinsics calibration solution. If the solution appears invalid, rerun the *Input* and *Matcher* steps to use different inputs and matches for the next solver iteration. Run the Solver step again.

   > To pause the Solver process, click the **Stop** button.

5. Continue to the Update step.

Update

The goal of Update step is to verify the solution generated and load the extrinsics calibration file onto the ECU.

1. Click the **Update** tab to move to the *Update* screen.

   The *Update* screen shows the current calibration data stored in the ECU and the best solution data from the current calibration.

2. Check the data for the Best solution to determine if the calibration solution is acceptable.

3. If the solution is acceptable, click the **Update Extrinsic** button to update the Extrinsic JSON files in the ECU.

   A confirmation dialog box appears.

4. Click the **Done** button.

   The camera calibration is completed.

   A check box is added to the *Update* box in the *Calibration Progress* bar.

5. Click the **X** button on the *Camera - Calibration* screen to close the window.

5.2.6 Checkerboard requirements

The checkerboard used for camera calibration must meet several quality checks to ensure a good camera calibration.

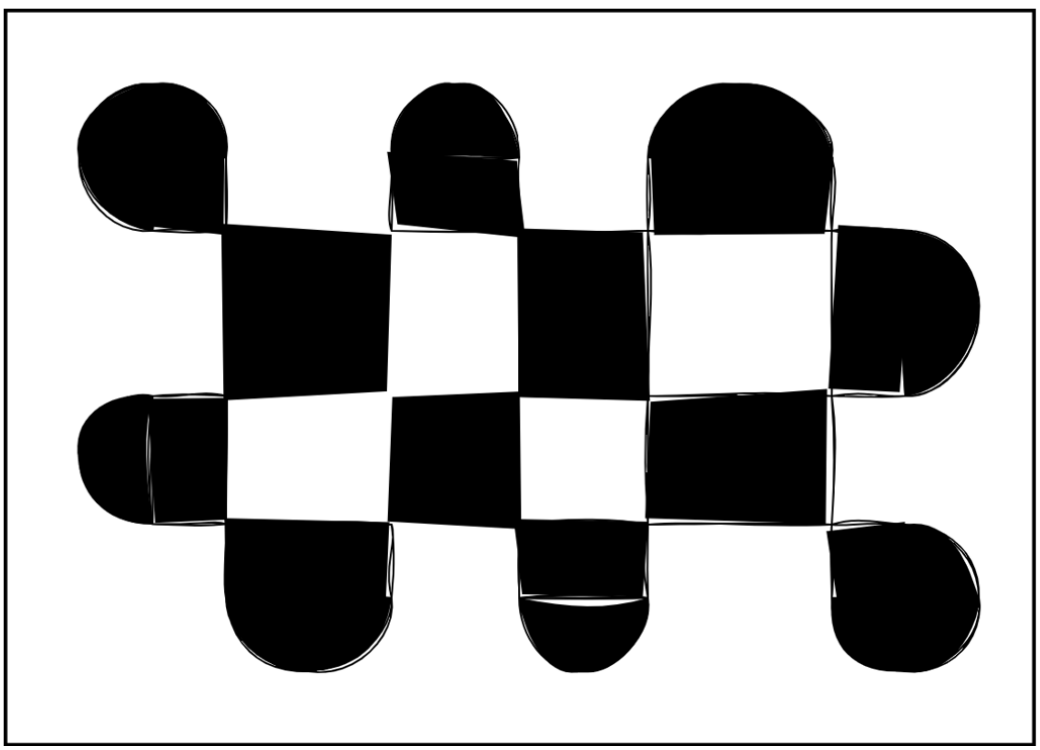
Visual quality verification

Use the following procedure to access the visual quality of the checkerboard pattern.

1. Visually inspect the smoothness of the checkerboard pattern.

   If the pattern appears rough, ripply or jagged, the checkerboard is not acceptable to be used for calibration.

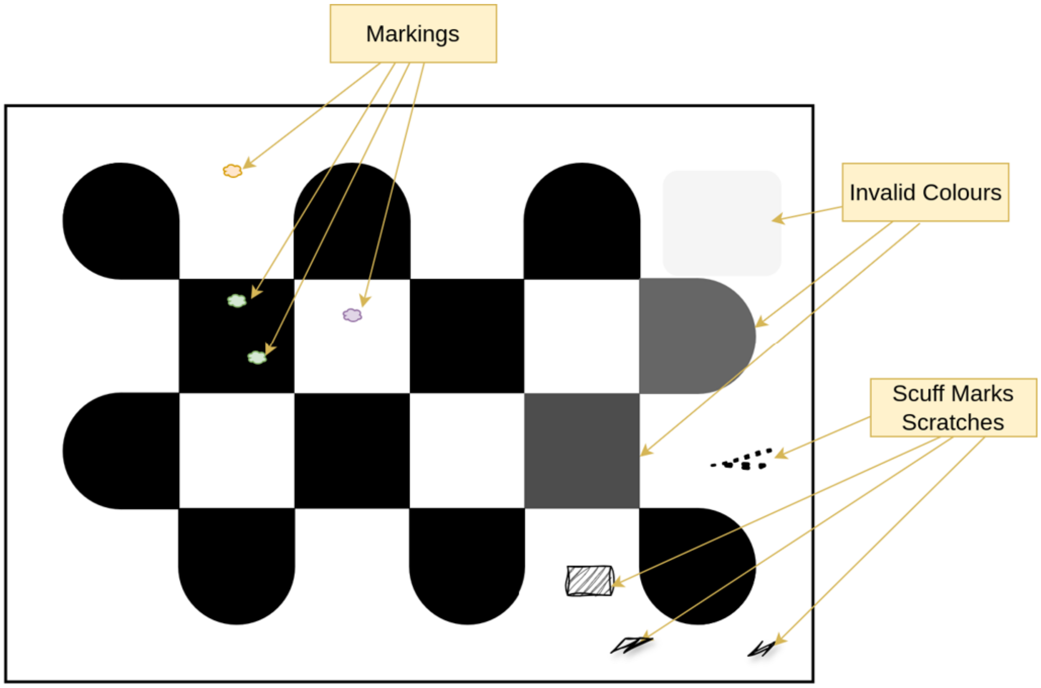
   The checkerboard below has several pattern errors.



2. Visually inspect and ensure that the checker squares are black without other markings, scratches or colours. Also ensure the other regions are white.

If there are visual defects, try to remedy the board by removing the invalid colours and markings. If the visual defects can not be remedied, the checkerboard may need to be replaced.

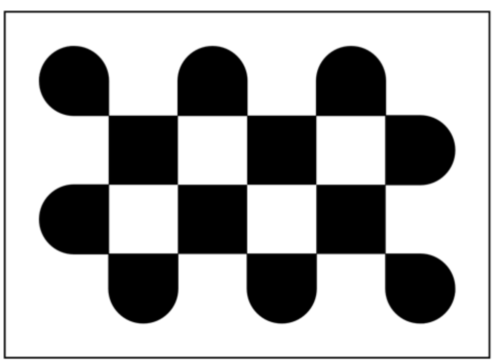
Below is an illustration of a checkerboard with various visual defects.



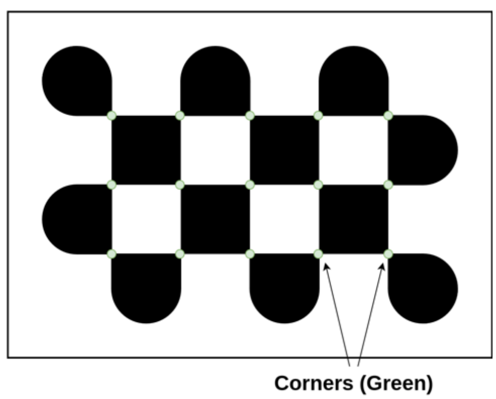
Checker size verification

> For the examples below, an arbitrary 1x1 (unitless) checker size is used to make it easier to illustrate. The same concepts can be applied to a 120mm x 120mm checker size.

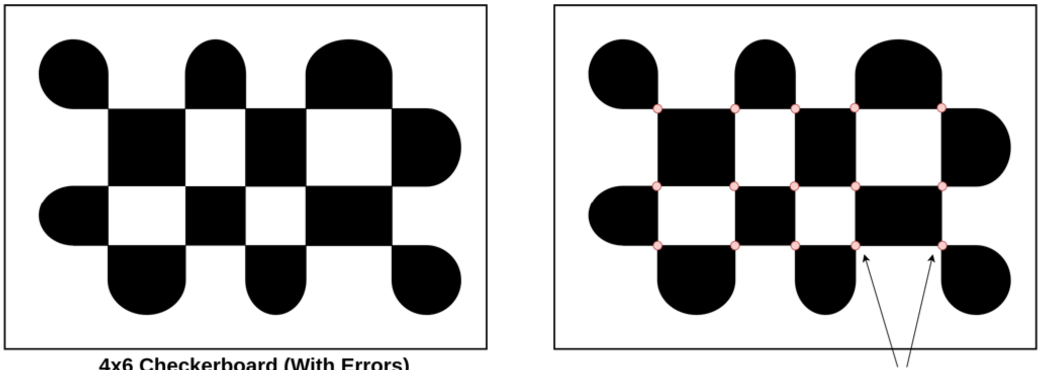
A diagram of a perfect 4x6 checkerboard pattern with a 1x1 unit checker size (with 15 corners) is shown below.



4x6 Checkerboard (No Errors)



A corresponding printed checkerboard pattern with minor errors is illustrated below.



4x6 Checkerboard (With Errors)

Printed Corners (Red)

The following procedures are recommended to measure whether the checkerboard meets checker size tolerances.

Horizontal Error Checks

For this procedure, use a precise ruler with a straight edge, preferably with a length that is longer than the longest side of the pattern. The ruler markings should have mm markings, if not sub-millimeter markings.

1. Align the ruler horizontally along the first row to measure the first row corner points.

   Make sure that the left edge of the ruler is aligned with the left edge of the checkerboard **pattern**, and not the checkerboard itself.

2. Since the checkerboard has 6 columns and the checker size is 1x1, we expect the corner points to be at **1**, **2**, **3**, **4** and **5** on the ruler.

   In *Figure 3: Horizontal checker errors* on the next page, the expected points are shown as green lines.

> For a 120mm x 120mm checker size, the points will be at 120mm, 240mm, 360mm, 480mm and 600mm.

3. Measure the exact horizontal positions of the corner points.

   In *Figure 3: Horizontal checker errors* on the next page, the measured points are shown as red lines.

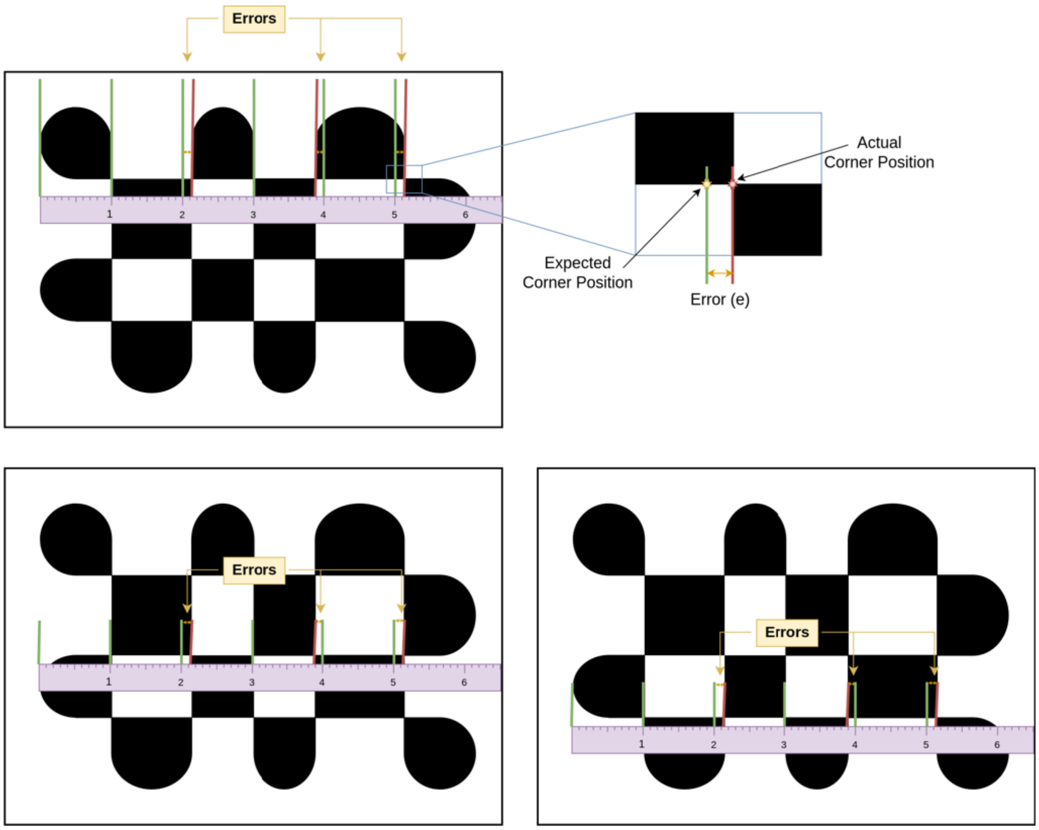
4. The absolute error (e) is taken to be: **abs(expected position - measured position)**.

   In *Figure 3: Horizontal checker errors* on the next page, the errors are shown as orange arrows.

5. If the absolute error (e) is above the acceptable tolerance (1mm), the checkerboard is not acceptable to be used for calibration.

6. Repeat steps 1 to 5 for the remaining rows in the checkerboard pattern.

Figure 3: Horizontal checker errors



Vertical error checks

For this procedure, use a precise ruler with a straight edge, preferably with a length that is longer than the longest side of the pattern. The ruler markings should have mm markings, if not sub-millimeter markings.

1. Align the ruler vertically along the first column to measure the first column corner points.

   Make sure that the top edge of the ruler is aligned with the top edge of the checkerboard **pattern**, and not the checkerboard itself.

2. Since the checkerboard has 4 rows and the checker size is 1x1, we expect the corner points to be at **1**, **2** and **3** on the ruler.

   In *Figure 4: Vertical checker errors* on the next page, the expected points are shown as green lines.

   > For a 120mm x 120mm checker size, the points will be 120mm, 240mm, and 360mm.

3. Measure the exact vertical positions of the corner points.

   In *Figure 4: Vertical checker errors* on the next page, the measured points are shown as red lines.

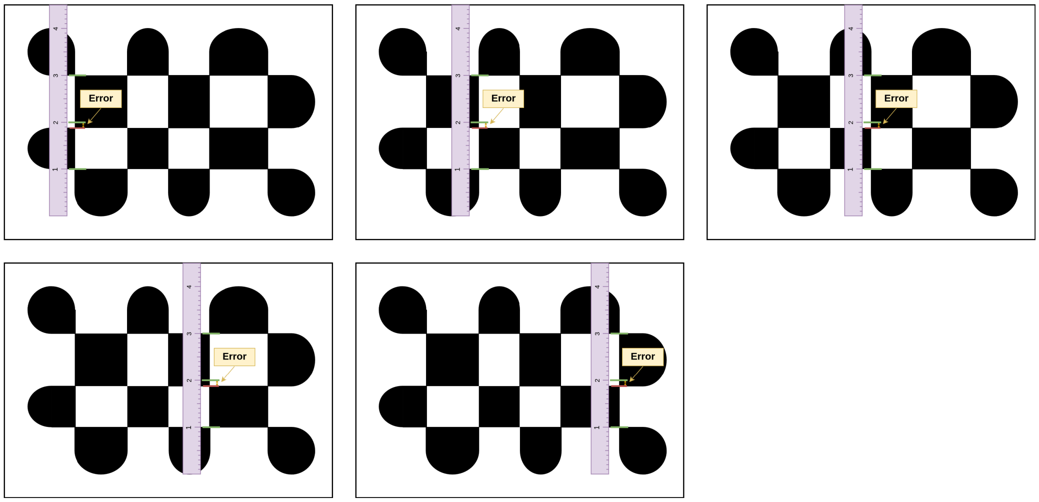
4. The absolute error (e) is taken to be: **abs(expected position - measured position)**.

   In *Figure 4: Vertical checker errors* on the next page the errors are shown as orange arrows.

5. If the absolute error (e) is above the acceptable tolerance (1mm), then the checkerboard is not acceptable to be used for calibration

6. Repeat steps 1 to 5 for the remaining columns in the checkerboard pattern

Figure 4: Vertical checker errors

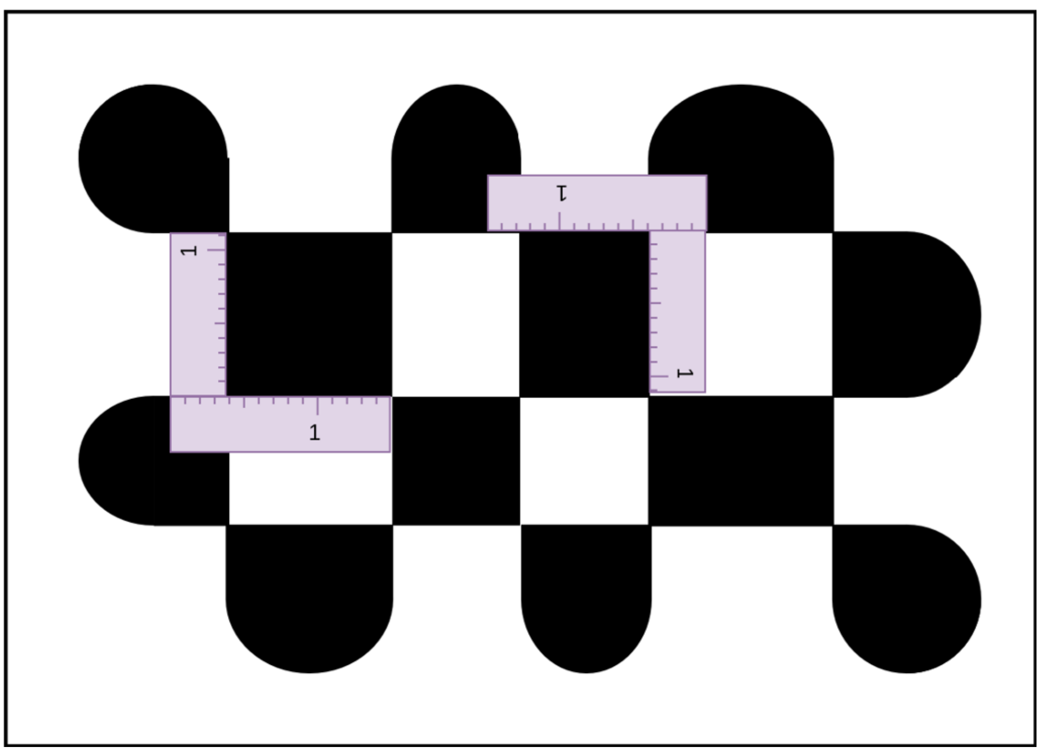


Squareness check

For this procedure, use a set square or right angled ruler to measure for 90 degree corners.

1. Use the set square/right angled ruler to ensure that each checker corner has 90 degree angles between adjacent edges.
2. If a checker square is not reasonably "square" in shape, then the checkerboard is not acceptable to be used for calibration.

Figure 5: Squareness error check



Checkerboard flatness verification

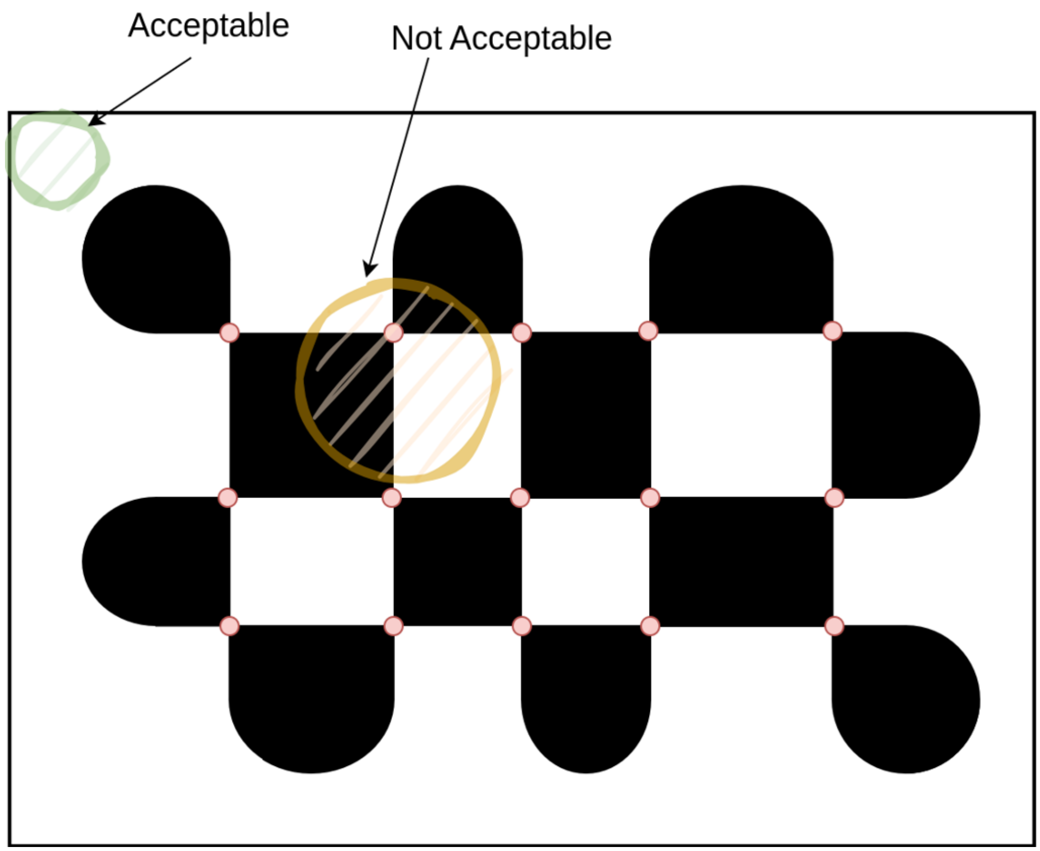
For this procedure, you need a straight ruler and a flat level.

1. Visually inspect the checkerboard for signs of obvious warpage, dents or protrusions.

   If these issues are outside of the checkerboard pattern (green region in *Figure 6: Localised level errors* below), the checkerboard may still be acceptable for calibration as long as it is not too pronounced.

   If these issues are inside the checkerboard pattern (orange region in *Figure 6: Localised level errors* below), the checkerboard is not acceptable to be used for calibration.

Figure 6: Localised level errors



2. Place the checkerboard face up on a flat surface.
3. Place a long level on top of the checkerboard along a row (or column).
4. Find the corner that dips the lowest from the level.

   In *Figure 7: Checkerboard level measurement convex* on the next page and *Figure 8: Checkerboard level measurement concave* on the next page the corners are indicated with green lines.

   Note that this does not mean measuring the largest dip on the entire checkerboard.
5. Measure the largest error from the dip to the level using a straight ruler.

   Refer to *Figure 7: Checkerboard level measurement convex* on the next page and *Figure 8: Checkerboard level measurement concave* on the next page. for examples of this measurement.
6. If the error is more than the acceptable flatness tolerance (3mm), then the checkerboard is considered not acceptable for calibration.
7. Perform step 3 to 6 for the remaining rows and columns.

Illustrations below shows an example of checking for flatness with a checkerboard pattern that has a convex and concave warp:

Figure 7: Checkerboard level measurement convex

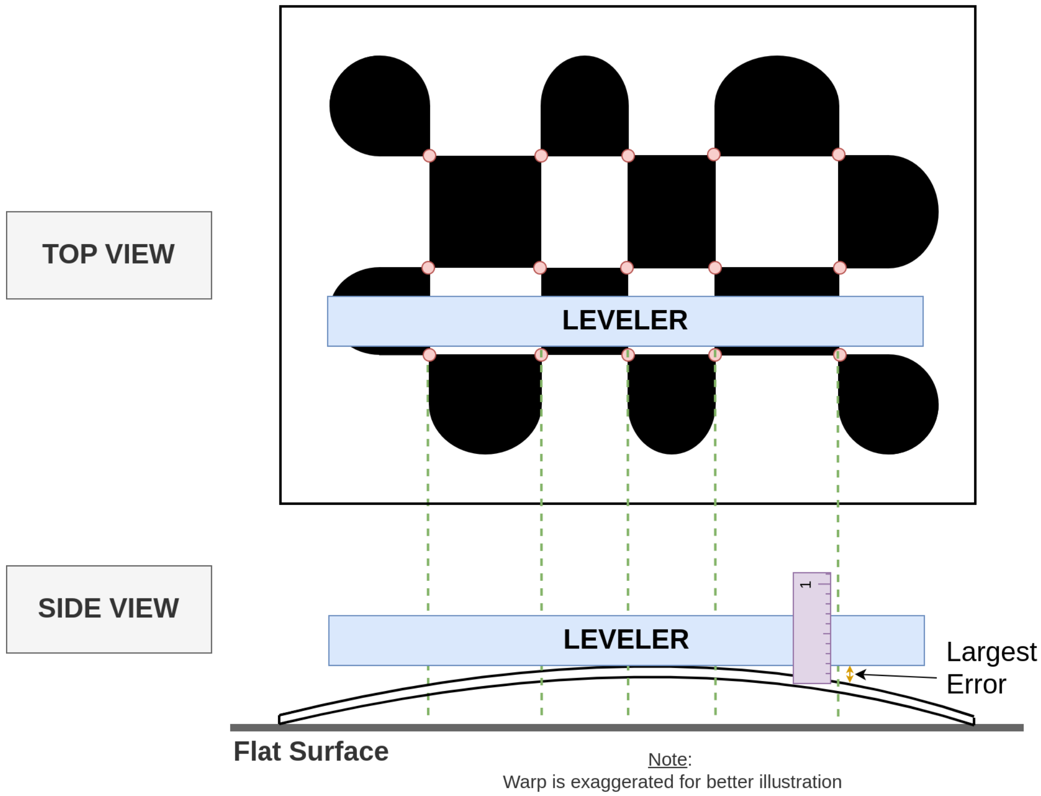
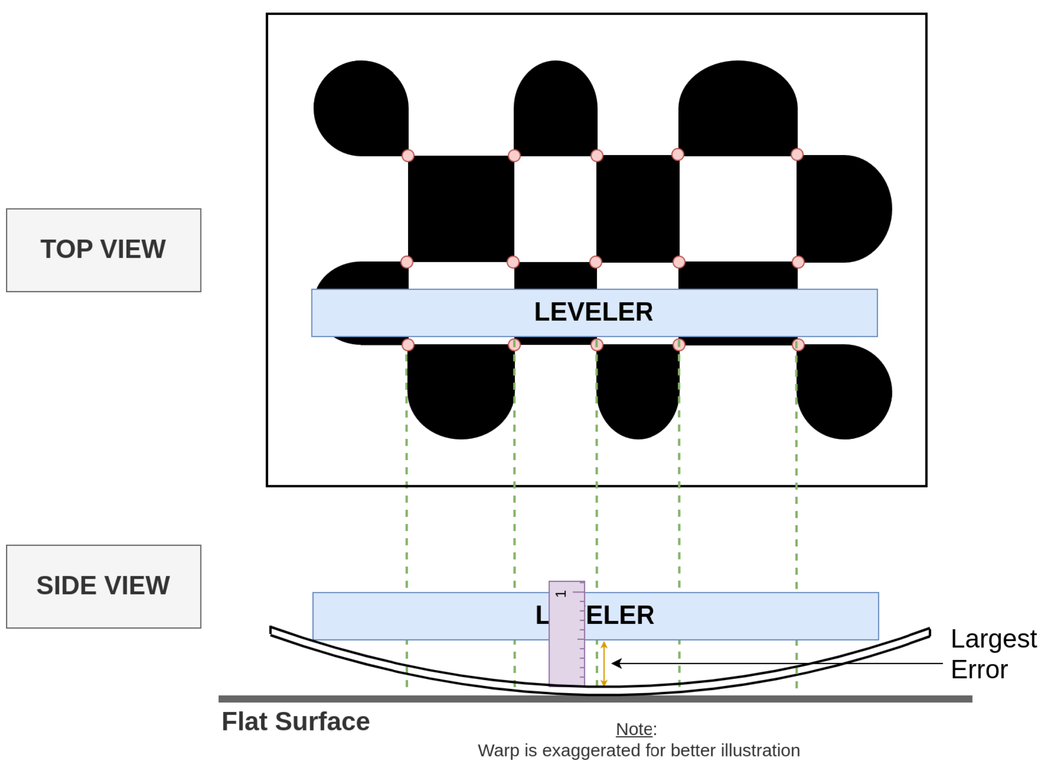


Figure 8: Checkerboard level measurement concave



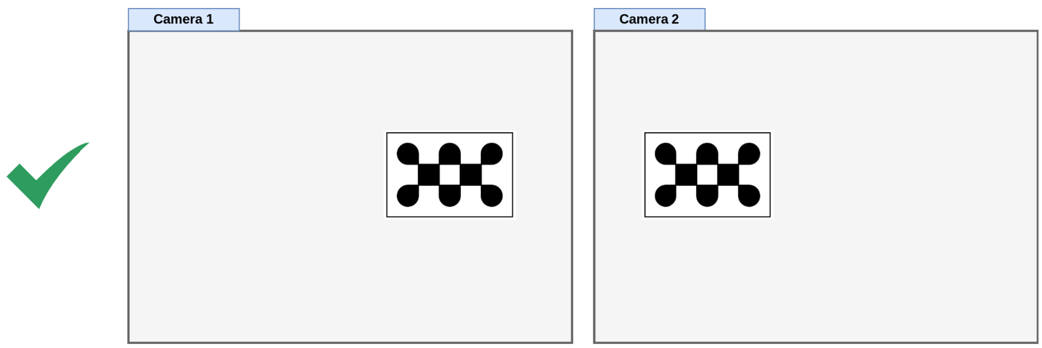
5.2.7 *Checkerboard positioning*

This section outlines the preferred positioning of the checkerboard pattern for the matcher to produce more effective matches.

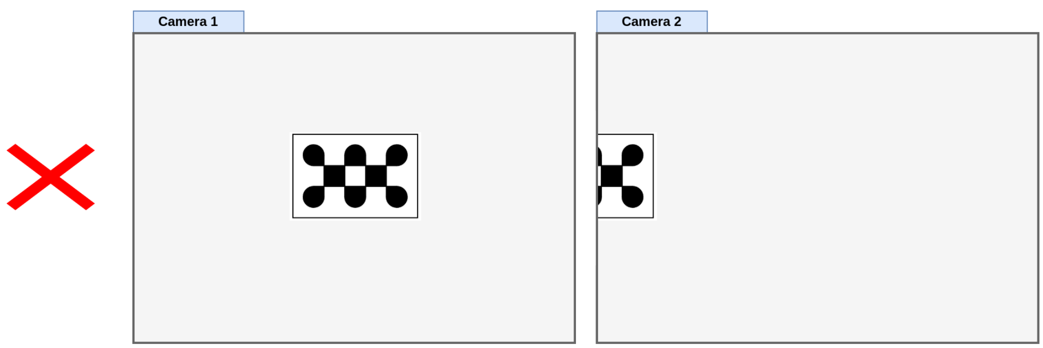
Matching objectives

A match is when the matcher can detect all of the checkerboard corner points when the checkerboard is in the overlapping field of view of two cameras.

For example, the diagram below shows a good checkerboard position, where the two camera images have the same checkerboard pattern in full view.



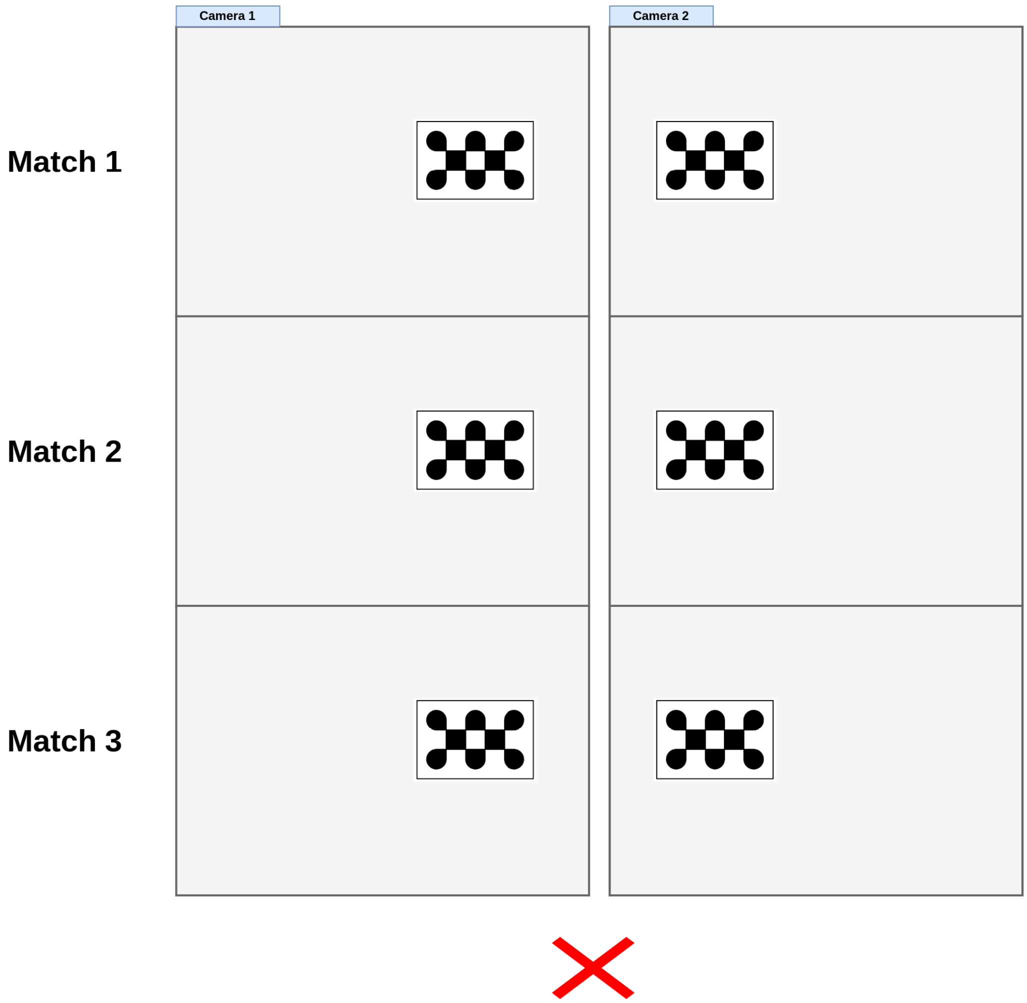
The next example shows a bad checkerboard position, where one or more camera images have a partial or no checkerboard pattern in sight.



The main goal to get effective calibration solutions is to vary the positions of the checkerboard so that it maintains the checkerboard in full view between the two cameras, while varying positions to have a variety of poses for the solver to use for finding camera extrinsics.

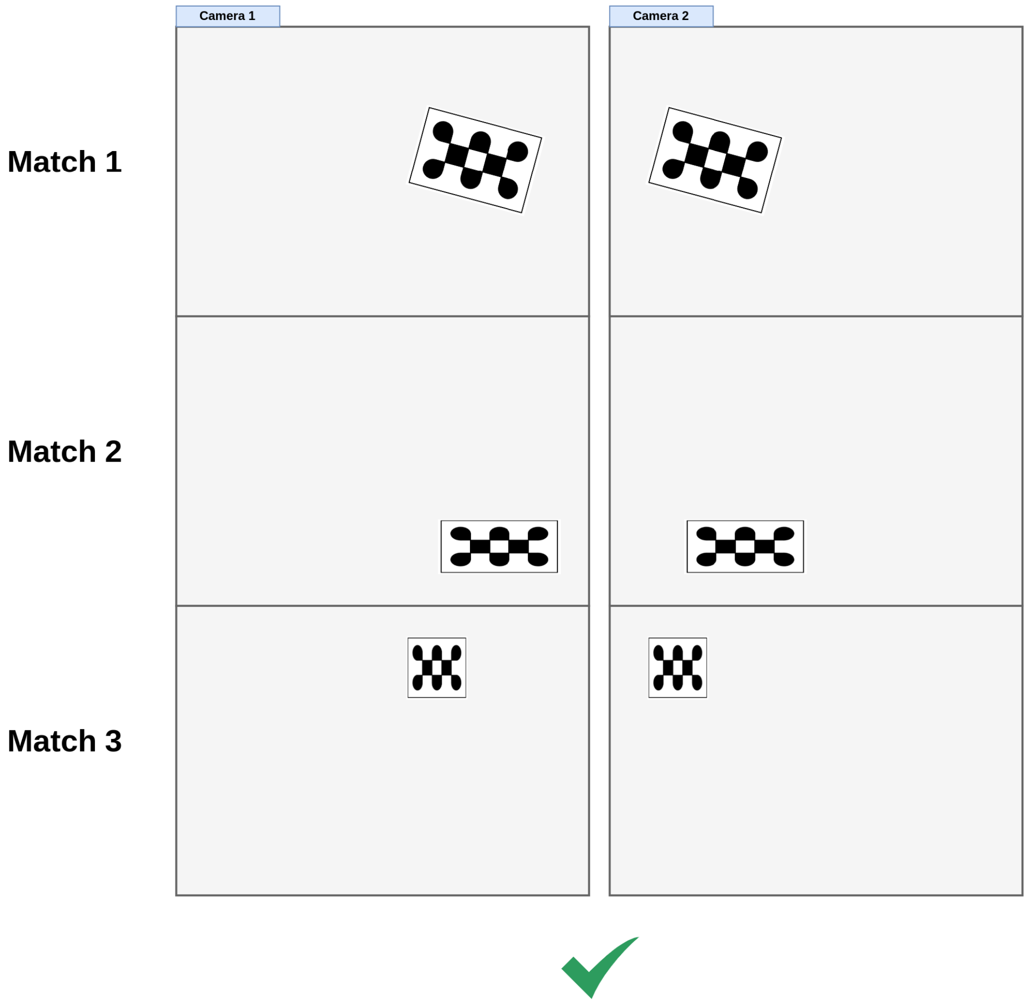
Figure 9: Static checkerboard poses on the next page shows an example of what not to do, which is to keep the checkerboard in one position to obtain all of the required amount of matches for each pair of cameras.

Figure 9: Static checkerboard poses



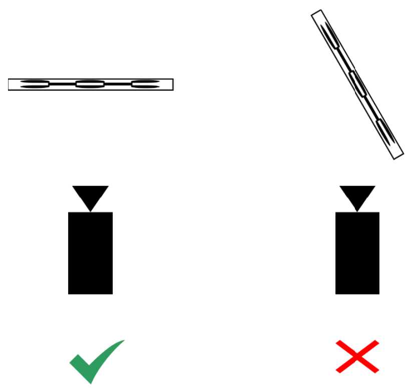
Instead, the aim is to change the poses while keeping the entire checkerboard in clear view between the cameras.

Figure 10: Varied checkerboard poses



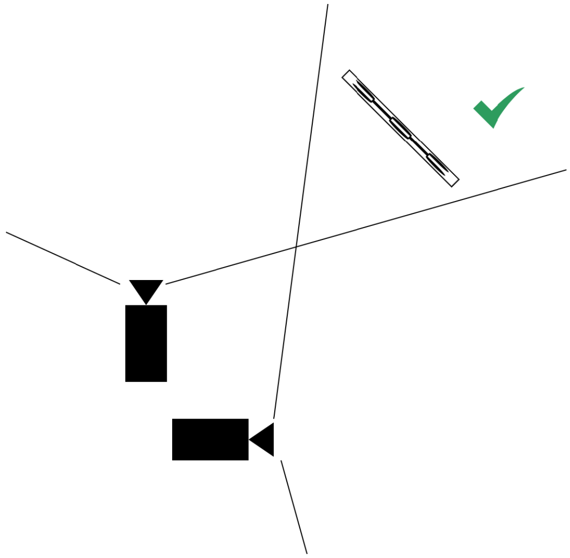
Direction of checkerboard relative to cameras

Always try to face the checkerboard directly at the camera. In the illustration below the left side shows a good example with the checkerboard facing directly at the camera, while on the right side shows a poor example where the checkerboard is highly tilted and not facing the camera.

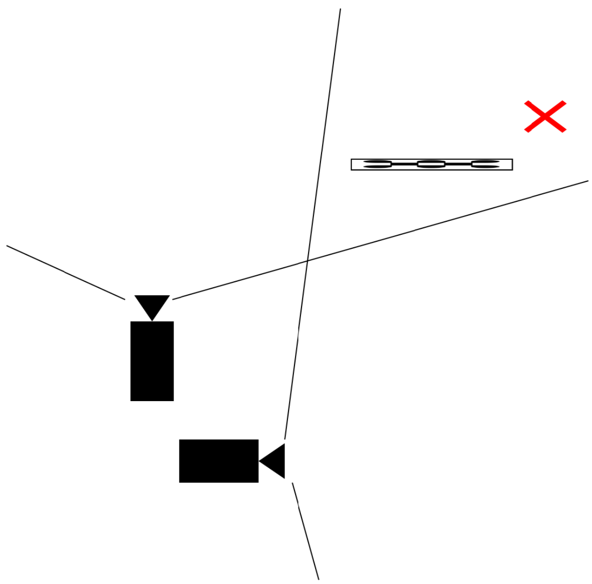


The goal is to maximise the checkerboard region on the camera image and minimise the checkerboard skew. Some skew is okay, but a highly skewed checkerboard image is harder to detect.

For camera pairs that are in facing right angles to one another, the checkerboard pattern must balance the between the two cameras. The illustration below shows an example of a good checkerboard direction, followed by a bad direction.



Good checkerboard direction to show the checkerboard as much as possible in both images

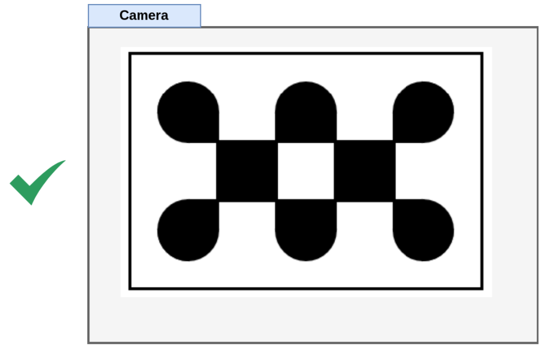


Bad direction of the checkerboard. Both cameras will see a highly skewed checkerboard pattern.

Checkerboard placement on image

Keep the checkerboard as close to the cameras as possible to maximise the checkerboard size in the image as this will help the detections.

The following image shows an exaggerated example of a close up checkerboard and a very far away one, to show that the detector will obviously find it easier to detect the top checkerboard as opposed to the bottom one. In practice, the checkerboard size will be in between the top and bottom samples, as the user will need to be a certain distance away in order to be in the overlap region between the two cameras.



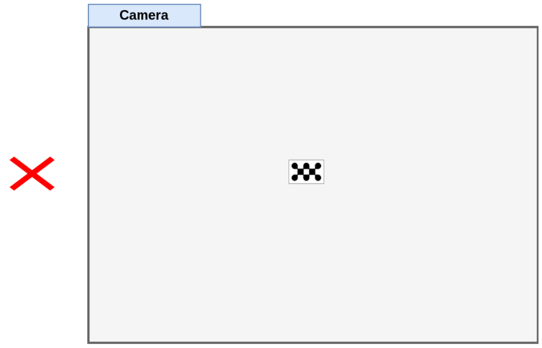


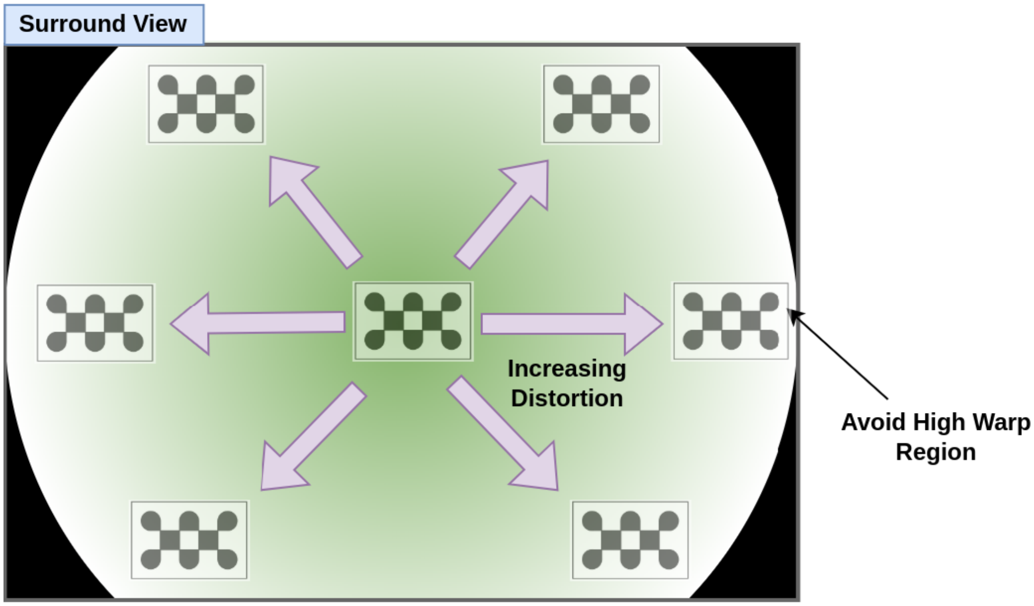
Image warping

In addition to pose variation, care must be taken to avoid checkerboard image warping as much as possible due to lens distortion. This is most prevalent for the surround view cameras as opposed to stereo cameras. The surround view cameras have a lot of distortion the closer to the edge of the image, whereas the stereo camera has very little distortion in comparison.

Surround view cameras

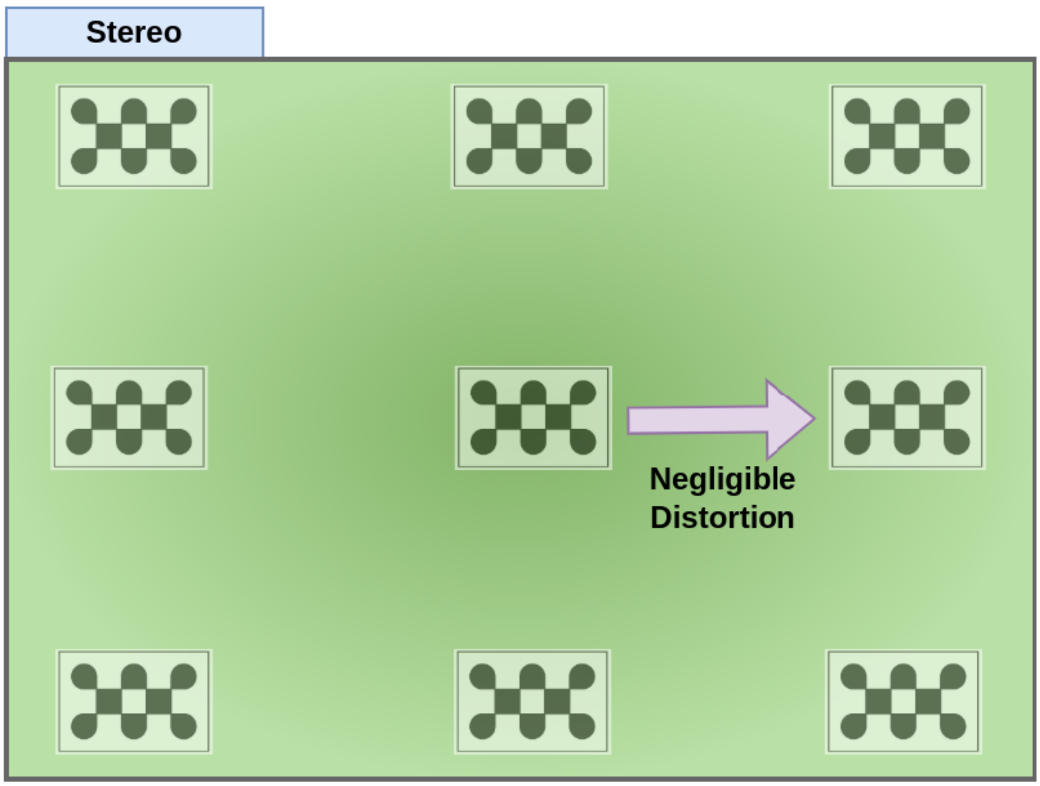
For the surround view cameras, the centre of the image is typically the least distorted and the image gets more distorted as the checkerboard moves towards the edge. See the following diagram to illustrate this. The more green the pixel, the less distortion there is, while the more white the more distortion.

For surround view cameras, keep the checkerboard closer to the centre of the image. Do not have the checkerboard touching the edge of the lens/high warp region.



Stereo Cameras

For stereo cameras, the checkerboard can generally be anywhere on the image without worry about significant distortion effects.

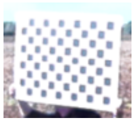


Lighting effects

The detector expects a perfect checkerboard image, so lighting plays an important role in detection. If the checkerboard is too dark or too bright then it will decrease the performance of the detector.

If possible, avoid glare, reflections and washout on the checkerboard from bright light sources (i.e. the sun) to improve accuracy of the detections and make it easier to detect the checkerboard. While not always true, indoor environments tends to be more favourable to produce more accurate matches.

Some examples of bright light sources affecting the pattern are shown below.





Changing positions for matching

Motion blur affects the precision of the checkerboard corner detections. As such, the following method is proposed to choreograph changing between different checkerboard poses to collect matches.

Use the stop-move-stop technique.

1. Stop and hold the checkerboard in place for a few seconds to collect 1 or 2 matches.
2. Move checkerboard to a position seen by both cameras.
3. Stop and hold the checkerboard in place for a few seconds to collect 1 or 2 matches.
4. Repeat steps 1-3 until there are a sufficient number of matches.

This method will help the matcher take better “snapshots” for each checkerboard match, and avoid “motion blur” affects on the checkerboard target image.

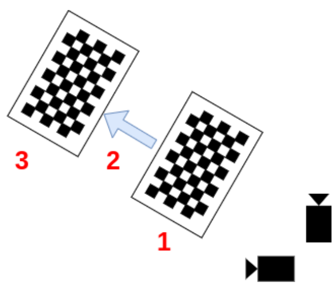


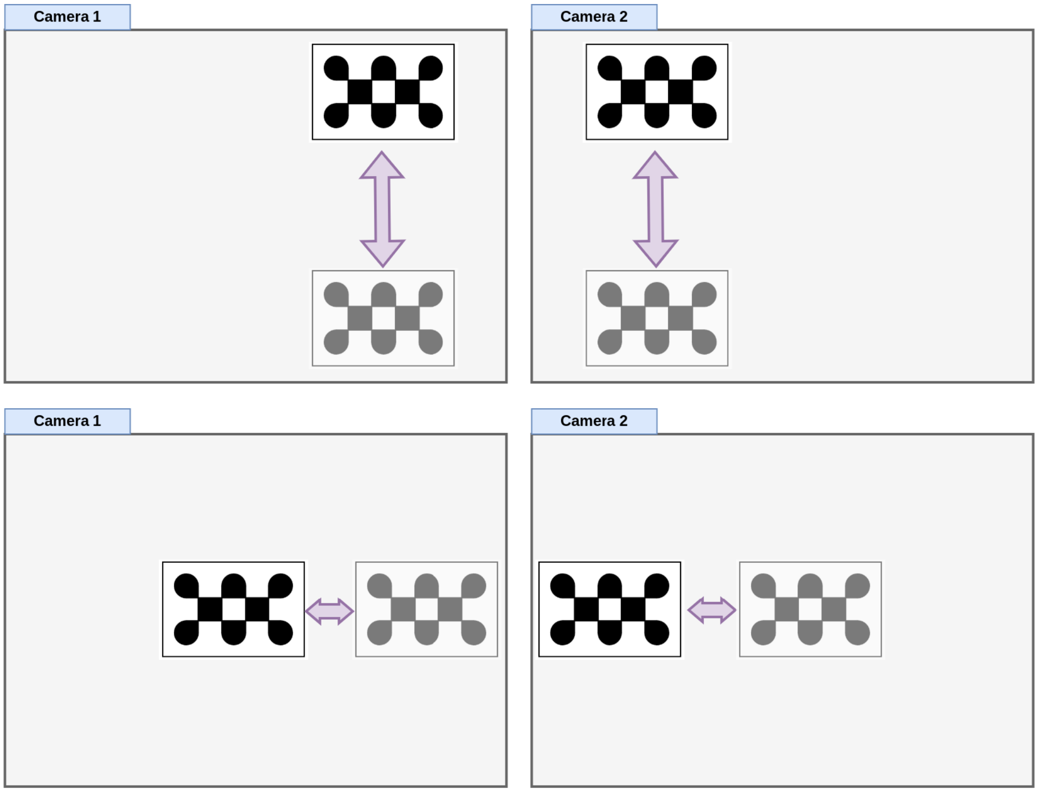
Illustration of the stop-move-stop technique

Pose variations

The following sections describe individual types of pose variations. The user can use single pose variations or a combination of pose variations for collecting matches.

Up-down and left-right position

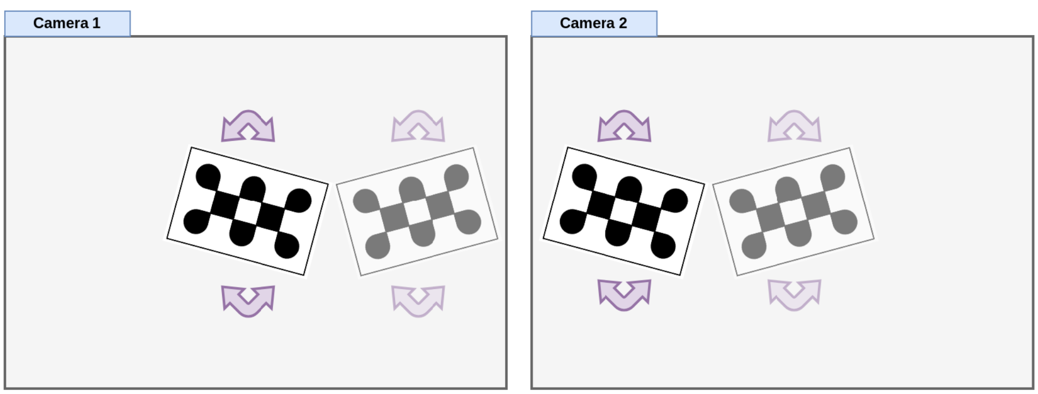
You can move the board up and down or left and right, as shown in the following diagrams.



Care must be taken to avoid having the checkerboard be within highly distorted regions of the image, as described in *Image warping* on page 50. As long as the full checkerboard is still in view for both images and not highly distorted then the pose is valid.

Sideways tilt

Below is an illustration of a sideways tilt.



The tilt should not be too much. Keep the tilt below 30 degrees both ways.

Up-down and left-right tilt

Below are illustrations of the up-down and left-right tilts.

Figure 11: Up-down tilt

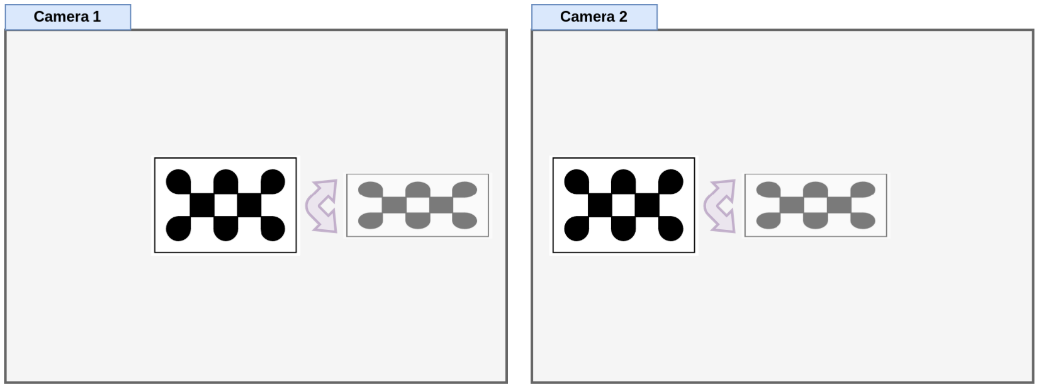
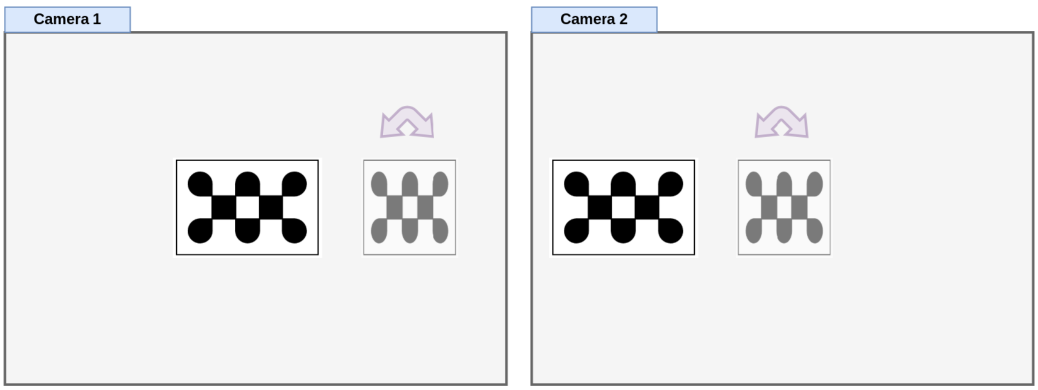


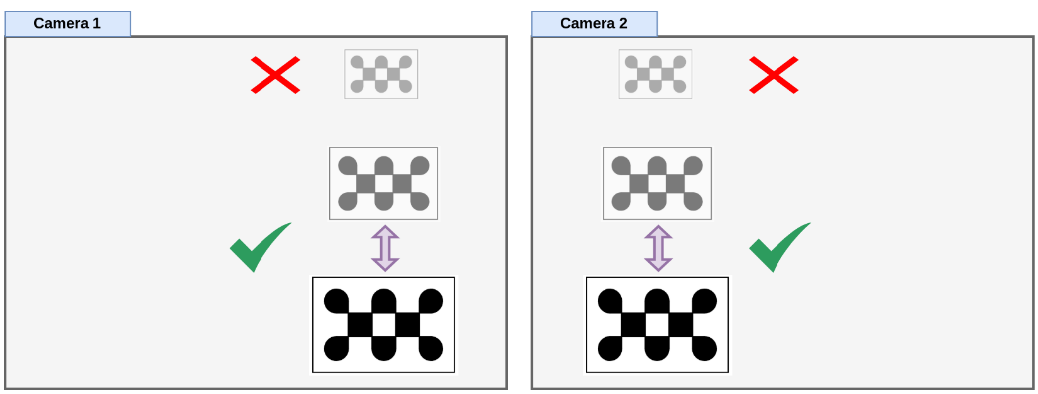
Figure 12: Left-right tilt



Because care must be taken to keep the direction of the board facing both cameras as much as possible, the up-down and left-right tilts should be small. Keep these tilts below 30 degrees in both ways.

Distance from camera

The user can move back and forward (away or toward) the cameras. This will increase or decrease the checkerboard size in each image. See an illustration below.



As described in *Checkerboard placement on image* on page 49, care must be taken not to move too far away from the cameras so that the detector can still detect the checkerboard corners.

5.3 Logging Configuration

The *Logging* configuration window is for internal Hexagon Support use only.

Chapter 6 Settings

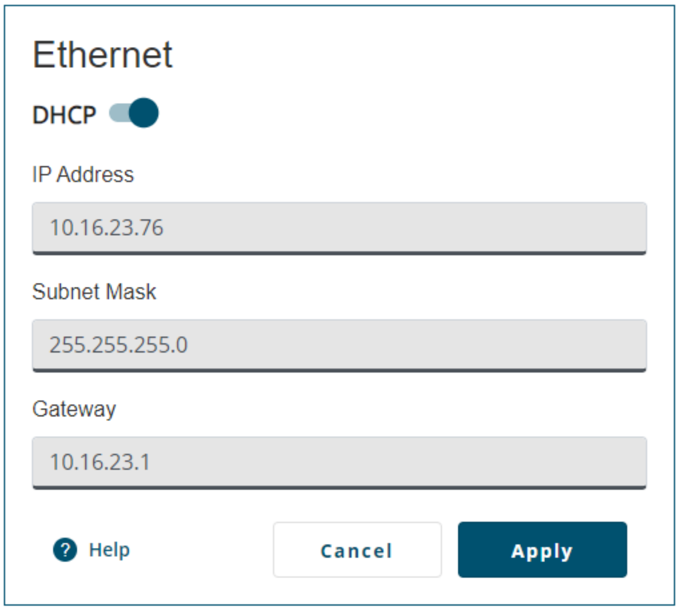
Use the *Settings* window to configure the Ethernet network settings for the ECU.

6.1 Vehicle Setup

The *Vehicle Setup* window is for internal Hexagon Support use only.

6.2 Network Settings – Ethernet

Use the *Ethernet* tile to configure the Ethernet interface on the Perception ECU.



If the receiver is connected to a network that uses DHCP:

1. Set the *DHCP* switch to **On** ( ) to enable DHCP.
2. Click the **Apply** button.

   The *IP Address*, *Subnet Mask* and *Gateway* fields displays the network settings assigned to the receiver.

If the receiver is being configured to use a static IP address:

1. Set the *DHCP* switch to **Off** ( ) to disable DHCP.
2. In the *IP Address* box, enter the IP address for the receiver.
3. In the *Subnet Mask* box, enter the subnet mask for the receiver.
4. In the *Gateway* box, enter the IP address of the gateway.
5. Click the **Apply** button.

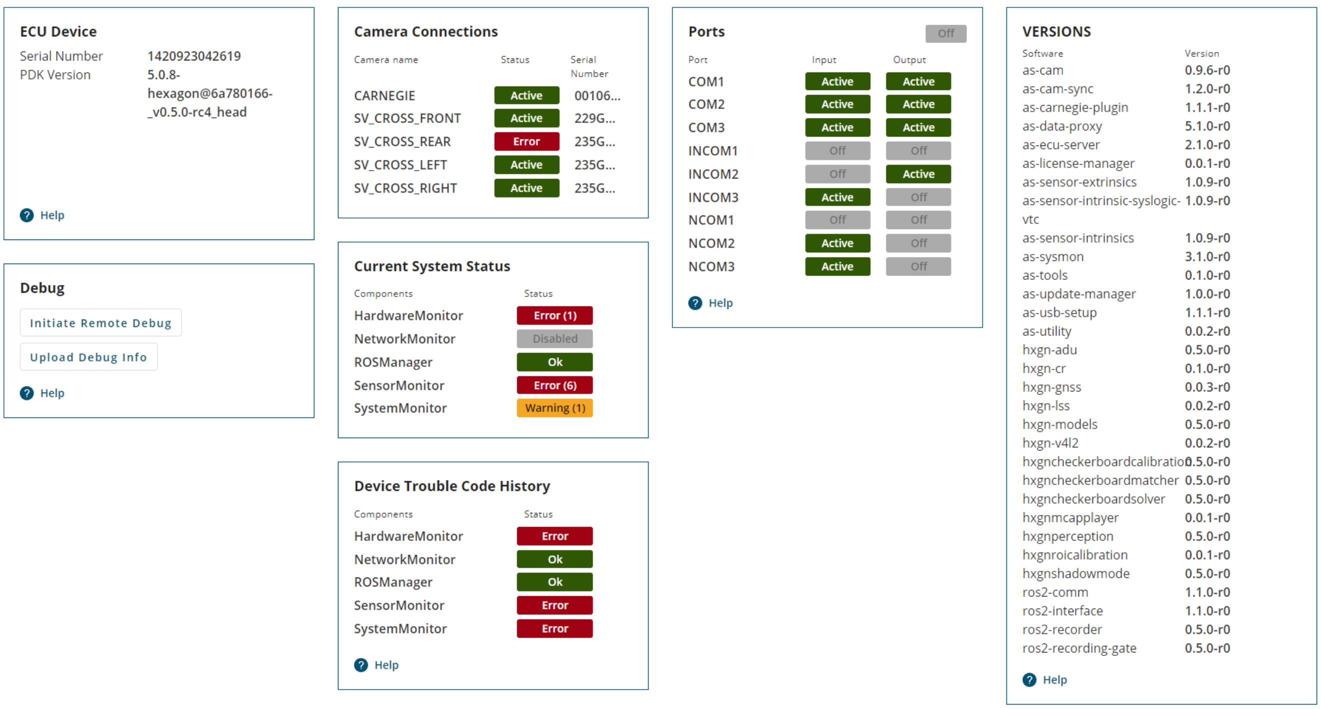
Chapter 7 Device

From the Device menu you can view the status information for the Perception system components, export data stored on the ECU or restart the system.

7.1 Details Window

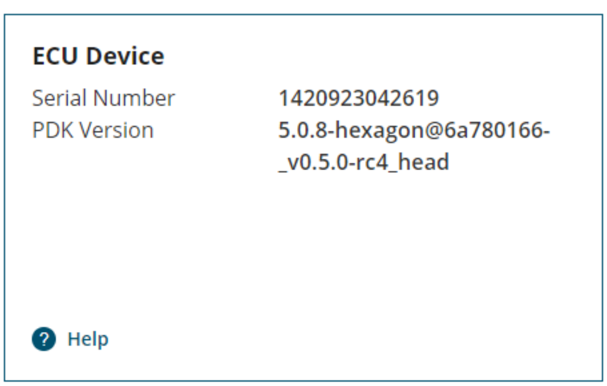
The *Details* window has several tiles that provide detailed status information for Perception system components.

To access the *Details* window, click the **Device** menu and click **Details**.



7.1.1 ECU Device

This tile provides status information for the Perception ECU.



Serial Number

The serial number of the Perception ECU.

PDK Version

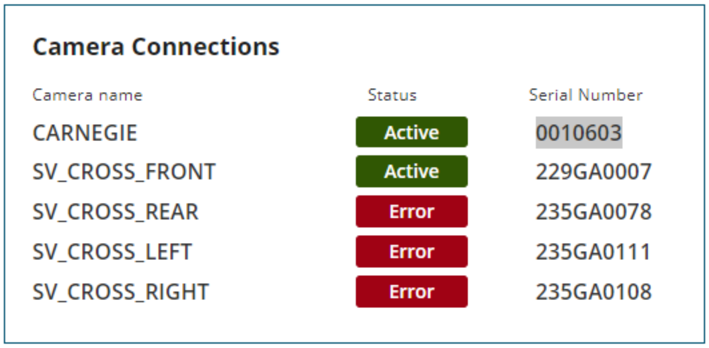
The version of Perception system firmware running on the Perception ECU.

7.1.2 Debug

The *Debug* tile is for internal Hexagon Support use only.

7.1.3 Camera Connections

This tile provides status information about the cameras connected to the Perception ECU.



Camera Name

The name for the camera.

Status

The current status of the camera.

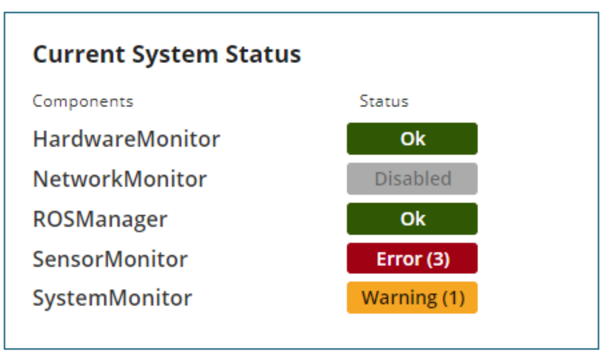
- **Active** – The camera is functioning properly and is able to stream video.
- **Error** – The camera is not valid or recognised by the system. As a result, the stream from this camera is not available.

Serial Number

The serial number of the camera.

7.1.4 Current System Status

The tile shows the status of the major system components.



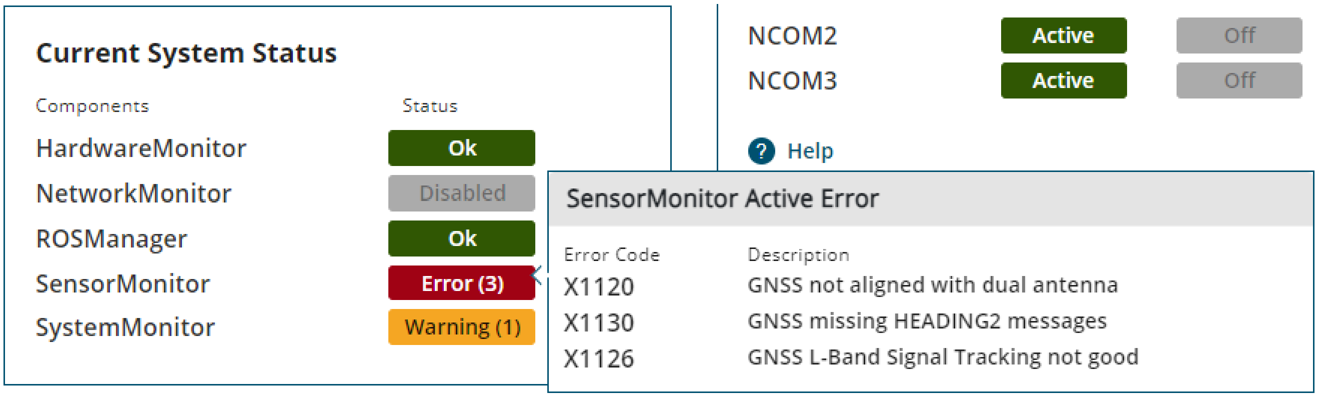
Components

Name of the component being monitored.

Status

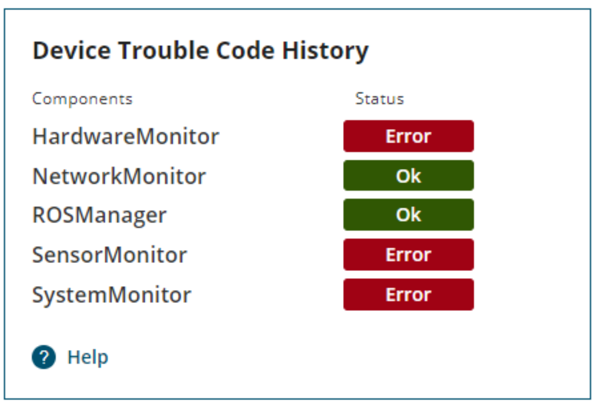
Status of the component.

If the component is in an error or warning state, the number of errors or warnings is shown on the status button. Clicking the status button opens a pop up window with the active error codes and a brief description of errors or warnings.



7.1.5 Device Trouble Code History

This tile shows the history of trouble codes on the major system components.



Components

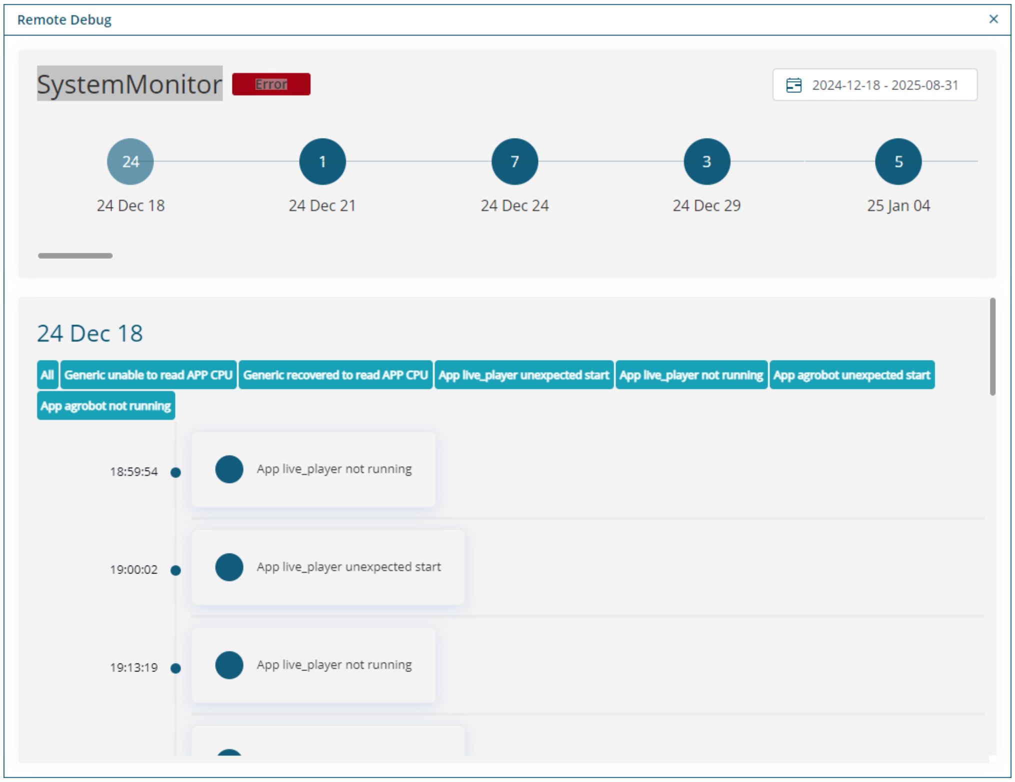
Name of the component.

Status

The error code status of the component.

- **OK** = There have been no errors detected on the component.
- **Error** = Errors have been detected on the component.

If the status of the component is Error, click the **Error** button to view more information about the errors. The *Remote Debug* window appears.



The time line box in the top portion of the *Remote Debug* window shows all of the dates on which an error occurred and the number of errors that occurred on each date. To view other dates on which an error occurred, click and drag the time line scroll bar.

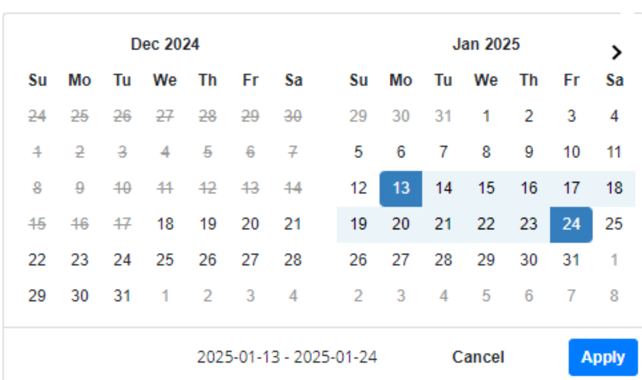
Clicking a blue circle for a date shows the errors that occurred on that date in the lower portion of the window. A brief description of the error and the time at which the error occurred is shown for each error.

To filter the errors to show a specific error, click one of the blue filter buttons.

The date range button in the top right of the window shows the range of dates represented in the time line box. To change this range of dates:

1. Click the date range button in the top right of the window.

   A calendar appears.



2. Click the start date and end date for the range of dates to view.

   The selected dates are highlighted in dark blue.

Dates with a strike through are outside the range of dates stored on the system and cannot be selected.

3. Click the **Apply** button.

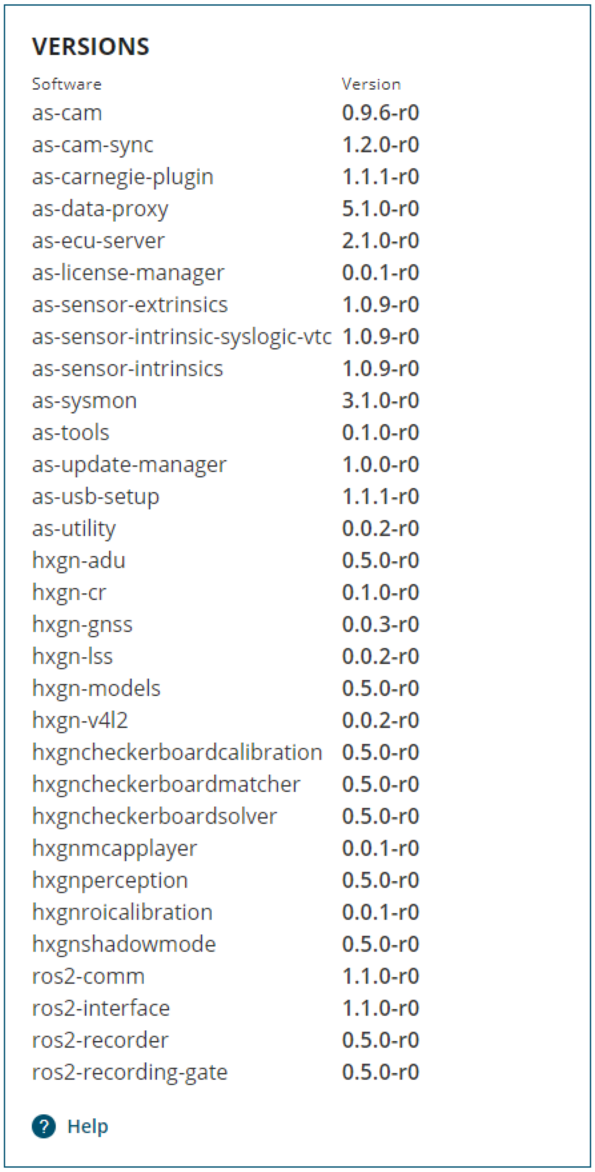
   The Time line changes to show the dates with errors from the range selected on the timeline

7.1.6 Ports

The *Ports* tile is for internal Hexagon Support use only.

7.1.7 Versions

The *Versions* tile shows the software version of the services running on the Perception system.



VERSIONS

Software	Version
as-cam	0.9.6-r0
as-cam-sync	1.2.0-r0
as-carnegie-plugin	1.1.1-r0
as-data-proxy	5.1.0-r0
as-ecu-server	2.1.0-r0
as-license-manager	0.0.1-r0
as-sensor-extrinsics	1.0.9-r0
as-sensor-intrinsic-syslogic-vtc	1.0.9-r0
as-sensor-intrinsics	1.0.9-r0
as-sysmon	3.1.0-r0
as-tools	0.1.0-r0
as-update-manager	1.0.0-r0
as-usb-setup	1.1.1-r0
as-utility	0.0.2-r0
hxgn-adu	0.5.0-r0
hxgn-cr	0.1.0-r0
hxgn-gnss	0.0.3-r0
hxgn-lss	0.0.2-r0
hxgn-models	0.5.0-r0
hxgn-v4l2	0.0.2-r0
hxgncheckerboardcalibration	0.5.0-r0
hxgncheckerboardmatcher	0.5.0-r0
hxgncheckerboardsolver	0.5.0-r0
hxgnmcapplayer	0.0.1-r0
hxgnperception	0.5.0-r0
hxgnroicalibration	0.0.1-r0
hxgnshadowmode	0.5.0-r0
ros2-comm	1.1.0-r0
ros2-interface	1.1.0-r0
ros2-recorder	0.5.0-r0
ros2-recording-gate	0.5.0-r0

Help

7.2 Export Data

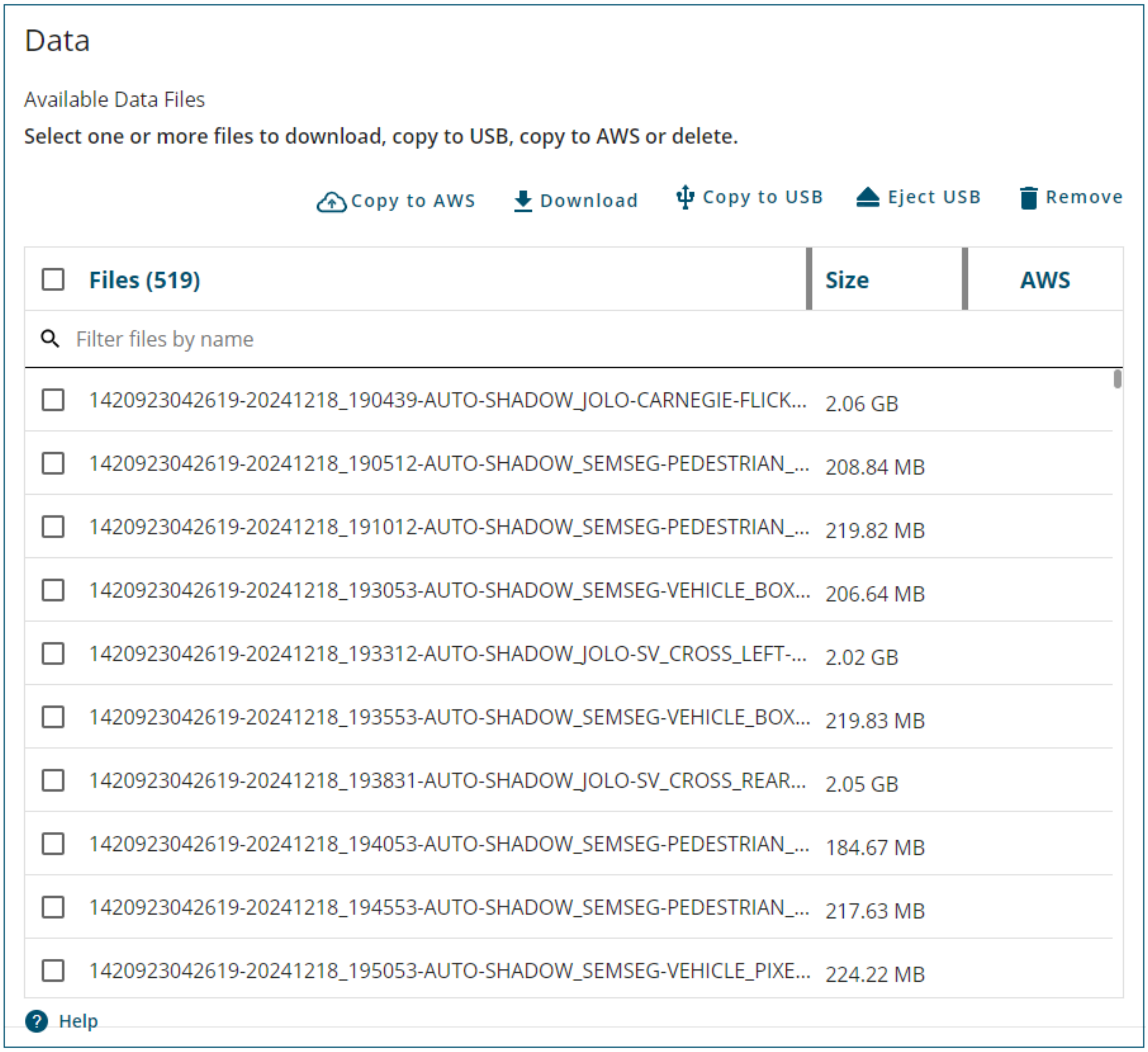
Use the *Data* window to manage the log and recording files saved on ECU internal storage.

Log files

Log files are text only files that contain information about the Perception system. These are typically small files.

Recording files

Recording files contain all of the raw outputs from the Perception system sensors. These are typically very large files.



7.2.1 Copy to AWS

To copy data to AWS:

1. Click one or more of the data files in the *Available Data Files* box.

   To select all the log files and recordings stored on internal memory, click the **Files** option.

2. Click **Copy to AWS**.

   If you have not input any AWS credentials, Perception Viewer requires you to input the following credentials before uploading to AWS:

   - Input Access key ID
   - Input Secret Access Key

- Input Bucket URL
- Input Region

> The AWS credentials are set by Hexagon Perception support. For information about the credentials to input, contact Hexagon Perception support at perceptionsupport@hexagon.com.

3. Click the **Save** button.

   Uploading to AWS starts.

7.2.2 Download

Log files and recordings stored on the ECU's internal storage can be downloaded on to the computer running Perception Viewer. To download files:

1. Click one or more of the log files or recordings in the *Available Data Files* box.

   To select all the log files and recordings stored on internal memory, click the **Files** option.
2. Click the **Download** button.
3. Navigate to the folder on the computer where the file will be saved.
4. Click the **Select Folder** button.
5. When the download has completed, click the **Done** button.

7.2.3 Copy to USB

Log files and recordings stored on the ECU internal memory can be copied to a storage device connected to the ECU USB port. To copy files to a USB device:

1. Connect a storage device, such as a USB memory key, to the ECU USB Host port.
2. Click one or more of the log files or recordings in the *Available Data File* box.

   To select all of the log files and recordings stored on internal memory, click the **Files** option.
3. Click the **Copy to USB** button.

   A dialog box appears showing the copy progress.
4. When the copy is complete, eject the USB.

7.2.4 Eject USB

You must eject the USB storage device to prepare it for safe physical removal. To eject a USB stick from ECU.

1. Click the **Eject USB** button.

   A confirmation dialog displays.
2. Click **Eject** to eject the USB storage device.

7.2.5 Remove

To delete log files and recordings from the ECU's internal memory:

1. Click one or more of the log files or recordings in the *Available Data Files* list.

   To select all the log files and recordings stored on internal memory, click the **Files** option.

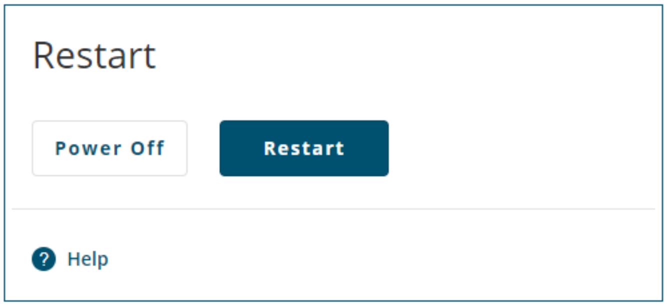
2. Click **Remove**.

   A confirmation dialog displays.

3. Click **Yes** to delete the log file

7.3 Restart

Click the *Device* menu and then click **Restart** to open the *Restart* page.



The **Restart** page provides two restart options.

- **Power Off**
  Click the **Power Off** button to shut down the Perception system.
- **Restart**
  Click the **Restart** button to restart the Perception system.