OPERATOR MANUAL

PRECISION HOE

HM 3004 M1 | HM 3006 M1 | HM 4506 M1 | HM 6008 M1 | HM 6012 M1
HS 3004 M1 | HS 3006 M1 | HS 4506 M1 | HS 6008 M1 | HS 6012 M1

Symbol photo

PLEASE READ CAREFULLY BEFORE COMMISSIONING AND OBSERVE!

Version 1.0 en_UK | Item number 00603-3-075 | 04/2024

Original operating manual

Table of Contents

1 About these instructions

1.1 Introduction

This operating manual is intended to make it easier for you to familiarise yourself with your implement and inform you about safe and proper handling, care and maintenance. You should therefore take sufficient time to read the instructions.

If you have any questions regarding the contents of this operating manual or questions about this implement, please contact our service address.

APV - Technische Produkte GmbH
HEADQUARTERS, Dallein 15
AT - 3753 Hötzelsdorf
Phone: +43 2913 8001 5500
Email: service@apv.at
Web: www.apv.at

The Product Liability Act obliges the manufacturer as well as the dealer to provide and operating manual when selling implements and to train the customer on the implement while referring to the safety, operating and maintenance instructions.

Every self-employed person and farmer is an entrepreneur for the purposes of the Product Liability Act. Entrepreneurial property damage within the meaning of the Product Liability Act is therefore excluded from liability of APV. Material damage within the meaning of the Product Liability Act is damage caused by an implement, but not to it.

Terminology

In this operating manual, this interchangeable equipment for agricultural vehicles is referred to as an implement within the meaning of the European Machinery Directive 2006/42/EC.

Vehicles intended to drive the implement in question are referred to as tractors.

The area of cultivated plants is known as the hoeing line. The hoeing line should be kept as narrow as possible.

The working width is used as a theoretical term to differentiate between the implement designs of hoes. In practice, the working width is determined by the frame width and row spacing.

The storage location of components or parts when not in use is referred to as the parking position.

Scope of validity

This operating manual is part of the implement. It must be kept for the entire service life of the implement and be accessible to personnel at all times. Instructions based on existing national regulations on accident prevention, road traffic regulations and environmental protection must also be observed.

When passing on the implement, hand over these instructions to the new owner. Train them and make them aware of the regulations mentioned.

All persons involved in the operation, maintenance or transport of the implement must have read and understood these instructions before starting work particularly Chapter 2 Safety. Failure to follow these instructions will invalidate the warranty.

This manual describes the combination of the implement with a tractor. The description can also be used where the requirements for the tractor are also fulfilled by other implements or vehicles.

Operating the tractor and its functions are not part of this operating manual. It is the operator or the user of the tractor's responsibility to adhere to the operating manual.

1.2 Equipment variants

- The implements can be equipped differently at the factory.
- Standard components, special equipment or optional accessories are not labelled separately.
- The contents of this operating manual may differ from the actual equipment of the implement.
- Illustrations with pictures that are different are to be understood as illustrative examples.
- Further documents may be required to operate the implement, depending on the equipment.

1.3 Target groups

The target groups of this operating manual are operators, users, and service personnel for the implement.

The target groups must meet the qualification requirements for staff.

⇨ *Chapter 2.4 Requirements of people working with the implement on page 23*

1.4 Representation of information

1.4.1 Signal words and hazard levels

The following signal words and hazard levels are used to indicate warnings and warn of residual risks.

Warning of personal injury

DANGER

Type and source of danger

Explanation of the type and source of danger.

▶ Measures to avert the danger.

Indicates a hazard with a high degree of risk that will result in death or serious injury if not avoided.

WARNING

Type and source of danger

Explanation of the type and source of danger.

▶ Measures to avert the danger.

Indicates a hazard with a moderate degree of risk that could result in death or serious injury if not avoided.

CAUTION

Type and source of danger

Explanation of the type and source of danger.

▶ Measures to avert the danger.

Indicates a hazard with a low degree of risk that could result in serious or minor injury if not avoided. (material damage is only allowed in this danger level in the ISO area!)

Warning of material damage

NOTE

Type and source of danger

Explanation of the type and source of danger.

▶ Measures to avert the danger.

Indicates a potentially hazardous situation which, if not avoided, could result in material damage.

Other notes and information

IMPORTANT

Explanation of the recommendations and advice for the user.

Marks special user tips and other particularly useful or important information for efficient work and economical use.

ENVIRONMENT

Explanation of the notes and measures for environmental protection.

Marking special user tips and other particularly useful or important information on environmental protection.

1.4.2 Symbols and labels

Symbol, label	Meaning
▶	■ Instruction ■ Measures to prevent danger in safety instructions and warnings
(1) (2)	Sequence of actions / steps
△	Result of action
⊙	Purpose
✓	Requirements
🛠	Required components, tools and materials
■ ▪	List
🔧	Activities for which service personnel is required

Symbol, label	Meaning
1 (1) 1 [1]	Position numbers
A (A) A [A]	Storage position of components or parts
1:	Assignment of description / meaning to pictures
Example: "Settings"	Display text
Example: *"Settings"*	Software element
Example: OK	Button, key, switch
⇨	Cross reference
Example: [ha]	Unit
Components coloured in grey or white	Irrelevant components made visible for orientation purposes
Components coloured red or yellow	Relevant components

1.4.3 Directions

The directions left, right, front and rear used in the text refer to the forward travelling direction of the tractor.

Orientation information on a picture of an implement detail refers to this picture itself and is only to be understood as relative to the direction of travel in some cases. The meaning of the orientation information can be clearly seen in the accompanying text.

1.4.4 Implement positions

The terms "working position" and "transport position" used in the text are explained in this section.

Working position

- The working position is the configuration or position in which the implement is ready for operation and performs the intended task.
- In the working position, the implement is usually in a position that is suitable for the application or use. This may mean that it is placed at a certain height, orientation or configuration to do the job effectively.
- All necessary settings, safety precautions and functions are activated in the working position to enable safe and efficient use.

Transport position

- The transport position is the configuration or position that the implement is placed in to move, transport or store it.
- In the transport position, the implements is normally folded, lowered, secured or rearranged into a more compact form to facilitate transport and minimise possible damage during transport.
- Safety devices can be activated in transport position to prevent unintentional operation or injuries during transport.

1.5 Other applicable documentation

Documents that are required and must be observed for operation:

- Tractor operating manual
- Camera control operating manual
- For partially assembled or disassembled delivery: Conversion, installation and assembly installation manual
- Spare parts catalogue
- spare parts list

IMPORTANT

In other documents and parts of this operating manual, the implement also referred to as an appliance.

1.6 Current version of documentation

IMPORTANT

The documentation is regularly revised and brought up to date.

The current versions of the documents can be found in the download area of the APV website (www.apv.at).

1.7 User-friendliness

Dear Readers,

Our technical documentation is regularly revised. Your suggestions for improvement will help to make the technical documentation more user-friendly with each revision.

Please send us your suggestions by letter, fax or e-mail.

APV Technische Produkte GmbH
Technical documentation
Zentrale: Dallein 15
A-3753 Hötzelsdorf
AUSTRIA

Fax: +43 2913 8002
Email: techdocs@apv.at

1.8 Change index

Version	Reason for change	Chapter changed	Date	Name
V1.0	First edition	First edition	17.04.2024	AHA

EC – Declaration of Conformity

Manufacturer: **APV - Technische Produkte GmbH**
Dallein 15
AT - 3753 Hötzelsdorf

hereby declares that the mounted implement series described in the following complies with the applicable basic safety and health requirements of the above-mentioned Directives in terms of its concept and design as well as the versions put on the market.

This declaration loses its validity if there are any changes to the implement that are not approved by **APV - Technische Produkte GmbH**.

Name of the mounted implement series:

Precision hoe
HM 3004 M1 | HM 3006 M1 | HM 4506 M1 |
HM 6008 M1 | HM 6012 M1

Precision hoe
HS 3004 M1 | HS 3006 M1 | HS 4506 M1 |
HS 6008 M1 | HS 6012 M1

Year of manufacture: from **2024**

Serial number: from
12003-01000 | 12004-01000 | 12005-01000
12006-01000 | 12008-01000 | 12009-01000

Relevant Directives: EC Machinery Directive 2006/42/EC

For the planing, design, construction and marketing of the implement, the following harmonised European standards were applied:

EN ISO 12100:2010	Safety of machinery – General principles for design; risk assessment and risk reduction
EN 60204-1:2019	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
EN ISO 4254-1:2022	Safety requirements for agricultural machinery – Part 1: General requirements

The special technical documents belonging to the implement in accordance with Appendix VII, Part A have been prepared.

Responsible for the technical documentation: Development and Design department, Dallein 15

Dallein / Hötzelsdorf, 04/2024

Ing. Jürgen Schöls
Managing Director (authorised person in the EU)

2 Safety

2.1 Basic safety instructions

Target group

All persons handling the implement.

Purpose

- These instructions are intended to ensure that the target group is sufficiently and thoroughly informed about dangers and safety measures and observes safety instructions.
- If the safety instructions are not followed, there is a risk of personal injury and damage to property.

Operator Manual

- ▶ Read the “Safety” chapter before commissioning the implement.
- ▶ Follow the specified steps.
- ▶ If necessary, clarify questions of understanding with the manufacturer's sales partner before carrying out the steps.
- ▶ Ensure that the instructions are always available on the implement and accessible to all users.
- ▶ Keep the instructions for the entire service life of the implement.
- ▶ Pass on instructions to all users / operators on handover.

Operating the implement

- ▶ Only use the implement for the intended purpose.
  - ⇨ *Chapter 2.2.1 Intended use on page 19*
- ▶ Never use the implement for other purposes that may seem similar.
  - ⇨ *Chapter 2.2.2 Reasonably foreseeable misuse on page 19*
- ▶ Only operate the implement with the safety devices mounted and in the protective position.
- ▶ Observe all of the safety measures that are specified in this operating manual and on the implement.
- ▶ Only operate the implement if it is in perfect technical condition.
  - ⇨ *Chapter 2.2.6 Technically perfect condition on page 20*
- ▶ Observe the maintenance instructions. Carry out all necessary checks.
- ▶ Only use original spare parts or parts approved by the manufacturer.
- ▶ Only use the listed auxiliary and operating materials.
- ▶ Dispose of auxiliary and operating materials in an environmentally friendly manner.

Persons working with the implement

- ▶ Only sufficiently qualified persons may handle the implement.
  - ⇨ *Chapter 2.4 Requirements of people working with the implement on page 23*

Operator obligations toward the operating personnel

- ▶ The operating personnel fulfils the requirements corresponding to their work.
- ▶ The operating personnel must have read and understood this operating manual before handling the implement.
- ▶ The regulations applicable in your country for safety at work are being observed.

Tractor

- ▶ Only use the implement with a suitable tractor.
  - ⇨ *Chapter 6.1 Checking tractor requirements on page 63*

IMPORTANT

The manufacturer is not liable for damage caused by incorrect installation and improper operation of the implement.

Hydraulic system

- The hydraulic system can be under high pressure.
- Pressurised hydraulic oil can enter the body through the skin.

This can result in injuries to body parts, eyes, face and unprotected skin areas.

- The hydraulic system can be hot.
- Hydraulic oil is harmful to your health.

- ▶ Never touch leaks with unprotected body parts.
- ▶ Depressurise all hydraulic circuits when working on the hydraulic system.
- ▶ Wear safety goggles and gloves when working on the hydraulic system.
- ▶ Check the condition of the hydraulic system according to the maintenance schedule.
- ▶ 🔧 Replace damaged or worn components of the hydraulic system immediately.

If hydraulic oil has entered the body, there is a risk of infection.

- ▶ Remove the hydraulic oil from the body as quickly as possible.
- ▶ Seek medical attention immediately.

Stored mechanical energy

- The implement is equipped with components which have stored mechanical energy, e.g. springs.
- Uncontrolled mechanical energy accelerates components like a bullet.
- This can result in death, serious injury or damage to the implement.

- ▶ Never remove or open components that store mechanical energy.

Road handling

- Mounted or trailed implements change the driving characteristics of the tractor.
- The driving characteristics depend on the operating status, the load and the surface.
- This can cause accidents if the driver does not take changed driving characteristics into account.

- ▶ Pay attention to changed road handling.

⇨ *Chapter 10 Driving on roads on page 121*

- ▶ If necessary, adapt your speed accordingly.
- ▶ Pay particular attention to driving behaviour when driving on gradients.

The implement/tractor configuration falling over

The implement/tractor combination can fall over in these situations:

- Folding it up
- Unfolding it
- Driving across slopes
- Driving around tight corners

This can result in death, serious injury or damage to the implement.

- ▶ When folding or unfolding the implement, make sure that it is positioned on a flat, stable surface.
- ▶ Be careful when driving on slopes.
- ▶ Adapt your speed accordingly before driving around tight corners.

Switching the implement off

An inadequately secured and unattended implement/tractor combination is a danger to people in the vicinity.

- ▶ Secure the implement/tractor combination before leaving it.
  - Apply the parking brake.
  - Switch off the engine.
  - Remove the ignition key.
- ▶ Check that the implement/tractor combination again to ensure it is safe before continuing the journey.

⇨ *Chapter 10 Driving on roads on page 121*

Liability and warranty

Liability and warranty are excluded if personal injury and damage to property are due to improper use or failure to observe the operating manual.

Accident prevention

The implement is designed and built in such a way that the persons using it can work with it without risk. Despite all safety measures taken, however, unforeseeable accidents can still occur under unfavourable circumstances.

- ▶ Observe your company guidelines regarding accidents.

2.2 Implement limits

2.2.1 Intended use

- The implement is used for mechanical weed control between rows and in rows of crops on agricultural land.
- The implement is designed solely for normal use in agricultural operations.
- The implement can be used both without steering in the HM series and with a linear sliding frame and camera control in the HS series.
- The implement is only intended for use in dry weather conditions.
- The implement may only be operated within the specified performance limits.
- The conditions for operation, maintenance, and servicing stipulated by the manufacturer must be adhered to.
- The applicable accident prevention regulations as well as the other general safety-related, road-safety related and occupational health regulations must also be observed by operators and users.
- The manufacturer is not liable for any damage resulting from unauthorised modifications and the use of components and auxiliary parts.
- Any other use is considered to be non-intended. The manufacturer is not liable for any resulting damage. The operator alone bears the associated risk.

2.2.2 Reasonably foreseeable misuse

- The implement must not be used for working on surfaces made of stone, concrete or similar ground conditions.
- The storage location of the implement must be selected in such a way that the machine is not affected by the weather.
- Non-observance of the operating manual.
- Non-observance of the conditions for operation, maintenance, and servicing stipulated by the manufacturer.
- Operating the implement without the protective devices provided.
- Bridging or modifying the protective devices.

2.2.3 Spatial boundaries

The dimensions of the implement must always be considered in combination with the tractor.

The dimensions of the implement differ in the working position and transport position.

Information on the actual dimensions of the implement can be found in

⇨ *Chapter 15 Technical data on page 136.*

2.2.4 Service life

The actual service life of the implement is at least 10 years, as long as the implement is kept in perfect technical condition during this time. Technically perfect condition essentially depends on the operating conditions and proper maintenance in accordance with the operating manual.

2.2.5 Thermal limits

The functionality of the implement may be permanently impaired if it is operated outside the specified ambient temperature range.

- ▶ Ensure that the implement is only operated at an ambient temperature between +5°C and +40°C.

2.2.6 Technically perfect condition

Expert preparations

The operational safety of the implement is only guaranteed if it has been properly prepared in accordance with this operating manual.

This could result in serious injuries.

- ▶ Only use the implement after expert preparation.
  - ⇨ *Chapter 6.1.2 Preparing the tractor on page 64*
  - ⇨ *Chapter 6.2.1 Preparing implement on page 65*

Technical limits

If the technical limits of the implement are not complied with, the safety equipment may not work properly and the machine may be damaged.

This could result in serious injuries.

- ▶ Comply with implement-specific limits.
  - ⇨ *Chapter 15 Technical data on page 136*

Damage to the implement

Damage to the implement can impair the operational safety of the implement and cause accidents.

This can result in death or serious injury.

Take the following measures to ensure that the implement is safe to use:

- ▶ Inspect the implement according to the maintenance schedule.
  - ⇨ *Chapter 13 Maintenance and servicing on page 127*
- ▶ Eliminate damage and causes of damage immediately.
- ▶ Remove any coarse dirt.
- ▶ 🔧 Have safety-related damage repaired by qualified specialist personnel if it cannot be repaired in accordance with this operating manual.

Modifications to the implement

Any structural modifications and additions could prevent the implement from working properly and safely.

This could result in serious injuries.

Additional equipment and spare parts that do not meet the manufacturer's requirements can impair the operational safety of the implement and cause accidents.

- ▶ Modifications and conversions may only be carried out with the written consent of the manufacturer.
- ▶ Structural modifications and additions may only be carried out by an authorised specialist workshop.
- ▶ Only use original spare parts or parts approved by the manufacturer.
- ▶ Only use the listed auxiliary and operating materials.
  - ⇨ *Chapter 15.8 Operating materials on page 141*

Welding

Improper welding work jeopardises the operational safety of the implement.

This could result in serious injuries.

- ▶ Only have welding work carried out by qualified specialists.

2.3 Danger areas

Failure to observe the danger zones can result in death or serious injury.

- ▶ Only switch on the drives and engines/motors when all persons have left the danger areas.

Any work required with the engine/motor or drive running in a danger area requires special attention and precautionary measures.

- ▶ Follow the instructions in this operating manual exactly.

Area between tractor and implement

Standing between the tractor and the implement is dangerous in case of tractor movements or sudden machine movements.

- ▶ Secure the tractor against rolling away.
- ▶ Before operating the three-point linkage, keep all persons away from the movement range of the three-point linkage.

Parked implement

An incorrectly parked implement can tip over. This can result in death or serious injury.

- ▶ Only park the implement on a flat and stable surface.

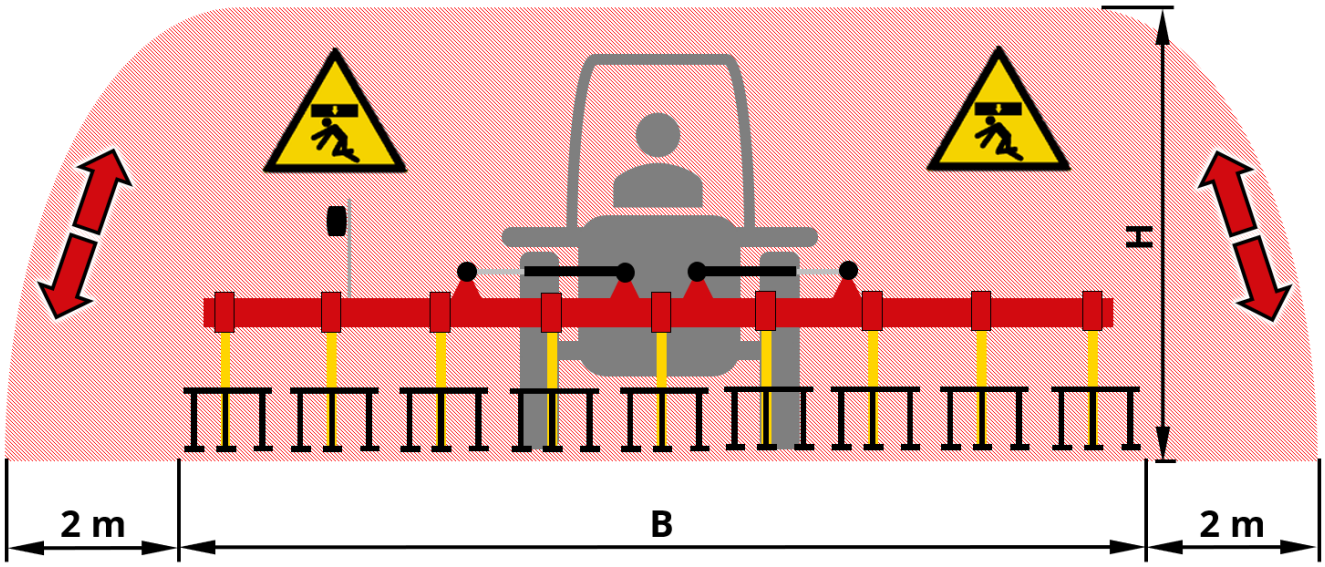
Raised implement

An implement with a high net weight can move down independently.

This can result in death or serious injury.

- Never stand underneath unsecured implements.
- Secure implements against moving down using suitable measures.

Folding process



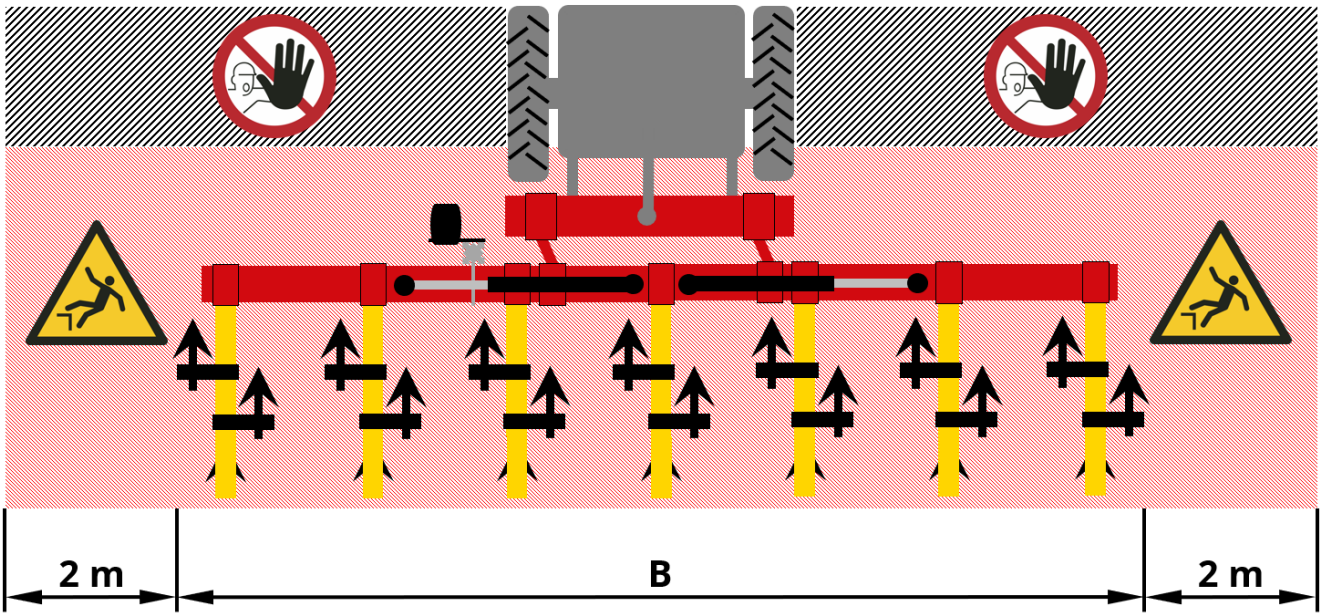
The danger area extends over the entire folding area [B] of the implement and the area above it resulting from the height [H].

No one should stand in the danger area. People in the danger area could result in death or serious injury.

- Maintain an additional 2 m safety distance from the danger area.
- Park the implement on a level and stable surface before folding.
- Never start the folding process if there are people in the danger area.
- Never start the folding process if there are overhead power lines in the vicinity.

Implement in operation

The danger area of the implement accompanies the implement during operation.



The danger area extends across the entire working width [B] of the implement and the resulting area in the direction of travel.

No one should stand in the danger area. People in the danger area could result in death or serious injury.

- Maintain an additional 2 m safety distance from the danger area.
- While driving on the area to be worked, keep an eye on the entire danger area. Come to a stop if necessary.
- Never climb out of the tractor while driving.
- Never let other people climb on or off while driving.

Trailing implement parts

Implement parts continue to run after the drives are switched off.

This can result in death or serious injury.

- Only touch parts at a standstill.

2.4 Requirements of people working with the implement

Operator

Operators within the meaning of this manual are obliged to instruct all users in the handling of the implement and the dangers that may arise. This can be done on the basis of this operating manual.

Operators are responsible for ensuring that the operating manual is available with the implement at all times and that users observe the operating manual.

Operators must also provide users with any necessary personal protective equipment.

Users

For the purposes of these instructions, users are persons who drive, adjust, operate or maintain the implement. Users must be able to use the implement safely.

That means:

- Users understand how the implement works.
- Users are aware of and avoid any danger.
- Users are physically capable of controlling the implement.

In order to use the implement correctly and in accordance with its intended use, users must have specialised, i.e. agricultural, knowledge.

Unless labelled otherwise, users may carry out all activities described in this operating manual themselves.

Service personnel

For the purposes of this manual, service personnel are all persons who maintain and service safety-relevant components.

Service personnel are qualified for these activities due to their training and experience (e.g. agricultural machinery mechanics).

Qualification

Persons who will be handling the implement must meet the following requirements:

Personnel	Category	Activities	Required qualification
Forwarder	-	■ Transporting the implement from business to business	■ Experience with transport of machinery ■ Qualification of a transport specialist for machinery
Transport provider	Operator User	■ Transporting the implement within the business	■ Forklift driver ■ Experience with handling the suitable lifting gear
Installer	Service personnel	■ Installing and commissioning the implement	■ Trained mechanic
Setter	Operator User Service personnel	■ Setting up the implement	■ Experience in the agricultural field ■ Experience with handling the implement
Operator	User	■ Operating the implement while in use	■ Trained assistant

Personnel	Category	Activities	Required qualification
		■ Cleaning the implement	■ Suitable driving licence
Maintenance personnel	Service personnel	■ Performing maintenance work ■ Performing servicing work	■ Trained mechanic
Disposer	Service personnel	■ Disposing of implement	■ Disposal specialist

2.5 Personal protective equipment

Carrying and wearing protective equipment is an essential part of safety.

Missing or unsuitable protective equipment increases the risk of damage to health and injury to persons.

Appropriate protective clothing is required when handling the implement. Apart from that, the following protective equipment is necessary for certain work:

- Protective clothing
- Hearing protection
- Safety shoes with non-slip soles
- Safety gloves

Use protective equipment as follows:

▶ Only use protective equipment that is in good condition.

▶ Only use protective equipment that provides effective protection.

▶ Adjust protective equipment to suit the person, e.g. size.

2.6 Workplaces and accompanying persons

The main workplace for handling the implement is the driver's seat on the tractor. Other workplaces are described in the respective instructions.

Dangerous situations can arise if several people operate functions of the implement at the same time.

▶ Pay attention to the danger areas.

▶ Watch out for other people in the vicinity of the implement.

Ascent

Careless behaviour when climbing up and down can cause people to fall from the ladder. Anyone who climbs onto the implement outside the intended access points can slip, fall and be seriously injured.

Dirt and operating fluids also increase the risk of slipping.

▶ Only use designated access points.

- Always keep access areas clean and in good condition.
- Only climb onto the implement if it has been prepared for climbing in accordance with its operating manual.
- Always maintain 3-point contact with steps and handrails when climbing up and down: Two hands and one foot or one hand and two feet on the implement at the same time.
- Never use controls as handles. Controls could be inadvertently actuated and trigger functions that could be dangerous.
- Climb on and off facing towards the implement.
- Never jump off the implement.
- Never climb onto a moving implement.

Accompanying people

Accompanying people could fall off the implement and suffer serious injury.

Objects thrown up can hit and injure accompanying people.

- Never carry people on the implement.

Platform

Careless behaviour on platforms can cause people to fall and injure themselves seriously.

Dirt and operating fluids also increase the risk of slipping.

- Only use designated platforms on the implement.
- Always keep platforms on the implement clean and in good order.
- Only access platforms if the implement has been prepared for this in accordance with its operating manual.
- Never carry out activities on the platform for which the platform is not intended according to the operating manual.
- Never jump off the implement.

2.7 Residual hazards

Residual hazards are special hazards when working with the implement, which cannot be eliminated despite safety-compliant construction and design.

Residual hazards are often not obvious and can be a source of possible injuries or health risks.

During transport

When lifting and setting down the implement, there is a risk of crushing due to its weight.

This can result in death or serious injury.

- Only have the implement transported by a forwarding agent in accordance with these instructions.

During installation

When lifting and setting down the implement, there is a risk of crushing due to its weight.

This can result in death or serious injury.

- ▶ The implement may only be transported with a forklift truck or pallet truck by qualified personnel in accordance with these instructions.

There is a risk of slipping, tripping and falling when mounting the implement on the tractor.

This can result in death or serious injury.

- ▶ Work must be performed on sturdy steps with personal protective equipment.
  - ⇨ *Chapter 2.5 Personal protective equipment on page 25*

During setup

Defective parts of the implement could come loose during operation.

This can result in death or serious injury.

- ▶ Check the implement before each use in accordance with the specifications in this operating manual.
  - ⇨ *Chapter 6.2 Checking implement requirements on page 65*

Unforeseen oil leakage when the hydraulic system is put into operation.

This can result in death or serious injury.

- ▶ Nobody may be standing in the danger area when commissioning the implement.
- ▶ Use personal protective equipment.
- ▶ Inspect the implement according to the maintenance schedule.
  - ⇨ *Chapter 13 Maintenance and servicing on page 127*

During operation

Individual parts of the implement rotate during operation.

This can result in death or serious injury.

- ▶ Make sure that all covers on the implement are closed during operation.

There is a risk of slipping, stumbling and falling when handling the implement.

This can result in death or serious injury.

- ▶ Work must be performed on sturdy steps with personal protective equipment.
  - ⇨ *Chapter 2.5 Personal protective equipment on page 25*
- ▶ The implement may not be operated in the rain or in a thunderstorm.

During servicing and maintenance

In restricted lighting conditions, such as darkness, there is a risk of incorrectly or poorly performed maintenance and servicing work.

This can result in death or serious injury.

▶ Carry out maintenance and servicing work with the aid of lighting equipment if necessary.

2.8 Safety devices and safety stickers

The implement is equipped with special safety devices to protect the user, other persons and the implement:

- Lighting system
- Stabiliser

The actual equipment of the implement with safety devices depends on the country-specific rules and regulations.

⇨ *Chapter 3.3.2 Safety devices on page 44*

Keeping safety devices in good working order

Fitted and functional safety equipment protects people from death or serious injury.

▶ Replace any damaged safety devices.

▶ Install any safety devices that have been removed BEFORE commissioning.

▶ Move the safety devices to the protective position.

▶ If in doubt as to whether all safety devices are properly installed and functional:

🔧 Authorise a specialist workshop or contact the service address.

Keep stickers in good condition

Stickers on the implement warn of hazards in danger areas and are part of the implement's safety equipment.

Missing stickers increase the risk of serious and fatal injuries.

▶ Keep the stickers clean and visible.

▶ Replace damaged, unrecognisable or lost stickers immediately.

▶ Apply designated stickers to spare parts.

⇨ *Chapter 3.3.1.1 Position of stickers on page 39*

⇨ *Chapter 3.3.1.2 Meaning of stickers on page 41*

2.8.1 Mandatory signs

To reduce the risk of serious and fatal injuries, it is essential to observe the mandatory signs in this operating manual.

Follow instructions

Incorrect use or operation of the implement can lead to death or serious injury.

Before commissioning:

- Read and comply with the operating manual.
- Follow instructions.

Using protective clothing

Failure to wear protective clothing when handling the implement can result in death or serious injury.

Wear tight-fitting protective clothing:

- During maintenance and servicing.
- When working in a dusty environment.

Using hearing protection

Failure to wear hearing protection when operating the implement can result in moderate or serious injury.

- Put on hearing protection before operating the implement.
- Wear hearing protection while operating the implement.

Using a protective mask

Failure to wear a protective mask when handling the implement can lead to minor or moderate injuries.

Wear mouth and nose protection:

- When working in a dusty environment.
- When cleaning and maintaining the implement.

Using eye protection

Lack of eye protection when handling the implement can lead to minor or moderate injuries.

Wear safety glasses:

- When working in a dusty environment.
- When cleaning the implement.

Using foot protection

Lack of foot protection when handling the implement can lead to minor or moderate injuries.

Wear safety shoes with non-slip soles:

- When operating the implement.
- During maintenance and servicing.

Using hand protection

Lack of hand protection when handling the implement can lead to minor or moderate injuries.

Use safety gloves:

- When manually moving parts.
- During maintenance and servicing.

2.9 Noise

The noise emission values of the implement can exceed 80 dB(A) during operation.

Frequent use of the implement can cause health problems such as hearing loss, deafness or tinnitus.

- ▶ Assess the noise hazard before commissioning the implement/tractor combination:
  - Tractor noise
  - Implement noise
  - Sound insulation in the tractor cab
- ▶ Wear suitable hearing protection as described in this operating manual.

3 Design and function

3.1 Implement overview

IMPORTANT

Different designs of the implement can have different equipment fitted.

⇨ *Chapter 1.2 Equipment variants on page 11*

Various models of the implement are available.

- **Hoe HM** excluding linear sliding frame, excluding camera control
- **Hoe HS** including linear sliding frame, including camera control

Different types of the parts are available.

The types differ in:

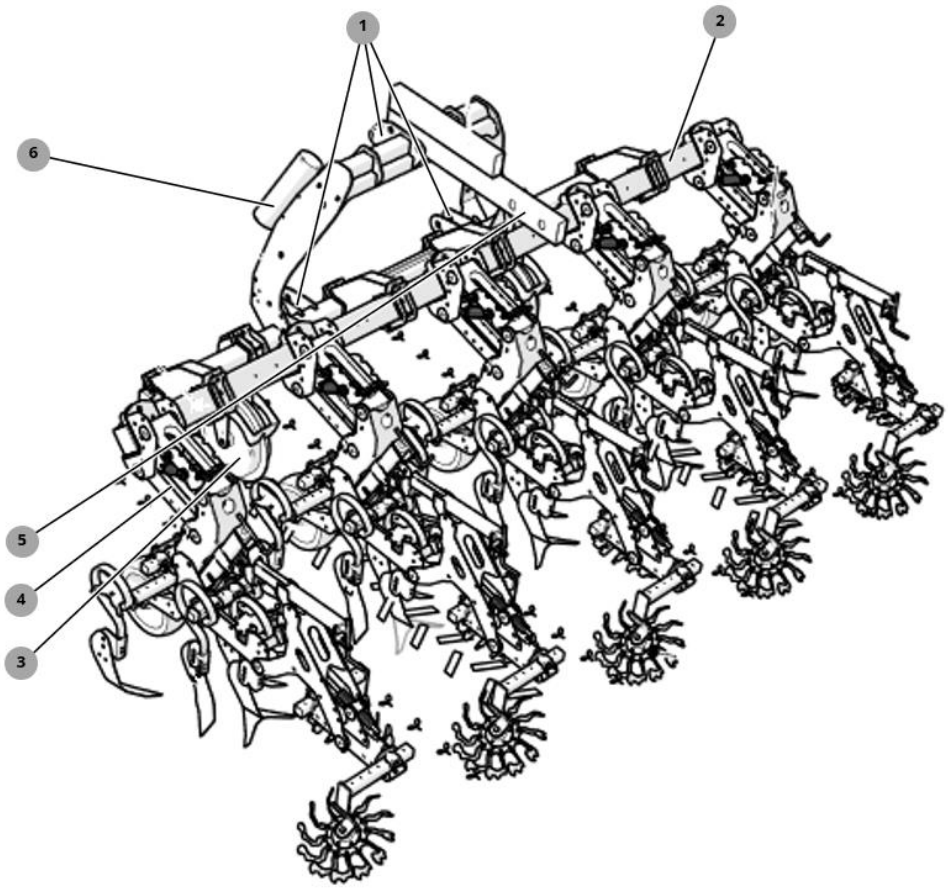
- Working width
- Number of rows
- Row spacing
- Rigid frame
- Folding frame

Each implement type can be configured for a specific application.

3.1.1 Overview of hoe HM

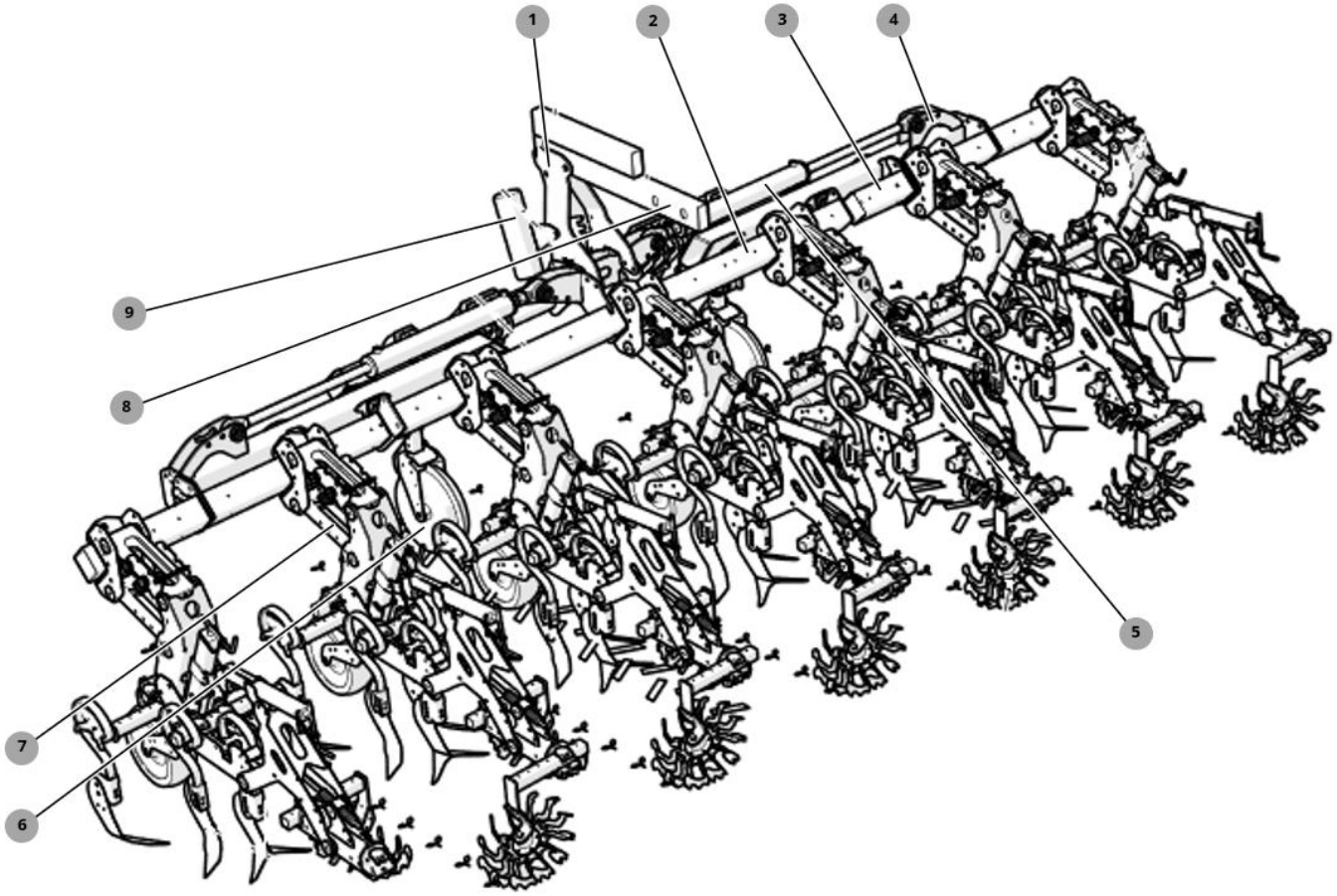
		Working width		
		3 metres	**4.5 metres**	**6 metres**
Number of rows	**4**	HM 3004 M1	-	-
	6	HM 3006 M1	HM 4506 M1	-
	8	-	-	HM 6008 M1
	12	-	-	HM 6012 M1

Hoe HM with rigid frame



Number	Designation	Function
1:	Three-point linkage	■ Connection of implement to tractor
2:	Frame	■ Support for chopping element
3:	Support wheel	■ To stabilise implement on the ground
4:	Chopping element	■ Support for working tools
5:	Transport frame	■ Lifting point with crane or forklift truck
6:	Document holder	■ For storing implement documentation

Hoe HM with folding frame



Number	Designation	Function
1:	Three-point linkage	■ Connection of implement to tractor
2:	Centre frame	■ Support for inner chopping elements
3:	Side frame	■ Support for outer chopping elements
4:	Folding linkage	■ Transmits the folding movement
5:	Folding cylinder	■ Generates power for the folding movement
6:	Support wheel	■ To stabilise implement on the ground
7:	Chopping element	■ Support for working tools
8:	Transport frame	■ Lifting point with crane or forklift truck
9:	Document holder	■ For storing implement documentation

3.1.2 Overview of hoe HS

		Working width		
		3 metres	4.5 metres	6 metres
Number of rows	4	HS 3004 M1	-	-
	6	HS 3006 M1	HS 4506 M1	-
	8	-	-	HS 6008 M1
	12	-	-	HS 6012 M1

Hoe HS with rigid frame

Number	Designation	Function
1:	Three-point linkage	■ Connection of implement to tractor

Number	Designation	Function
2:	Top link	■ Top link coupling point connection linear sliding frame
3:	Frame	■ Support for chopping element
4:	Linear sliding frame	■ Moving the implement sideways
5:	Support wheel	■ To stabilise implement on the ground
6:	Chopping element	■ Support for working tools
7:	Camera system	■ Capture and process images of the cultivated area ■ Controls linear sliding frame
8:	Document holder	■ For storing implement documentation

Hoe HS with folding frame

Number	Designation	Function
1:	Three-point linkage	■ Connection of implement to tractor
2:	Top link	■ Top link coupling point connection linear sliding frame
3:	Centre frame	■ Support for inner chopping elements
4:	Side frame	■ Support for outer chopping elements
5:	Folding linkage	■ Transmits the folding movement
6:	Folding cylinder	■ Generates power for the folding movement

Number	Designation	Function
7:	Linear sliding frame	■ Moving the implement sideways
8 (not visible):	Support wheel	■ To stabilise implement on the ground
9:	Chopping element	■ Support for working tools
10:	Camera system	■ Capture and process images of the cultivated area ■ Controls linear sliding frame
11:	Document holder	■ For storing implement documentation

3.2 Implement function

Hoe HM

- Mechanical hoe for removing weeds between the crop rows to loosen the top layer of soil.
- The implement works as follows:
  (1) The chopping elements penetrate the soil and remove weeds between the crops.
  (2) The top layer of soil is loosened by the working tools penetrating the soil.

Hoe HS

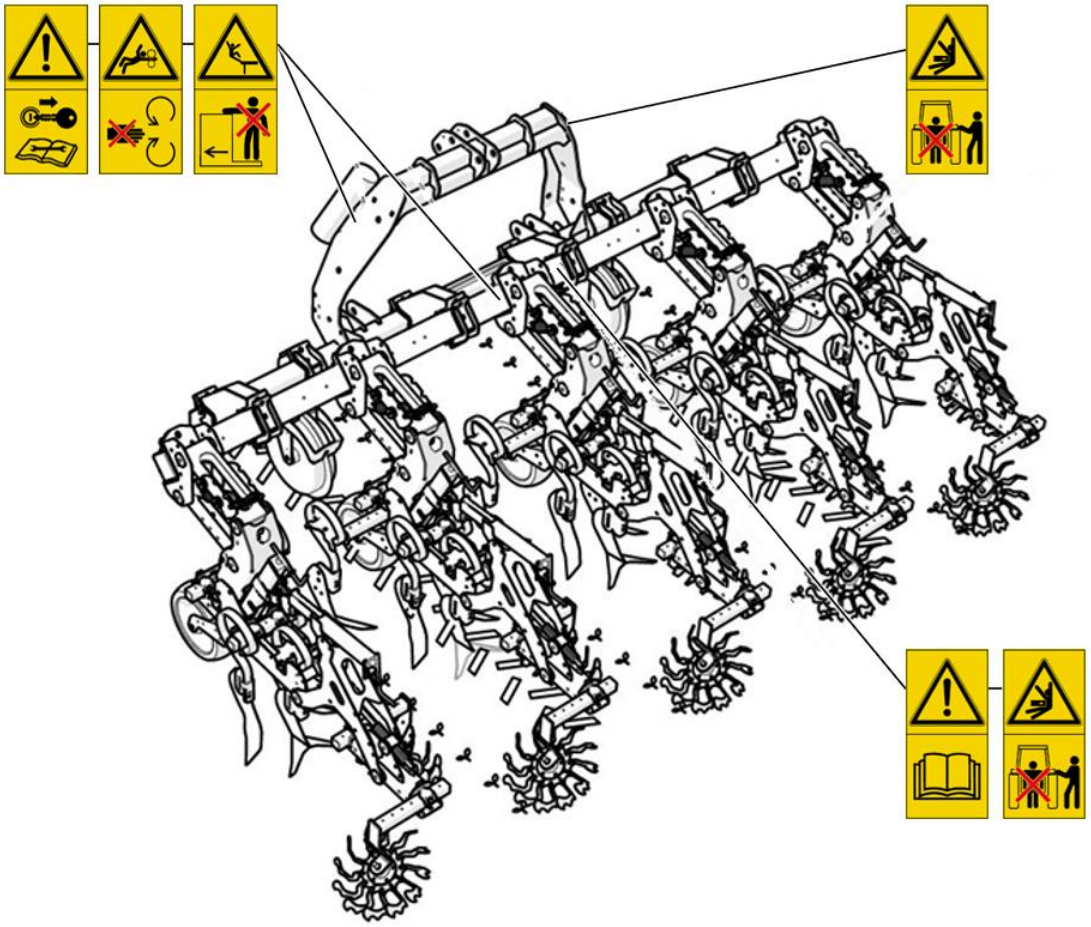
- Mechanical hoe for removing weeds between the crop rows to loosen the top layer of soil.
- The linear sliding frame combined with camera control offers the following options:
  - Precision steering and alignment
  - Automatic steering and alignment
  - Weed identification and control
  - Adapting the working speed
- The implement works as follows:
  (1) The chopping elements penetrate the soil and remove weeds between the crops.
  (2) The top layer of soil is loosened by the working tools penetrating the soil.

3.3 Implement safety

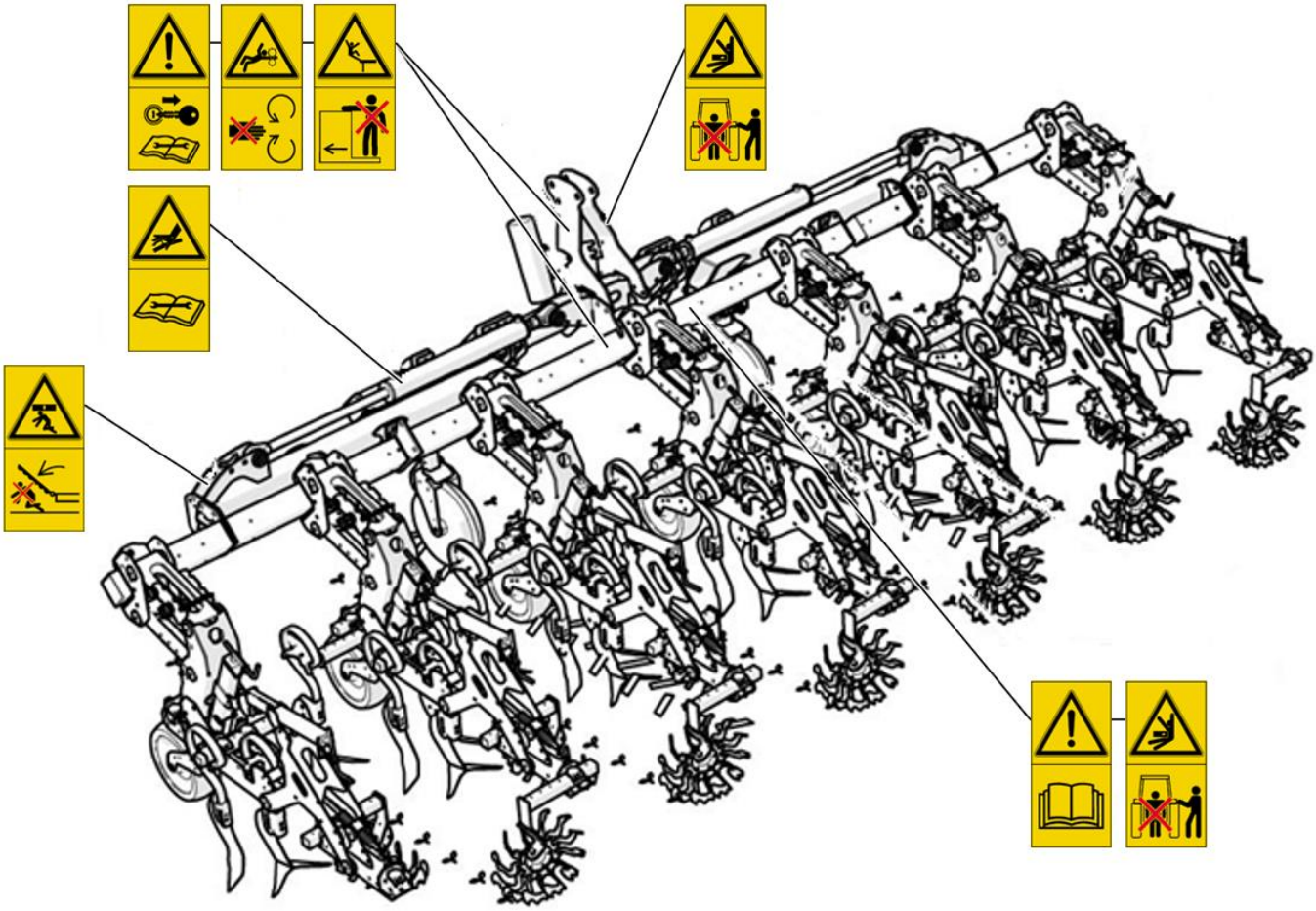
3.3.1 Safety stickers

3.3.1.1 Position of stickers

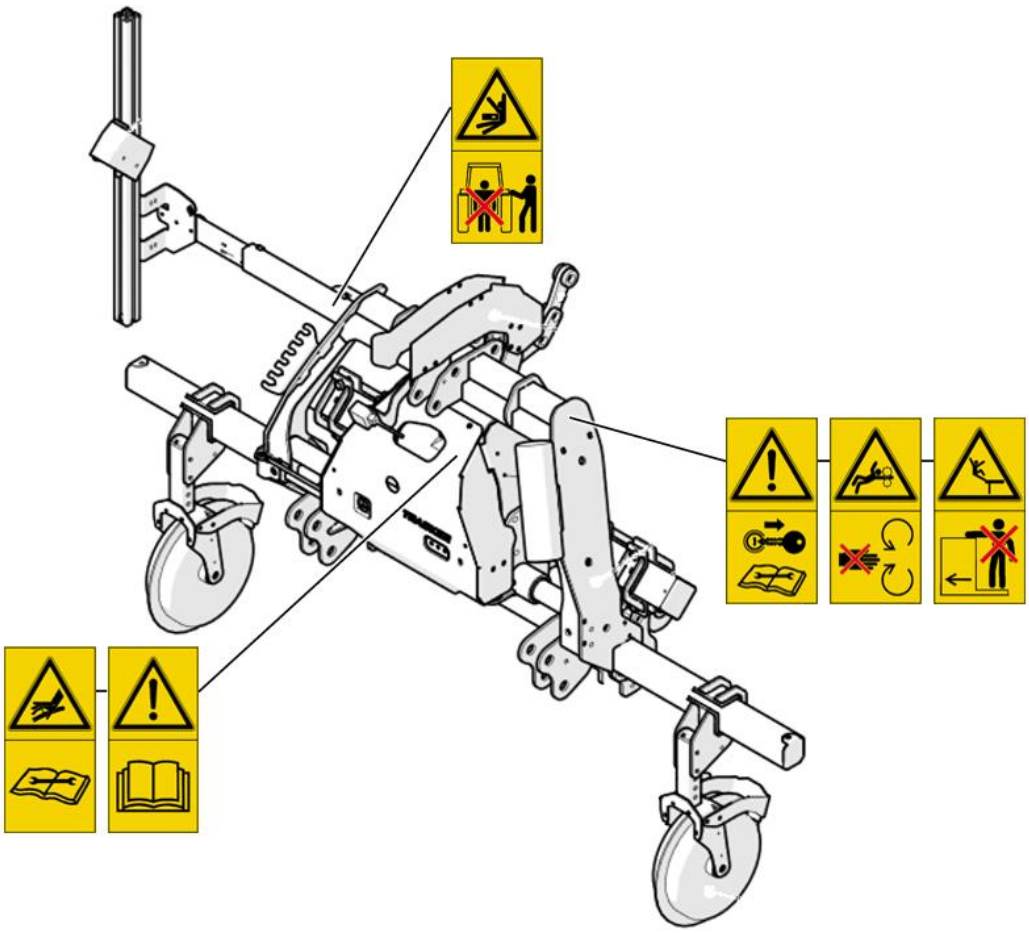
Hoe HM with rigid frame



Hoe HM with folding frame



Hoe HS



3.3.1.2 Meaning of stickers

Pay attention to operating manual

Incorrect use or operation of the implement can lead to death or serious injury.

Before commissioning:

- ▶ Read and comply with the operating manual.
- ▶ Follow instructions.

Switching off the engine

A tractor with the engine running can trigger unintentional movements. This can result in death or serious injury.

Prior to maintenance and repair work:

- ▶ Switch off the engine.
- ▶ Apply the tractor's parking brake.
- ▶ Remove the ignition key.

Rotating parts

Rotating parts can cause death or serious injury.

- ▶ Maintain a safe distance to rotating parts.

Accompanying persons on the implement are prohibited

Falling from the treads and platforms while driving or during operation can result in death or serious injury.

While driving or during operation:

- ▶ Never carry people on the implement.

Area between tractor and implement

A tractor with the engine running can make or trigger unintentional movements. This will result in death or serious injury.

When the tractors is running:

- ▶ Do not stand in the area between the tractor and the implement.

Components with high-pressure liquid

Caution with components with high-pressure liquid.
Components with high-pressure liquid are under high pressure.

- Always have work on high-pressure liquid components carried out by service personnel or a specialised workshop.

Swivel range of the implement

Implement components swivel out when folding or at the headland. This can result in death or serious injury.

- Never stand in the swivel range of the implement.
- Observe the danger areas as defined in this manual.

3.3.2 Safety devices

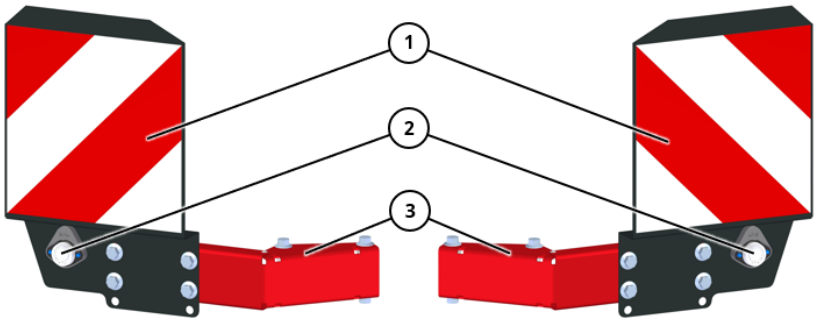
3.3.2.1 Lighting system

The lighting system increases safety when travelling on the road.

The implement must be equipped with the following components for use on public roads in accordance with the relevant national regulations:

- Lighting system

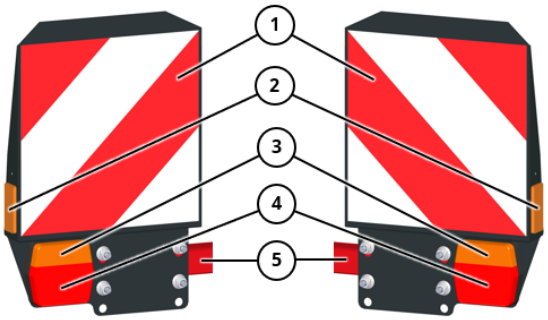
Lighting system at the front



[1] Warning sign
[2] Marker light
[3] Mounting arm

Example of lighting system at the front

Lighting system at the rear



[1] Warning sign
[2] Sidelights
[3] Indicator
[4] Rear light
[5] Mounting arm

Example of lighting system at the rear

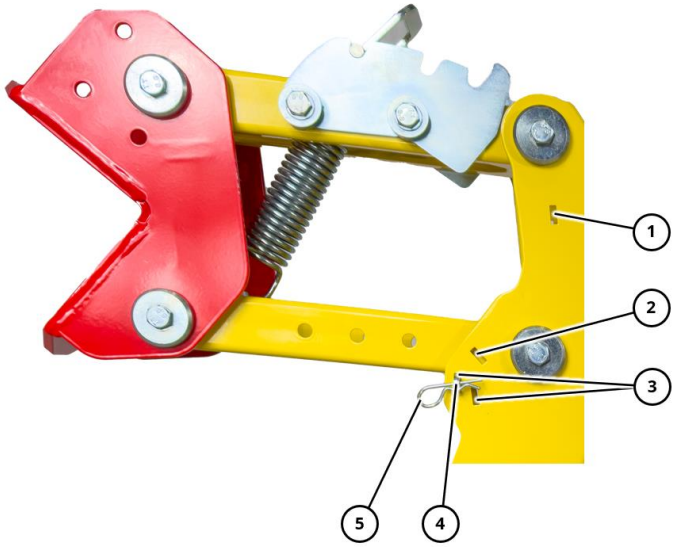
IMPORTANT

- Ensure that the stripes on the warning sign point outwards and downwards after installation in the transport position.

3.3.2.2 Stabiliser

The stabiliser ensures that the dismantled implement stands securely. The lock on individual chopping elements acts as a stabiliser.

Parking lock



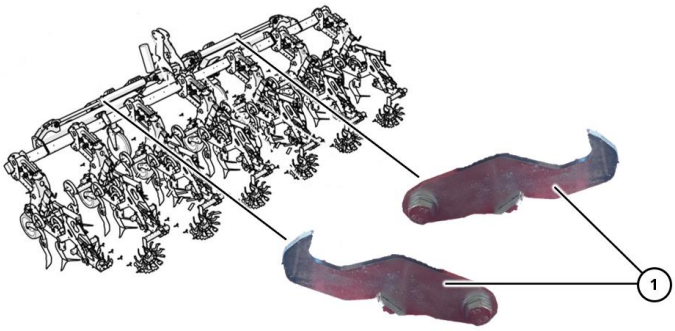
[1] Opening parking position
[2] Opening locking position for mechanically lifting the chopping elements
[3] Opening locking position for switching off the implement
[4] Pin
[5] Safety cotter pin

3.3.2.3 Transport lock

Folding lock

The folding lock ensures a secure transport position for implements with a folding frame.

Implements with a folding frame are fitted with a catch hook on each side frame to lock them in transport position.



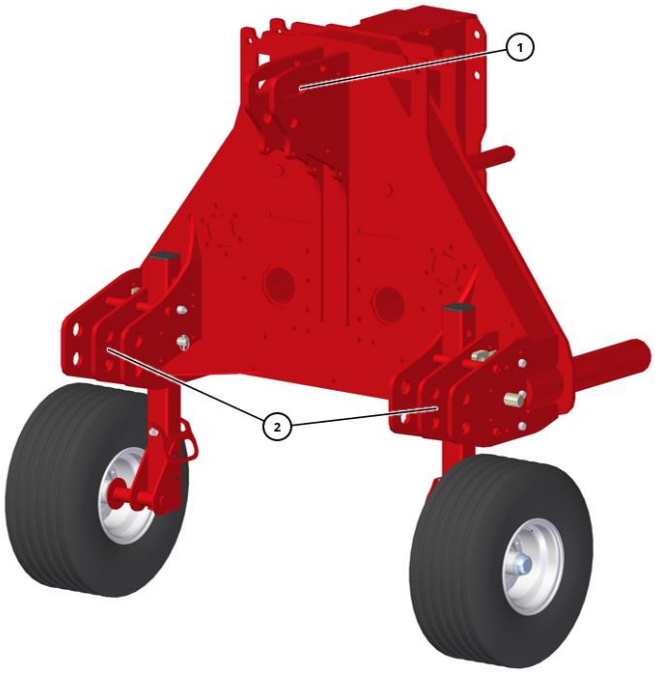
[1] Catch hook

3.4 Three-point linkage

The three-point linkage complies with the ISO 730 standard and is used to connect the implement to the tractor's three-point linkage.

For authorised options for connecting the implement to the tractor, see

⇨ *Chapter 15.9 Direction of connection on the implement on page 141*



[1] Top link coupling point

[2] Lower link coupling point

Example of three-point linkage

3.5 Support wheels

Support wheels are used to guide the implement on the ground when rear-mounted.

The support wheels are attached to the frame and relieve the tractor of some of the implement's weight. The height of the frame is determined by adjusting the height of the support wheels.

The following types of support wheels are available:

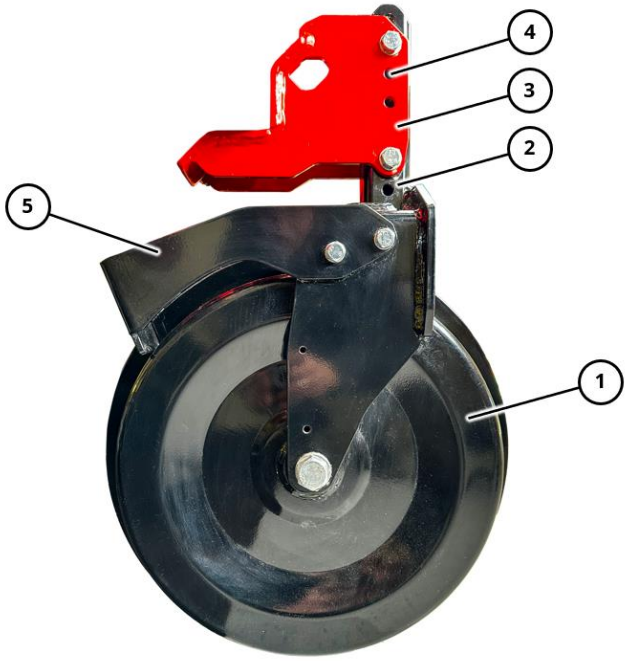
- Flanged wheel
- Feeler wheel

3.5.1 Flanged wheel

Flanged wheels are only designed for rear mounting.

Flanged wheels are available in different sizes.

⇨ *Chapter 15.10 Tyres and wheels on page 141*

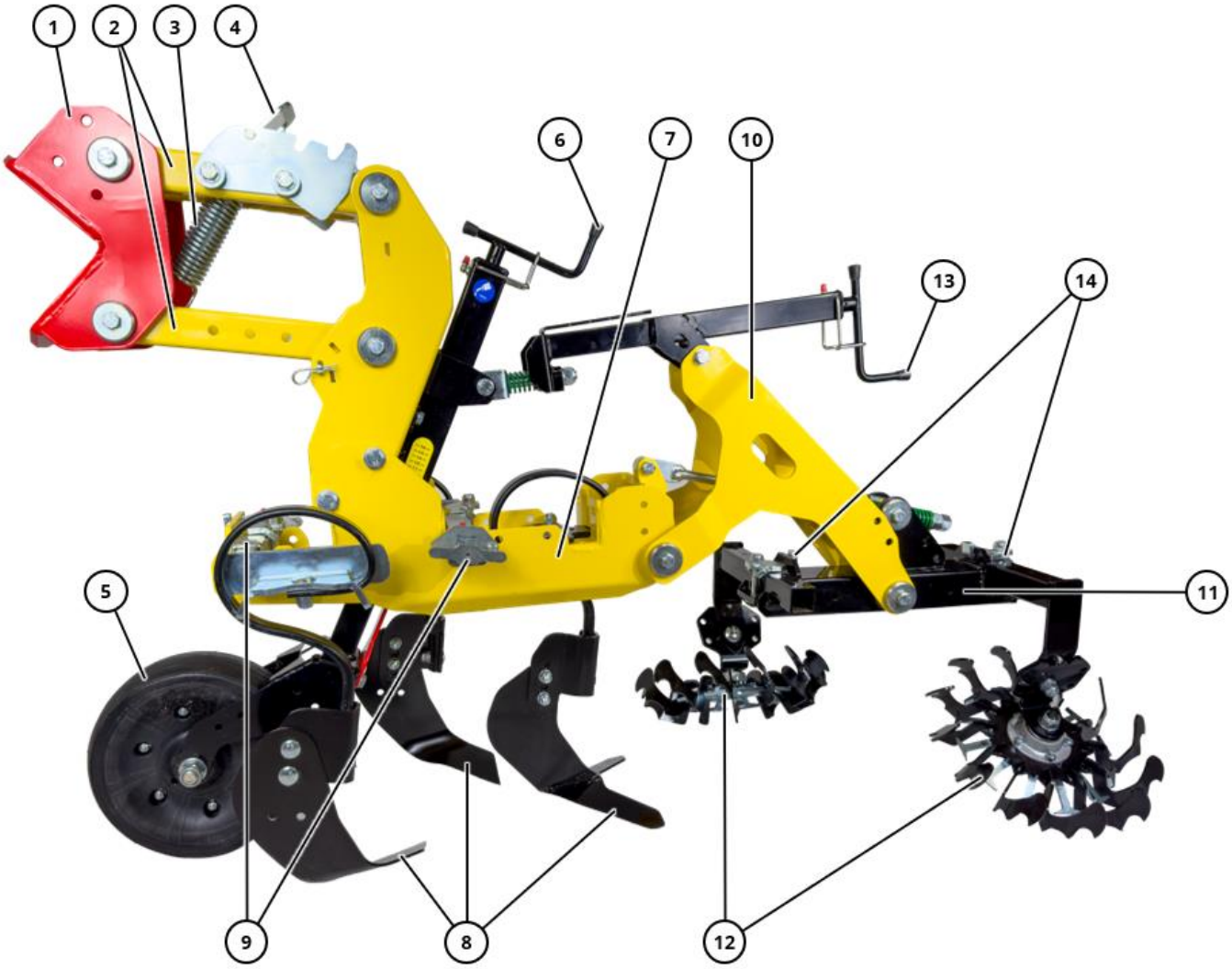


[1] Flanged wheel
[2] Flanged wheel bracket
[3] Retaining profile
[4] Opening for fixing
[5] Dirt remover

3.6 Chopping elements

The chopping elements are attached to the frame and act as supports for the working tools.

chopping elements are individually configured with working tools for a specific crop.



Number	Designation	Function
1:	Mounting flange	■ Connecting chopping elements to the frame
2:	chopping element parallelogram	■ Connecting the chopping coulter support with the mounting flange
3:	Parallelogram tensioning spring	■ Generates ground pressure force of the chopping element
4:	Pressure setting	■ Set ground pressure force of the chopping element
5:	Depth control wheel	■ Depth control of chopping element

Number	Designation	Function
6:	Depth control crank	■ Setting working depth of the chopping elements
7:	Chopping coulter support	■ Holds the chopping coulter
8:	Chopping coulter	■ Breaks the ground ■ Loosens the ground ■ Undercuts weeds
9:	Chopping coulter track adjustment	■ Set track of chopping coulter
10:	In-row hoeing parallelogram	■ Connect in-row hoeing support with chopping coulter support
11:	In-row hoeing support	■ Accept in-row hoes
12:	In-row hoe	■ Hoeing weeds
13:	In-row hoe crank	■ Adjusts the working depth of the in-row hoes
14:	In-row hoe track adjustment	■ Setting the track for the in-row hoes

3.7 Working tools

A wide range of tools are available for mechanical weed control:

- Chopping coulter
- In-row hoe
- Protective discs

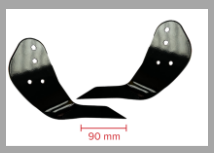
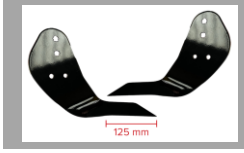
⇨ *Chapter 7.2 Selecting and setting working tools on page 94*

3.7.1 Chopping coulter

3.7.1.1 Angle coulter

Angle coulters are available in the following versions:

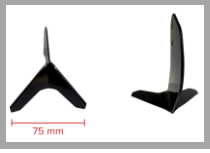
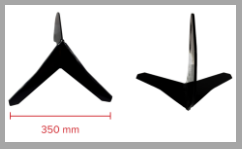
- left
- right

Working tool	Angle coulter 90	Angle coulter 125	Angle coulter 150	Angle coulter 185
				
Coulter width	90 mm	125 mm	150 mm	185 mm

Feed tip angle coulter

To ensure optimum depth control of the working tools, a feed tip can be attached to the angle coulter.

3.7.1.2 Central coulter

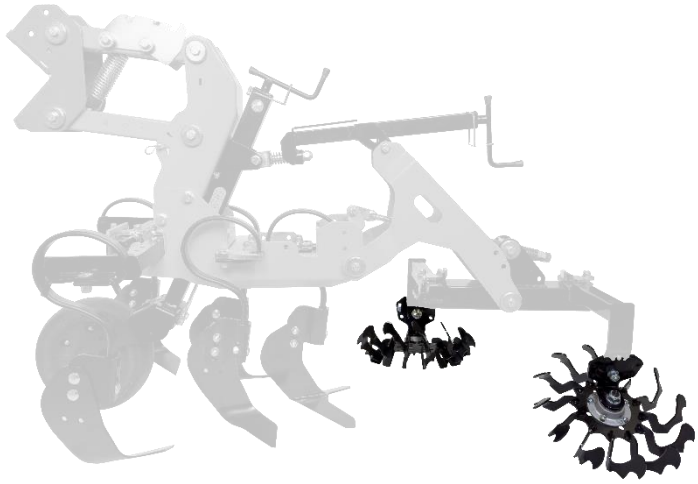
Working tool	Central coulter 75	Central coulter 245	Central coulter 350
			
Coulter width	75 mm	245 mm	350 mm

Feed tip central coulter

To ensure optimum depth control of the working tools, a feed tip can be attached to the centre coulter.

3.7.2 In-row hoe

3.7.2.1 Steel fan wheels

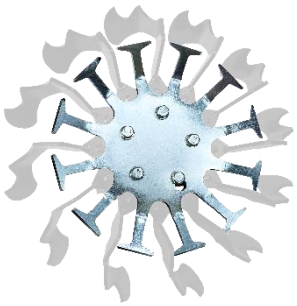


Using steel fan wheels to hoe is a more gentle working method for crops and ground.

Steel fan wheels are available in the following sizes:

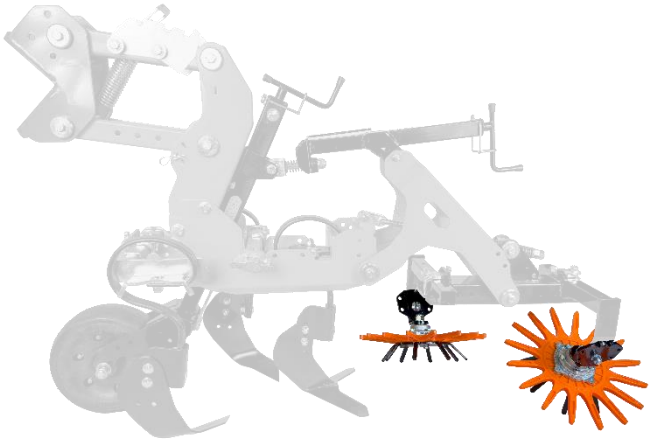
- From 30 cm row spacing: Ø 250 mm
- From 40 cm row spacing: Ø 350 mm

3.7.2.2 Stone protection disc

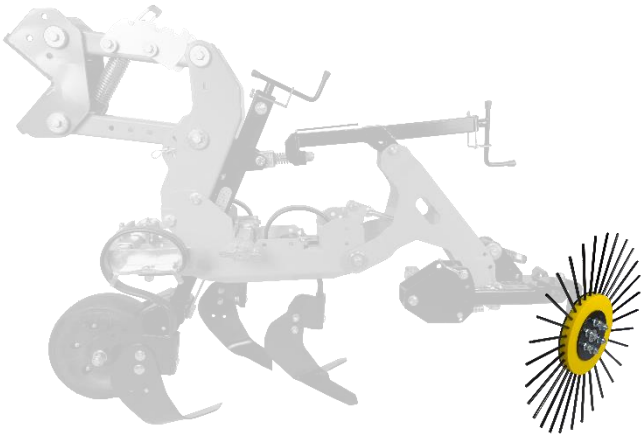


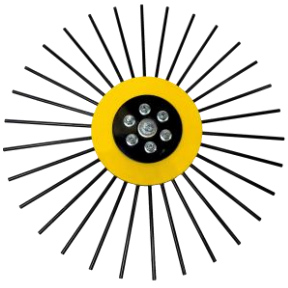
Stone protection discs are available for steel fan wheels and prevent stones from jamming between fans.

3.7.2.3 Finger hoe

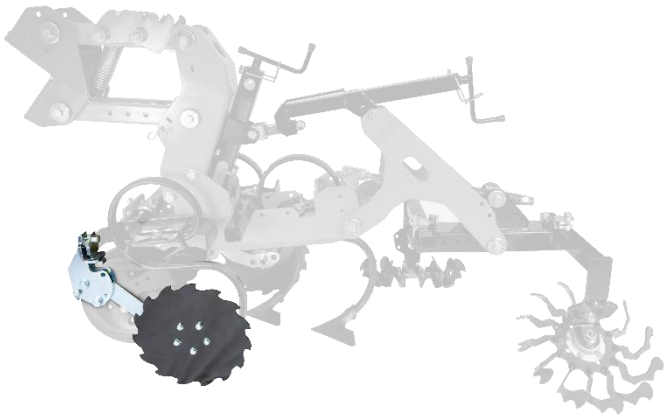


3.7.2.4 Harrow ring





3.7.3 Crop protection discs



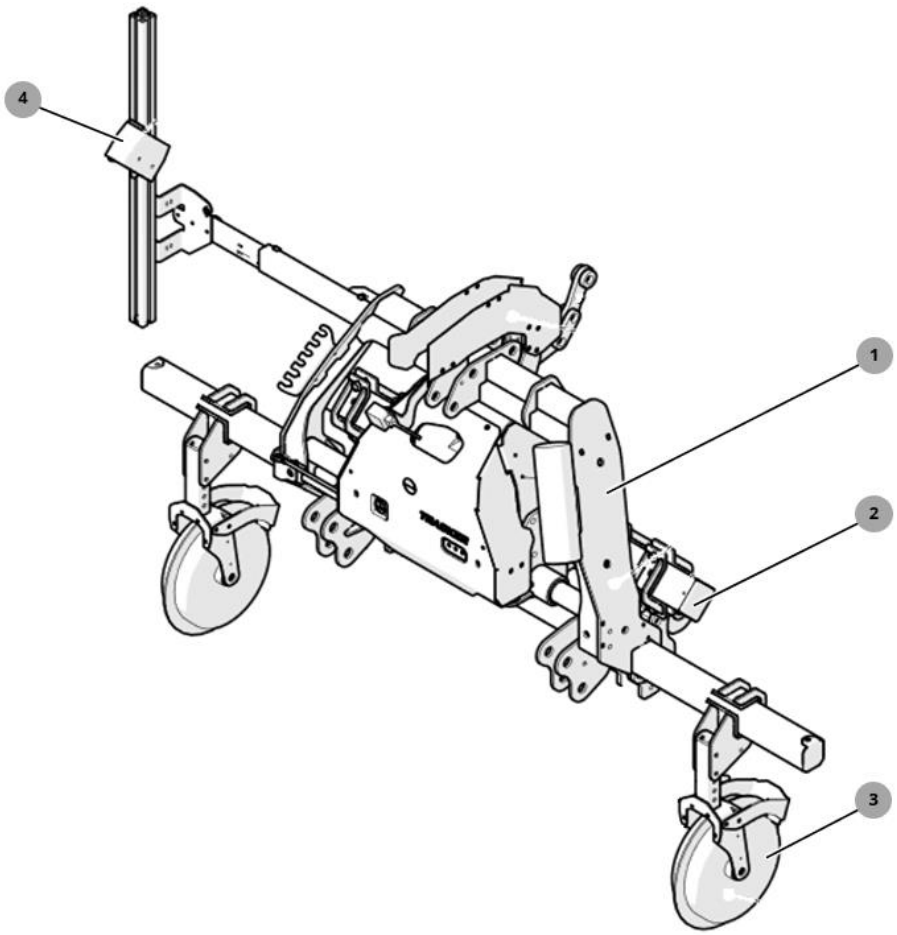
Crop protection discs are used for smaller crops to protect the plant from working tools.

IMPORTANT

- Ensure that the crop protection discs are only used in combination with central coulters.

3.8 Linear sliding frame

In the HS hoe series, the linear sliding frame acts as the interface between the tractor and the hoe. The linear sliding frame combined with the camera system enables the hoe to be moved along the hoeing line with absolute precision.



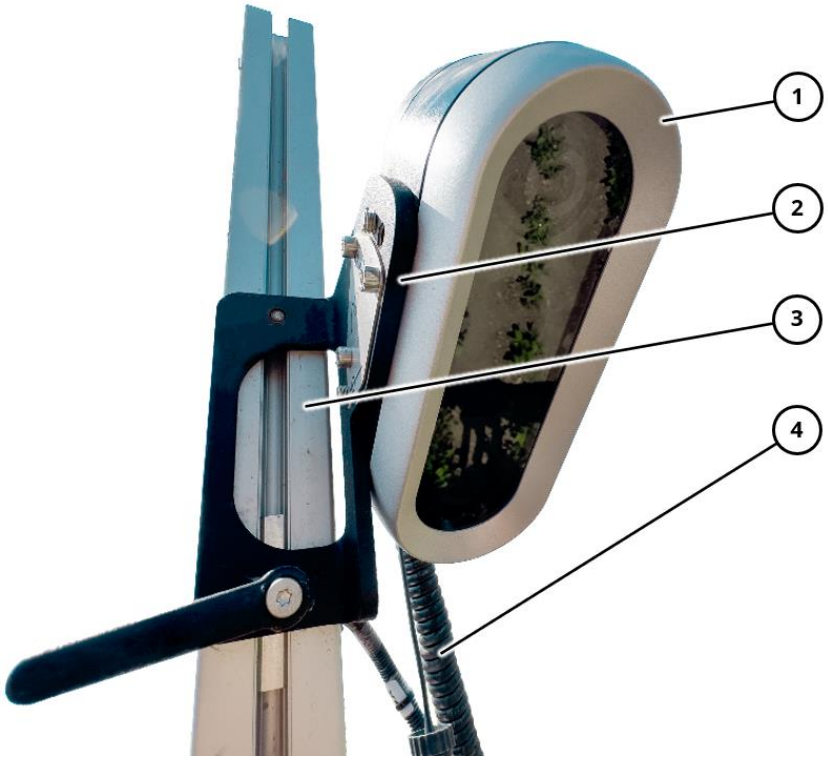
Number	Designation	Function
1:	Rigid frame	■ Connecting the tractor to the linear sliding frame
2:	Sliding frame	■ Moving the implement sideways
3:	Support wheel	■ To stabilise implement on the ground
4:	Camera system	■ Capture and process images of the cultivated area ■ Controlling the linear sliding frame

3.9 Camera system

In the hoe HS series, the camera system is used to record and process images of the cultivation area and to control the linear sliding frame. The camera system combined with the linear sliding frame enables the hoe to be moved along the hoeing line with absolute precision.

3.9.1 Camera

The camera processes high-resolution colour images in the RGB range. The camera continuously records images of the cultivated area and transmits this data to the control terminal. The image data is shown in the display area of the control terminal.



Number	Designation	Function
1:	Camera	■ Capture and process images of the cultivated area
2:	Camera holder	■ Attach the camera to the rail profile ■ Adjust camera angle
3:	Rail profile	■ Attach camera to implement ■ Adjust height of camera
4:	Wiring harness	■ Consisting of tractor cable and implement cable ■ Secure power supply ■ Connecting linear sliding frame, camera and control terminal

3.9.2 Control terminal

Number	Designation	Function
1:	Touchscreen	■ Operating camera system
2:	XV video signal connection	■ Reading image data from camera
3:	RS223 data signal connection (optional)	■ Communicating with camera and linear sliding frame (optional)
4:	XC CAN data signal connection	■ Communicating with camera and linear sliding frame
5:	Power supply button ⏻	■ Switching camera system on ■ Switching camera system off
6:	Terminal connection arm	■ Connecting touchscreen to terminal holder
7:	Terminal bracket	■ Attaching the control terminal in the tractor cab

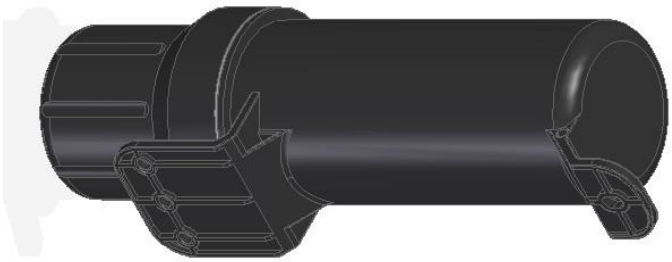
3.9.3 Linkage sensor

The linkage sensor is used to query the implement positions “raised” and “lowered” via the top link.

3.9.4 Camera lighting

The camera lighting is designed for operation in poor lighting conditions or at night.

3.10 Document holder



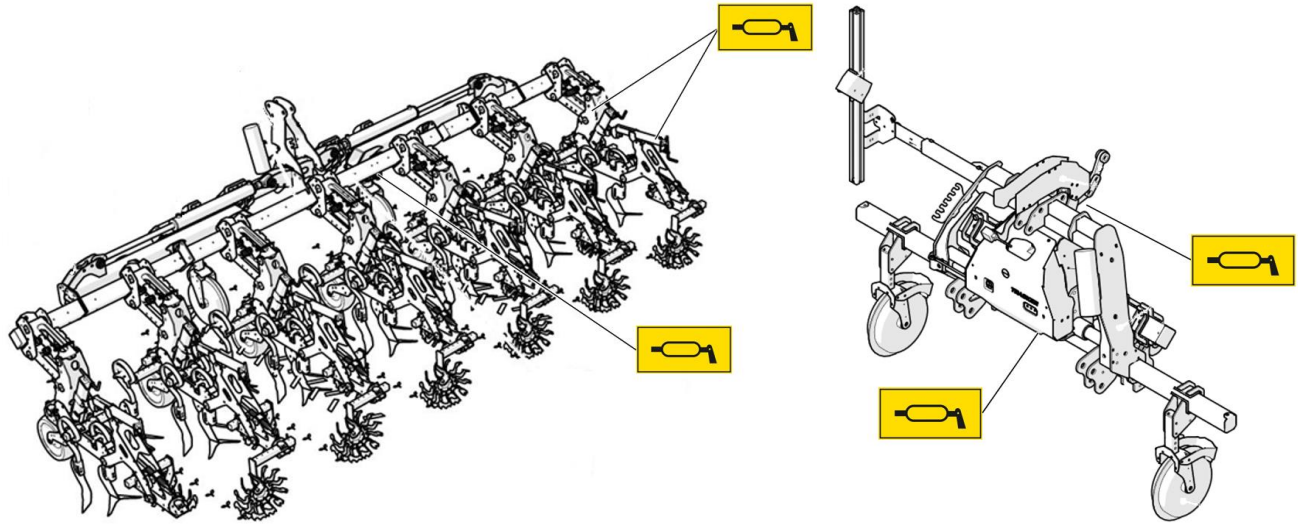
The document holder is used to store:

- Implement documentation

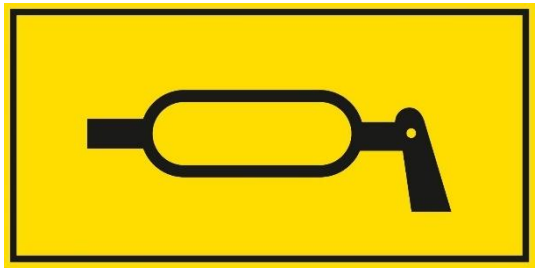
3.11 Information on the implement

3.11.1 Stickers lubrication points

Position



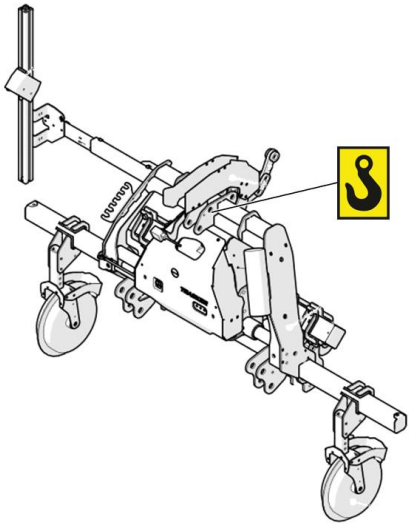
Meaning



- ▶ Lubricate marked points via grease nipples according to the lubrication plan.
  - ⇨ *Chapter 13.3.2 Lubricating components via grease nipples on page 132*

3.11.2 Sticker loading hook

Position



Meaning

▶ When lifting the implement using chains, ropes or straps, attach the loading hook at this point.

4 Scope of delivery

The scope of delivery includes all assembly groups and components that are delivered as a standard by the manufacturer.

Hoe HM

Designation
Frame with markings for the most common row widths
Parallelograms on ball bearings
Chopping element made of Strenx 700
Chopping coulter made of Hardox
In-row hoe parallelogram-guided on the chopping element
Maximum external width of 2.5 m with folding frame
Tension spring in the parallelograms

Hoe HS

Designation
Hoe HM
Linear sliding frame
Camera control

5 Handing over implement

5.1 Identifying implement

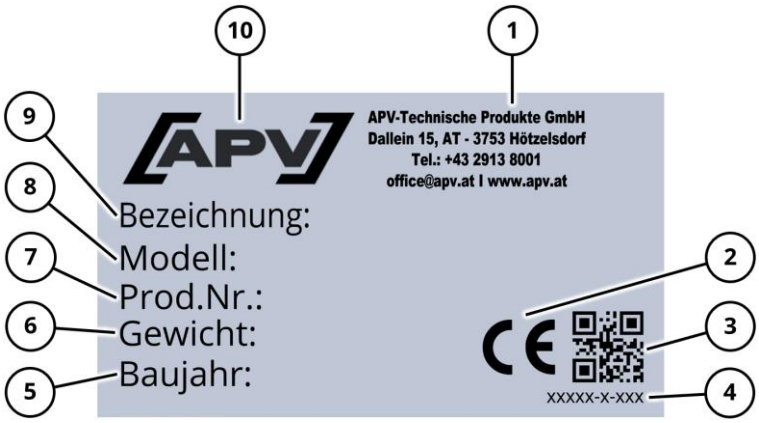
5.1.1 Type plate

The implement is labelled with a type plate. The implement can be clearly identified by the following information on the type plate:

- Designation
- Model
- Production number

Position

Meaning



1: Manufacturer's address
2: CE mark
3: QR code
4: Item number of type plate
5: YoM
6: Weight
7: Product number / serial number
8: Model
9: Designation
10: Manufacturer, company logo

5.2 Checking that scope of delivery is complete

The scope of delivery and equipment of the implement vary depending on the configuration of the order.

(1) Check that all original APV parts are present as ordered.

(2) Check that all parts are undamaged and correctly fitted.

(3) Check whether all implement documents are available in the right language.

⇨ *Chapter 1.5 Other applicable documentation on page 14*

▶ If there are any problems, contact the dealer or manufacturer.

6 Commissioning the implement

6.1 Checking tractor requirements

6.1.1 Making sure the tractor is suitable

WARNING

Risk of accidents caused by unsuitable tractor

If the tractor is not suitable for the implement, it could be overloaded by implement components. This means that the implement cannot be operated safely in combination with the tractor.

This could result in accidents resulting in serious injury or death and damage to the implement.

- ▶ Before mounting, ensure that the tractor is suitable for operation with the implement.
- ▶ Follow the tractor operating manual.

Check list

Tractor performance	
The tractor power must be within the permissible power range. The tractor power must be sufficient for the consumers on the connected implement.	⇨ *Power data, page 137*
Three-point linkage	
The category of the tractor's three-point linkage and the implement's three-point linkage must match. If the categories don't match: ▶ Adapt tractor's three-point linkage.	⇨ *Direction of connection on the implement, page 141*
Electrical connections	
A suitable electrical connection must be available on the tractor for each consumer.	⇨ *Electrical data, page 138*
Hydraulic connections	
A suitable hydraulic connection and a suitable control unit must be available on the tractor for each consumer.	⇨ *Hydraulic data, page 139*
Hydraulic power	
The tractor must have sufficient hydraulic power to meet the requirements of the implement.	⇨ *Power data, page 137* ⇨ *Hydraulic data, page 139*
Hydraulic oil	
The hydraulic oils of the implement and tractor must be compatible.	⇨ *Operating materials, page 141*

Axle loads	
Determine axle loads and required ballasting.	⇨ *Calculation of axle load and ballasting for attached implements, page 145*
Load-bearing capacity of tyres	
The load index of the tyres must be compatible with the weight of the implement and the speed being driven.	⇨ *Tractor operating manual*

6.1.2 Preparing the tractor

WARNING

Risk of accident caused by implement tipping over

If the lifting struts of the tractor are not set rigidly and the slotted holes are not locked, the implement may tip over.

This could result in accidents resulting in serious injury or death and damage to the implement.

- ▶ Set the lifting struts to be rigid before mounting.
- ▶ Lock the slotted holes before mounting.

Check list

Tyres
▶ Check the air pressure of tractor tyres. ▶ Ensure the same air pressure in all tyres on one axle. ▶ Comply with the information provided by the tractor manufacturer.
Lifting struts
▶ Check the length of the lifting struts. ▶ Set the lifting struts of the tractor to the same length. ▶ Ensure that the lifting struts can move vertically during operation. ▶ Comply with the information provided by the tractor manufacturer.
Stabilisers
▶ Check that the stabilisers can move. ▶ Ensure lateral stability of the lower links during road travel. ▶ Ensure lateral stability of the lower links during operation. ▶ Ensure that the implement is centred behind the tractor when driving on the road. ▶ Comply with the information provided by the tractor manufacturer.
Top link

▶ Check mounting position of the top link.

For tractors with several mounting positions:

▶ Link top link parallel to the ground or at a slight incline to the implement.

Top link balls and lower link balls

▶ Mount lower link balls on the lower link pins.

▶ Ensure lateral clearance-free fit between lower link balls and lower link pins, e.g. with enclosed washers.

▶ Mount top link balls on the top link pins.

Control terminal

▶ Attaching the control terminal in the tractor cab.

6.2 Checking implement requirements

6.2.1 Preparing implement

Check implement for:

- visible damage, e.g. corrosion, frost or animals
- condition of the operating equipment
- tightness of the hydraulic system

6.3 Installing camera system

The hoe HS series can be equipped with one or two cameras.

IMPORTANT

Keep the camera's field of view clear. Parts of the implement, such as frames or cables, must not interfere with the camera image.

✓ Implement is installed on the tractor.

✓ Engine is off.

✓ Ignition key has been removed.

✓ Implement/tractor combination is secured against rolling away.

✓ The rail profile including camera holder is pre-assembled on the frame.

(1) Check the position of the rail profile

(2) Install camera

(3) Attach control terminal

(4) Connecting camera system lines

(5) Setting up sensors

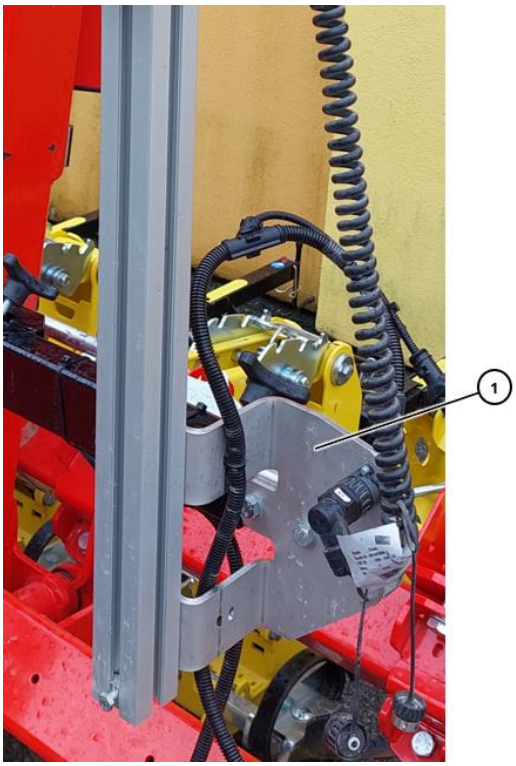
6.3.1 Checking the position of the rail profile

(1) Check vertical alignment of the rail profile.

(2) If the rail profile is not vertical, slightly readjust the pre-assembled connection [1].

(3) If the user is unable to compensate for the deviation from vertical alignment, 🔧 have the rail profile aligned by service personnel.

△ Check the position of the rail profile and, if necessary, readjust and align the rail profile.



6.3.2 Install camera

Two star knob screws [1] are pre-assembled on the camera.

(1) Position the camera using the two star knob screws [1] on the threads [2] provided in the camera holder [3].

IMPORTANT

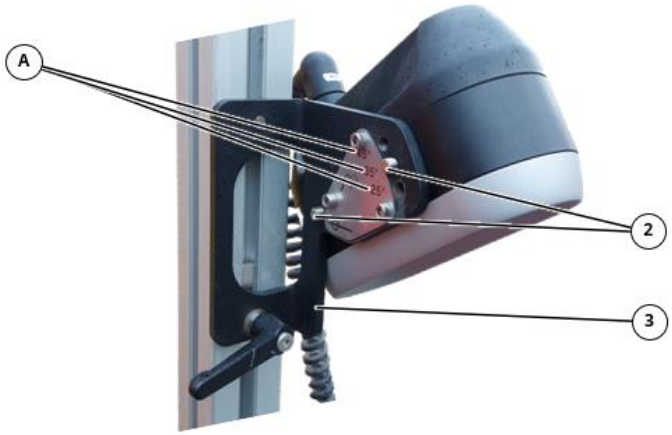
Recommended camera angle setting [A]: 35°

The lower the camera height, the wider the camera angle.

⇨ *Chapter 7.7 Set the camera system on page 108*

(2) Tighten star knob screws.

△ Camera system is mounted on camera holder.



6.3.3 Installing control terminal

(1) Secure the terminal holder [1] in the tractor cab using the fixing bracket [5].

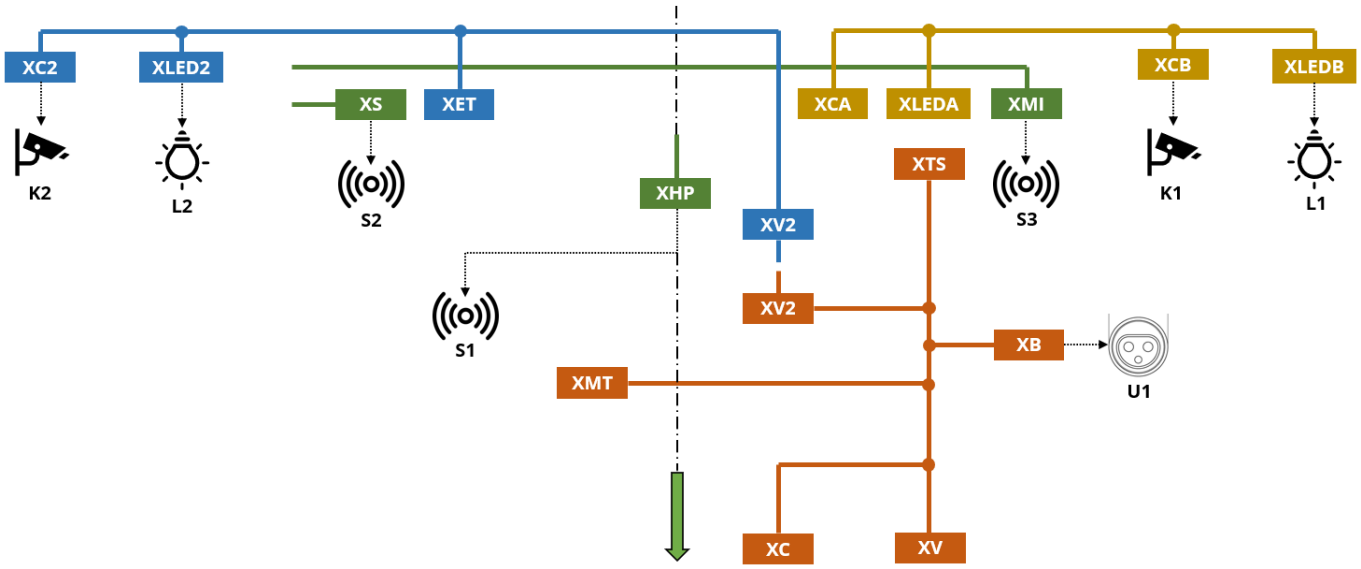
(2) Attach the touchscreen to the terminal holder using the terminal connection arm [2] with the fixing screw [3].

(3) Set up the terminal position using ball joints [4].

△ Control terminal has been removed from tractor cab.

6.3.4 Connecting camera system lines

Connection diagram



Abbreviation	Designation
K1	Camera 1, on left
L1	Camera lighting on left
K2	Camera 2, on right

Wiring harness tractor

Wiring harness camera on left

Wiring harness camera on right

Additional cable

L2	Camera lighting on right
S1	Linkage sensor
S2	Wheel sensor
S3	Row sensor
U1	Voltage supply
↓	Direction of travel

Connecting wiring harnesses

(1) Connect the tractor wiring harness and the camera wiring harness.

(2) Connect the power supply [1] to the tractor.

(3) Connecting control signal line [2] to linear sliding frame.

Connecting cables to control terminal

(4) Connect XC CAN data signal cable [3].

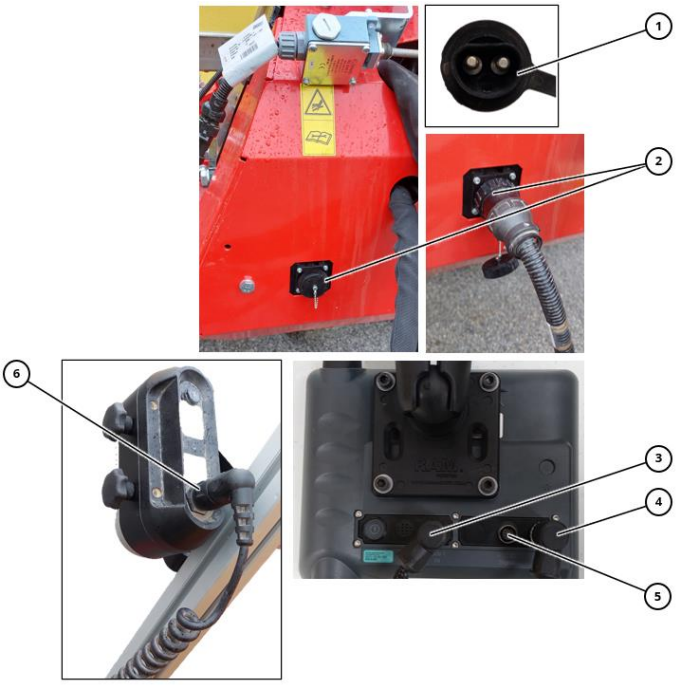
(5) Connect XV video signal cable [4].

(6) Connect RS232 data signal cable [5] (optional).

Connecting cable to camera

(7) Connect video signal cable [6].

△ Camera signal cables connected.



6.3.5 Setting up sensors

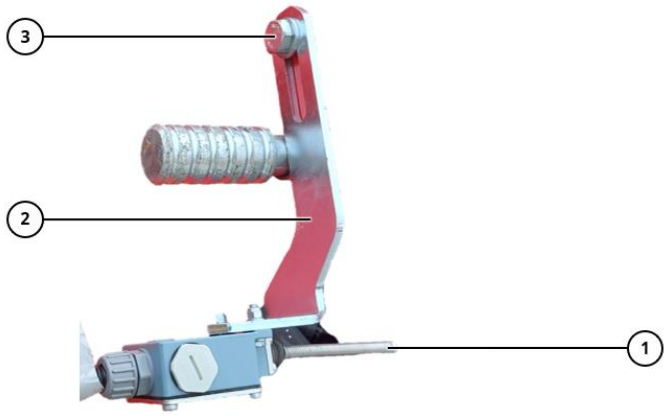
Linkage sensor

The linkage sensor [1] is pre-assembled in parking position.

(1) Loosen the hexagon bolt [3].

(2) Move the mounting bracket [2] into the correct position in the slotted hole.

- The linkage sensor must be mounted above the top link.
- The top link must not touch the linkage sensor during operation.
- When lifting, the top link must operate the linkage sensor.



IMPORTANT

The linkage sensor indicates complete actuation with a clicking sound.

(3) To check the position, raise the implement.

(4) To correct the position if necessary, move the mounting bracket in the slotted hole.

△ Linkage sensor is aligned.

6.4 Mounting the implement

WARNING

Risk of accidents caused by unsuitable tractor

If the tractor is not suitable for the implement, it could be overloaded by implement components. This means that the implement cannot be operated safely in combination with the tractor.

This could result in accidents resulting in serious injury or death and damage to the implement.

▶ Before mounting, ensure that the tractor is suitable for operation with the implement.

▶ Follow the tractor operating manual.

Check list

✓ The tractor is suitable for operation with the implement.	⇨ *Chapter Making sure the tractor is suitable, page 63*
✓ The tractor is ready.	⇨ *Chapter Preparing the tractor, page 64*
✓ The implement is ready for operation and in perfect technical condition	⇨ *Chapter Technically perfect condition, page 20*

✓ The operator and user have been instructed in the function, operation and safety of the implement.	
✓ Tractor and implement are positioned on a level and stable surface.	

6.4.1 Installation options

The hoe has a three-point linkage that is connected to the tractor's three-point linkage.

Rear mounting

- Hoe HM
- Hoe HS

6.4.2 Mounting implement on rear of tractor

🛠 Top link

🛠 Top link ball

🛠 Lower link balls

(1) Switch the linkage hydraulics on the tractor to position control.

(2) Mount the top link ball on the top link pin [1] on the implement.

(3) Mount the lower link balls on the lower link pins [2] on the implement.

(4) Secure all pins and balls with safety cotter pins.

△ Top link ball and lower link ball are mounted on the implement's three-point linkage.

(5) Adjust the lifting struts to the same length, lock and secure.

(6) Drive the tractor straight backwards towards the implement.

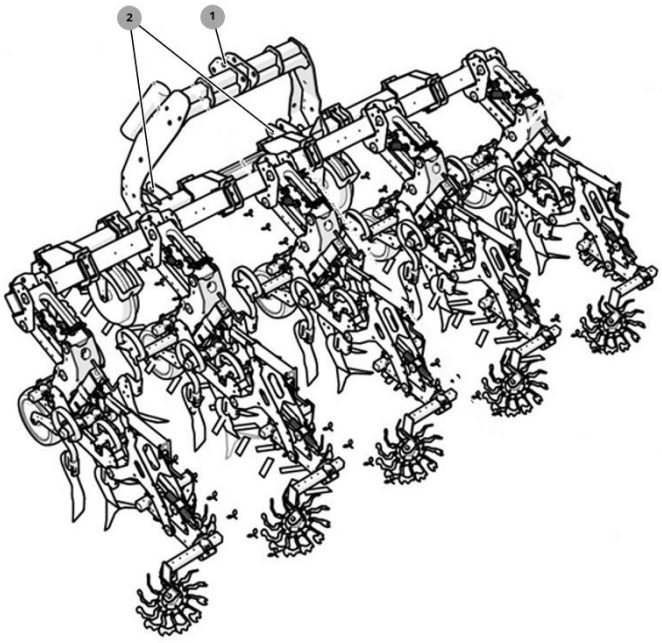
- Lower links are positioned in front of the lower link coupling points of the implement.

(7) Connect the hydraulic hoses and lines to the tractor.

⇨ *Connecting hydraulic hoses and lines on page 72*

(8) Reverse the tractor so close to the implement that the lower links are below the lower link coupling points of the implement.

(9) Connect the lower link of the tractor with lower link balls.



(10) Secure the tractor against rolling away.

(11) Raise the parking supports.

⇨ *Operating the parking lock on page 112*

(12) Select mounting position for top link.

- Align the top link parallel to the ground up to a slight incline to the implement.

NOTE

If the top link rises too much towards the implement, the implement can damage the tractor cab when folded.

- The parallelogram of the chopping element is horizontal and parallel to the ground.

IMPORTANT

Check this setting before operating in the field. Correct any settings where necessary.

⇨ *Settings before operation on page 94*

(13) Set the top link to the correct length.

(14) Connect the top link to the top link ball.

△ Implement is mounted on the back of the tractor.

6.4.3 Connecting hydraulic hoses and lines

(1) Secure the tractor against rolling away.

WARNING

Risk of injury when standing between the tractor and implement due to the tractor rolling away or sudden implement movements.

(2) Depressurise the tractor's auxiliary control units.

(3) Keep hydraulic couplings and hydraulic connectors clean.

(4) Connect hydraulic hoses to the tractor.

- Makes sure they are assigned correctly.
- Pay attention to hydraulic sticker.

(5) Connect electric cables to the tractor.

NOTE

Ensure that hydraulic hoses and cables cannot become trapped in the moving parts of the implement.

(6) Make sure that the lighting system is installed and working correctly

(7) If necessary, install control terminal in the tractor cab.

⇨ *Chapter 6.3.3 Installing control terminal on page 68*

(8) If necessary, connect cables for the control terminal.

⇨ *Chapter 6.3.4 Connecting camera system lines on page 68*

△ Hydraulic hoses and lines are connected.

6.5 Commissioning the camera system

✓ Camera system is installed on the implement.

⇨ *6.3 Installing camera system on page 65*

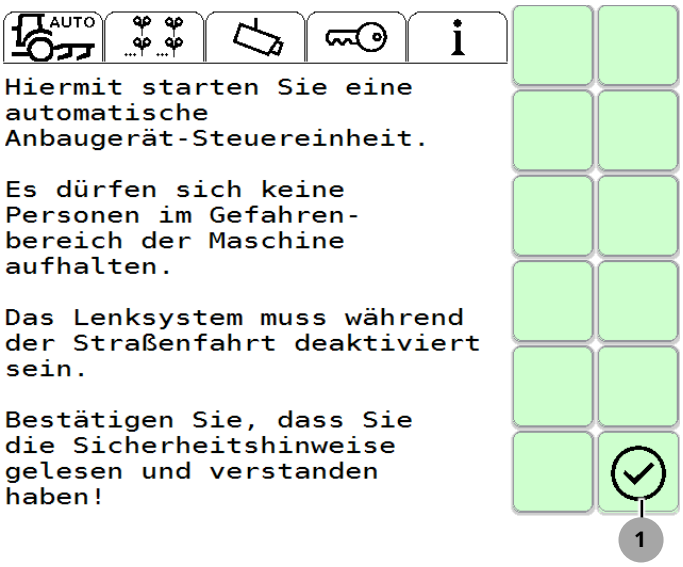
6.5.1 Basic information on control terminal

Starting camera system

▶ Press power supply button ⏻.

[1] ▶ Wait for start-up message and confirm.

△ The menu navigation opens.



Overview of menu navigation

[1] Work menu

- Operating in the field

[2] Crop menu

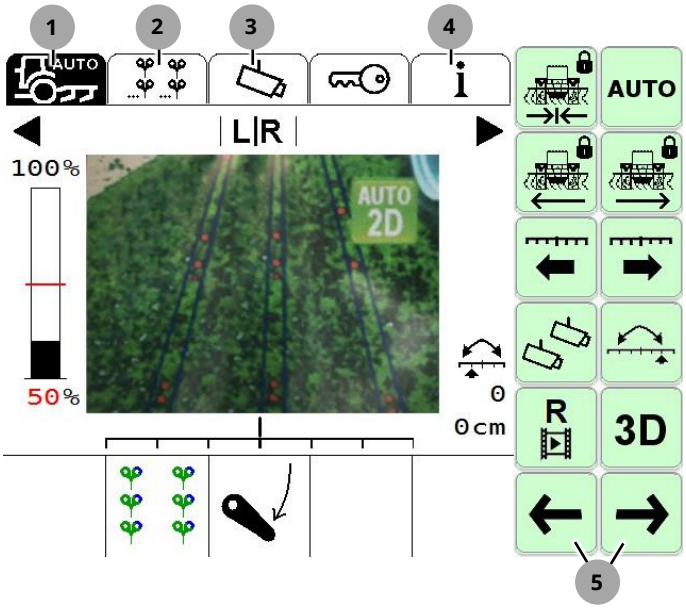
- Setting crop parameters

[3] Camera menu

- Camera settings

[4] Information menu

[5] Changing menu



6.5.2 Crop menu

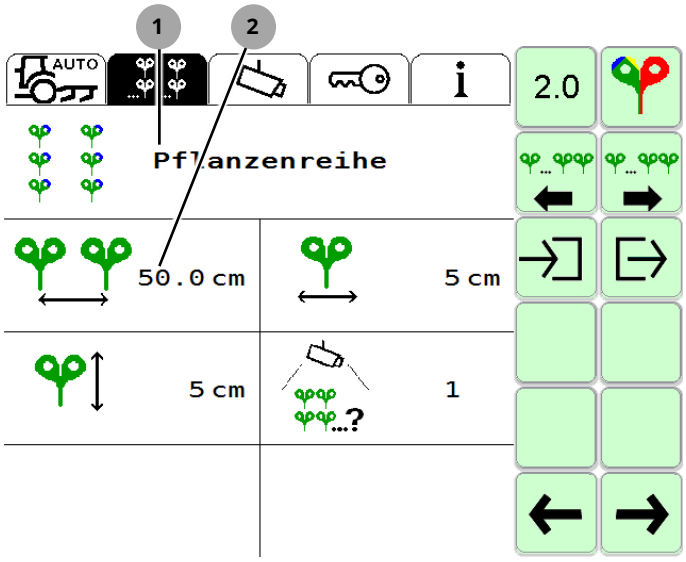
Set single row

[1] Current row setting:

- Crop row = single row, standard

[2] ▶ Set the row spacing between the crop rows.

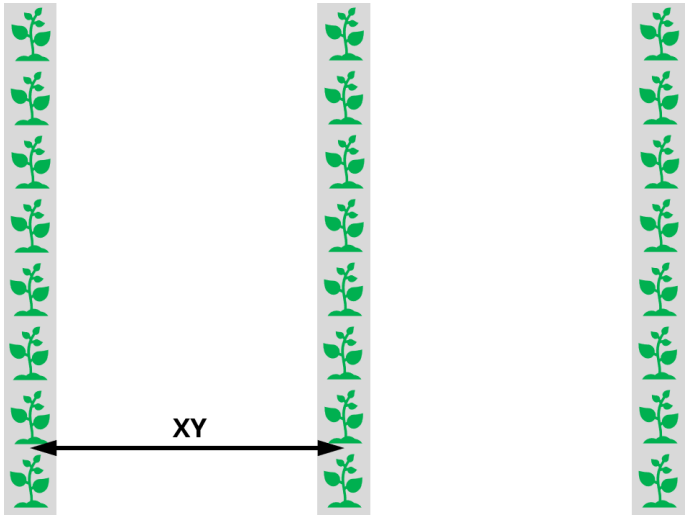
- Maize: 75 cm
- Soya: 45 cm
- Sugar beet: 50 cm
- Cereals: 25 cm



▶ Check that the row spacing [XY] between the rows of crops is correct.

▶ Measure the row spacing from the centre of the crop.

- Row spacing must match the seed row spacing.



Setting multiple rows

[1] ▶ Switching from single row to multiple rows.

[2] Row setting display:

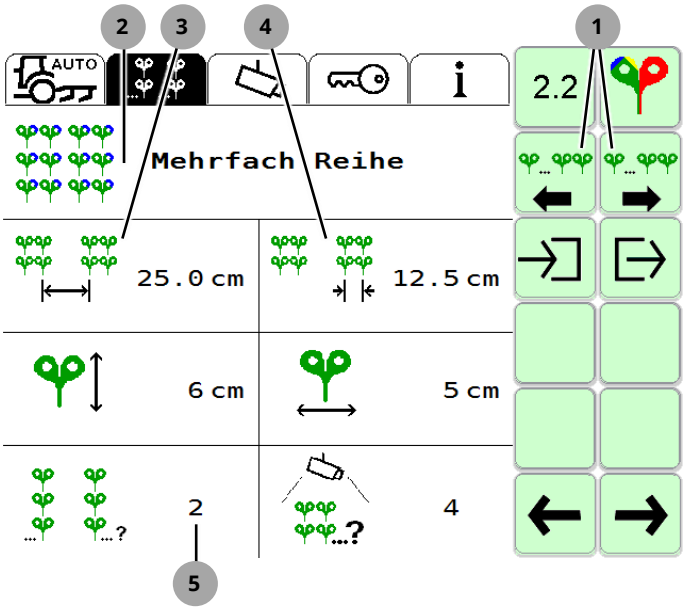
- single or multiple

[3] Row spacing between multiple row

[4] Row spacing between double row

[5] Row number per multiple row

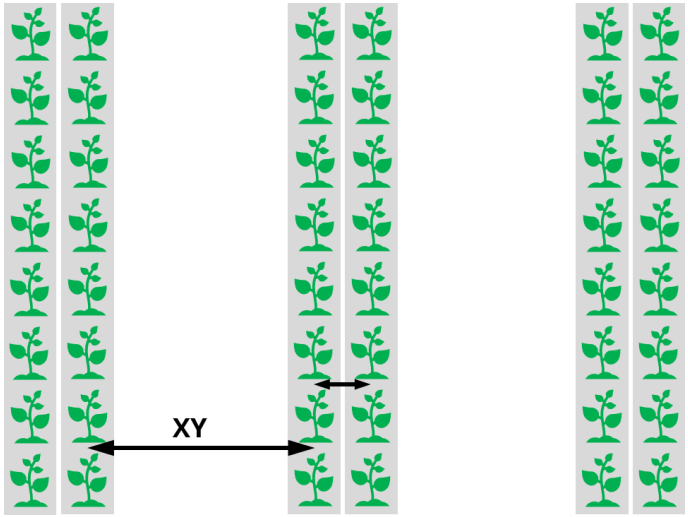
- e.g. cereals with a double row of 15 cm and 45 cm



▶ Check that the row spacing [XY] between the rows of crops is correct.

▶ Measure the row spacing from the centre of the crop.

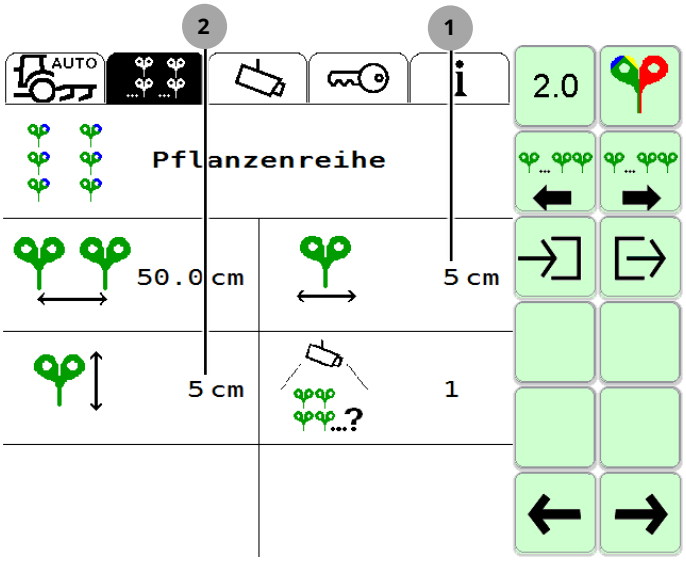
- Row spacing must match the seed row spacing.



Setting crop width and crop height

[1] ▶ Set crop width.

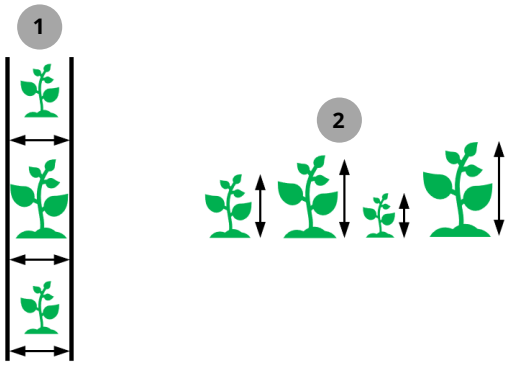
[2] ▶ Set crop height.



[1] Crop width:

▶ Select the width so that the crop plants in the video image are positioned between the two lines.

- Leaves should not protrude beyond the lines.
- Lines must not be too far away from the leaf edges.

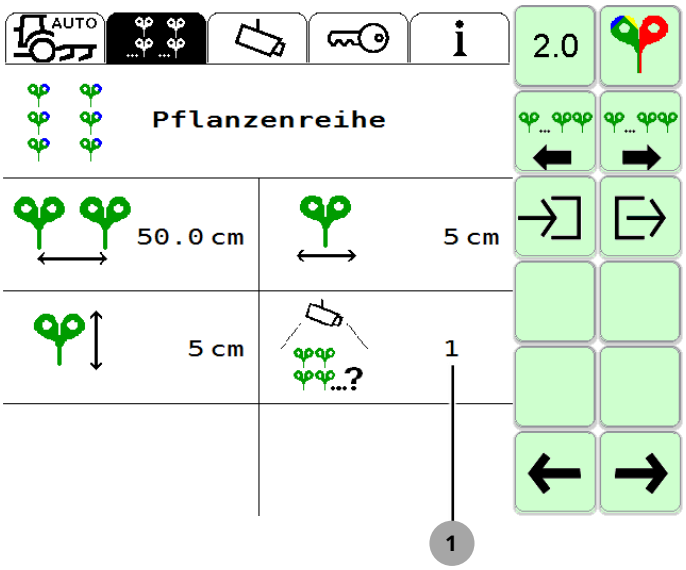


[2] Crop height:

▶ Measure several plants, calculate an average value and enter it.

Setting the number of rows in the camera field of view

[1] ▶ Set the number of rows in the camera field of view.

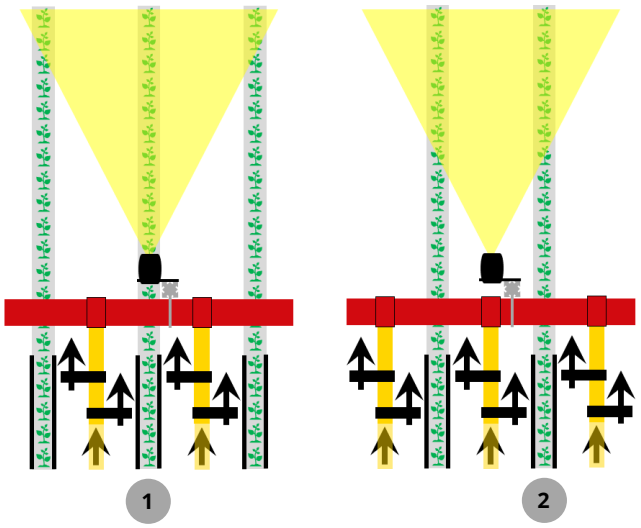


[1] Odd number of rows in camera field of view (1,3,5):

▶ The camera holder must be mounted exactly above a row or exactly in the centre of 2 chopping elements.

[2] Even number of rows in camera field of view (2.4):

▶ The camera holder must be mounted exactly between 2 rows or exactly in the centre of a chopping element.



IMPORTANT

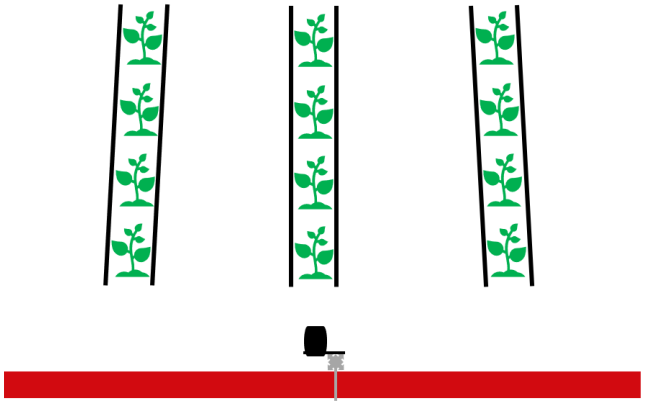
Recommended setting:

- 75 cm maize = 2 rows
- 50 cm beet = 3 rows
- 25 cm cereals = 5 rows

Checking crop parameters

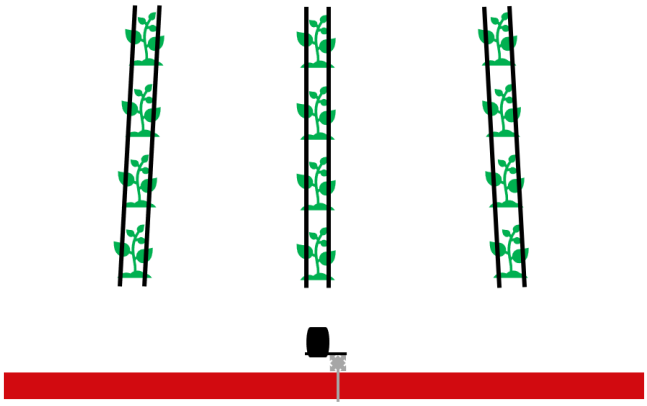
RIGHT:

- The boundary lines of the camera must lie well above the actual row of plants.



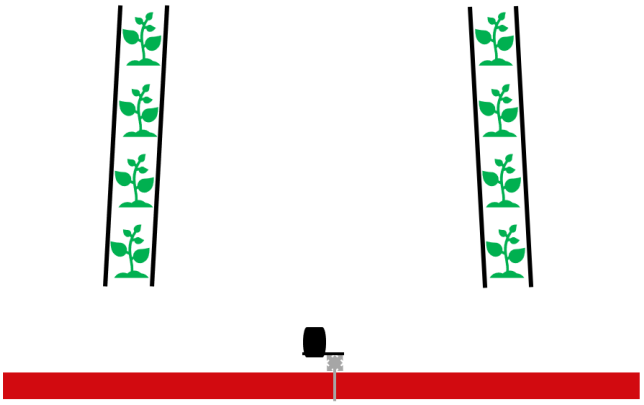
WRONG:

- The boundary lines of the camera must lie well above the actual row of plants.



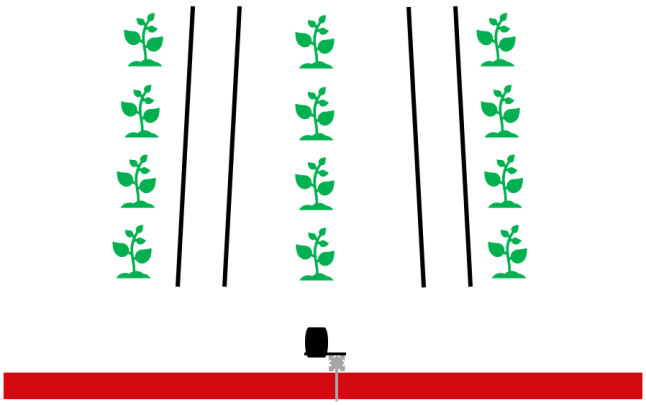
RIGHT:

- The boundary lines of the camera must lie well above the actual row of plants.



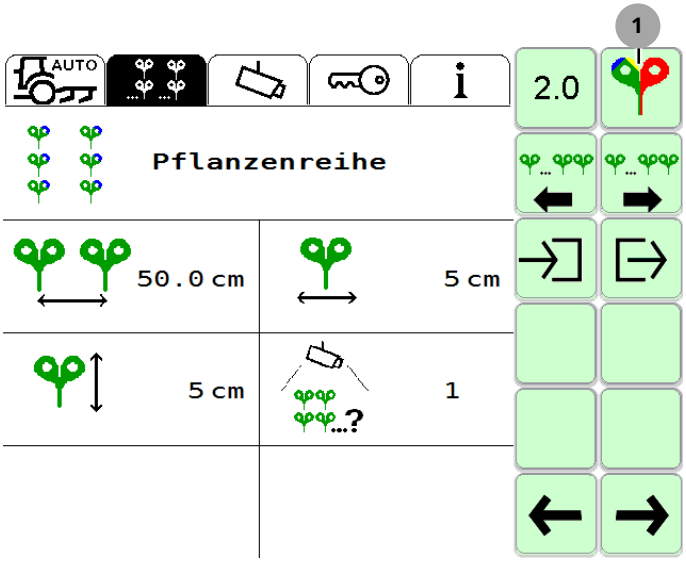
WRONG:

- The boundary lines of the camera must lie well above the actual row of plants.



Setting colour detection

[1] Colour selection



The different colour schemes have a positive or negative effect on the image quality.

▶ If the image quality fluctuates, try out different variations to achieve the best possible image quality.

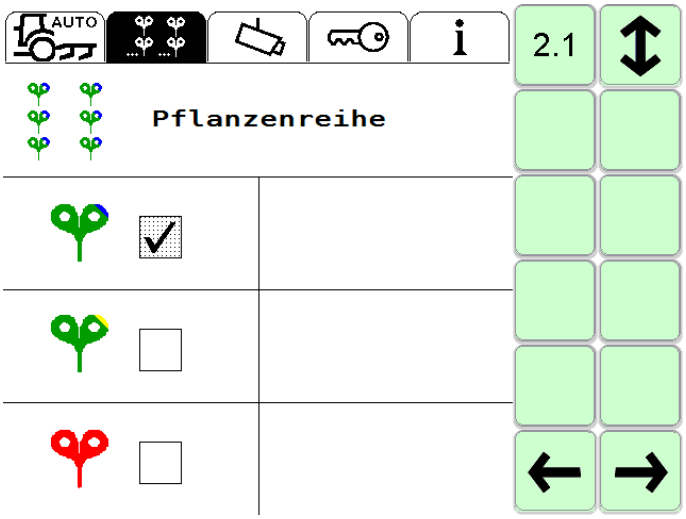
- Examples:

  Maize = green/yellow

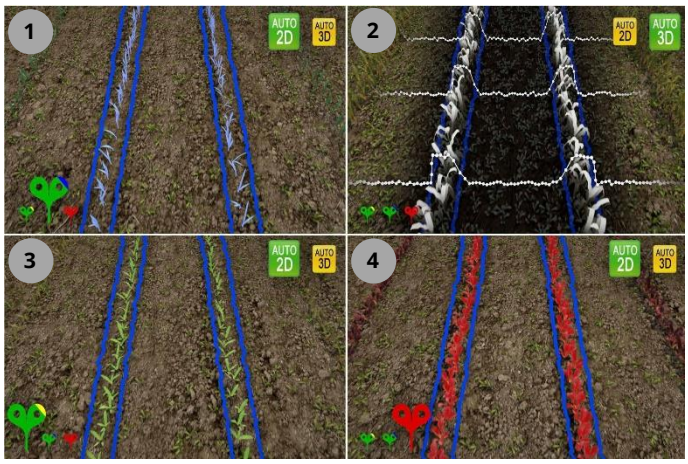
  Soya = green/blue

  Cereals = green/yellow & green/blue

  Special crops = red



▶ Do not set too many displays at the same time. Combinations are possible.



[1] Selected setting:

- green/blue and 2D

[2] Selected setting:

- 3D without colour

[3] Selected setting:

- green/yellow and 2D

[4] Selected setting:

- red and 2D

IMPORTANT

Recommended setting:

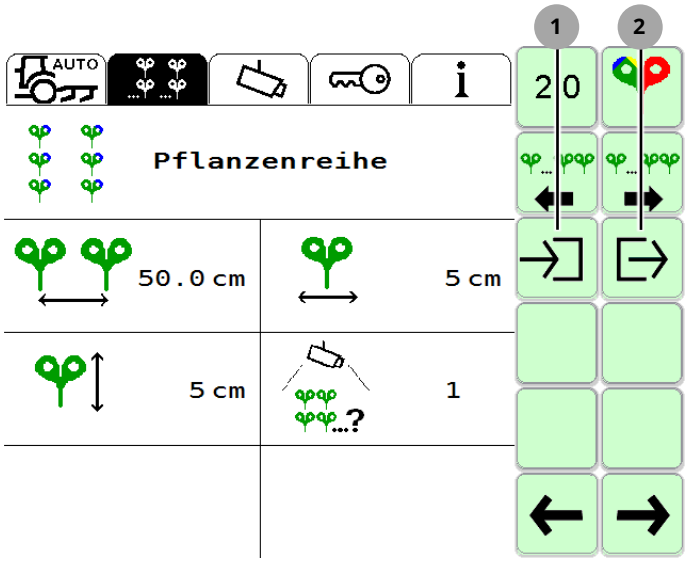
- green/blue & green/yellow

Saving and loading crop settings

[1] ▶ Save crop settings.

[2] ▶ Load crop settings.

- Parameters are saved in the clipboard and can be reloaded.



6.5.3 Camera menu

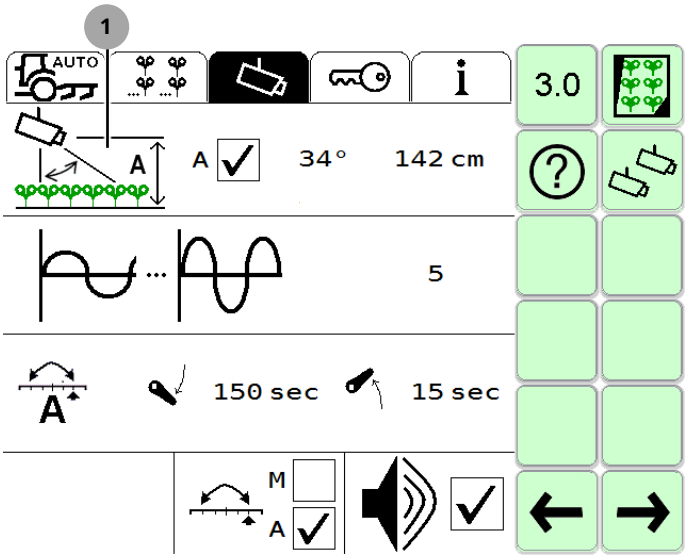
Setting camera position

[1] Set camera angle and camera height

A ☑ = automatic detection (recommended)

A ☐ = manual input of camera angle and camera height

⇨ *Chapter 7.7 Set the camera system on page 108*

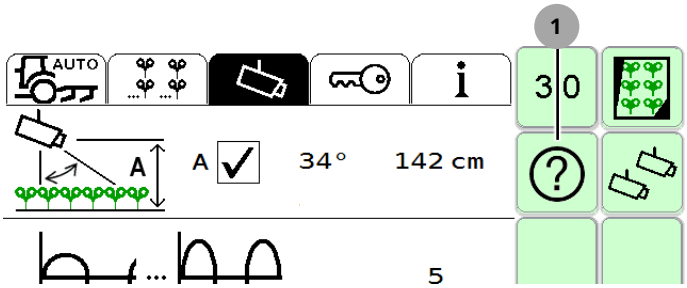


Opening table of recommendations for camera position

[1] ▶ Open table of recommendations for camera position.

Multiple crop rows

- The table is automatically adapted to the crop parameters entered.



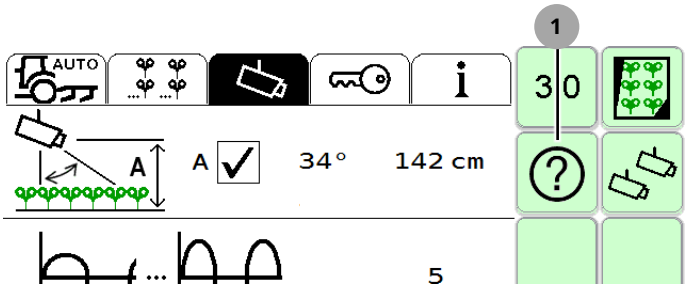
Row spacing/ seed row spacing [cm]	Number of rows	Recommended camera height ±10 cm, minimum [cm]	
		Small plants Row Ø and height < 10 cm	Tall plants Row Ø and height > 10 cm
12.5 (e.g. cereals)	5	100	≥ 120
12.5	6	110	≥ 130
25 (e.g. organic wheat)	3	100	≥ 130
25	4	120	≥ 150
25	5	140 [1)]	≥ 170
37.5 (e.g. soya beans)	2	90	≥ 130
37.5	3	120	≥ 160
50 (e.g. sugar beet)	2	100	≥ 150
50	3	140 [1)]	≥ 190
75 (e.g. maize)	2	120	≥ 190

[1)] Plant diameter ≥ 3 cm

[1] ▶ Open table of recommendations for camera position.

Single crop row

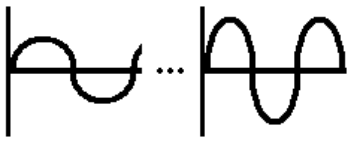
- The table is automatically adapted to the crop parameters entered.

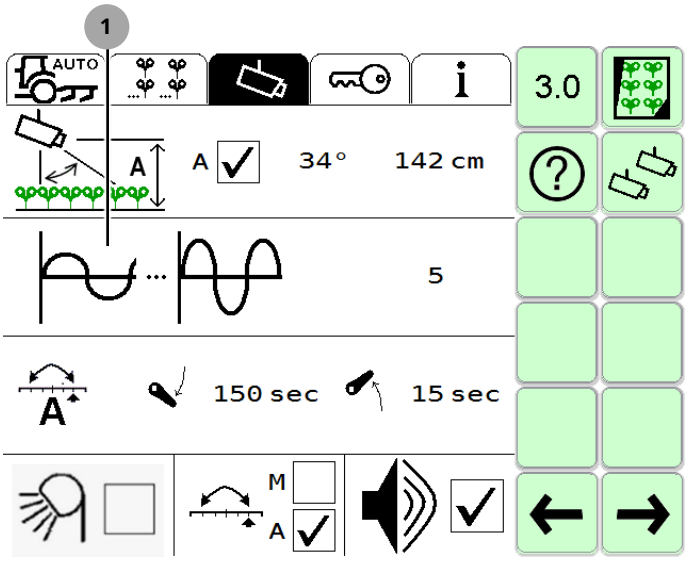


Crop height/ Plant Ø [cm]	Recommended camera height ±10 cm, minimum [cm]	
	2D-mode	3D-mode
1 [1)]	50	80
2	53	83
5	55	85
10	60	90
20	70	100
40	90	120
60	110	140
80	130	160
[1)] valid for CULTI CAM Professional		

Setting control inertia

[1] Control inertia





- Display and input field:

  Sensitivity of linear sliding frame:

  Value 1 = slow

  Value 2 = fast

IMPORTANT

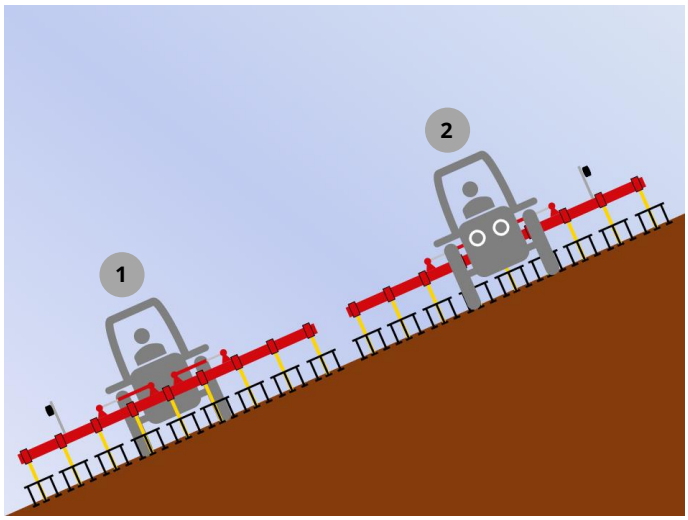
Recommended setting:

- Value 5

Setting offset

▶ When operating on sloping surfaces, enter the offset in the work menu and adjust according to the circumstances.

■ No offset is required for operation on flat surfaces.

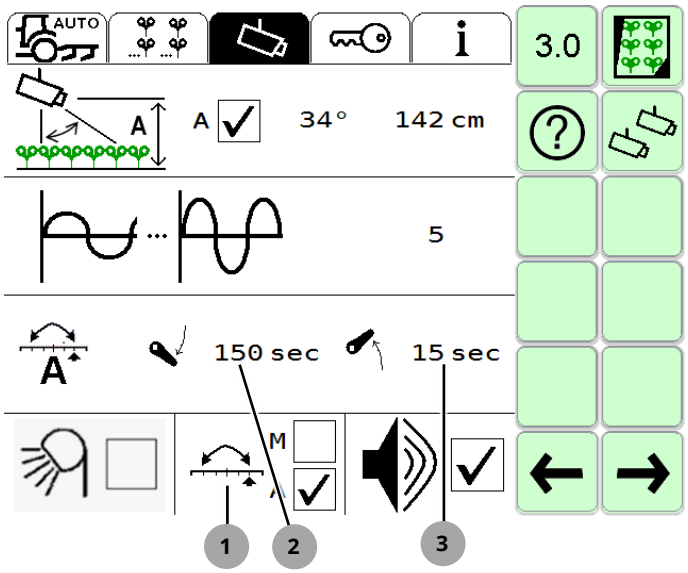


[1] ▶ When drifting to the left in the direction of travel:

Enter offset to the right.

[2] ▶ When drifting to the right in the direction of travel:

Enter offset to the left.



[1] Offset switching:

■ manual

■ automatic

Input for “automatic”:

[2] Lowering time display and input field:

■ Minimum time that the implement must be lowered into working position before the automatic offset switches over.

[3] Raising time display and input field:

■ Minimum time that the implement must be raised when turning at the headland before the automatic offset switches over.

▶ Enter the offset value [cm] in the work menu.

Setting camera lighting and warning sound

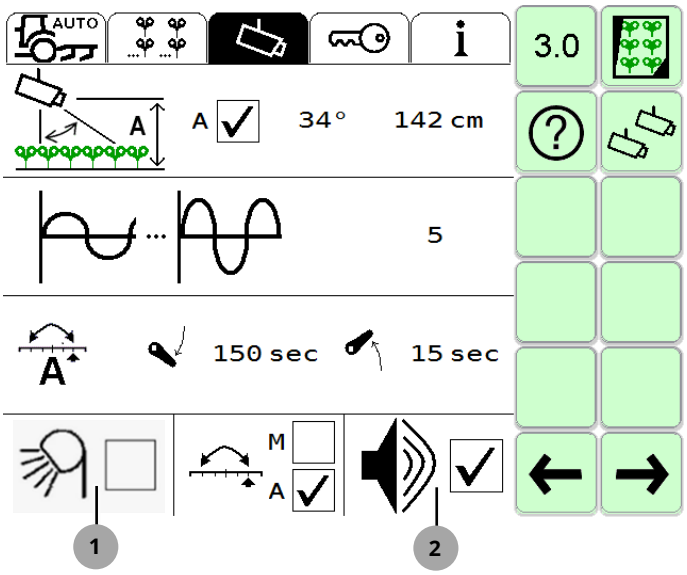
✓ Camera lighting connected.

[1] Camera lighting:

- switch on
- switch off

[2] Warning sound:

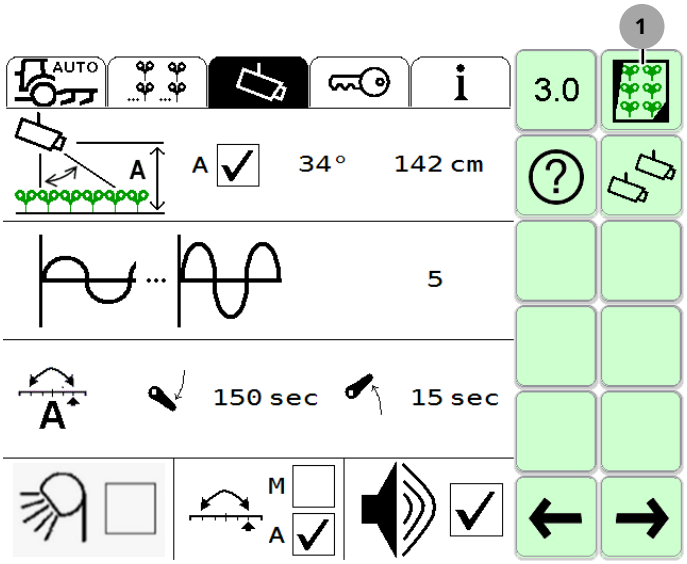
- switch on
- switch off



Cropping camera image - “image masking”

[1] ▶ Crop camera image.

- For example, if tractor tyres or implement components interfere with the tractor image.



[1] Select camera (R = right, L = left)

- With 2-camera mode (optional)

[2] “Image masking” switched off

▶ Switch on “Image masking” by tapping.

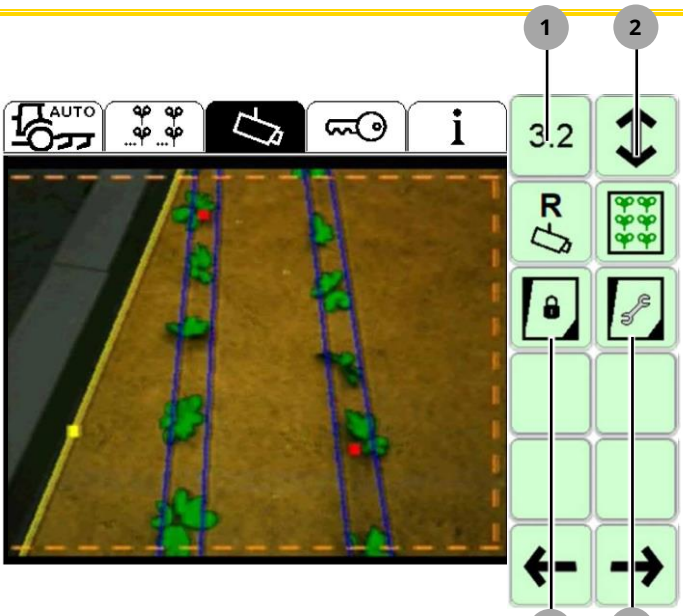
- Function is opened.

△ Mask ready for settings.

[3] ▶ Fix the mask to the camera by tapping on it.

△ A double-arrow will appear.

[4] ▶ Tap to open "crop" option.



[1] Reset lines:

- Lines are reset to known position.

[2] Select active line:

▶ Change line selection by tapping.

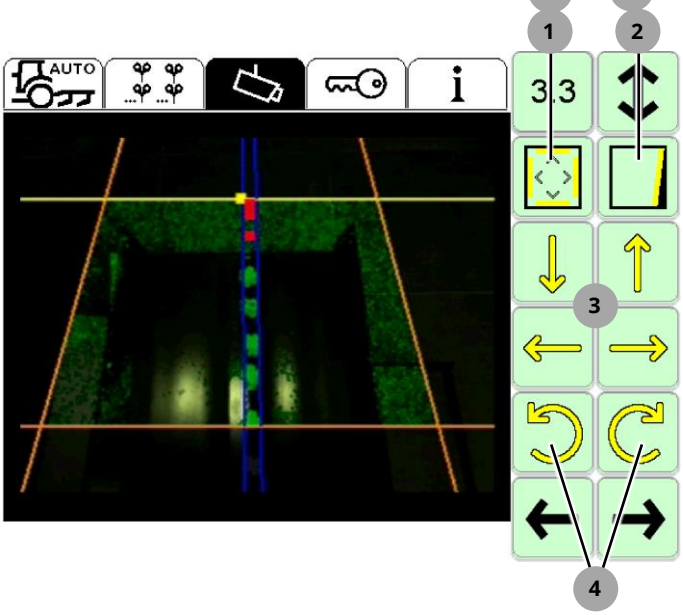
- Line shown in yellow in the image can be edited.

[3] ▶ Move line in the direction of arrow.

- Line is moved making the image smaller or larger.

[4] ▶ Rotate line in direction of arrow.

- Line can be rotated clockwise or anti-clockwise by tapping it.



6.5.4 Working with the camera system

Work screen in general

[1] Centre position of sliding frame:

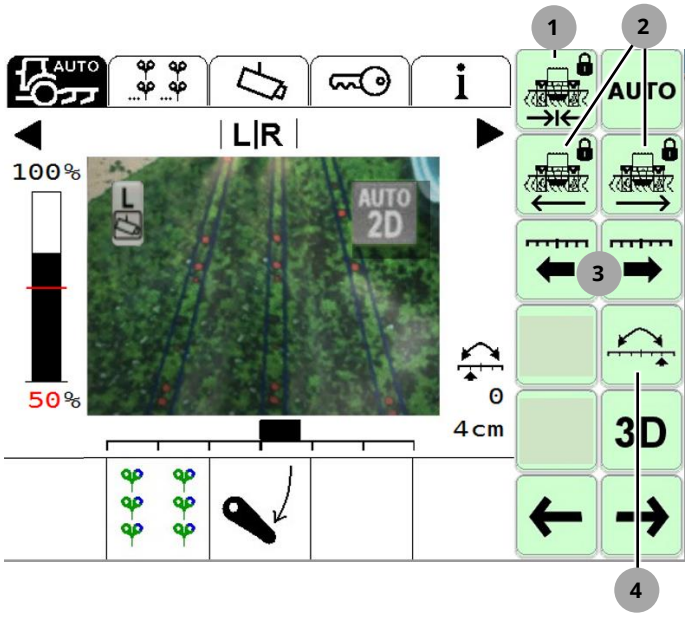
▶ Tap twice to release.

[2] ▶ Can slide manually to the left or right

▶ Tap twice to release.

[3] ▶ Enter offset [cm] to the left or right.

[4] ▶ Manually switch offset.

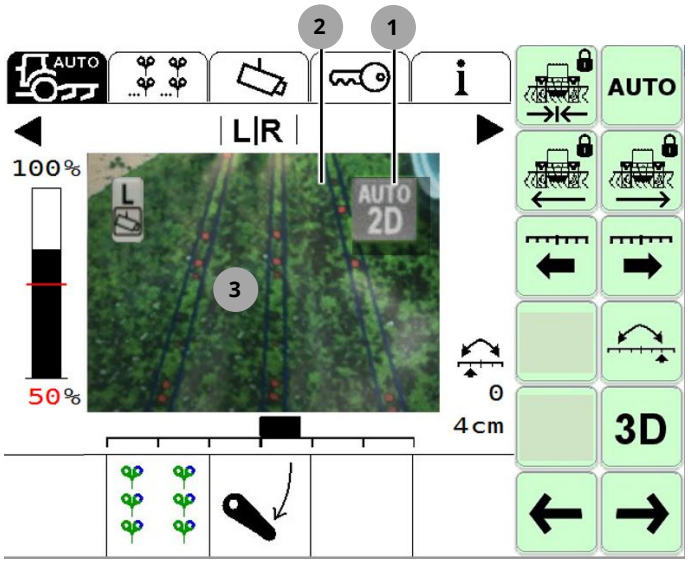


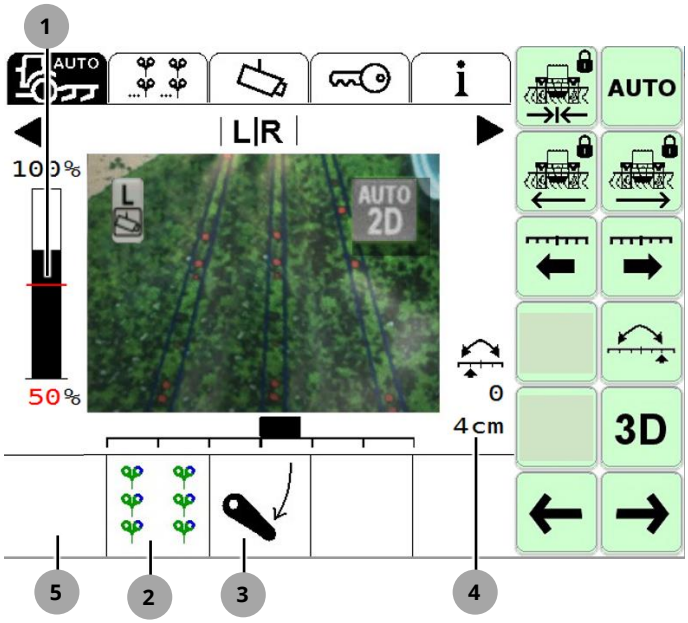
Display and information

[1] Display 2D or 3D mode active

[2] Camera image

[3] ▶ Tap on the camera image to zoom in.





[1] Signal quality of camera with threshold value

- Target value >30%

▶ Enter the threshold value by tapping on the value

[2] Selected crop row and colour setting

- single
- multiple

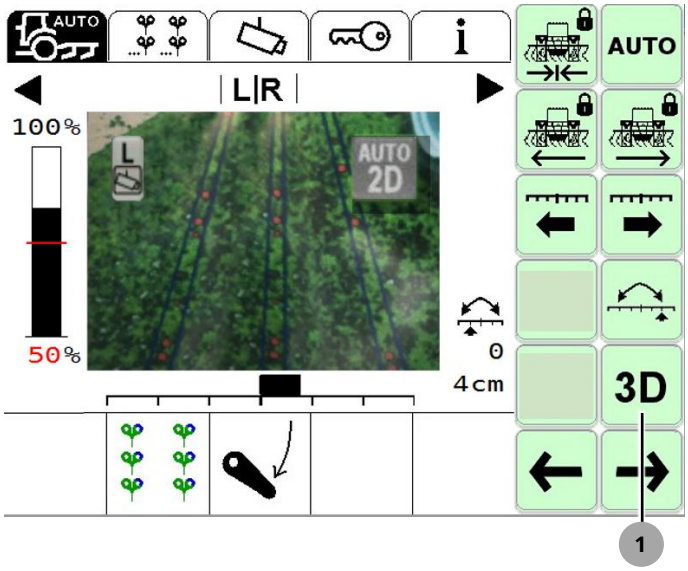
[3] Position of implement

- raised
- lowered

[4] Offset entered

[5] Error messages

Switch to 3D mode



[1] 3D-mode

- Only use 3D mode in an emergency in the event of extensive weed infestation.

▶ Tap to activate 3D mode.

- The crop must have a height difference of at least 10 cm to the weed.

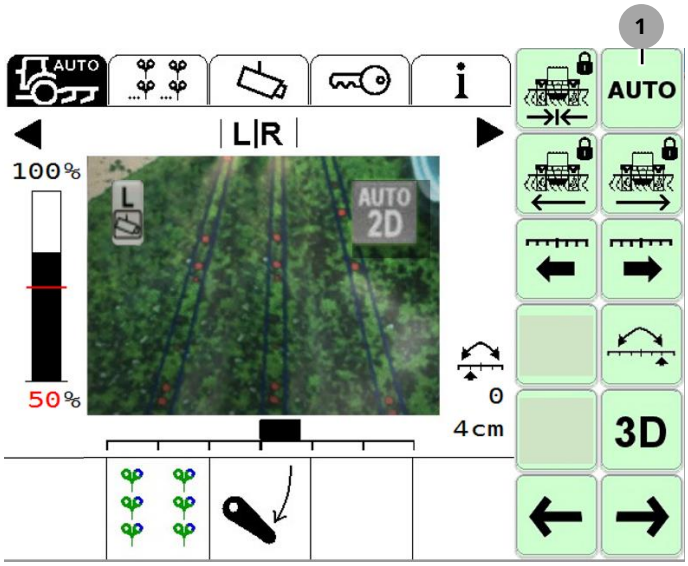
Starting system

(1) Activate the supply control unit of the linear sliding frame with constant oil supply.

- 15...20 l/min

[1] (2) Start system

(3) Move the implement into working position and drive away.



Checking that it is working and stopping the system

[1] Status automatic control

- flashing: control is active, but is not steering
- cylinder symbols are moving: automatic control is active and steers

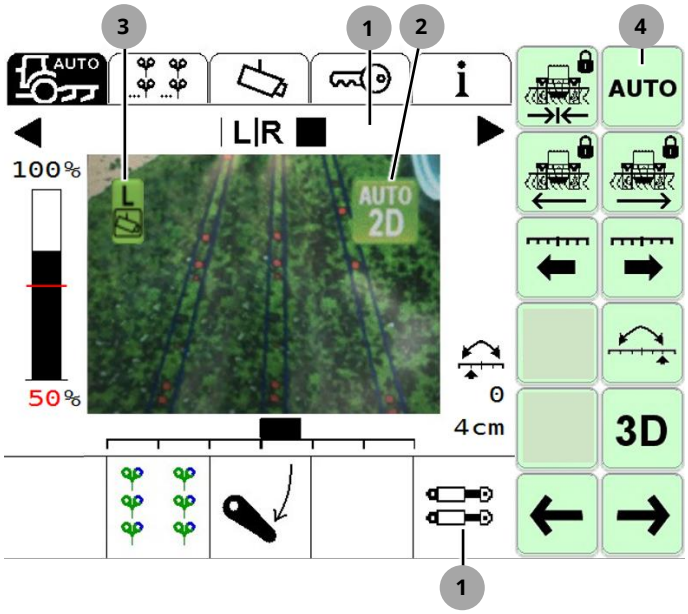
[2] 2D / 3D symbol in the video image

- Grey = system deactivated
- Yellow = system activated, but poor crop detection
- Green = system activated, crop is recognised

[3] Camera symbol in the video image

- Grey = system deactivated
- Yellow = system activated, but poor crop detection
- Green = system activated, crop is recognised

[4] ▶ Stop the system.



6.5.5 Wheel sensor

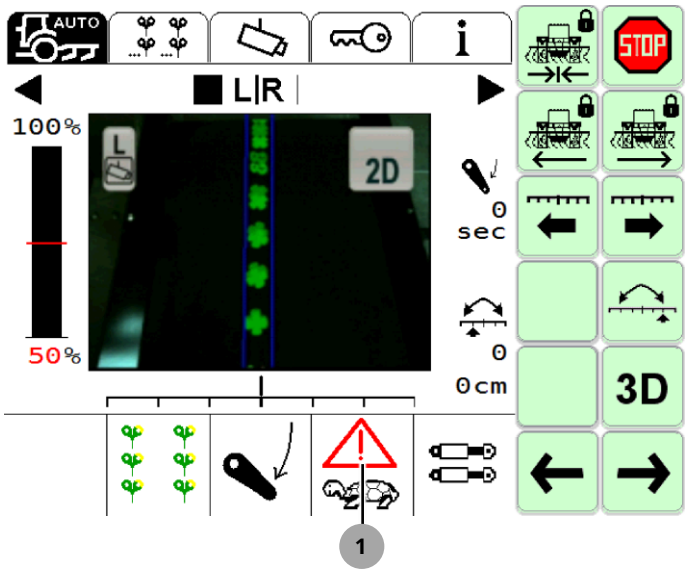
✓ Wheel sensor mounted on the flanged wheels

✓ Control lamp on wheel sensor lights up, wheel sensor sends signal

[1] Fault message

- Wheel sensor does not send a signal

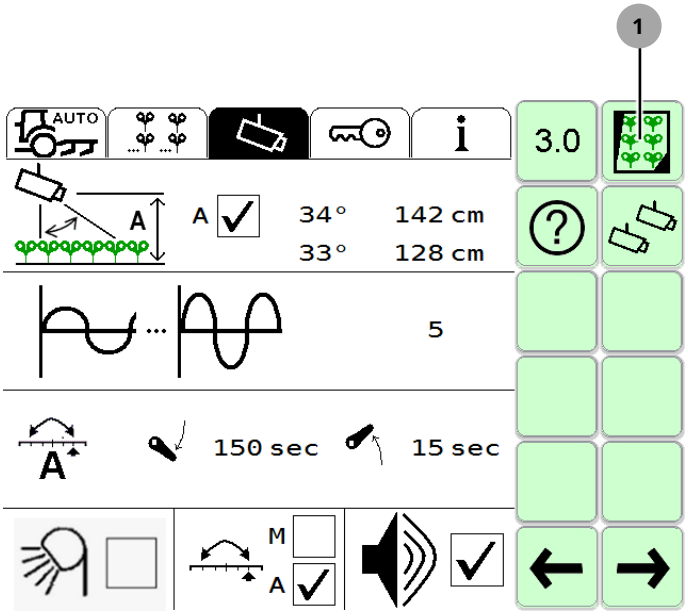
⇨ *Chapter 9 Troubleshooting on page 118*



6.5.6 Working with 2 cameras

Setting up second camera

[1] Call up the second camera settings.



[1] ▶ Activate video.

Choose between the functions:

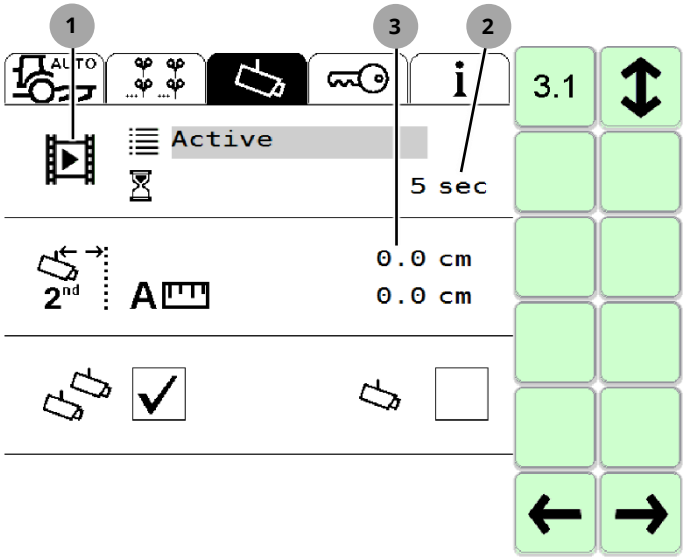
- Timer: time interval
- Active: camera image with top signal quality is shown
- User: manual selection

[2] ▶ Set time interval.

- Setting required for “Timer” function.
- The video image changes after this time.

[3] ▶ Enter position offset X for the second camera.

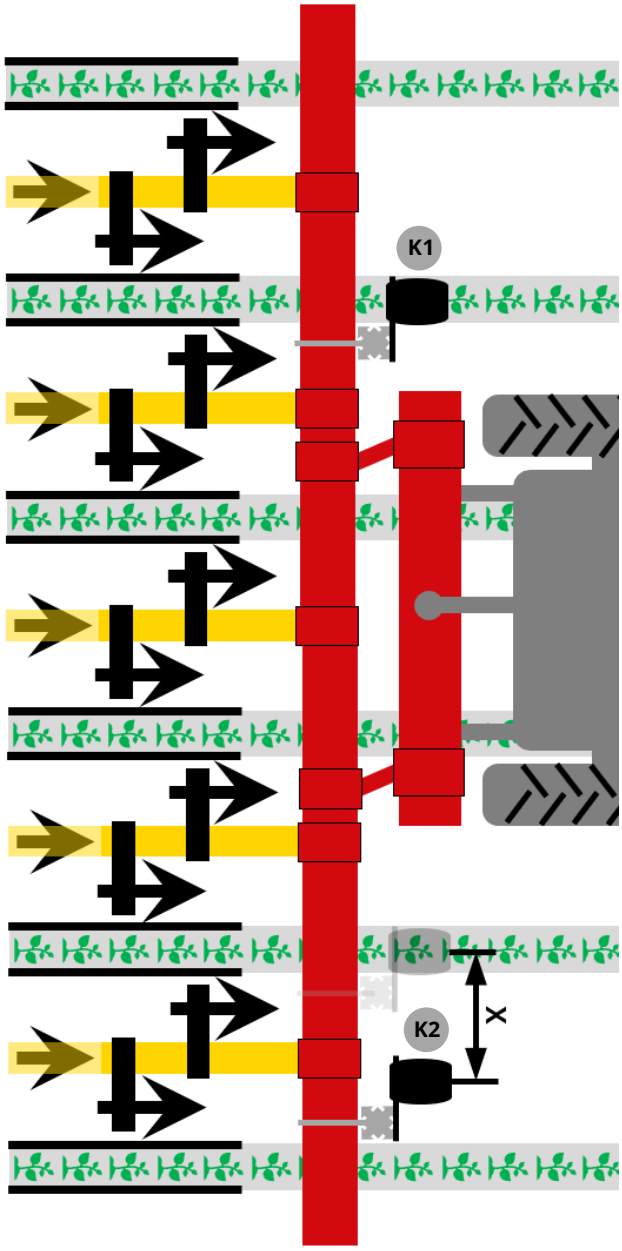
- First line: offset of the right camera compared to the left camera.
- Second line: measured deviation of the camera.
- X = position offset of the second camera to the right.
- K1 = camera 1, on left
- K2 = camera 2, on right



IMPORTANT

During operation, only camera 1 or camera 2 is active at any one time.

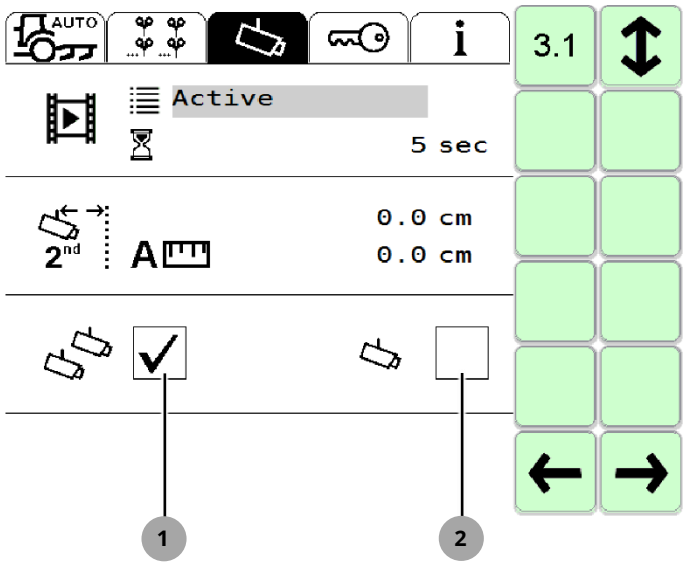
Camera 1 and camera 2 cannot be operated simultaneously.



[1] ▶ Select 2-camera mode.

- Active at system startup.

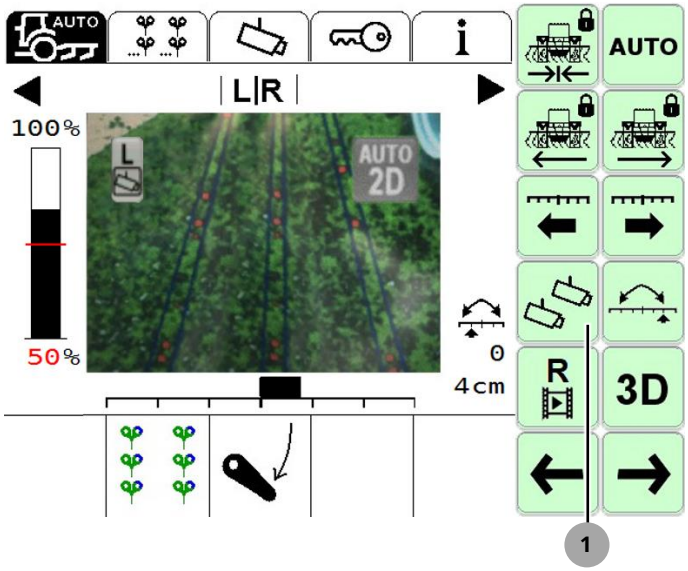
[2] ▶ Select 1-camera mode.



Working in 2-camera mode

[1] ▶ Switch camera over to dual.

- Switch over to 2-camera mode.



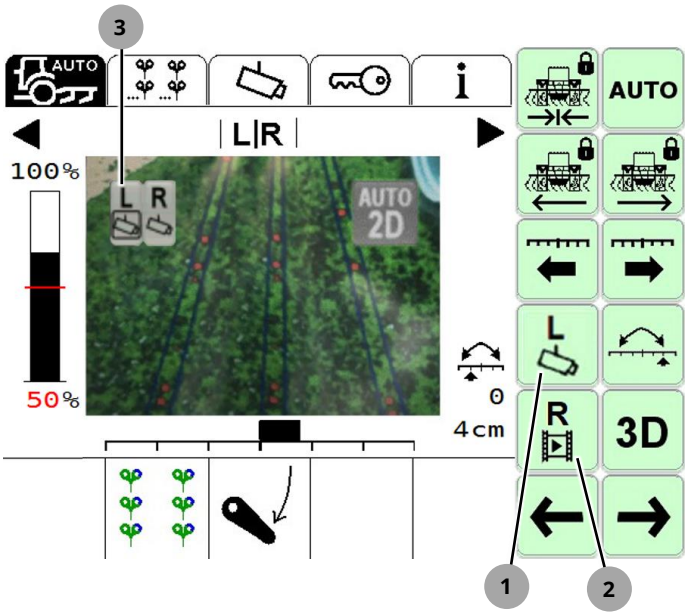
[1] ▶ Switch between:

- Camera 1, on left
- Camera 2, on right

[2] ▶ Switch between:

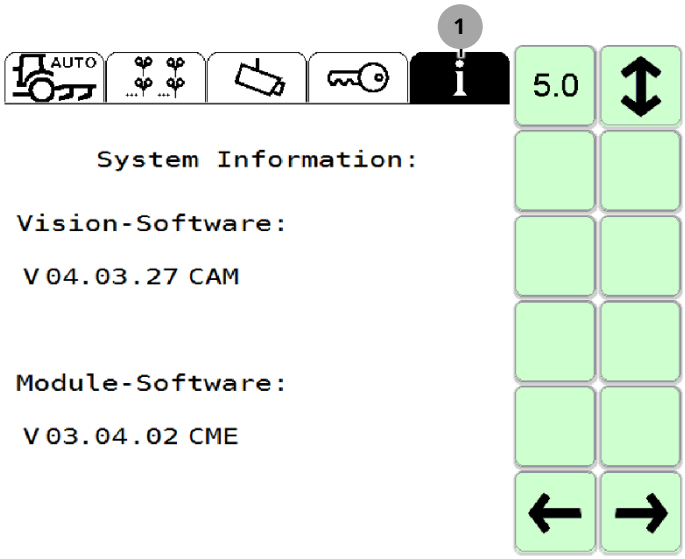
- Video source camera 1, on left
- Video source camera 2, on right

[3] Display of active video source



6.5.7 Software version

[1] The software version can be seen in the information menu.



7 Setting up implement

7.1 Settings before operation

Before operating the implement, the user must make settings that must be carried out at the following work locations:

- Business premises
- Field

NOTE

Destroying crops

The user must check the settings and measurements made in advance before operating in the field and correct them if necessary.

✓ Implement properly mounted on tractor.

✓ Folding implements are fully unfolded.

✓ Implement/tractor configuration is on a level, horizontal, stable surface.

Overview of settings

Place carried out	Setting	
Business premises	Select working tools and set them.	⇨ *Page 94*
Business premises	Check spacing between the chopping elements and set them.	⇨ *Page 101*
Field	Align implement over support wheels: ■ Adjust the height of the support frame. ■ Adjust the height of the support wheels. ■ Align the parallelogram.	⇨ *Page 104*
Field	Set the working depth of the chopping elements.	⇨ *Page 107*
Field	Set ground pressure force of the chopping elements.	⇨ *Page 108*
Field	Set the camera system	⇨ *Page 108*

7.2 Selecting and setting working tools

⦿ Control weeds in a way that is gentle on the crop.

⦿ Keep hoeing lines as narrow as possible.

✓ Working tools on the chopping elements are selected to match the crop.

✓ Crop protection discs have been fitted where necessary to protect the crops.

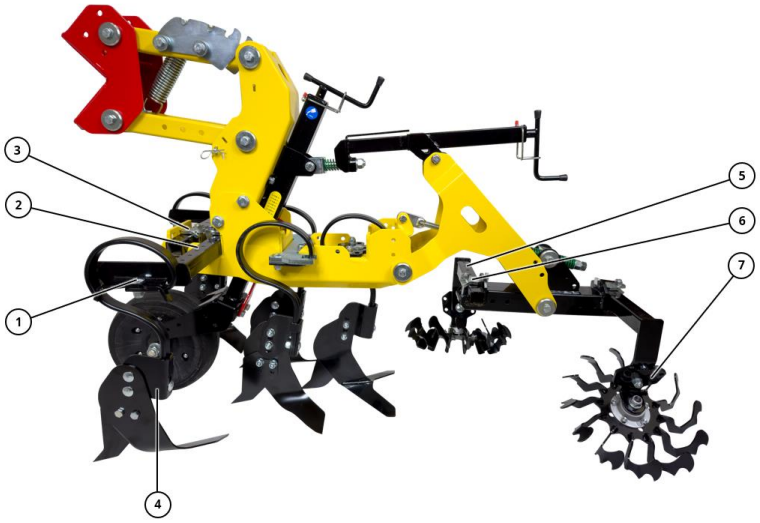
✓ The width of the individual hoeing lines between the crops has been measured.

7.2.1 Basic settings

7.2.1.1 Attaching the working tools

Attachment position	Working tool
Chopping coulter support	■ Angle coulter with feed tip as an option ■ Centre coulter with feed tip as an option ■ Crop protection disc
In-row hoeing support	■ Steel fan wheel with stone protection disc as an option ■ Finger hoe ■ Harrow ring

The working tools can be adjusted with nuts and carriage bolts either via sliding elements or bolted directly on the chopping element.



[1] Screw connection of the working tools
[2] Sliding element for chopping coulter
[3] Retaining clip on chopping coulter support
[4] Tool holder for chopping coulter
[5] Sliding element for in-row hoeing
[6] Retaining clip on in-row hoeing support
[7] Tool holder for in-row hoe

7.2.1.2 Changing working tools

🛠 Hexagon key

🛠 Carriage bolts including nuts

(1) Loosen nuts from carriage bolts.

(2) Remove carriage bolts.

(3) Remove working tool from tool holder.

(4) Position new working tool on the tool holder.

(5) Insert carriage bolt into the opening.

(6) Tighten nuts on carriage bolts.

- If necessary, use new carriage bolts including nuts.

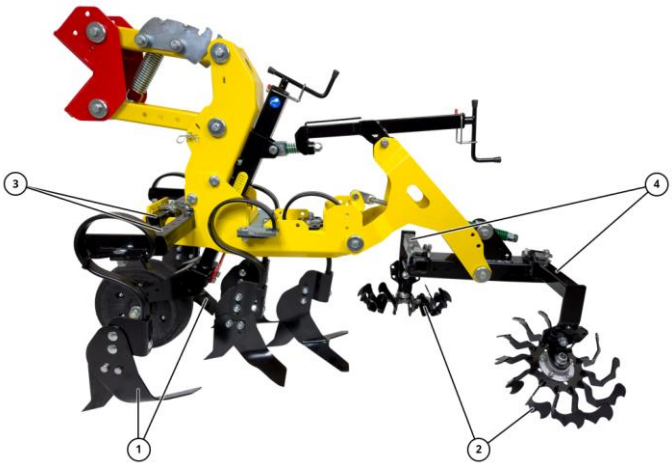
7.2.1.3 Set the working width on the chopping element

The outer chopping coulters [1] and the in-row hoes [2] determine the working width of the chopping element.

▶ Move the sliding element [3, 4] outwards or inwards using the working tool.

⇨ *Chapter 7.3 Checking and setting spacing between chopping elements on page 101*

△ Working width is set.



7.2.2 Special settings for working tools

7.2.2.1 Fastening position of the chopping coulters

The chopping coulters can be attached to the tool holder in different positions.

▶ Attach the chopping coulter to the tool holder in the upper [1] or lower [2] position.

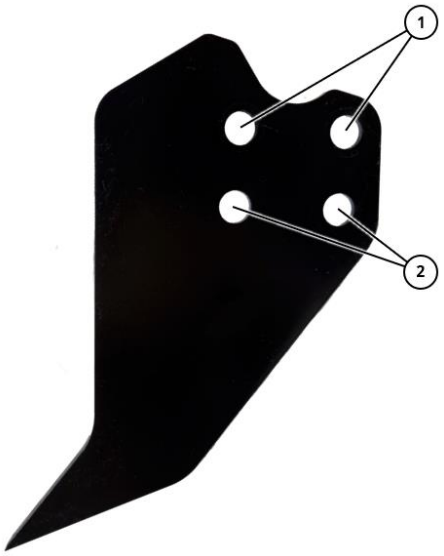
■ If necessary, use new carriage bolts including nuts.

7.2.2.2 Position to attach the feed tips

The feed tips can be attached to the chopping coulter in different positions.

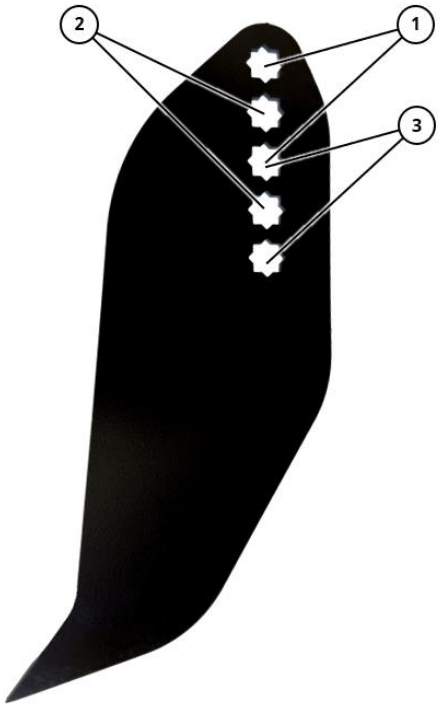
Feed tip angle coulter

- ▶ Attach the feed tip to the angle coulter in the upper [1] or lower [2] position.
  - ■ If necessary, use new carriage bolts including nuts.



Feed tip central coulter

- ▶ Attach the feed tip to the centre coulter in the upper [1], middle [2] or lower [3] position.
  - ■ If necessary, use new carriage bolts including nuts.



7.2.2.3 Aggressivity of steel fan wheel

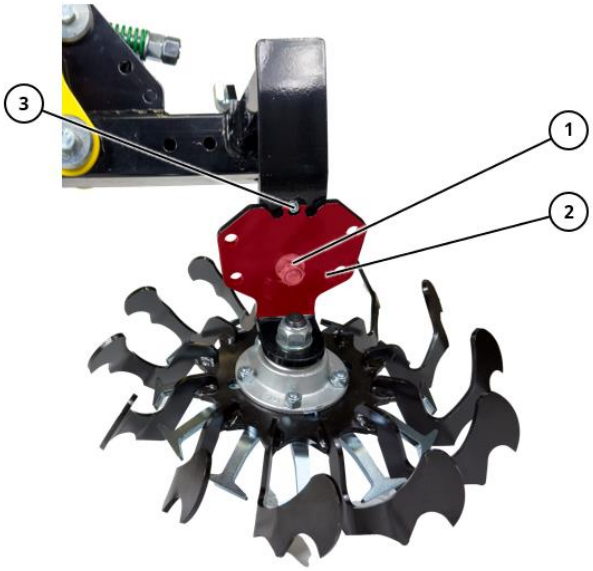
(1) Undo nuts [1].

(2) Fasten the tool holder [2] of the steel fan wheels in the front, centre or rear pin position [3].

(3) Tighten nuts.

- If necessary, use new carriage bolts including nuts.

△ Aggressivity of steel fan wheel is set.



7.2.2.4 Aggressiveness of the finger hoe

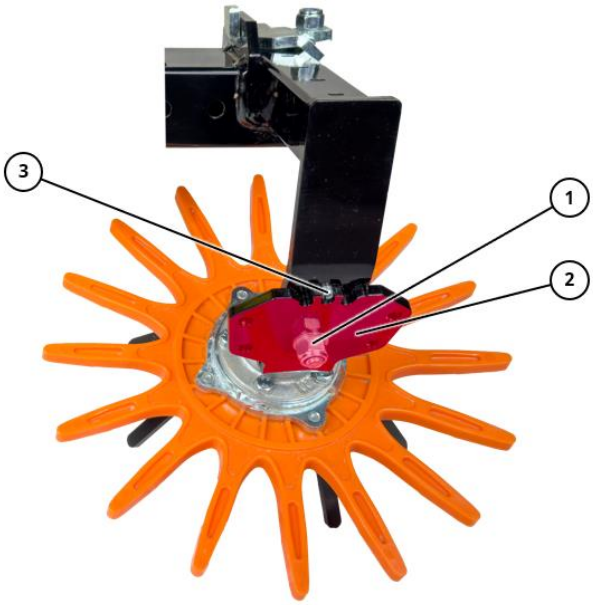
(1) Undo nuts [1].

(2) Fasten the tool holder [2] of the finger hoe in the front, centre or rear pin position [3].

(3) Tighten nuts.

- If necessary, use new carriage bolts including nuts.

△ Aggressiveness of the finger hoe is set.



7.2.2.5 Pitch of harrow ring

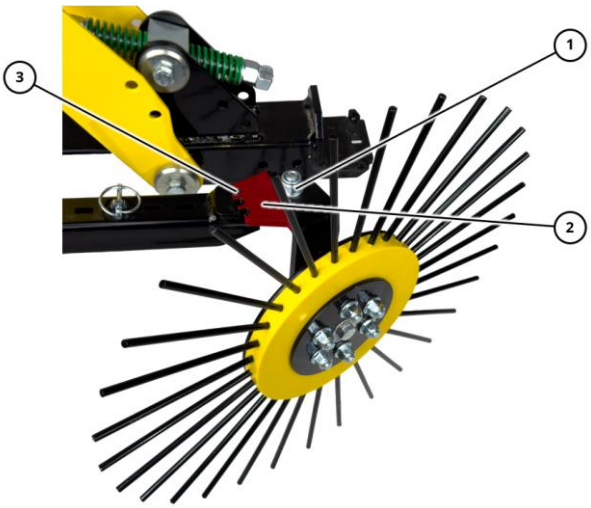
(1) Undo nuts [1].

(2) Fasten the tool holder [2] of the harrow ring in the front, centre or rear pin position [3].

(3) Tighten nuts.

- If necessary, use new carriage bolts including nuts.

△ The pitch of the harrow ring is set.



7.2.2.6 Ground pressure force of harrow ring

The ground pressure force of the harrow ring [1] is set using the pre-tensioning force of the spring [2].

(1) Remove the safety cotter pin [3].

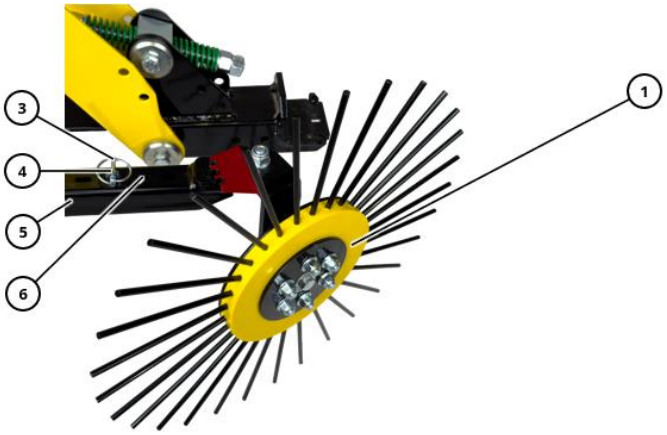
(2) Select position of retaining clip [4] on in-row hoeing support [5].

- The further back the position, the higher the preload force of the spring.

(3) Insert retaining clip in previously selected opening [6].

(4) Secure the retaining clip with a safety cotter pin.

△ The pitch of the harrow ring is set.



7.2.2.7 Parking position harrow ring

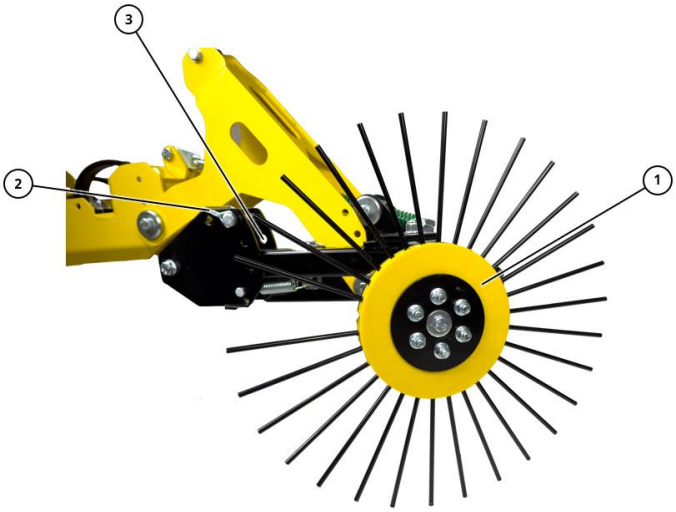
The harrow ring [1] can be manually raised to a parking position.

(1) Remove locking pin [2].

(2) Manually raise the in-row hoeing support beyond the opening [3].

(3) Insert the locking pin into the opening underneath the in-row hoeing support.

△ Harrow ring in parking position.



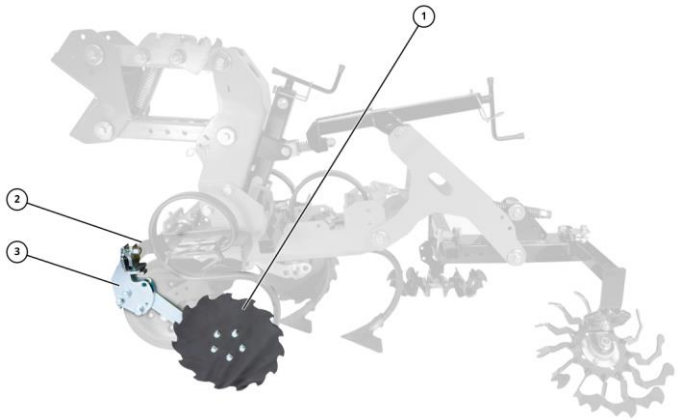
7.2.2.8 Track of crop protection disc

The track of the crop protection disc [1] can be adjusted on the sliding element [2].

▶ Move the tool holder [3] with the working tool outwards or inwards.

⇨ *Chapter 7.3 Checking and setting spacing between chopping elements on page 101*

△ Track is set.



7.2.2.9 Parking position crop protection disc

The plant protection disc [1] can be raised manually into a parking position.

(1) Undo nuts [2].

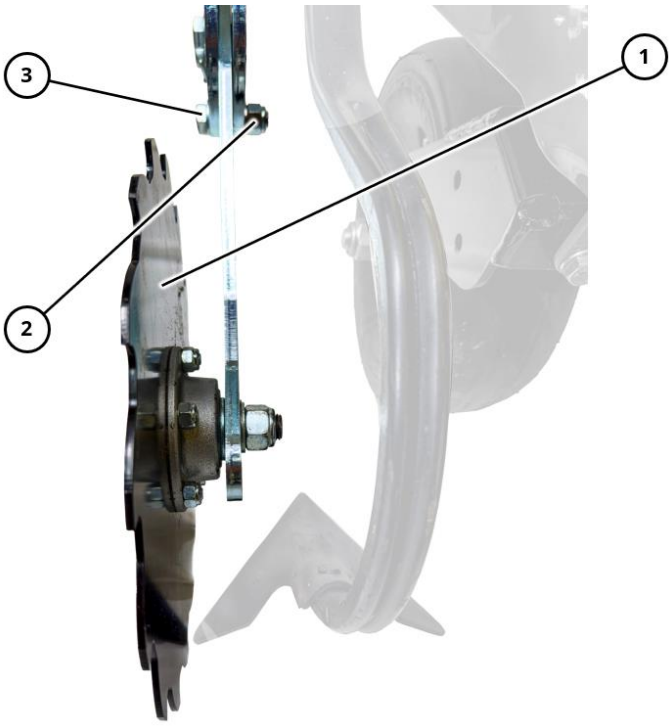
(2) Remove the hexagon bolt [3].

(3) Manually raise the tool holder beyond the opening.

(4) Insert the hexagon bolt into the opening underneath the tool carrier.

(5) Tighten nuts.

△ Crop protection disc in parking position.



7.3 Checking and setting spacing between chopping elements

The chopping elements are factory-fitted to the frame at the correct spacing for the crops. To adjust the chopping elements precisely to the current condition of the crop, the user must check the spacing and working widths and correct them if there are deviations.

⦿ The spacing of the chopping elements on the frame corresponds exactly to the row spacing of the crops.

⦿ The widths of the working tools on the chopping element correspond exactly to the width of the area to be hoed between the crops.

7.3.1 Checking spacing between chopping elements

(1) Determine the row spacing of the crops.

(2) Check the spacing of the chopping elements on the frame.

- Measure the distance from the centre of the implement for each chopping element.

(3) If there are large deviations, move the chopping elements on the frame.

If there are minor deviations, move the working tools on the sliding elements.

7.3.2 Checking width of working tools

(1) Measure the width of the area to be cultivated between the crops.

(2) Measure the distance between the two outermost working tools on each chopping element.

(3) In the event of deviations, move the working tools with the sliding elements on the respective supports.

7.3.3 Moving the chopping elements on the frame

CAUTION

Risk of crushing from moving parts

Components with a high net weight can move downwards independently due to gravity.

- ▶ Never reach between components that can move independently under their own net weight.
- ▶ Use protective gloves when moving the components manually.

(1) If necessary, ask a second person to help move the chopping elements.

(2) Raise the hoe with the linkage.

(3) Loosen the screw connections on the mounting flange.

- ■ Leave nuts and bolts connected.

(4) Slide the chopping element to the corrected position.

- ■ Touch the chopping element on the mounting flange or on the parallelogram.

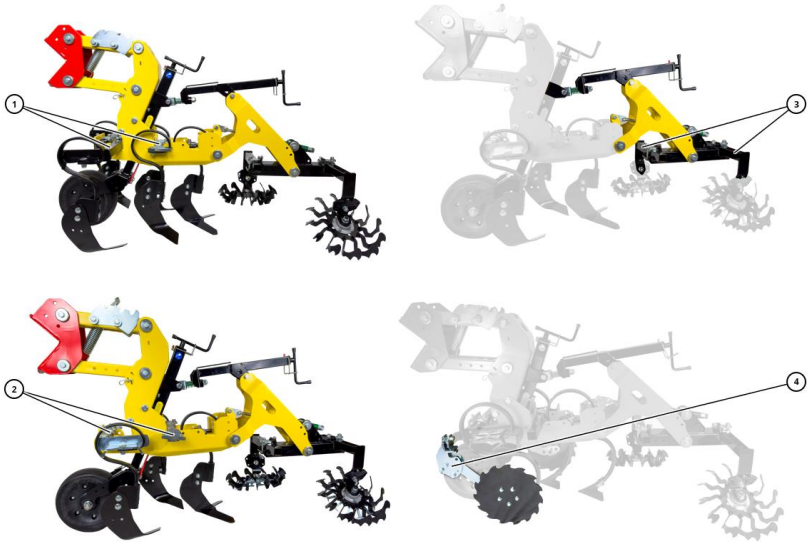
△ The spacing of the hoeing elements corresponds to the row spacing of the crops.

(5) Tighten the screw connections.

NOTE

The screw connections of the chopping elements on the frame must be tightened to a torque of 200 Nm.

7.3.4 Moving working tools on the chopping element



[1] Standard adjustment of the outer chopping coulters via sliding elements on the chopping coulter support

[2] Quick adjustment of the outer chopping coulters via sliding elements on the chopping coulter support

[3] Adjustment of the in-row hoes via sliding elements on the in-row chopping coulter support

[4] Adjustment of the crop protection discs via tool holder on the sliding element

The working tools are bolted to sliding elements via tool holders. Depending on the design, the user can move the working tools with the sliding elements in a standard or fast transverse direction. This allows the user to adjust the working width of the chopping element or compensate for small deviations in the row spacing.

7.3.4.1 Standard shift of the working tools

The sliding element has holes as an orientation aid for measuring the working width setting.

(1) If necessary, ask a second person to help moving the working tools.

(2) Loosen the screw connection [1] on the retaining clip [2].

(3) Move the working tools with the sliding element [3].

△ The working widths correspond to the widths of the area to be processed between the crops.

(4) Tighten the screw connection on the retaining clip.

7.3.4.2 Quick adjustment of working tools

The sliding element has a scale for measuring the working width setting.

(1) If necessary, ask a second person to help moving the working tools.

(2) Open locking mechanism [1].

(3) Turn the adjusting element [2] until the specified position of the working tools is reached.

- Working tools with sliding element [3] is moved.

△ The working widths correspond to the widths of the area to be processed between the crops.

(4) Close the locking mechanism.

- Ensure that the handle of the adjusting element is horizontal to the floor.

7.4 Aligning the implement on the support wheels

In order for the implement to work successfully and remain stable while moving between the crops, the user must align the implement.

CAUTION

Risk of crushing from moving parts

Components with a high net weight can move downwards independently due to gravity.

▶ Never reach between components that can move independently under their own net weight.

▶ Use protective gloves when moving the components manually.

Work steps for aligning the implement

▶ Set the height of the frame.

▶ Set the track gauge of the support wheels.

▶ Align chopping coulter support to be horizontal to the ground.

The height of the frame is determined by adjusting the height of the support wheels.

IMPORTANT

▶ Set all support wheels to the same height to achieve horizontal alignment of the frame.

7.4.1 Setting the height of the frame

⦿ The lower edge of the frame is at a height h of approx. 60 to 65 cm.

⦿ The frame is aligned horizontally to the ground

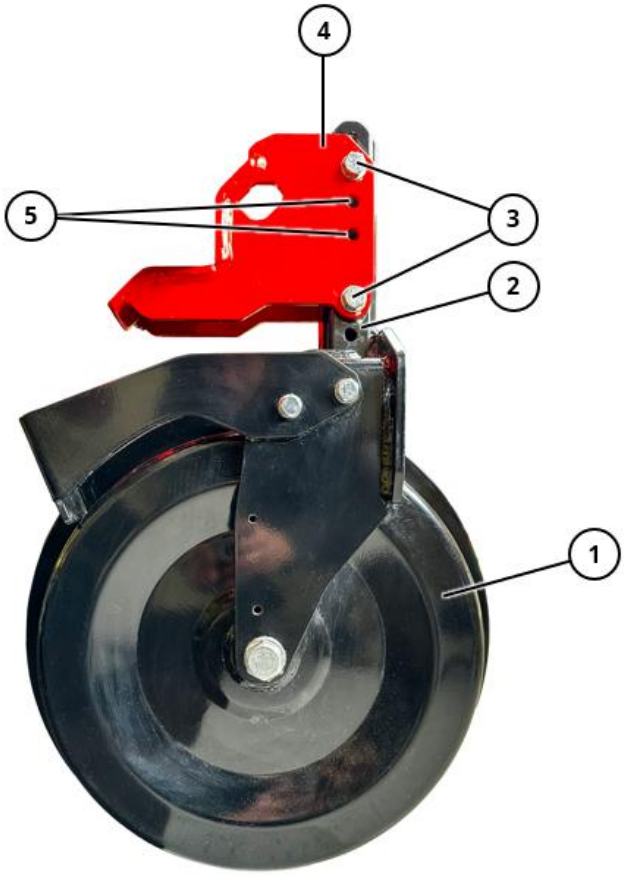
7.4.2 Setting the height of the support wheels

✓ To be able to loosen the fastening elements of the support wheels, raise the implement until it is not under pressure using the tractor's linkage.

🛠 Hexagon key

The support wheel [1] is fixed in the retaining profile [4] via the support wheel bracket [2] using hexagon bolts [3].

The hole spacing of the openings [5] for fixing the support wheel is 30 mm.



(1) If necessary, ask a second person to help adjusting the height of the support wheels.

(2) Loosen the hexagon nuts.

(3) Manually secure the support wheels from falling off.

(4) Remove hexagon nuts and hexagon bolts.

(5) Select the height position for the support wheel.

(6) Insert the hexagon bolts into the openings.

(7) Tighten the hexagon nuts.

(8) Repeat the process for each support wheel.

△ The height of the support wheels has been adjusted.

7.4.3 Setting the track gauge of the support wheels

To adjust the track gauge of the support wheels to that of the tractors, the user must adjust the track gauge of the support wheels.

⇨ *Chapter 15.6.2 Support wheel track on page 140*

✓ To be able to loosen the fastening elements of the support wheels, raise the implement until it is not under pressure using the tractor's linkage.

🛠 Hexagon key

The support wheel [1] is fixed to the frame [4] via the retaining profile [2] using hexagon bolts [3].

(1) If necessary, get a second person to help setting the track gauge of the support wheels.

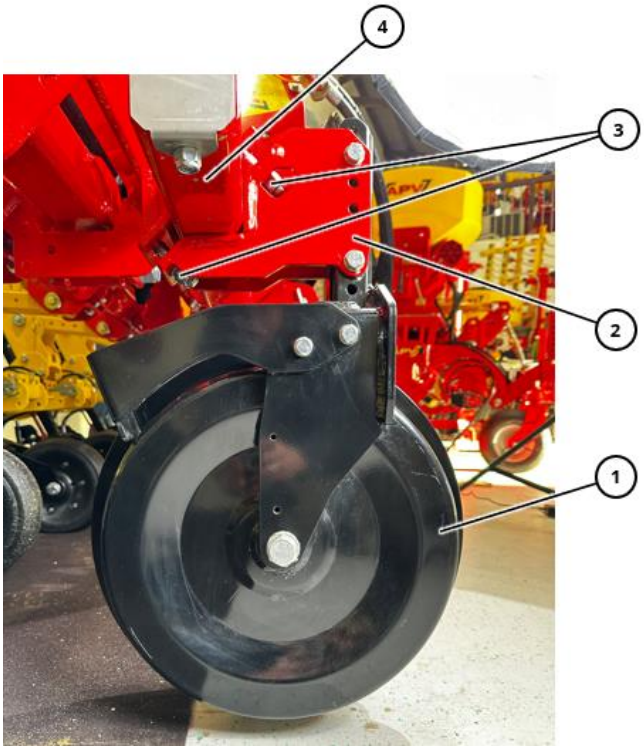
(2) Loosen the hexagon nuts.

(3) Select track gauge position for support wheels.

(4) Tighten the hexagon nuts.

(5) Repeat the process for each support wheel.

△ Track gauge of support wheels is set.



7.4.4 Aligning chopping coulter support and parallelogram

The movable parallelogram [1] at the transition from the chopping element to the frame determines the position of the chopping element.

▶ Retract or extend the top link until the chopping coulter support [2] is horizontal and parallel to the ground.

△ The parallelogram is orientated at a right angle to slightly sloping backwards.

IMPORTANT

The chopping elements work most efficiently at an incline of 0° to 30°.

7.5 Setting the working depth of the chopping elements

⦿ The working depth of all chopping elements is set the same.

⦿ For full-surface cultivation, the chopping coulters are between 3 cm and 5 cm below the topsoil.

✓ Level, reconsolidated seed bed.

✓ The row spacing is set correctly.

✓ The implement is fully lowered via the linkage.

Setting the working depth using the depth control wheel

The working depth of the chopping elements is set using a spindle with a crank on the depth control wheel.

The depth control wheel [1] has a scale for measuring the depth setting.

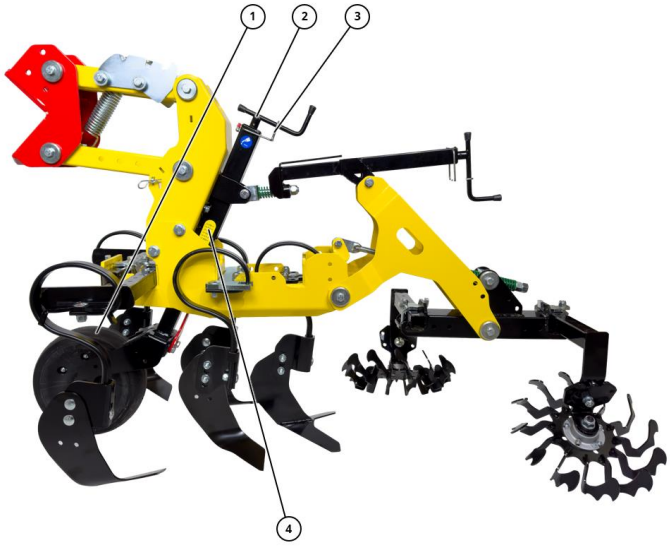
(1) Fold the safety catch [3] away from the depth control crank [2].

(2) Use the crank to set the height of the depth control wheel.

(3) Set all depth control wheels to the same depth according to the scale [4].

(4) Close the safety catch after depth setting using the crank.

△ All depth control wheels are set to the identical depth.



7.5.1 Adjusts the working depth of the in-row hoes

The working depth of the in-row hoes is set individually on each chopping element using a spindle with crank on the in-row hoe parallelogram.

The sliding element [1] has a scale for depth setting measurement.

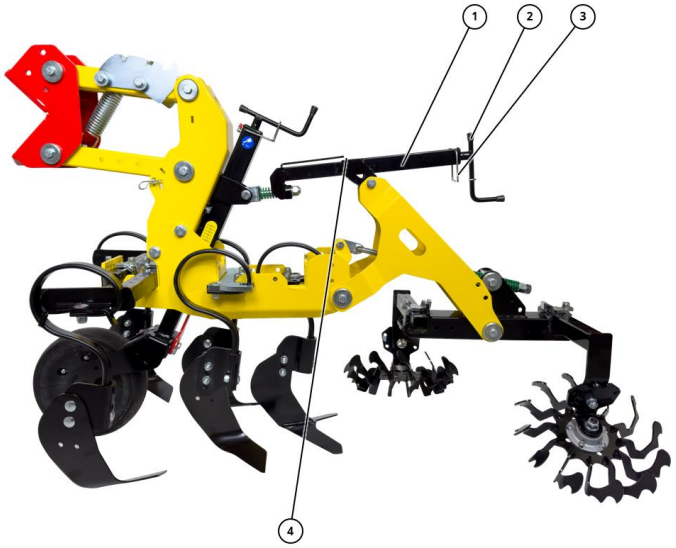
(1) Fold the safety catch [3] away from the in-row hoe crank [2].

(2) Use the crank to adjust the height of the in-row hoes.

(3) Set all in-row hoes to the same depth according to the scale [4].

(4) Close the safety catch after depth setting using the crank.

△ All in-row hoes are set to the identical depth.



7.6 Setting the ground pressure force of the chopping elements

The ground pressure force of the chopping elements is set manually using a handle at the end of the tension spring. The tension spring is preloaded accordingly via the position of the handle.

Position	Ground load [kg]
A:	10
B:	20
C:	30

⦿ The chopping elements press onto the ground with identical force.

✓ Level, reconsolidated seed bed.

✓ The row spacing is set correctly.

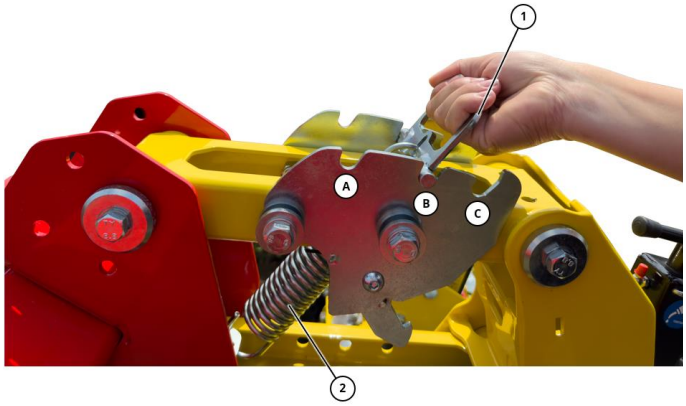
✓ The working depth of all chopping elements is set the same.

✓ The implement is fully raised via the linkage.

(1) Manually raise the handle [1] at the end of the tension spring [2] and move it to the corresponding position (A, B, C).

(2) Set all handles at the end of the tension spring on the chopping elements to the same position.

△ All chopping elements are set to the same ground pressure force.



7.7 Set the camera system

✓ The growth of crops has changed the conditions in the field.

(1) Measure the size of the crop.

(2) Regularly check the growth.

(3) Adjust the height of the camera.

(4) Set the camera angle.

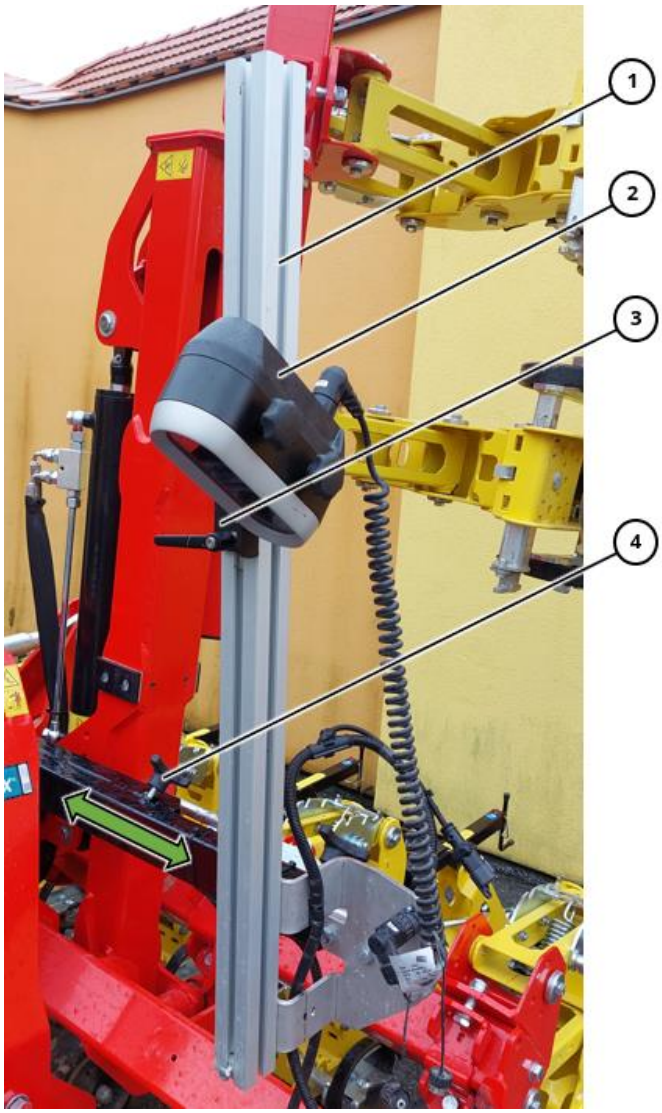
(5) Enter the camera height and camera angle on the control terminal in the *"Settings"* menu.

Setting the camera row position

(1) Loosen the star knob screw [4].

(2) Move the camera [1] with the camera holder [2] and rail profile [3] to the left or right.

(3) Tighten the star knob screw in the desired position.



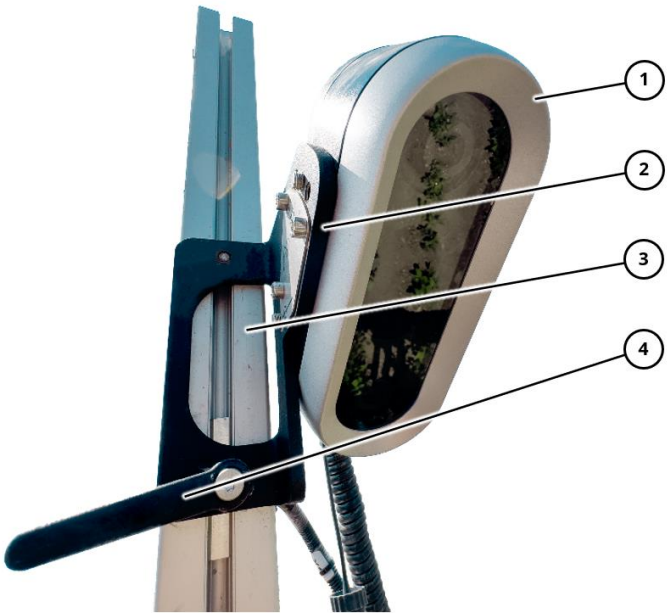
Setting the camera height

(1) Hold the camera [1]. Loosen the clamping lever [4].

(2) Move the camera up or down with the camera holder [2] in the rail profile [3].

- The camera height is measured from the floor to the mark [A].

(3) Tighten the clamping lever to the desired position.

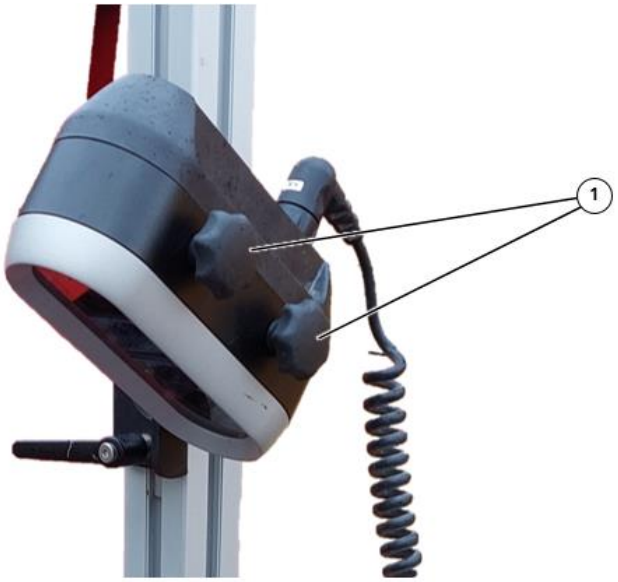


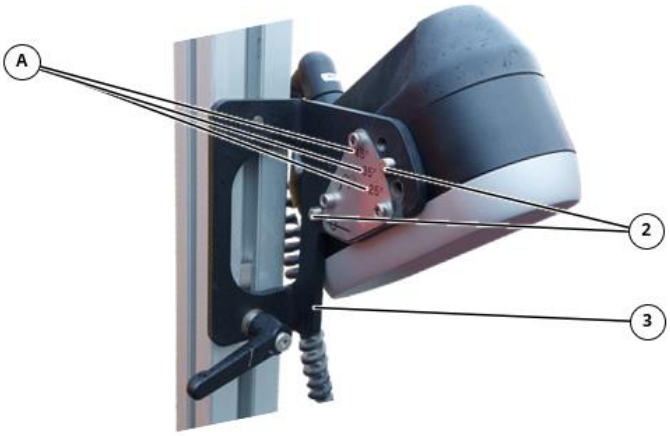
Setting the camera angle

(1) Hold the camera. Loosen the star knob screws [1] and position the camera at the desired angle position [A] in the camera holder [3].

> **IMPORTANT**
>
> Recommended camera angle setting [A]: 35°
>
> The lower the camera height, the wider the camera angle.

(2) Tighten star knob screws.





8 Operation

8.1 Basic information on operation

8.1.1 Requirements for successful operation

Check list

✓ The crop is standing straight and parallel in the row.

✓ The working width of the chopping elements is equal to the sowing width or plant width.

- The more precisely the seeds are sown, the closer the hoe can work to the crop.

✓ The implement is attached to the tractor on a flat surface.

✓ The right tools for the soil and the crop are selected.

✓ The soil and weather conditions are dry.

- The crop is then less sensitive to mechanical stress.
- The weeds will dry out on the surface.
- The soil will not be smeared.

✓ Control success is greatest at the cotyledon to three-leaf stage of the weed.

✓ The ground clearance of the hoe is 60 to 65 cm.

✓ When working with section control:

- The contours of the field boundaries and the contours of the cross rows where chopping elements are to be raised and lowered are recorded by the GPS system.
- The control is set for the current crops.

8.1.2 The hoeing process

(1) Ensure that the hoe equipment is suitable for the condition of the crop.	⇨ *Chapter 7.2 Selecting and setting working tools on page 94*
(2) Ensure that the spacing of the chopping elements and working tools is appropriate for the crop.	⇨ *Chapter 7.3 Checking and setting spacing between chopping elements on page 101*
(3) Align the frame and chopping element parallelograms horizontally.	⇨ *Chapter 7.4 Aligning the implement on the support wheels on page 104*

(4) Set the same working depth for all chopping elements.	⇨ *Chapter 7.5 Setting the working depth of the chopping elements on page 107*
(5) Set the same ground pressure force for all chopping elements.	⇨ *Chapter 7.6 Setting the ground pressure force of the chopping elements on page 108*
(6) Lower the implement in the rows to be processed.	
(7) Drive along the rows of crops at a steady speed. ■ Observe the chopping elements while doing so.	
(8) Raise the implement at the headland.	
(9) Switch off and clean the implement after hoeing.	⇨ *Chapter 12.1 Cleaning the implement on page 125*

8.2 Basic operation

8.2.1 Operating the parking lock

Depending on the equipment, the implement is fitted with 2 or more pins for locking the chopping elements when it is parked.

During operation, the pins must be fixed in the upper parking position.

✓ Implement is connected.

✓ Implement/tractor combination is secured against rolling away.

▶ If necessary, ask a second person to help.

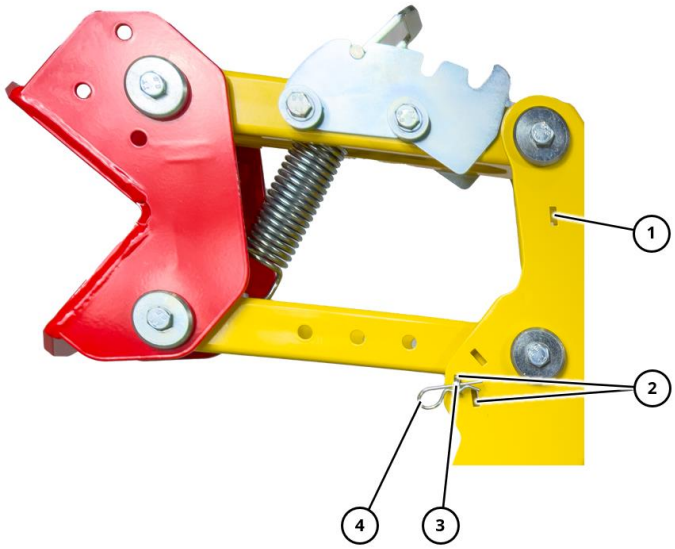
Activating the parking lock

(1) Remove the safety cotter pin [4] and pin [3] from the parking position [1].

(2) Move the pin to parking position [2] and secure with a safety cotter pin.

△ The parking lock is active.

(3) Activate the parking lock in at least 2 chopping elements.



Deactivating the parking lock

(1) Remove safety cotter pin [4] and pin [3] from parking position [1].

(2) Move the pin to the park position [2] and secure with a safety cotter pin.

△ The parking lock has been deactivated.

8.2.2 Operating the folding lock

Implements with a folding frame are fitted with a catch hook on each side frame to lock them in transport position.

✓ Implement is connected.

✓ Implement/tractor combination is secured against rolling away.

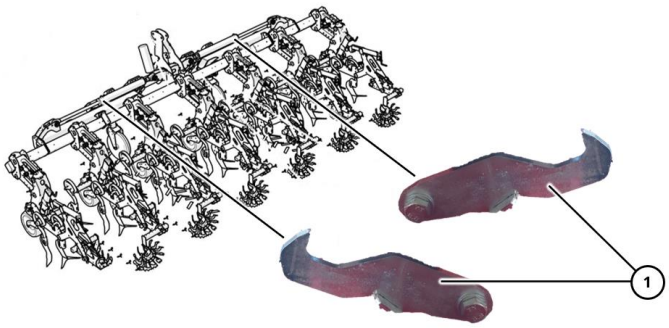
▶ If necessary, ask a second person to help.

Activating the folding lock

(1) Fold up implement.

(2) Manually close the catch hook [1].

△ The folding lock is active.



Deactivating the folding lock

✓ The implement is folded up.

▶ Manually remove the catch hook.

△ The folding lock is inactive.

8.2.3 Mechanically raising and lowering chopping elements

Chopping elements are raised and lowered manually using the lifting lever via the lifting mechanism of the chopping element parallelograms.

The outermost chopping elements have a quick-locking mechanism.

The inner chopping elements are locked using the parallelogram locking mechanism.

⇨ *Chapter 3.3.2.2 Stabiliser on page 45*

IMPORTANT

The working depth must be identical for all elements for uniform weed control.

▶ Check the working depth after raising and lowering the chopping elements several times.

⇨ *Chapter 7.1 Settings before operation on page 94*

CAUTION

Risk of crushing from moving parts

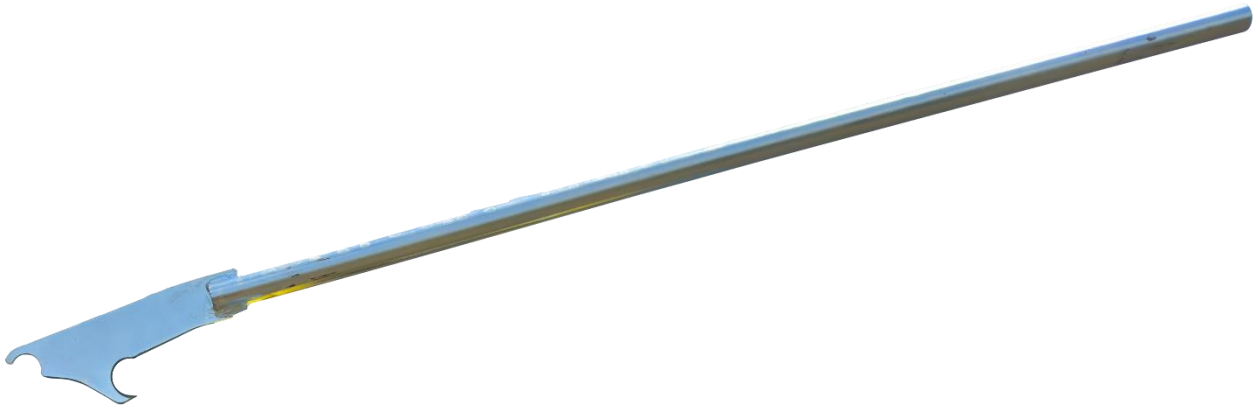
Components with a high net weight can move downwards independently due to gravity.

▶ Never reach between components that can move independently under their own net weight.

▶ Use protective gloves when moving the components manually.

🛠 Raising lever

- The parking position is located on the mounting flange of the chopping elements in the centre of the machine.



8.2.3.1 Raise and lower external chopping elements mechanically

▶ If necessary, ask a second person to help with mechanically raising and lowering the chopping elements.

Mechanically raising the outermost chopping elements

(1) Move the locking lever [1] to position A.

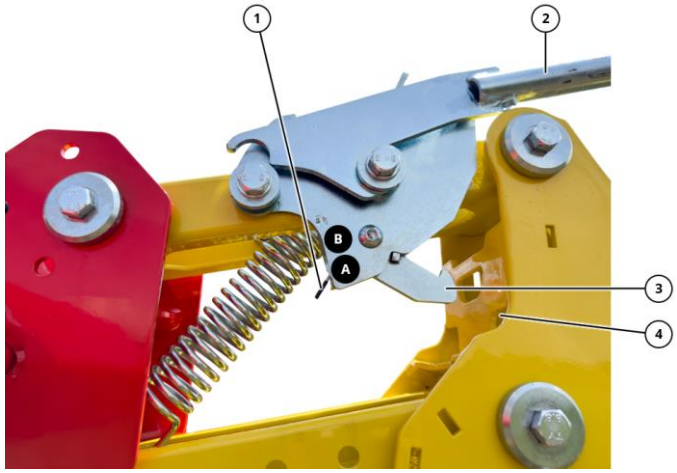
(2) Remove the lifting lever [2] from parking position and insert it into the intended position of the lifting mechanism.

(3) Push the lifting lever up manually and lift out the chopping element.

- The catch hook [3] engages in the opening provided [4] and is locked in place.

(4) Remove the lifting lever from the position of the lifting mechanism and move it to parking position.

△ Chopping element lifted out and locked.



Lowering the outermost chopping elements mechanically

(1) Move the locking lever [1] to position B.

(2) Remove the lifting lever [2] from parking position and insert it into the intended position of the lifting mechanism.

(3) Push the lifting lever down manually and lower the chopping element.

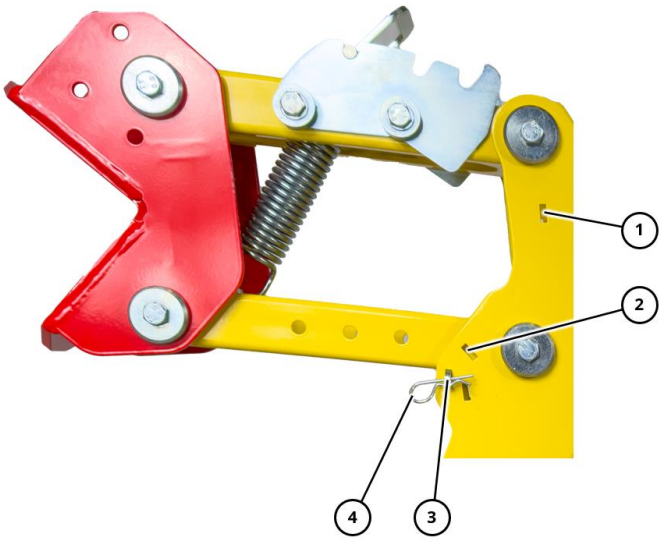
(4) Remove the lifting lever from the position of the lifting mechanism and move it to parking position.

△ Chopping element unlocked and lowered.

8.2.3.2 Raising and lowering internal chopping elements mechanically

▶ If necessary, ask a second person to help with mechanically raising and lowering the chopping elements.

Raising internal chopping elements mechanically



(1) Remove the lifting lever from parking position and insert it into the intended position of the lifting mechanism.

(2) Push the lifting lever up manually and lift out the chopping element.

(3) Remove the safety cotter pin [4] and pin [3] from parking position [1] and move to the locking position [2].

(4) Remove the lifting lever from the position of the lifting mechanism and move it to parking position.

△ Chopping element lifted out and locked.

Lowering internal chopping elements mechanically

(1) Remove the lifting lever from parking position and insert it into the intended position of the lifting mechanism.

(2) Remove the safety cotter pin [4] and pin [3] from the locking position [2] and move to parking position [1].

(3) Push the lifting lever down manually and lower the chopping element.

(4) Remove the lifting lever from the position of the lifting mechanism and move it to parking position.

△ Chopping element unlocked and lowered.

8.3 Carry out a test run

⦿ Before starting work in the field, to ensure that the implement is set correctly.

⦿ At each crop change or field change to ensure that the implement is working correctly.

✓ Follow procedure according to

⇨ *Chapter 8.2 Basic operation on page 112.*

Test run steps

(1) Move the hoe to the appropriate position at the start of the row.

(2) Drive a few metres through the vegetation at low speed.

(3) Check the results. Correct the settings if necessary.

(4) Drive a few metres through the vegetation at a higher speed.

(5) Check the results. Correct the settings if necessary.

(6) Repeat the process until the desired hoeing result is attained.

(7) When working with Section Control, raise and lower chopping elements at the touch of a button.

(8) When working with the GPS function of Section Control, check that all chopping elements at the field boundaries and on the cross rows are automatically raised and lowered.

△ If all chopping elements are working correctly, the test run is complete.

NOTE

▶ After the test run, make sure all the bolts and cotter pins on the chopping elements are tight.

▶ If necessary, tighten the bolts and fasten the safety cotter pins.

8.4 Operating implement

✓ Follow procedure according to

⇨ *Chapter 8.2 Basic operation on page 112.*

Steps to take when operating the implement

(1) Put the implement/tractor combination in position.

(2) Unfold the folding implement.

(3) Adjust the lower link.

⇨ *Chapter 6.1.2 Preparing the tractor on page 64*

(4) Set up the implement or check the settings.

⇨ *Chapter 7.2 Selecting and setting working tools on page 94*

⇨ *Chapter 7.3 Checking and setting spacing between chopping elements on page 101*

⇨ *Chapter 7.4 Aligning the implement on the support wheels on page 104*

⇨ *Chapter 7.5 Setting the working depth of the chopping elements on page 107*

⇨ *Chapter 7.6 Setting the ground pressure force of the chopping elements on page 108*

⇨ *Chapter 7.7 Set the camera system on page 108*

(5) Lower the chopping elements into the ground.

IMPORTANT

With hydraulically operated chopping elements, i.e. operation via Section Control, this is also possible when driving in a straight line.

(6) Make sure that all chopping elements are lowered.

(7) Switch linkage to floating position.

(8) Carry out weed control.

- Drive over the surface to be weeded at a constant working speed.
- Monitor the work results.
- Watch out for any possible disruptions.
  - Are all chopping elements constantly on track?
  - Are the working tools holding their place and working depth?
  - Are the chopping coulters still cutting the weeds?

  ⇨ *Chapter 9 Troubleshooting on page 118*
- Monitor danger areas. Interrupt soil tillage if necessary.

(9) Completely raise the implement before the headland.

NOTE

If parts of the implement touch the ground, implement components may be damaged while turning.

(10) On the headland, adjust the driving speed to the terrain and ground conditions.

(11) After the headland, only lower the implement to the ground when travelling in a straight line.

(12) After operating the implement in the field, remove any soil build-up.

(13) Prepare the implement for driving on the road.

⇨ *Chapter 10.2 Preparation for driving on the roads on page 121*

9 Troubleshooting

9.1 Finding and rectifying faults

✓ Personal protective equipment is worn.

🛠 Suitable tools are used

🛠 Climbing aids

🛠 Support elements

(1) Park the implement/tractor combination.

(2) Secure the implement/tractor combination against rolling away.

(3) When working on a folding implement, fold out the folding components of the implement or secure them against folding out.

(4) When working on a raised implement, secure the implement against lowering.

(5) Remove the ignition key.

(6) Use lifting gear to remove and attach heavy components.

(7) To prevent tools from slipping off:

- Use aids to reduce the effort required, e.g. extensions.
- Check nuts and bolt heads etc. for wear. If necessary 🔧 call in specialised personnel.

(8) Follow the troubleshooting instructions.

9.2 Fault overview – Cause – Corrective action

9.2.1 Faults on the implement

Error description	Cause	Corrective action
The implement doesn't exactly stay on track on uneven terrain.	The support wheels are not tracking correctly.	Check the lower link stabilisers and adjust them.
The chopping coulter on the tool holder or sliding element is displaced.	Fastening screw has come loose.	Reposition the chopping coulter. Tighten the fastening screw again.
The working depth of the working tools has changed.	The safety catch of the depth control crank has come loose.	Correct the depth of the chopping element. Fix the safety catch in place and close it.
	Fastening screws on the chopping elements or working tools have come loose.	Check bolted connections. Tighten bolts where required.

Error description	Cause	Corrective action
The in-row hoes are working too aggressively and the chopping coulters too little.	The implement is tilted too far backwards.	Align the implement using the tractor's hydraulics.
		Use the crank to adjust the working depths if required.
The chopping coulters are working too aggressively and the in-row hoes too little.	The implement is tilted too far forwards.	Align the implement using the tractor's hydraulics.
		Use the crank to adjust the working depths if required.
Hydraulic components are not reacting.	Valve blocked, dirt in the system.	Clean the hydraulic system.
The implement can only be raised slowly or not at all.	Two double-acting control units are under continuous flow.	If possible prioritise the functions on the tractor side.
The hydraulic valves are faulty.	The oil volume l/min is set too high.	Valves: Have the fault rectified by service personnel.
		Set the oil volume l/min to the permitted value (15...20 l/min).
Electrical connection between tractor and control terminals is disrupted.	The electrical cables are pinched.	Switch off tractor. Release electric cables and check them for damage.
		Have defective electric cables replaced by service personnel.
No camera picture	Data cable or control cable is not connected.	Connect data cable or control cable.
	Data cable or control cable is faulty.	Replace data cable or control cable.
	Computer has crashed.	Restart computer.
	Not all of the planned cameras have been installed and connected.	Install and connect camera.
Camera image is faulty.	Camera lens is dirty.	Clean camera lens with a soft cloth.
	Water has got into the camera.	Have the fault rectified by service personnel.
	Frames, wheels or cables are obstructing the camera's field of view.	If possible, reposition parts such as cables that are in the way. If not possible, set up the camera in a different way or attach it in a different position.

Error description	Cause	Corrective action
	Unfavourable lighting conditions, e.g. low sun	Attach camera lighting.
	The minimum voltage of 10 volts is not present.	Check the power supply.
		🔧 Have the fault rectified by service personnel.
	The cameras are not attached to the designated camera holder.	Attach the camera on the left to the camera holder on the left. Attach the camera on the right to the camera holder on the right.
Control terminal is not working.	Fuse is faulty.	Replace fuse.
	Data cable or control cable is not connected.	Connect data cable or control cable.
	Data cable or control cable is faulty.	Replace data cable or control cable.
	The power supply switch is not switched on.	Switch the power supply switch on.
The hydraulic linear sliding cylinder does not move.	Malfunction in the hydraulic system.	Check the connection and direction of flow of the oil.
		Check whether valves or couplings are blocked.
		Check hydraulic valve.
		Set the speed of the lateral sliding movement.
		🔧 Have the fault rectified by service personnel.
	Minimum voltage is not reached.	🔧 Have the fault rectified by service personnel.
No sliding movements	The lift sensor is misaligned.	Align the lift sensor. ⇨ *Chapter 6.3.5 Setting up sensors on page 70*
Wheel sensor is not working.	The switching distance is incorrect.	Adjust switching distance to required distance.

10 Driving on roads

10.1 Basic road safety instructions

IMPORTANT

Laws on driving on public roads vary from country to country.

- ▶ Observe country-specific laws and regulations:
  - Driving on public roads
  - Maximum permissible transport width
  - Maximum permissible transport height
  - Maximum permissible transport weight
  - Lighting system
- ▶ Never exceed the maximum permissible transport speed of the implement
  - ⇨ *Chapter 15.3 Power data on page 137*

10.2 Preparation for driving on the roads

- ▶ Work through the checklist before every journey on public roads.

Check list

Connection between implement and tractor
▶ Check that the top link pin is secure and secure if necessary. ▶ Check the connection between the lower link and the lower link coupling points and secure if necessary.
Folding the implement
▶ Make sure a folding implement is in transport position. ▶ Check the safety catch is activated to ensure the implement cannot unintentionally unfold. ▶ Check the transport lock and activate if necessary.
Stabilisers
▶ Ensure lateral stability of the lower links during road travel. ▶ Ensure that the implement is centred behind the tractor when driving on the road. ▶ Comply with the information provided by the tractor manufacturer.
Parking supports
▶ Ensure that the parking supports are raised or folded in. ⇨ *Chapter 8.2.1 Operating the parking lock on page 112*

Lighting system
▶ Make sure that the lighting system meets any country-specific requirements.
▶ Make sure that the lighting system is fully functional.
Tractor control units
▶ Lock tractor control units to avoid any unintentional implement movements.
▶ Comply with the information provided by the tractor manufacturer.
Control terminal
▶ Make sure the control terminal has been deactivated.

10.3 Preparing the lighting system

The lighting system increases safety when travelling on the road.

The implement must be equipped with the following components for use on public roads in accordance with the relevant national regulations:

- Lighting system

Check electric cables

(1) Connect the plug of the lighting system to the socket on the tractor.

(2) Check the electrical cable between the tractor and the lighting system.

Check that the lighting system is working properly

(1) Activate the indicators on the tractor.

(2) Check the control lamps in the tractor.

- The control lamp for the indicator on the tractor and the control lamp for the indicator on the implement flash:
  - △ Lighting system connected up properly.
  - △ Lighting system successfully tested.
- The control lamp for the indicator on the tractor flashes and the control lamp for the indicator on the implement does not flash:
  - △ Lighting system not connected up properly or not working.
  - ▶ Check all lighting system connections and make sure it works.
  - ▶ Service lighting system if required.

11 Decommissioning the implement

11.1 Preparing to decommission the implement

(1) Take the implement to a parking place with a stable and level surface.

WARNING

A folded implement can tip over after being parked on an unsuitable surface.

(2) Activate the parking lock.

⇨ *Page 112*

(3) Completely lower the implement.

(4) Secure the implement/tractor combination against rolling away.

(5) Clean and lubricate the implement before long breaks or preparing for winter.

11.2 Decommissioning the implement

✓ The implement is ready to be decommissioned.

⇨ *Page 123*

(1) Take the weight off the top link.

(2) Uncouple the top link from the three-point linkage.

(3) Disconnect the lower link of the tractor from the lower link coupling points of the implement.

- Follow the tractor operating manual.

(4) Move the tractor a maximum of 50 cm away from the implement.

(5) Depressurize the auxiliary control units of the hydraulic system.

WARNING

Hydraulic oil can spray out of the hydraulic lines under pressure when uncoupling.

(6) Secure the tractor against rolling away.

(7) Uncouple the hydraulic lines from the tractor.

(8) Push the protective caps onto the hydraulic lines.

(9) Hook the hydraulic lines into the line holder.

(10) Uncouple the electric cables from the tractor.

(11) Push the protective caps onto the electric cables.

△ Implement is decommissioned.

11.3 Removing the camera system

(1) Disconnect the plug [1] on the camera

(2) Disconnect the plug on the control terminal.

(3) Disconnect the plug on the linear sliding frame.

(4) Disconnect the power supply plugs.

(5) Store away the wiring harnesses.

(6) Hold the camera [2]. Loosen the star knob screws [3].

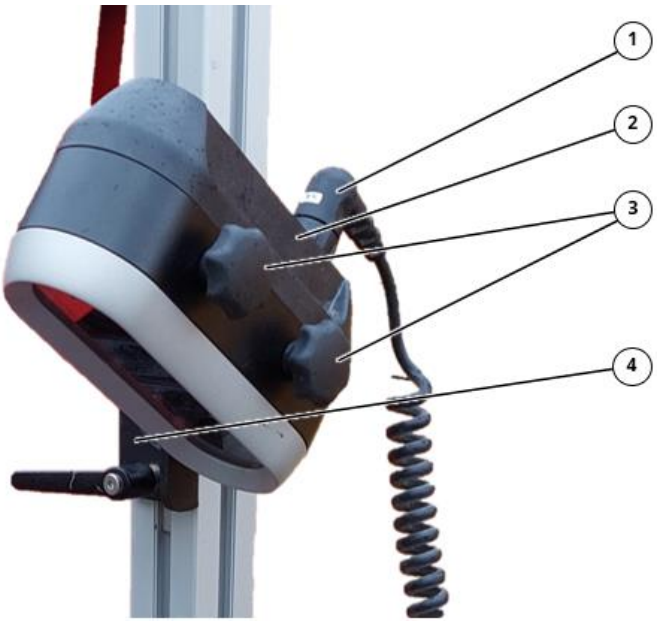
(7) Remove the camera from the camera holder [4].

(8) Store the camera in its case.

(9) Remove control terminal.

(10) Store control terminal in case.

△ Camera system decommissioned and stowed away.



12 Cleaning and care

Cleaning intervals

- Recommended after every use
- At the end of the season

12.1 Cleaning the implement

The user can clean the implement with a high-pressure cleaner.

✓ Implement/tractor configuration is parked on a level, horizontal, stable surface.

✓ Implement/tractor combination is secured against rolling away.

🛠 High pressure cleaner

CAUTION

Risk of injury when cleaning with a high pressure cleaner

Cleaning with a high-pressure cleaner can lead to eye injuries and skin injuries.

▶ Wear safety goggles when cleaning with a high-pressure cleaner.

NOTE

Material damage caused by cleaning with a high-pressure cleaner

Cleaning with a high-pressure cleaner can damage components.

▶ Set water temperature to max. 80 °C.

▶ Do not use round jet nozzles, dirt cutters or power cleaning nozzles.

▶ Maintain a minimum distance of 30 cm between the machine surface and the high-pressure nozzle.

▶ Always keep the water jet moving during the cleaning process.

▶ Note the position, meaning and condition of the stickers.

▶ Make sure that no water gets into electrical, electronic or hydraulic components.

▶ Do not aim the jet of the high-pressure cleaner directly at bearings or seals.

(1) Remove soil build-up from the implement.

(2) Thoroughly clean the implement with a high-pressure cleaner.

(3) Allow the implement to dry thoroughly after wet cleaning.

(4) Check that stickers are complete and in good condition and replace if necessary.

△ Implement cleaned and dry.

12.2 Cleaning the camera system

▶ Observe the operating manual for the camera control unit.

⇨ *Chapter 1.5 Other applicable documentation on page 14*

NOTE

Control box failure due to water ingress in the camera

Cleaning with a high-pressure cleaner can damage components.

- ▶ Remove the camera before cleaning the implement with a high pressure cleaner.
- ▶ Only clean the camera with a damp cloth.

12.3 Cleaning the control terminal

▶ Observe the operating manual for the camera control unit.

⇨ *Chapter 1.5 Other applicable documentation on page 14*

NOTE

Control system failure due to water ingress into the control terminal

Control terminals for the control system are not waterproof.

- ▶ Never submerge the control terminal in liquid when cleaning it.

NOTE

Damage to control terminal due to unsuitable cleaning agents

- ▶ Do not use aggressive cleaning agents to clean the control terminal.

🛠 Mild household cleaner

🛠 Soft cleaning cloth

▶ Clean the control terminal with a damp cleaning cloth and household cleaner.

13 Maintenance and servicing

13.1 Ensure maintenance is carried out correctly

Personnel

Some jobs are reserved exclusively for service personnel, e.g. working on the hydraulics.

- These jobs are marked with the 🔧 symbol.
- Marking in the maintenance plan in the service personnel column.

13.1.1 Preparing maintenance

IMPORTANT

Any necessary deviations from the following procedure are described in the respective maintenance chapters.

(1) Switch off the engine.

(2) Apply the tractor's parking brake.

(3) Remove the ignition key.

(4) Secure the implement/tractor combination against rolling away.

(5) When working on folding implements:

Fold out the folding components of the implement or secure them against folding out.

(6) When working on a raised implement:

Secure the implement against lowering e.g. using support elements.

(7) Advise people in the vicinity that work is being carried out on the implement.

13.1.2 Carrying out maintenance

During maintenance and servicing, ensure that:

✓ Personal protective equipment is worn.

🛠 Suitable tools are used

🛠 Climbing aids

🛠 Support elements

▶ Use lifting gear to remove and attach heavy components.

▶ Check nuts and bolt heads for wear. If necessary 🔧 call in specialised personnel.

▶ Follow the maintenance instructions.

13.2 Maintaining the implement

13.2.1 Maintenance schedule

Chapt.	Activities	Service personnel	before the season	after cleaning	after the first 2 hours of operation	every 10 hours of operation	every 20 hours of operation	every 50 hours of operation	every 100 hours of operation	annually	at the latest 6 years after the date of manufacture	Page
13.2.2	*Check top link pin and lower link pin on the three-point linkage*		■					■				*129*
13.2.3.1	*Check wheels*					■						*129*
13.2.3.1	*Check wheel nuts*		■		■							*129*
13.2.4	*Check the bolted connections on the chopping elements*				■				■			*130*
13.2.4	*Check parallelograms*				■				■			*130*
13.2.5	*Check lighting system*							■				*130*
13.2.5	*Check stabilisers*						■					*130*
13.2.5	*Check safety stickers*							■				*130*
13.2.6	*Check hydraulic lines*					■						*130*
13.2.6	*Change hydraulic lines*	■									■	*130*
13.2.6	*Check hydraulic couplings*					■						*130*
13.2.7	*Check connectors and electric cables*		■					■				*131*
13.2.8	*Check working tools*					■						*131*
13.2.8	*Check the sharpness of the chopping coulter*					■						*131*

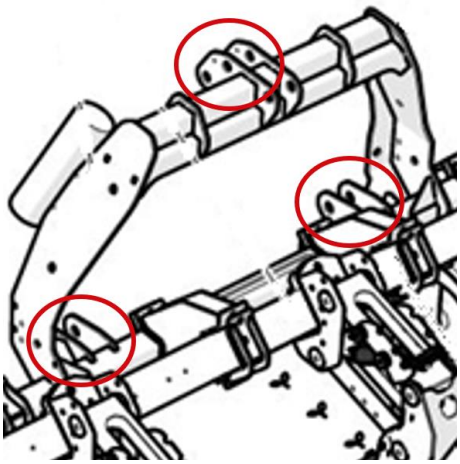
13.2.2 Tractor connection

Check top link pin and lower link pin on the three-point linkage

(1) Visual inspection of top link pins and lower link pins on the three-point linkage for

- damage
- wear and tear

(2) Replace damaged or worn pins.



13.2.3 Frame

13.2.3.1 Tyres and wheels

Checking wheels

(1) Visual check for

- damage
- wear and tear

(2) Immediately replace damaged wheels.

Checking air pressure

WARNING

Risk of accident due to incorrect tyre pressure

Excessive tyre pressure can cause the tyres to burst. If the pressure in tyres is too low, it can cause the tyres to be overloaded. It has a negative impact on the track stability of the implement.

This could result in accidents resulting in serious injury or death and damage to the implement.

▶ Set the air pressure according to the specifications in the technical data.

⇨ *Chapter 15 Technical data on page 136*

▶ Check the air pressure.

- If necessary, correct according to the specifications in the technical data.

⇨ *Chapter 15.10 Tyres and wheels on page 141*

Checking wheel nuts

▶ Tighten the wheel nuts on the implement to the appropriate tightening torque.

13.2.4 Bolted connections

Checking bolted connections on the chopping elements

Bolted connections on the chopping elements and working tools must always be tight.

(3) Check bolted connections.

(4) Tighten bolts if necessary.

Checking parallelograms

The parallelograms of the chopping elements and in-row hoes are movably suspended.

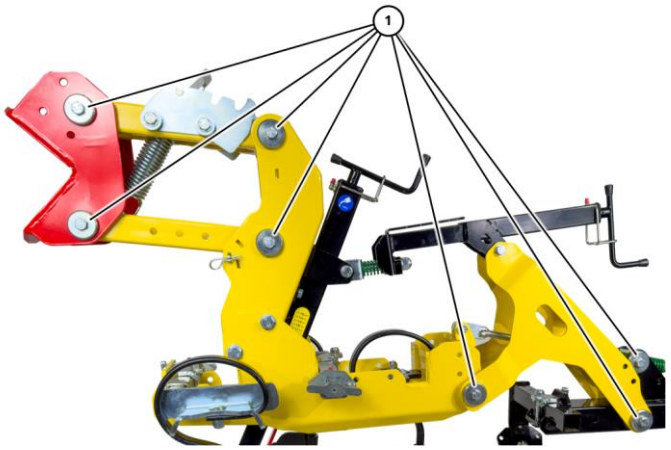
(1) Check bolted connections.

(2) Check ball bearing [1] for tight fit.

(3) Check moving parts for play.

(4) If a parallelogram is too loose at the side, tighten the bolts.

(5) Replace damaged or worn parts immediately.



13.2.5 Safety devices

Check lighting system

▶ Make sure it works properly.

Check stabilisers

(1) Visual check for

- damage
- wear and tear

(2) Replace damaged or worn parts immediately.

Check safety stickers

▶ Make sure they are visible and in good condition.

13.2.6 Hydraulic system

Check hydraulic lines

(1) Check hydraulic lines for

- damage
- leaks

▶ Replace damaged or leaking hydraulic lines immediately.

(2) Check the date of manufacture of the hydraulic lines.

▶ 🔧 Replace hydraulic lines after 6 years at the latest.

Changing hydraulic lines

▶ 🔧 Replace hydraulic lines every 6 years after the manufacturer's date.

- Only use hydraulic lines approved by the manufacturer, see spare parts list.

Checking hydraulic couplings

(1) Check pressureless hydraulic couplings for

- damage
- leaks

▶ 🔧 Immediately repair or replace damaged or leaky hydraulic couplings.

(2) Connect hydraulic couplings without pressure.

(3) Check the hydraulic couplings for leaks under pressure.

▶ 🔧 Immediately repair or replace damaged or leaky hydraulic couplings.

13.2.7 Electric system

Check connectors and electric cables

▶ Carry out a visual check. Look for

- bent or broken contact pins in the plugs
- exposed spots on the cable

▶ 🔧 Immediately repair or replace damaged connectors or electric lines.

13.2.8 Working tools

Check working tools

▶ Visual check for

- damage
- wear and tear

▶ Replace damaged or worn working tools.

Checking chopping coulter width

(1) Check the width of the chopping coulter.

(2) Replace worn chopping coulters.

△ Flat cut ensured.

13.3 Lubricating implement parts

13.3.1 Lubrication schedule

IMPORTANT

The lubrication points on the implement are colour-coded.

Chapt.	Activities	before the season	after cleaning	every 10 hours of operation	every 20 hours of operation	every 50 hours of operation	every 100 hours of operation	Page
13.3.2	*Lubricate folding joints*	■				■		*132*
13.3.2	*Lubricate depth guide of chopping element*	■	■		■			*132*
13.3.2	*Lubricate chopping coulter adjustment*	■	■		■			*132*
13.3.2	*Lubricate hydraulic cylinder*	■	■		■			*132*
13.3.3	*Grease bolts*	■	■					*133*
13.3.3	*Grease piston rods*	■	■					*133*

13.3.2 Lubricating components via grease nipples

Lubricating folding joints

▶ Lubricate the lubrication point on every folding joint.

Lubricating the depth control of the chopping element

▶ Lubricate the lubrication point on the depth control of all chopping elements.

Lubricating chopping coulter adjustment

▶ Lubricate the lubrication point on the quick shift of the working tools of all chopping elements.

Lubricating the hydraulic cylinder

▶ Lubricate lubrication points on every hydraulic cylinder.

13.3.3 Grease components

Greasing bolts

- Remove, grease and refit the bolts.

Greasing piston rods

- Grease piston rods with acid-free grease.

14 Permanently decommissioning and disposing of the implement

ENVIRONMENT

Never expose implement components to the weather for long periods of time, as operating fluids may be released into the environment.

ENVIRONMENT

At the end of its service life, dispose of the implement in the country-specific legally regulated waste recycling system.

14.1 Permanently decommissioning

If the implement can no longer be used, it needs to be dismantled into its individual parts.

Special knowledge is required to dismantle the implement into its individual parts.

✓ Further use of the implement as described in these instructions is no longer intended.

(1) Call in qualified specialist personnel to permanently decommission the implement.

(2) Empty and clean all existing hoppers and hoses.

⇨ *Chapter 12 Cleaning and care on page 125*

△ All implement components are free from auxiliary materials, e.g. seeds.

(3) Remove operating materials from the implement, e.g. grease.

⇨ *Chapter 15.8 Operating materials on page 141*

(4) Decommission the implement.

⇨ *Chapter 11 Decommissioning the implement on page 123*

(5) Have the implement dismantled by specialised personnel.

WARNING

Risk of injury due to discharge of stored energy

Springs are under pressure.

Hydraulic components are under pressure.

▶ Deploy qualified personnel for disassembly.

(6) Dispose of implement components and operating materials properly.

⇨ *Chapter 14.2 Disposal and recycling on page 135*

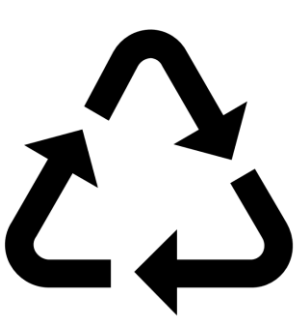
14.2 Disposal and recycling

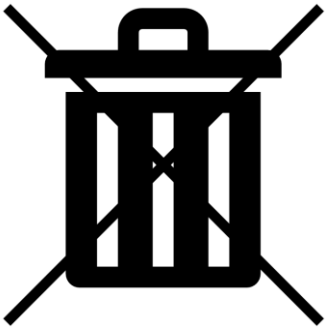
Special knowledge is required for the disposal of implement components and operating materials.

(1) Call in qualified specialists to dispose of the implement.

(2) Return implement components to the material cycle.

(3) Dispose of auxiliary and operating materials in an environmentally friendly manner.





ENVIRONMENT

Never dispose of implement components and operating materials in the environment or in household waste.

15 Technical data

15.1 Dimensions

Hoe HM rear mounting

Data	Value				
	HM 3004 M1	HM 3006 M1	HM 4506 M1	HM 6008 M1	HM 6012 M1
Frame width [m]	3.13	3.13	4.65	6.25	6.25
External width in working position, maximum [m]	3.25	3.15	4.65	6.25	6.25
Transport dimensions, Height x Width x Depth [m]	1.35 x 3.25 x 2.00	1.35 x 3.15 x 2.00	2.70 x 2.50 x 2.00	3.30 x 2.50 x 2.00	3.30 x 2.50 x 2.00

Hoe HS rear mounting

Data	Value				
	HS 3004 M1	HS 3006 M1	HS 4506 M1	HS 6008 M1	HS 6012 M1
Frame width [m]	3.13	3.13	4.65	6.25	6.25
External width in working position, maximum [m]	3.25	3.15	4.65	6.25	6.25
Transport dimensions, Height x Width x Depth [m]	2.00 x 3.25 x 2.25	2.00 x 3.15 x 2.25	2.70 x 2.50 x 2.25	3.30 x 2.50 x 2.25	3.30 x 2.50 x 2.25

IMPORTANT

To determine the actual dimensions:

▶ Measure the implement.

15.2 Weight

IMPORTANT

The weight of the implement as delivered is stated on the type plate.

Hoe HM rear mounting

Data	Value				
	HM 3004 M1	HM 3006 M1	HM 4506 M1	HM 6008 M1	HM 6012 M1
Net weight, maximum [kg]	720	870	1080	1310	1610

Hoe HS rear mounting

Data	Value				
	HS 3004 M1	HS 3006 M1	HS 4506 M1	HS 6008 M1	HS 6012 M1
Net weight, maximum [kg]	820	970	1300	1520	1820

WARNING

Risk of accidents due to incorrect ballasting

The hoe may be lighter or heavier than when delivered, depending on how it is equipped with chopping elements and working tools.

▶ Weigh the implement to determine the actual weight and for correct ballasting.

15.3 Power data

15.3.1 Ambient conditions and operating conditions

Hoe HM rear mounting

Data	Value				
	HM 3004 M1	HM 3006 M1	HM 4506 M1	HM 6008 M1	HM 6012 M1
Working speed, minimum...maximum [km/h]	4...8				
Transport speed, maximum [km/h]	40				

Hoe HS rear mounting

Data	Value				
	HS 3004 M1	HS 3006 M1	HS 4506 M1	HS 6008 M1	HS 6012 M1
Working speed, minimum...maximum [km/h]	4...12				
Transport speed, maximum [km/h]	40				

15.3.2 Tractor power requirements

Hoe HM rear mounting

Data	Value				
	HM 3004 M1	HM 3006 M1	HM 4506 M1	HM 6008 M1	HM 6012 M1
Tractor performance, minimum [HP]	50	50	70	90	90
Tractor performance, minimum [kW]	36	36	52	66	66

Hoe HS rear mounting

Data	Value				
	HS 3004 M1	HS 3006 M1	HS 4506 M1	HS 6008 M1	HS 6012 M1
Tractor performance, minimum [HP]	50	50	70	90	90
Tractor performance, minimum [kW]	36	36	52	66	66

15.3.3 Requirements for the tractor's hydraulic system

Data	Value
Required pressure in the tractor's hydraulic system for hydraulic cylinders on the implement-side [bar]	150
Permitted operating power, maximum [bar]	200
Volume flow, minimum [l/min]	15

15.4 Electrical data

CAUTION

Material damage caused by overvoltage and undervoltage

Overvoltage and undervoltage lead to malfunctions and can destroy electrical components.

- ▶ Make sure that the power supply to the implement is within the tolerance range.
- ▶ Make sure that the required fuse protection of the power supply is guaranteed.

15.4.1 Power sources

Consumers	Voltage [Volt]	Current [Ampere]	Direct connection to the tractor battery	Power socket
Lighting system	12	25	-	In acc. with DIN ISO 1724
Control terminal control system	9...30	1	–	In acc. with DIN ISO 9680
Voltage = supply voltage Current = maximum power consumption				

15.5 Hydraulic data

15.5.1 Hydraulic control units

Consumers	Single-acting control unit	Double-acting control unit	Pressureless return
Cylinder for folding frame	–	■	■
Linear sliding frame	–	■	■

15.5.2 Hydraulic lines

Cylinder for folding frame on left

Data	Length [m]	Connection	Colour	Code
Pressure line	< 3	BG 3	red	-
Return flow line	< 3	BG 3	red	-

Cylinder for folding frame on right

Data	Length [m]	Connection	Colour	Code
Pressure line	< 3	BG 3	blue	-
Return flow line	< 3	BG 3	blue	-

Linear sliding frame

Data	Length [m]	Connection	Colour	Code
Pressure line	< 3	BG 3	yellow	-
Return flow line	< 3	BG 3	yellow	-

15.6 Settings data

15.6.1 Row spacing

Hoe HM rear mounting

Data	Value				
	HM 3004 M1	HM 3006 M1	HM 4506 M1	HM 6008 M1	HM 6012 M1
Row spacing, minimum...maximum [cm]	60...80	40...55	60...80	60...80	40...55

Hoe HS rear mounting

Data	Value				
	HS 3004 M1	HS 3006 M1	HS 4506 M1	HS 6008 M1	HS 6012 M1
Row spacing, minimum...maximum [cm]	60...80	40...55	60...80	60...80	40...55

15.6.2 Support wheel track

Hoe HM rear mounting

Data	Value				
	HM 3004 M1	HM 3006 M1	HM 4506 M1	HM 6008 M1	HM 6012 M1
Number of support wheels	2				
Track gauge support wheels, minimum...maximum [cm]	130...195				

Hoe HS rear mounting

Data	Value				
	HS 3004 M1	HS 3006 M1	HS 4506 M1	HS6008 M1	HS 6012 M1
Number of support wheels	2				
Track gauge support wheels, minimum...maximum [cm]	130...240				

15.7 Noise, air-borne sound

Data	Value
Noise level of the implement during operation [dB(A)]	80...85

IMPORTANT

- Measurement of noise emission values in accordance with EN ISO 3746.
- Measurement tolerance ± 2 dB(A)

15.8 Operating materials

Operating material	HG 300 M1
Hydraulic oil [type]	RENOLIN B 68 HVI HYDR.OIL
Grease [type]	Type EP2 or equivalent

15.9 Direction of connection on the implement

Authorised mounting categories for lower link coupling points and upper link coupling points

Direction of connection	Value
Three-point linkage, Category	CAT 2

15.10 Tyres and wheels

Support wheels

Type of wheel	Wheel size
Flanged wheel	300 x 100
Flanged wheel	400 x 150

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17 Appendix

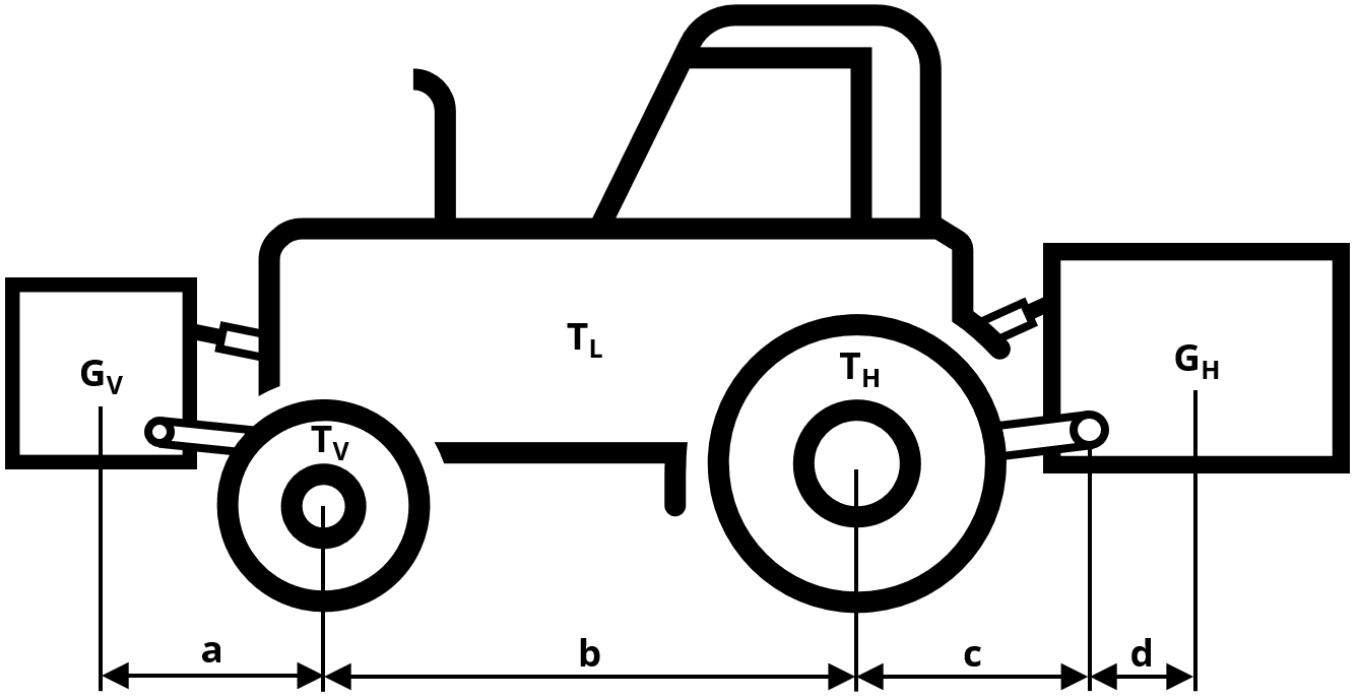
17.1 Calculation of axle load and ballasting for attached implements

Calculating the axle loads and the required ballasting is based on data from the operating manual for the tractor and the implement.

The calculation results in a guide value for the initial assessment of the axle loads and the required ballasting.

▶ For accurate results, weigh the tractor with and without the implement attached.
- Tractor
- Front axle
- Rear axle

17.1.1 Data



Data required to calculate the axle loads for each tractor used:

- Data from the tractor's operating manual
- Data from the implement's operating manual
- Data from measurements made on the tractor
- Data from measurements made on the implement/tractor combination

Data acquisition for axle load calculations

Abbreviation	Description	Value	Unit
Tractor data from the operating manual or determined by weighing			
T_{Gzul}	Permitted total weight of the tractor		[kg]
T_{Hzul}	Permitted front axle load		[kg]
T_{Vzul}	Permitted rear axle load		[kg]
T_L	Tare weight of the tractor		[kg]
T_V	Front axle load of the empty tractor		[kg]
T_H	Rear axle load of the empty tractor		[kg]
Data from the tractor operating manual or from the tyre manufacturer's documentation			
	Permissible tyre load capacity, front axle per tyre		[kg]
	Permissible tyre load capacity, rear axle per tyre		[kg]
Implement data from the operating manual or determined by weighing Front weight or rear weight data determined from documents or by weighing			
G_H	Total weight of the rear-mounted implement or rear weight		[kg]
G_V	Total weight of the front-mounted implement or front weight		[kg]
d	Distance from the centre of the lower link ball to the centre of gravity of the rear-mounted implement or rear weight		[m]
Data from measurements made on the implement/tractor combination			
a	Distance between the centre of gravity of the front-mounted implement and the centre of the front axle		[m]
b	Wheelbase of the tractor		[m]
c	Distance between the centre of the rear axle and the centre of the lower link ball		[m]

17.1.2 Calculating the axle load and ballasting

▶ Perform calculations separately for each tractor used.

Minimum ballasting Front $G_{V\,min}$ for rear mounted implement	
$G_{Vmin} = \frac{G_H \cdot (c + d) - T_V \cdot b + 0.2 \cdot T_L \cdot b}{a + b}$	▶ Enter calculated value in the results table.
Minimum ballasting rear $G_{H\,min}$ for front mounted implement	
$G_{Hmin} = \frac{G_V \cdot a - T_H \cdot b + 0.45 \cdot T_L \cdot b}{b + c + b}$	▶ Enter calculated value in the results table.
Actual total weight G_{tat}	
$G_{tat} = G_V + T_L + G_H$	▶ Enter calculated value in the results table. ▶ Enter total weight in the results table. ■ Refer to the tractor operating manual.
Actual front axle load T_{Vtat}	
$T_{Vtat} = \frac{G_V \cdot (a + b) + T_V \cdot b - G_H \cdot (c + d)}{b}$	▶ Enter calculated value in the results table. ▶ Enter the permitted front axle load in the results table. ■ Refer to the tractor operating manual.
Actual rear axle load T_{Htat}	
$T_{Htat} = G_{tat} - T_{Vtat}$	▶ Enter calculated value in the results table. ▶ Enter the permitted rear axle load in the results table. ■ Refer to the tractor operating manual.
Maximum front load in percent $T_{V\%}$	
$T_{V\%} = \frac{T_{Vtat} \cdot 100}{T_L}$	▶ Enter calculated value in the results table.
Tyre load capacity	
▶ Determine the permissible tyre load capacity from the tractor manufacturer's or tyre manufacturer's documentation. ▶ Enter double value in the results table. ■ For 2 tyres.	

17.1.3 Results of axle load and ballasting for implement/tractor combinations

▶ Create a separate results table for each tractor used.

Data	Actual value acc. to calculation or measurement			Permissible value acc. to tractor operating manual			Double permissible tyre load capacity ■2 tyres	
Minimum ballast front[1]	G_{Vmin}		kg			-		-
Minimum ballasting rear[1]	G_{Hmin}		kg			-		-
Total weight[2]	G_{tat}		kg	≤		kg		-
Front axle load[2, 3]	T_{Vtat}		kg	≤		kg		kg
Rear axle load[2, 3]	T_{Htat}		kg	≤		kg		kg
Front axle load in percent[4]	$T_{V\%}$ 20 ≤		%					-

[1]Positive values: ballast required, negative values: ballast sufficient.

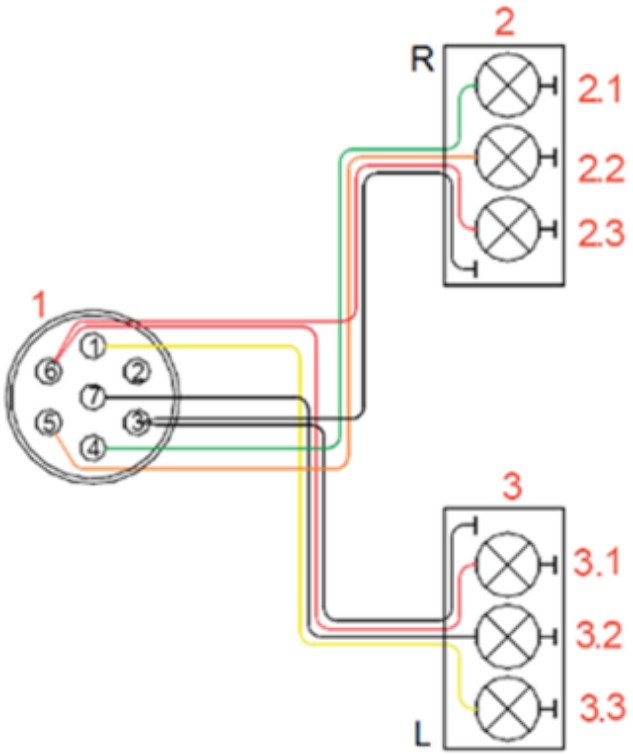
[2]The actual values must be less than or equal to the permissible values.

[3]The actual values must be less than or equal to twice the tyre load capacity.

[4]The front axle load must be at least 20 % of the tractor's unladen weight.

17.2 Plans and wiring diagrams

17.2.1 Lighting system wiring diagram



1	Plug 7-pin, 12 V
R	Lighting unit on right
2	Rear light right
2.1	Indicator right
2.2	Rear light right
2.3	Brake light right
L	Lighting unit on left
3	Rear light left
3.1	Brake light left
3.2	Rear light left
3.3	Indicator left

Pin assignment and cable assignment of the lighting system

Number	Cable name	Cable colour	Function
1	L	Yellow	Indicator left
2	54g	-	--
3	31	White	Ground
4	R	Green	Indicator right
5	58R	Brown	Rear light right
6	54	Red	Brake light left, brake light right
7	58L	Black	Rear light left

APV Technische Produkte GmbH
Zentrale: Dallein 15
AT - 3753 Hötzelsdorf

Tel.: +43 2913 8001
office@apv.at
www.apv.at