Interface Control Design



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# 1. Scope

This section describes the system-of-interest to which this document describes the interface characteristics.

## 1.1 Identification

The system-of-interest is the AGCO combine harvester, which is, broadly speaking, comprised of three primary subsystems, as per defined in our ConOps: the combine header, the feederhouse and the processor. As such, we will be specifying two interfaces, one between the combine harvester header and its feederhouse and one between the feederhouse and the processor.

In the next subsystems, the purpose of each of these subsystems is described.

### 1.1.1 Combine header

The header of the combine harvester operates mainly in 4 states. When the harvester is operating at a field, the first thing to occur is the crop being fed into the header, as seen at point 1.  The crop is then cut at the stem, as shown at point 2, before being transported into the collector, which handles and distributes the crop into the combine harvester.

### 1.1.2 Feederhouse

After the crops have been harvested by the combine header, it is being transported to the feederhouse. In this the crops are being collected, stored and transferred to the processor.

### 1.1.3 Processor

The last subsystem is the processor. In this, the harvest is being cleaned by mechanical processes, and the harvest is being handled for local storage, remote storage or further processing. It is also in the processor that residue management happens.

# 2. Referenced documents

In this section, the documents that are being referenced are declared.

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| **Document name** | **Abbreviation** |
| Concept of Operations | ConOps |

# 3. Interface design

In this section, the design of each of the two interfaces is elaborated.

## 3.1 header to feederhouse interface

The most common interface between the header and the feederhouse is called a header adapter. A header adapter is a piece of equipment that connects the header of a combine harvester to the feederhouse. It is designed to be compatible with different types of headers and crops, allowing the combine harvester to be used in a variety of harvesting conditions.

The header adapter typically consists of:

* **Frame:** The frame of the header adapter is usually made of sturdy materials such as steel or aluminum and is designed to support the weight of the header while also providing a secure attachment point for the adapter arms.
* **Adapter arms:** The adapter arms are usually adjustable and connect the header to the feederhouse. They are typically designed to be compatible with a range of header sizes and types, allowing the adapter to be used with different crops and harvesting conditions.
* **Auger or conveyor:** In some header adapter designs, an auger or conveyor may be included to help transfer the harvested crop from the header to the feederhouse. This can help ensure a smooth and consistent flow of material into the combine harvester.
* **Hydraulic or electrical connections:** Some header adapters may include hydraulic or electrical connections to provide power and control signals to the header. This can allow the header to be raised, lowered, or adjusted while in use, improving the efficiency and effectiveness of the harvesting process.
* **Latching mechanism:** The header adapter may also include a latching mechanism to securely attach the header to the adapter arms. This can help prevent the header from becoming detached during operation, which could cause damage to the machine or create a safety hazard.

## 3.2 feederhouse to processor interface

The interface between the feederhouse and processor typically consists of several key components, including:

* **Feeder Chain:** The feeder chain is responsible for moving the crop from the feederhouse to the processor. It is typically made up of a series of metal links that grip and move the crop through the machine.
* **Auger:** The auger is another component of the interface that helps move the crop from the feederhouse to the processor. It is a screw-like device that rotates and pushes the crop towards the threshing system.
* **Crop Flow Sensors:** These sensors are often located at various points along the interface between the feederhouse and the processor. They help monitor the flow of the crop through the machine and can alert the operator to any issues or blockages.
* **Threshing System:** This is the main processing unit of the combine harvester, responsible for separating the grain from the chaff. The threshing system typically consists of a series of rotating cylinders or rotor bars that crush and separate the crop. Overall, the interface between the feederhouse and processor in a combine harvester is a critical component of the machine. It must be carefully designed and maintained to ensure efficient and effective processing of the crop.

# Contributions

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| --- | --- | --- |
| **Date** | **Contribution** | **Contributor** |
| 2023-29-03 | Header to feederhouse interface | Alexander & Shivaram |
| 2023-29-03 | Feederhouse to processor interface | Liulihan & Henrik |
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