



Motec Camera Monitor Systems
for agricultural vehicles

MOTEC HEAVY-DUTY CAMERA SOLUTIONS

Motec specializes in the development and production of camera-based driver assistance systems for utility vehicles and mobile machinery.

Motec protects lives by making mobile machinery and their surroundings safer. Its cameras make operators' work easier by reducing stress and uncomfortable physical movements. And, it helps companies become more successful by accelerating processes and avoiding damage.

Motec has over 25 years of experience in the construction and manufacture of robust, reliable mobile cameras, including the associated electronics.

Its product range includes reversing cameras, industrial cameras, displays, advanced video controllers, DVRs, customer-specific wiring looms, and wireless video transmission solutions.

Motec's customers are leading OEMs of utility vehicles and mobile machinery for industries working in tough environments.

At its development center for utility vehicle assistance systems (MENAS) Motec develops, tests and validates software algorithms for customized driver assistance systems. Its suite of algorithms incorporates solutions for real-time image processing, aerial view projection, sensor fusion (e.g. cameras, ultrasound sensors, radar sensors, lasers), stereo view, image processing and driver assistance systems.

Motec is a unit of AMETEK Inc. a leading global manufacturer of electronic instruments and electromechanical products.



2 3

Motec camera systems for agricultural vehicles

The future of farming is "smart farming". Motec has been working for many years to develop digital camera monitor systems with smart functionalities to make agricultural work processes even more efficient. We develop and manufacture customised and application-specific smart mobile cameras with integrated image processing for this purpose.

In 2015, we established our Development Centre for Commercial Vehicle Assistance Systems (MENAS) to be able to complement our hardware optimally with internally developed software. This Centre pools all of the competences we have built up in image processing and algorithm development over the years. Motec's most recent camera generation not only delivers outstanding image quality due to Full HD resolution, but also incorporates a processor for integrated image processing. This provides Motec cameras with "embedded mobile machine vision", allowing them to recognise seedlings, for example, or to detect grain quality or adhere to tramlines.

The software forms part of a series of sophisticated visibility algorithms. Motec's accumulated hardware and software expertise is the basis for the company's ability to meet individual needs in precision farming.



Technical service – guaranteed fast support

Top quality means also top service. When faced with difficult technical challenges or questions that need answers, Motec can assist. Its sales and engineering departments work hand in hand. Customers benefit from efficient communication with no red tape. Motec engineers understand customers processes, know what they need and can find a solution quickly.

Hotline

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Robust modular hardware and smart software

- High housing protection rating
- Shock and vibration resistant
- Large temperature range
- Modular components
- Internally manufactured cables
- Digital technology for superior image quality
- Development, validation and integration of algorithms
- Real-time image processing
- 270°/360° top-view projection
- Sensor fusion (ultrasonic/radar)
- Stereo cameras (object recognition)
- Operator assistance systems (active collision warning)

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Product overview

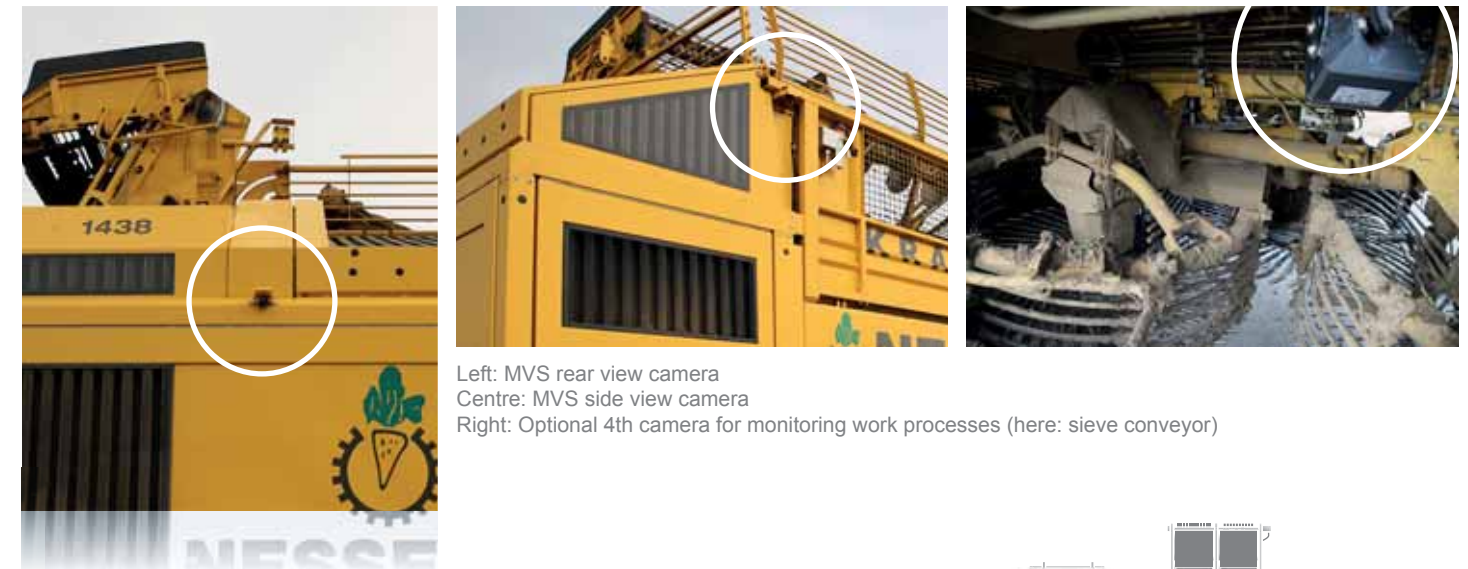
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Mobile Vicinity Scout – 270° visual system with ultrasonic sensors

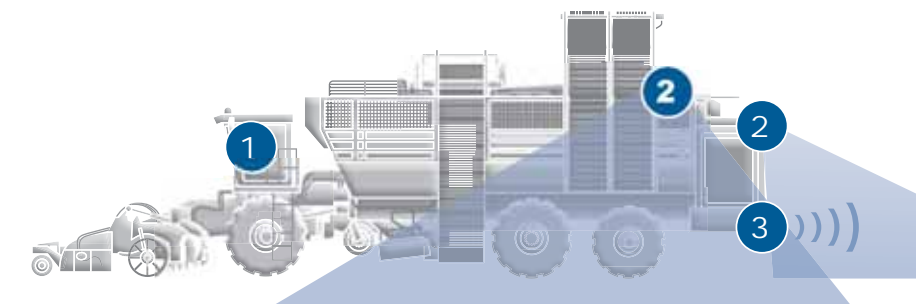
Example: sugar beet harvester

With large agricultural machinery, areas that are fully or partially out of operators' sight create a particularly high safety risk for people and machinery. The MVS system intelligently puts together the images received from the side and rear cameras to produce a rear view. Operators are able to monitor the immediate environment of their vehicles, which facilitates manoeuvring, navigating tight thoroughfares or animal housing and situations where the rear swings out, among others.

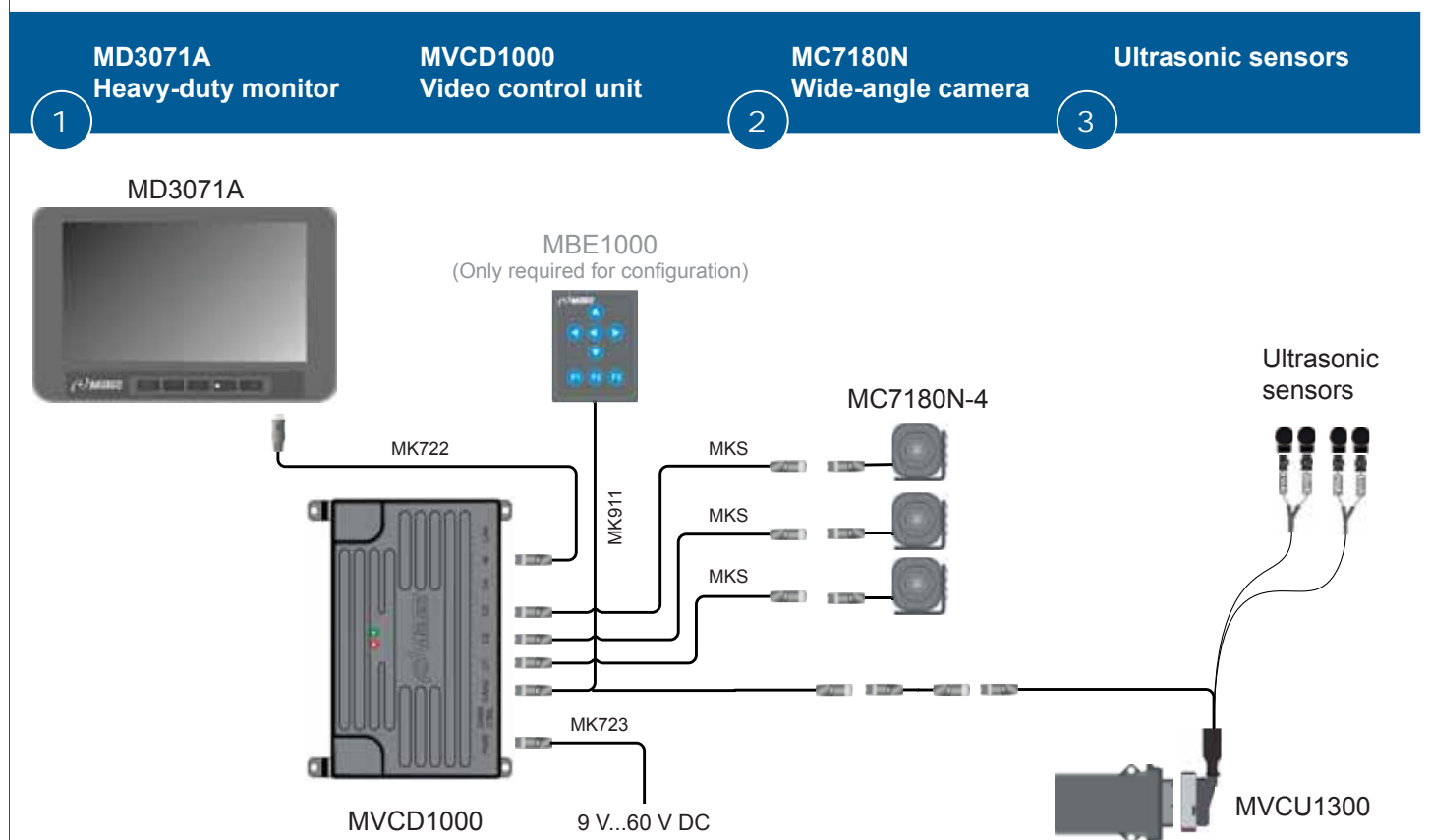
With the 270° system, a fourth camera can be installed as an option to monitor work processes such as transfers, crop transports or fill levels in seeder hoppers to increase efficiency and save costs.



Left: MVS rear view camera
Centre: MVS side view camera
Right: Optional 4th camera for monitoring work processes (here: sieve conveyor)



EXAMPLE: Sugar beet harvester with 270° system



Mobile Vicinity Scout – 360° visual system

Example: grape harvester

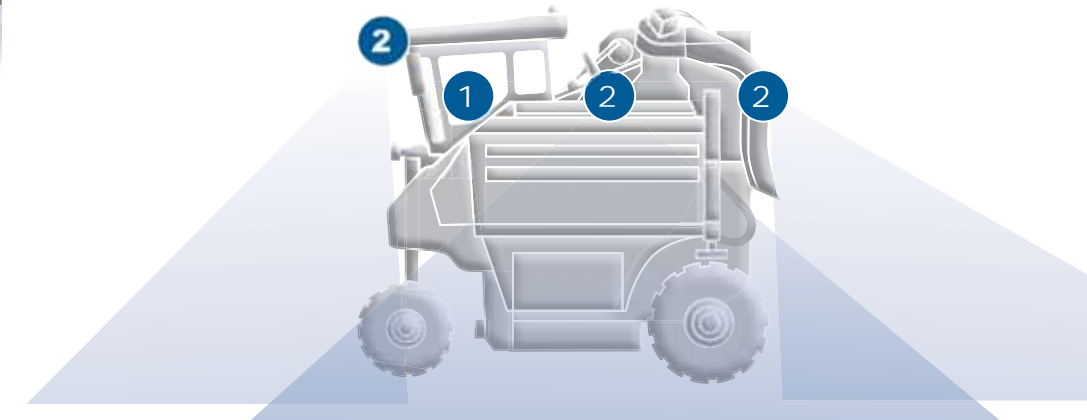
The Motec Mobile Vicinity Scout (MVS) camera system provides operators with seamless visibility all around their vehicles. A video control unit combines the images received from four wide-angle cameras (at the front, rear and both sides) to a bird's eye view image. Depending on the application, the system delivers visibility of up to seven metres around the vehicle.

Operators are able to monitor the immediate environment of their vehicles, which facilitates operations such as manoeuvres on vineyards, alignment with other vehicles and unloading crops, among others.

A coloured image overlay additionally marks the unloading area. This prevents harvest losses, increases efficiency and saves costs.



Left: Front camera
Centre: Rear view camera
Right: Unloading of harvested grapes



EXAMPLE: Grape harvester

MD3071A-V
Heavy-duty monitor

MCDE1000
Video control unit

MC7180N
Wide-angle camera

MD3071A-V



MBE1000
(Only required for configuration)



MVCD1000

MC7180N-4

MKS

9 V...60 V DC



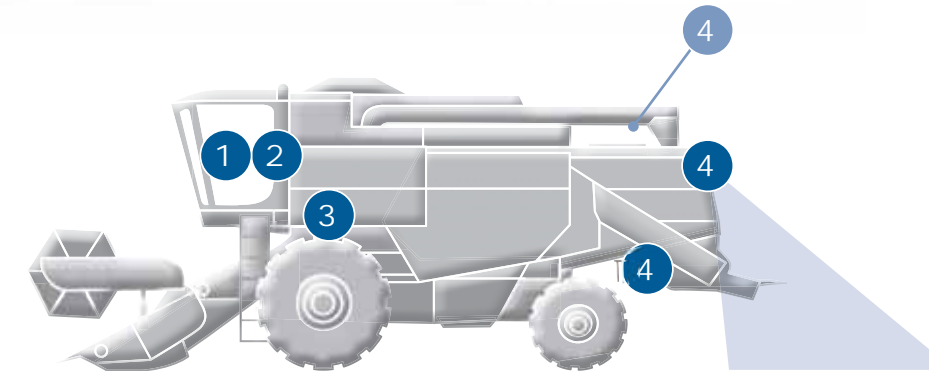
4-camera system for combine harvesters

Workspace and rear-space monitoring

Motec cameras support operators of agricultural machinery in numerous ways, when monitoring the rear of vehicles for greater safety of people and materials, by facilitating the attachment to trailer couplings, when attaching headers, on spouts for the precise filling of silage trailers, on grain tanks for monitoring fill levels, and on returns for optimal machine settings.

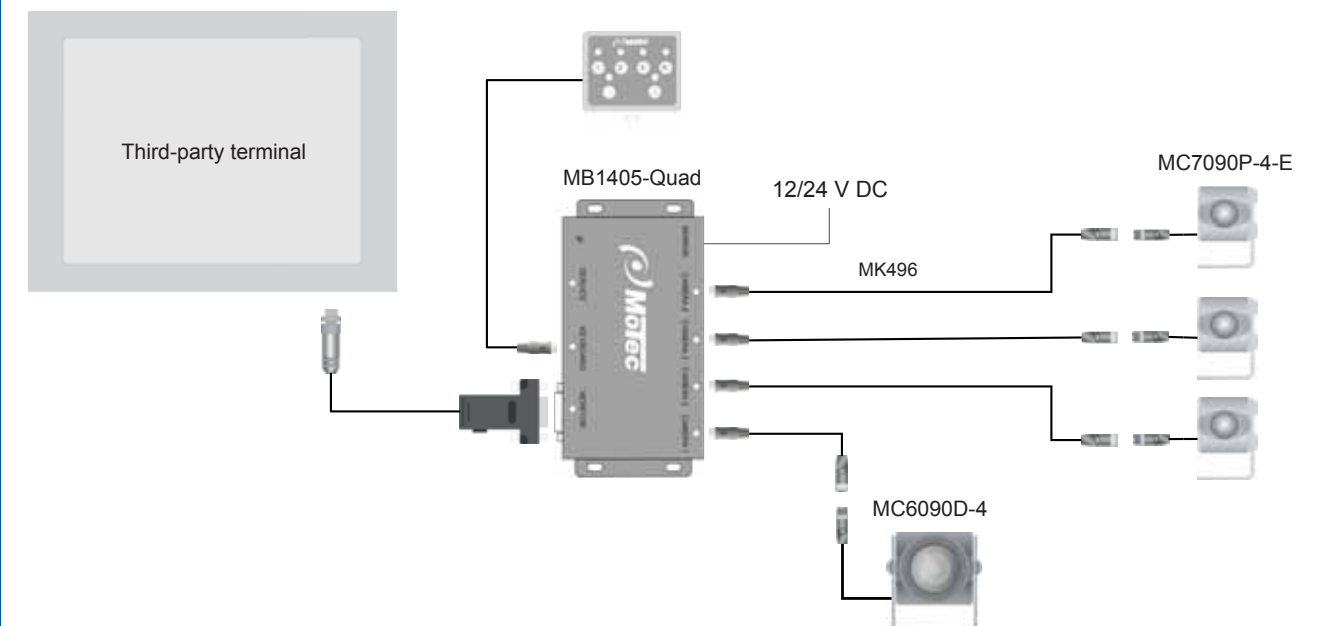


Top: Towing jaw monitoring during coupling
Left: Rear view camera
Right: Camera on the spout



EXAMPLE: Combine harvester

1	2	3	4
Monitor/ third-party terminal	MB1405-Quad Video control unit	MC6000D Heavy-duty camera	MC7000P-E Wide-angle camera



4-camera system for towed harvesters

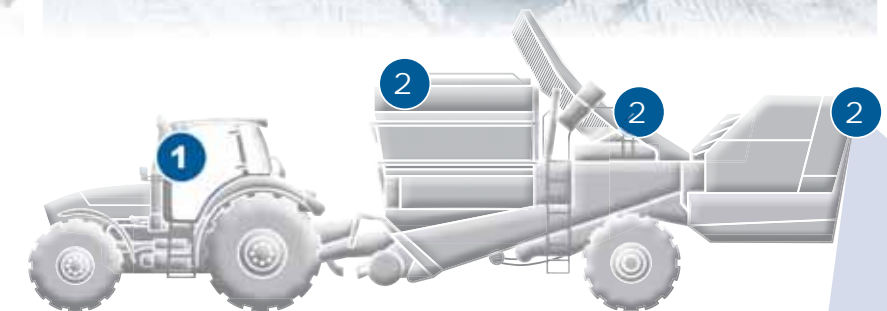
Workspace and rear-space monitoring

Potato harvesters can be set up in very different ways in order to achieve the desired harvest quality. A sophisticated camera system ideally complements existing machinery. 4 cameras at the most important positions ensure that operators always have a clear overview of all machine functions. Conveyor belts are monitored during both harvest and transfer. The rear view camera for rear-space monitoring provides additional safety during manoeuvres.

The Motec MD3074A-Quad monitor used here allows each of the four cameras to be displayed separately or all at once in a split image. The monitor housing complies with IP66 protection rating, and the monitor is therefore completely dust-proof and fully protected even against powerful water jets.



Conveyor belt monitoring camera



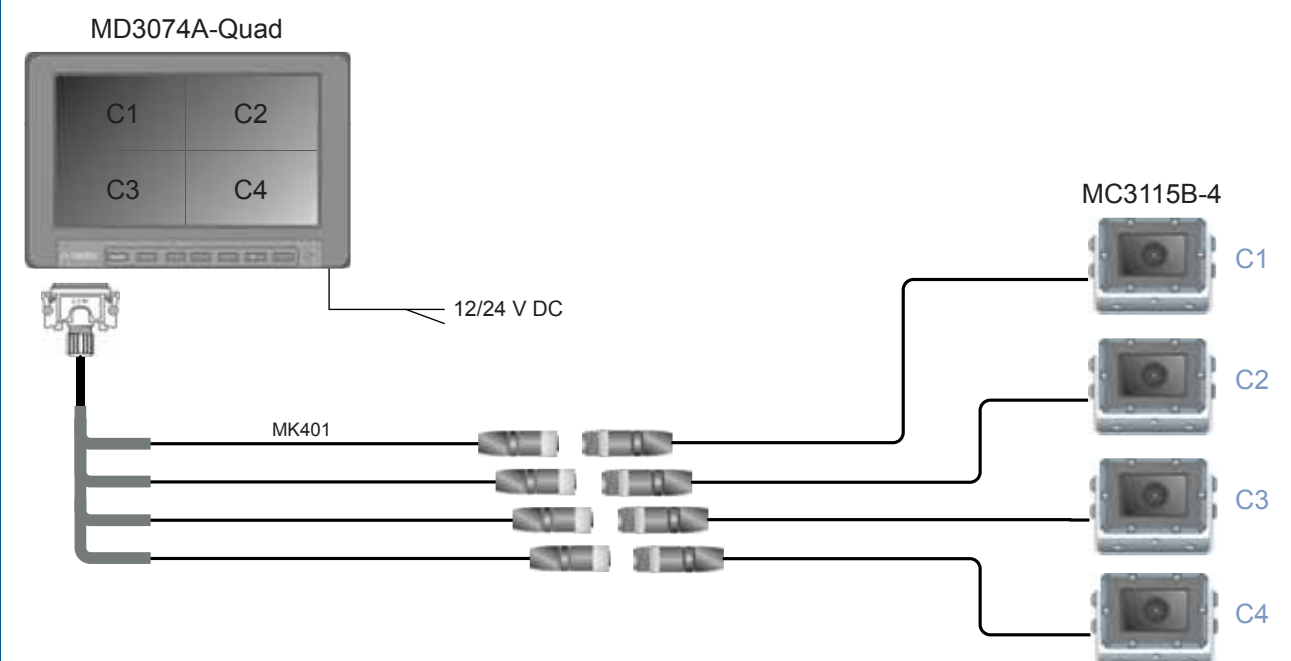
EXAMPLE: Potato harvester

MD3074A-Quad
Heavy-duty monitor

1

MC3000B
Heavy-duty camera

2



2-camera system for trailers and towed machines

Workspace and rear-space monitoring

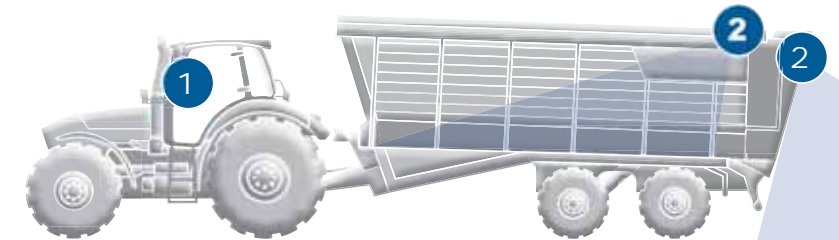
Modern silage trailers have impressive loading capacities, and a camera is essential for rear-space monitoring when manoeuvring these trailers on a yard or in a bunker silo, unless a separate signaller is available. A second camera for monitoring the cargo area provides operators with useful information on fill levels.

All Motec monitors are suitable for connecting at least two cameras. Video cables are also available with protective hoses to ensure reliable transmission of video images at all times. The connector complies with the AEF (Agricultural Industry Electronics Foundation) standard and provides a reliable connection between trailer-side and tractor-side cables



Top: Cargo area monitoring
Bottom: Rear-end monitoring

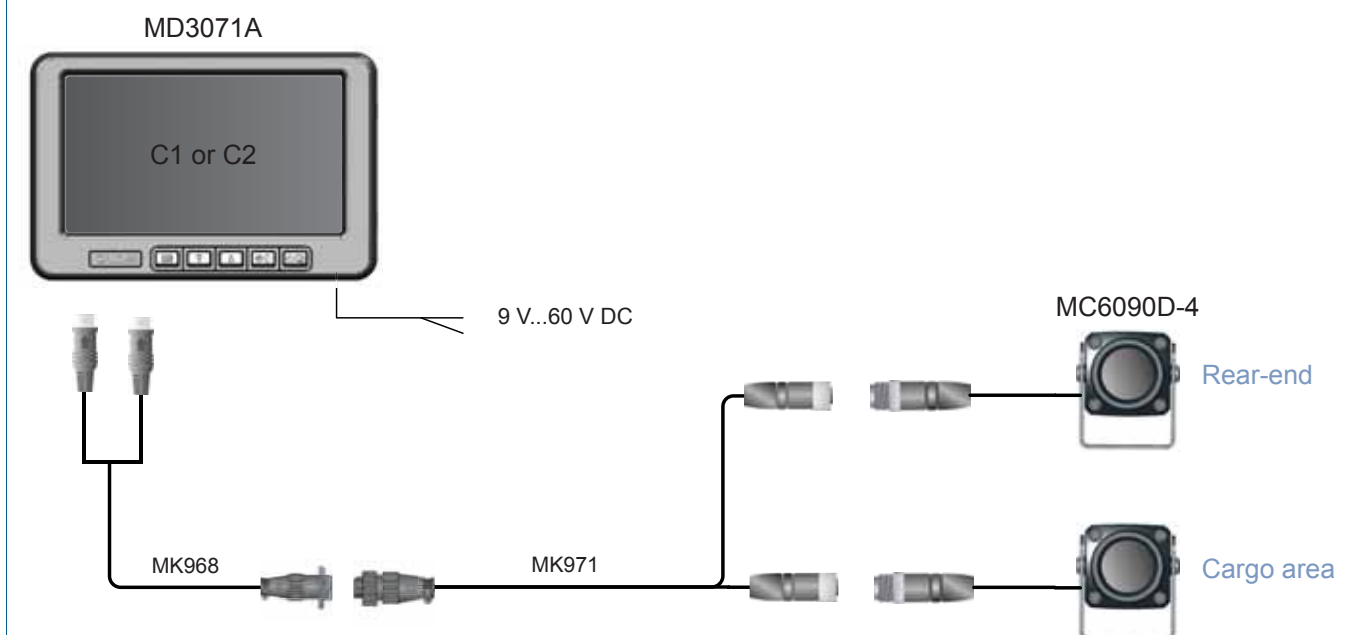
12 13



EXAMPLE:
Trailer

MD3071A
Heavy-duty monitor

MC6000D
Heavy-duty camera



1-camera system for towed machines

Machine monitoring

The quality of bale wrapping or tying is decisive for overall bale quality. A rear view camera installed at the bale chute ensures that operators always have a clear overview. Another camera can additionally be pointed inside the machine to allow any workflow disruptions to be identified early on.

The Motec range includes fast-aperture wide-angle cameras that are ideally suited for reliably monitoring work areas. Durable connectors ensure that tractors can be used with a variety of implements fitted with mobile cameras.

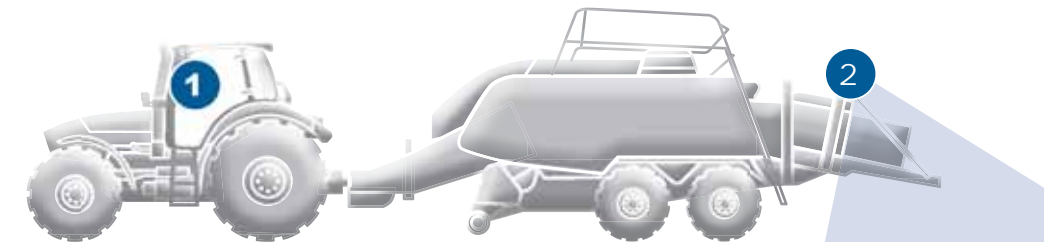
A range of connection cables are available for displaying camera images on a Motec monitor or popular commercial terminals.



Top: Camera for monitoring bale ejection



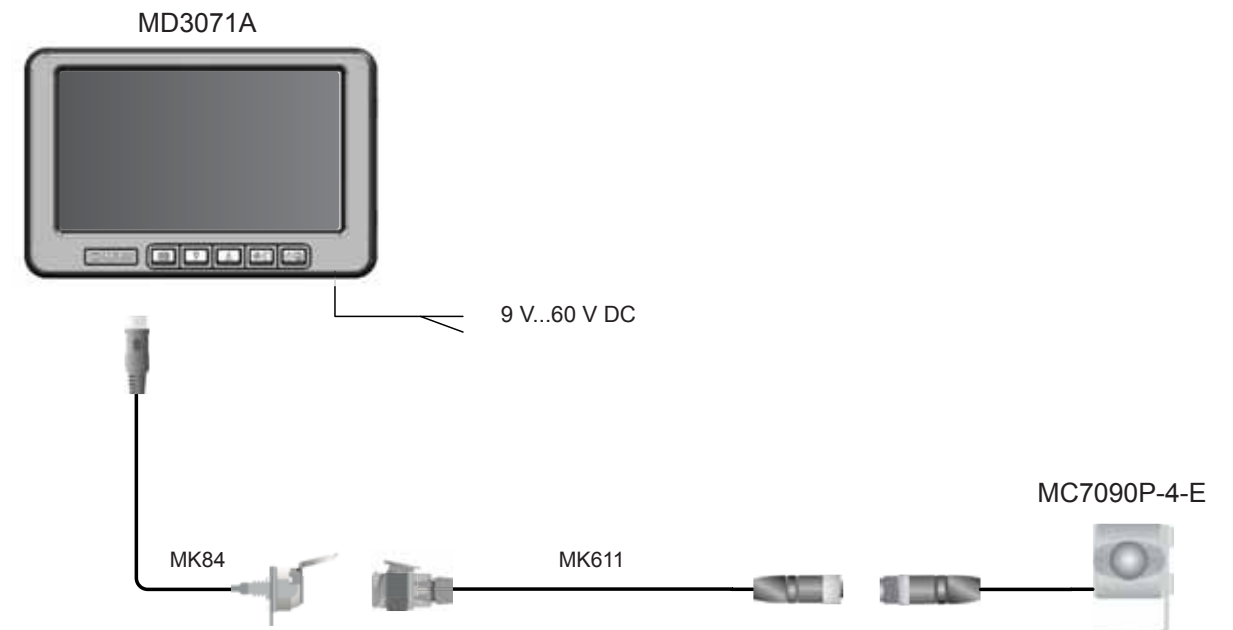
14 15



EXAMPLE:
Big baler

MD3071A
Heavy-duty monitor

MC7000P-E
Heavy-duty camera



Integrated front and rear view cameras

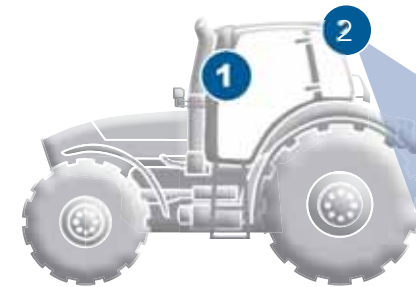
Machine monitoring

These days, tractors with beautifully as well as functionally designed chassis are awarded design prizes, and it is therefore only logical to integrate camera technology with vehicle design. Seamlessly integrated front and rear view cameras will only gain further importance in the future.

A front camera installed in the bonnet gives operators good visibility of a front power lift to provide support when attaching implements or front-end weights. A rear view camera integrated with the cab roof assists in coupling trailers and extends the range of vision beyond that available from the operator seat, thus delivering substantially improved safety, especially when reversing.



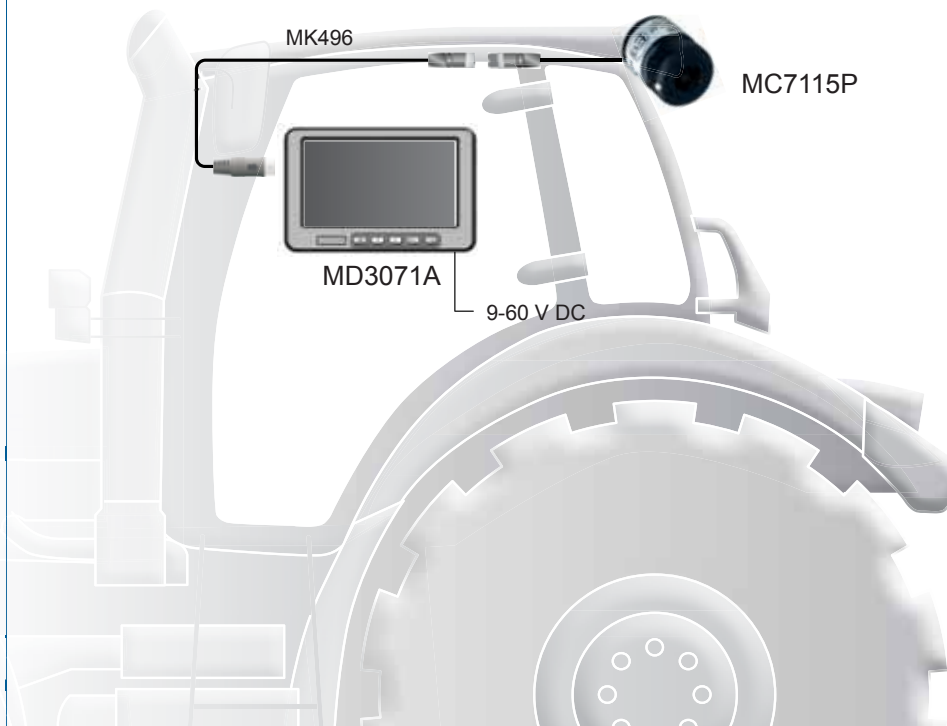
Top: Integrated front camera on the bonnet
Bottom: View through the rear window from the driver's seat



EXAMPLE: Integrated rear view camera

MD3071A
Heavy-duty monitor

MC7000P
Heavy-duty camera



Mobile camera with LED white light or IR illumination

Machine monitoring Example: Fill level indicator

Motec cameras are equipped with fast-aperture image sensors as standard. However, additional lighting is required if mobile cameras are to detect images inside machines or provide images in absolute darkness. Possible light sources include work lights or LEDs integrated in the camera.

Motec's new MC3000C camera series features either white or IR light. Infrared light at a wavelength of 940 nm is not visible to the human eye. In this mode, the image is displayed in black and white on the monitor.



Top: Camera-monitored fill level indicator
Bottom: Track monitoring

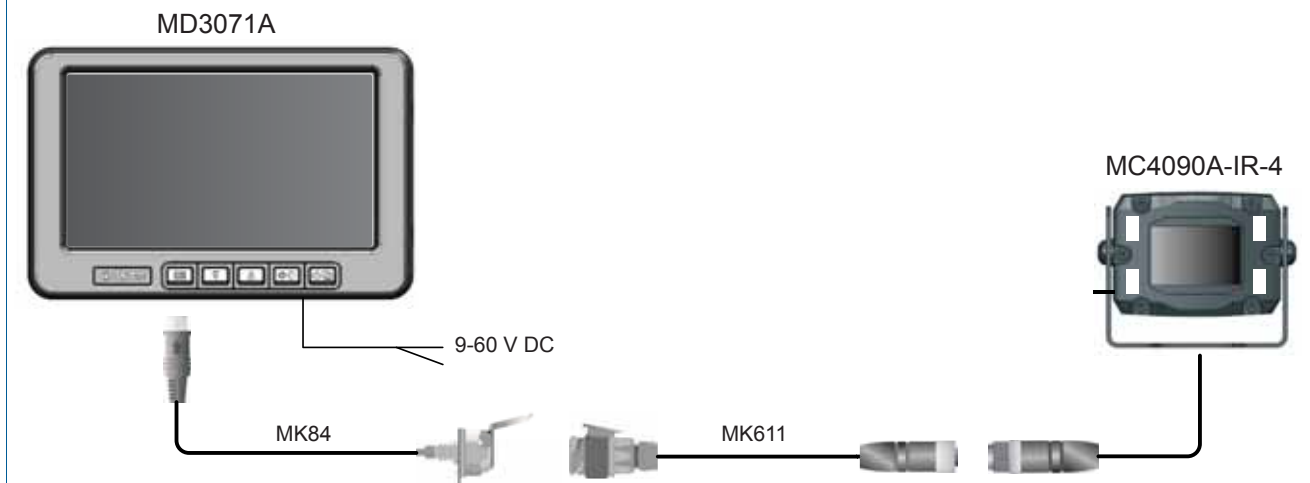


EXAMPLE: Fertiliser spreaders and seeders



MD3071A
Heavy-duty monitor

MC4000A-IR
Heavy-duty night vision camera



Camera monitor system for front implements

Cross-traffic monitoring

According to German regulations, a signaller or a suitable camera system must be used to compensate for limited visibility when the distance between the centre of the steering wheel and the end of a front implement exceeds 3.50 m.

Two cameras are installed on the front implement to ensure that the tractor and implement can safely turn into priority roads and intersections. The Motec MC3000B camera series provides operators with good visibility of both their immediate and mid-range environment to allow them to identify other road users or obstacles early on and avoid accidents.



Camera positions on various front-mounted implements



20 21



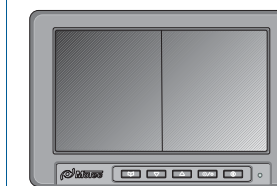
EXAMPLE: Front-mounted system



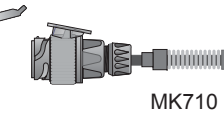
MD3072B-Quad
Heavy-duty monitor

MC3000B
Heavy-duty camera

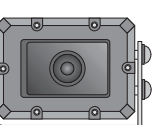
MD3072B-Quad



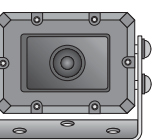
12/24 V DC



MC3040B



Right



Left

Digital radio solution Telehandler

Mobile cameras on the telehandler boom give operators visibility of the unloading area and therefore facilitate the handling of bales and other materials.

Since these machines can work at a wide range of lifting heights and with very different payloads, wireless data transmission by radio is the solution of choice.

The system can be extended by an automatically activated rear view camera for safe manoeuvring and work.



Telehandler with implement

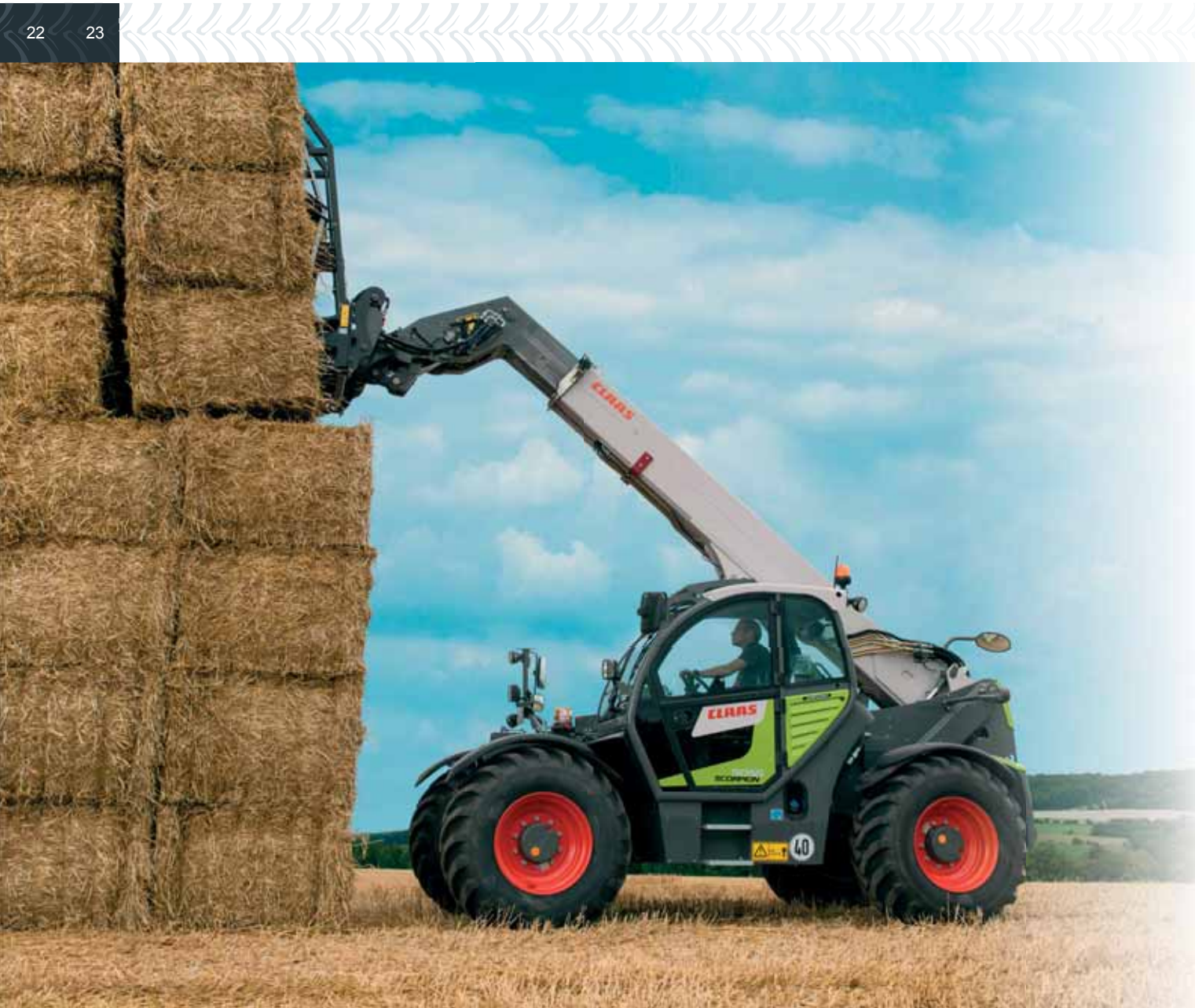
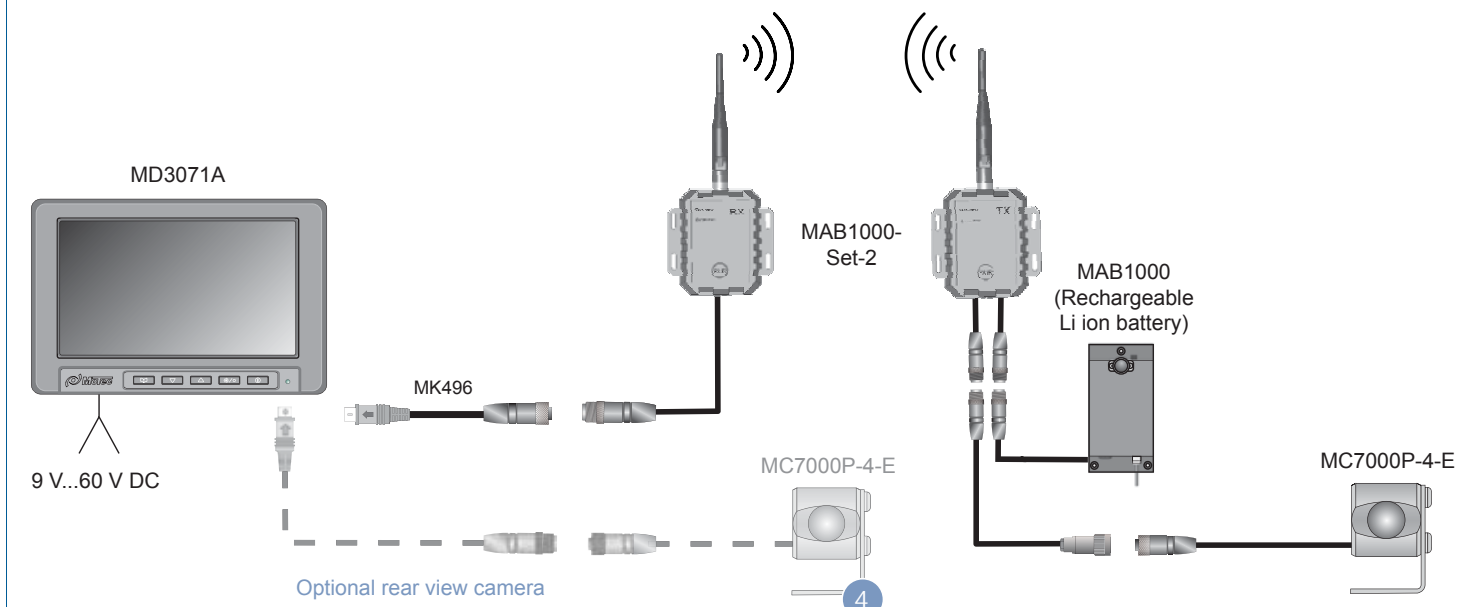


EXAMPLE: Telehandler

MD3071A
Heavy-duty monitor

MAB1000-Set-2
Digital radio system

MC7000P-E
Heavy-duty camera



Fleet radio solution

Forage harvester with tractors and loading wagons

The operators of other tractors along fields are able to receive the camera images from the discharge chute and monitor fill levels on the trailer. Operators are additionally able to monitor even filling and trailer fill levels. The Motec radio system thus ensures optimal, seamless workflows between harvesters and trailers.

Images received from a trailer can be transmitted to any number of receivers and displayed on both the Motec monitor or tractor terminals to ensure that all operators are aware of current trailer fill levels and are therefore able to harmonise work speeds optimally.



Top: Discharge chute camera for cargo area monitoring



Bottom: Monitor with radio receiver in the support tractor's cab

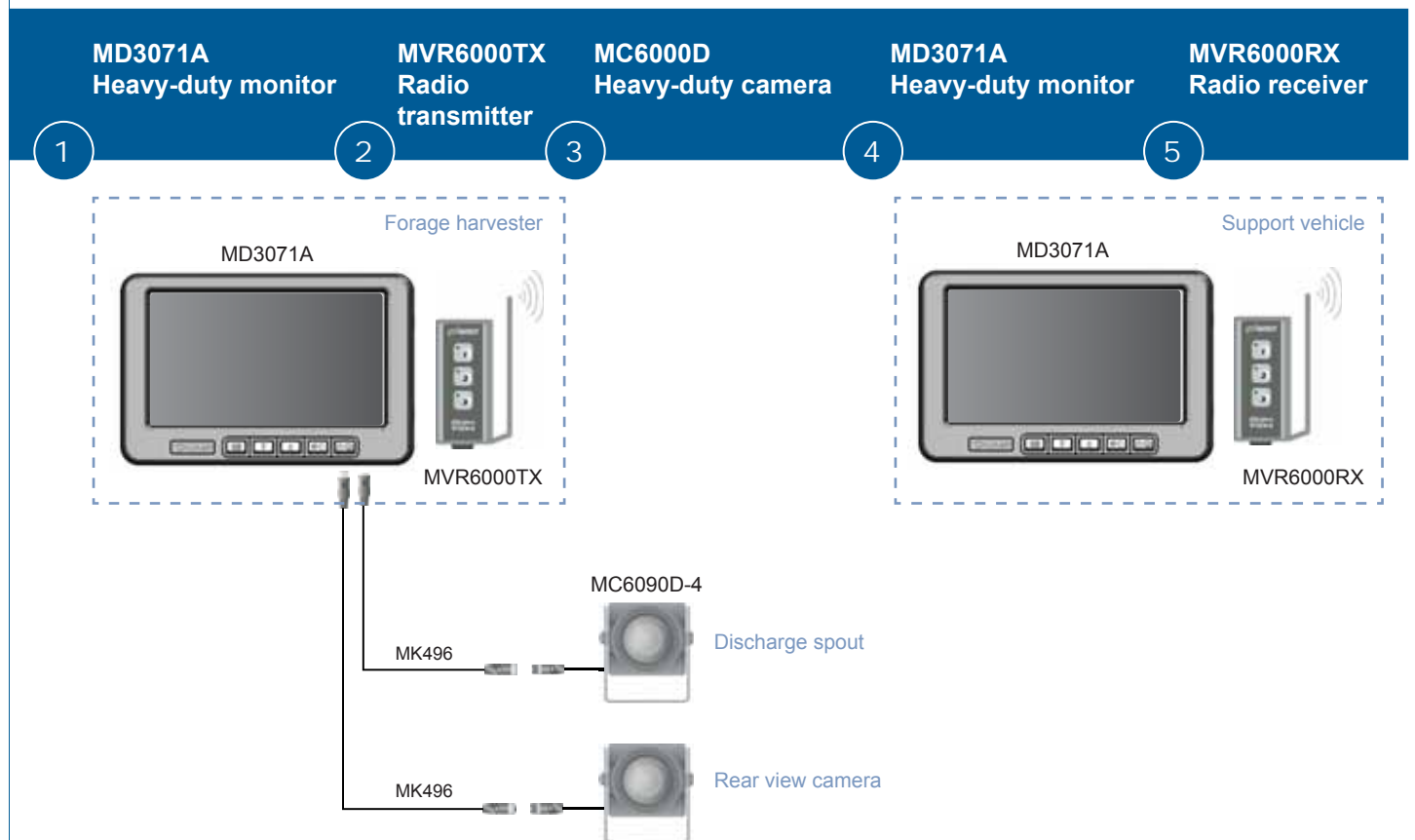


24 25



EXAMPLE:

Forage harvester with tractors and loading wagon



Terminal integration

Connectivity – easy retrofit

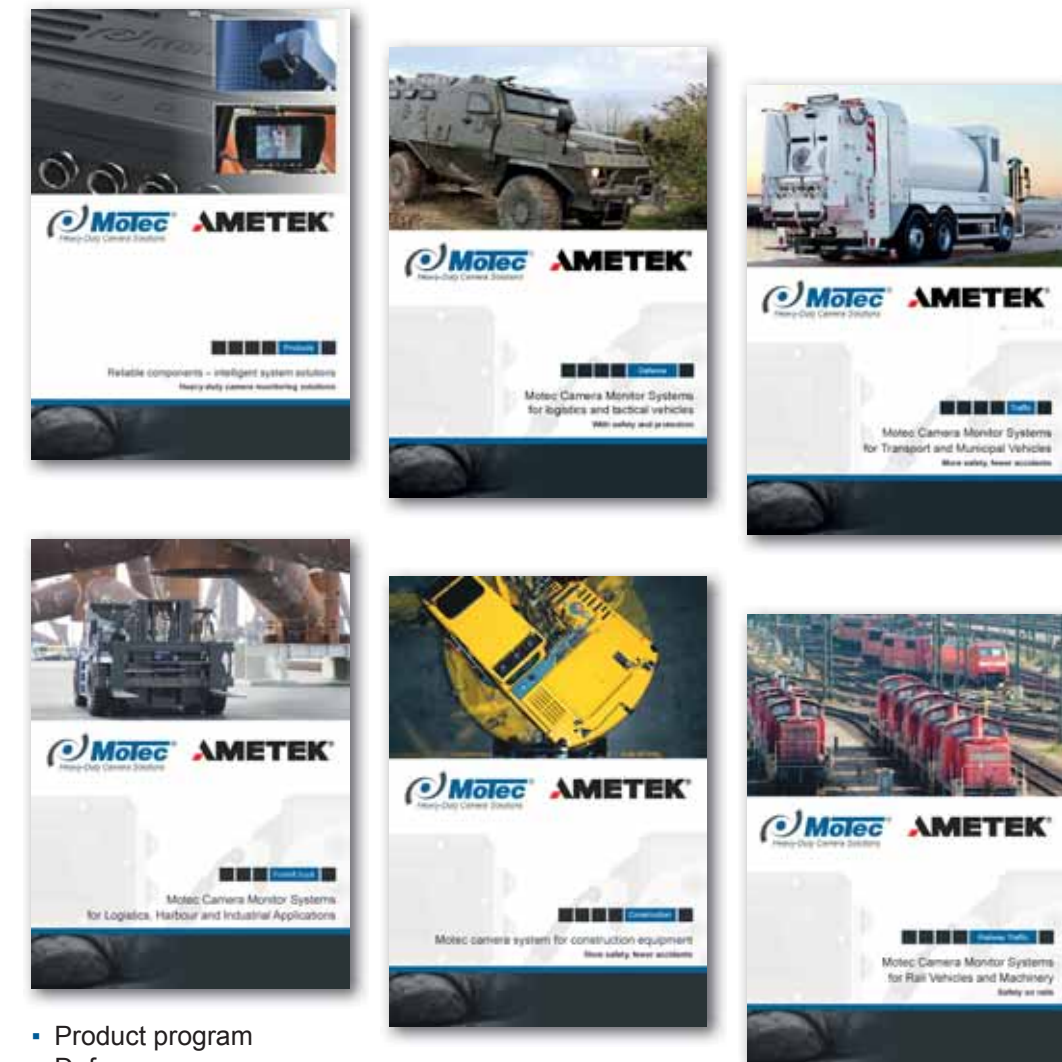
Vehicles and machines that come with a video-capable operating terminal as standard can be quickly and easily fitted with a camera system by simply using appropriate adapters for connection.

A video image displayed on the existing terminal provides operators with an optimal overview from their cabs, allowing them to monitor their environment and the machine work area reliably at all times. Operator strain during manoeuvres is reduced significantly, and operators are able to detect potential hazards early to prevent injuries or machine damage.



System solutions

Customised solutions for numerous other industries



- Product program
- Defence
- Traffic/Transport
- Forklift truck
- Construction machines
- Railways

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Mobile analogue cameras

Overview



MC3000B Heavy-duty camera

Its flexible design and features make the MC3000B a highly versatile **heavy-duty camera**. It provides numerous image angle options and features a durable aluminium housing, making it an ideal camera for large, mobile machinery that is difficult to see around and that is exposed to extreme weather and environmental conditions. The MC3000B is also available in an EX 1 version.

Features:

- Milled aluminium housing
- Automatically controlled camera heating
- Automatic brightness compensation
- Energy-efficient automotive CMOS sensor
- Withstands continuous exposure to frost down to -60 °C
- Salt spray resistant
- Ultimate shock and vibration resistance
- Resistant to immersion in water and high-pressure cleaning (IP68 and IP69K)
- 20°, 40°, 70°, 90°, 100° and 115° horizontal image angle (other angles upon request)

MC4000A-IR Heavy-duty camera

The MC4000A-IR is a durable, night vision-capable **heavy-duty infrared camera** with high electromagnetic compatibility (EMC) developed with a view to the stringent requirements of industry and defence applications. Its mechanical and electrical design resists even extreme loads in terms of shock, vibration, dust and water.

Features:

- Infrared illumination at a wavelength of 940 nm
- Custom-made glass heating for clear view – melts ice up to 3 mm thick
- 40° and 90° image angle; others upon request
- Scratch-resistant front glass (MIL-STD-810G, method 510.6 procedure II, blowing sand test)
- Programmable overlays
- Future-proof with software updates
- Quality “Made in Germany”

Also available as **MC4000A-WL** with white light.

MC6000D Heavy-duty camera

The MC6000D is designed as a highly flexible **heavy-duty camera** for agricultural machinery in terms of both construction and features. It is equally well suited for use as a rear view camera and a mobile camera for monitoring work processes. With its durable design and specially treated surface, this camera can be used even in extreme weather conditions.

Features:

- Interference-resistant electrical design
- -40 °C...+85 °C operating and storage temperature
- Thermally tempered, distortion-free glass
- 2.5 W glass heating
- Automotive CMOS sensor
- Suitable for 9 V...32 V DC on-board power supplies
- Resistant to immersion in water and high-pressure cleaning (IP68 and IP69K)
- 90° or 70° horizontal image angle

MC7000A Heavy-duty camera

Its extremely compact size with only 23 mm side length makes the reliable MC7000A ideally suited as a **heavy-duty rear view camera** for integration in the chassis of commercial vehicles. It features a durable aluminium housing, making it also ideal as a side-view camera for commercial vehicles and mobile machinery.

Features:

- Sophisticated image electronics (CMOS image sensor)
- High shock and vibration resistance
- Rapid adaptation to ambient light
- Sharp, high-contrast images
- Resistant to immersion in water and high-pressure cleaning (IP68 and IP69K)
- Durable aluminium housing
- Vibration-resistant to 10 g
- Shock-resistant to 100 g
- Quality “Made in Germany”

Mobile analogue cameras

Overview

Mobile digital cameras

Overview



MC7180N

Heavy-duty camera

The MC7180N is a **heavy-duty wide-angle camera** used for 270°/360° visibility systems. Its 180° visible image angle and highly compact, robust design ensure superior durability even in demanding conditions. This camera offers outstanding flexibility and can be adapted to very different vehicles to solve a wide range of visibility issues.

Features:

- CMOS 1/3, 6" image sensor with sensor resolution
- H 672 x V 492 pixels
- -40 °C...+85 °C operating and storage temperature
- Resistant to high-pressure cleaning (IP69K)
- 180° horizontal image angle

MC7000P-E

Heavy-duty camera

With its **compact design**, the MC7000P-E is ideally suited for installation on mobile machinery with limited space. Its separate objective adjustment allows it to be installed vertically, horizontally, diagonally or even upside down. This heavy-duty camera is available with an elastomer or stainless steel housing, making it suitable for a very wide range of applications.

Features:

- Sophisticated image electronics (CMOS image sensor)
- Rapid adaptation to ambient light
- Sharp, high-contrast images
- High shock and vibration resistance
- Highest IP69K protection rating
- 70°, 90° and 115° horizontal image angle

MCDE7000-FullHD

Heavy-duty digital camera

The MCDE7000 is a highly compact **digital camera** that is suitable for mobile applications in networks according to the IEEE 802.3 standard (LANs). It features Full HD resolution, a large dynamic range (HDR) and adjustable overlays, allowing it to be used as a smart sensor for a wide range of applications, including integration with existing video monitoring systems or video streaming across large distances. The video stream can be configured via customised control protocols.

Features:

- Full HD resolution (1920 x 1080)
- HDR sensor (large dynamic range)
- Fully digital image/video transmission (60/30 fps)
- Motion-JPEG/H.264 video output format
- Configurable video resolution, compression rate and image refresh rate
- Automotive PoE power supply
- Future-proof with software updates
- Durable aluminium housing
- Quality "Made in Germany"

Also available in the following versions:

Heavy-duty BroadR-Reach camera MCDB7000
Heavy-duty LVDS camera MCDL7000

MCDE3000-FullHD

Heavy-duty Ethernet camera

The MCDE3000-FullHD is a **heavy-duty Ethernet camera** suitable for mobile applications that can be used in networks according to the IEEE 802.3 standard (LANs). It features smart image processing and dynamic overlays, allowing it to be used as a smart sensor for a wide range of applications, including integration with video monitoring systems or video streaming.

Features:

- Full HD resolution (1920 x 1080)
- HDR sensor (large dynamic range)
- Integrated, FPGA-based video processing for customised functions such as:
 - Image processing
 - Object tracking, active overlay
 - Inspection and measurement of objects
 - Reading of coded data (QR codes, OCR)
 - Binary image processing
 - Augmented reality
- Fully digital image/video transmission (30 fps)
- Motion-JPEG video output format
- Configurable video resolution, compression rate and image refresh rate

Mobile monitors

Overview



MD3071A Heavy-duty monitor

Its flexible design and features make the MD3071A a **heavy-duty monitor** that is suitable for use in a wide range of industries. The display provides crystal-clear images even in challenging environmental conditions. The MD3071A software can be updated to future-proof this monitor and ensure it remains state-of-the-art.

Also available as a vertical model, MD3071A-V.

Features:

- 7" monitor (17.8 cm screen size)
- PAL/NTSC video system
- Connection of up to 2 cameras and an additional external video controller (for up to 4 additional cameras)
- Auto-dimmer function
- Illuminated keypad
- Deep light protection hood as standard (compliant with impact protection regulations)
- Quality "Made in Germany"
- 9 V...60 V DC supply voltage
- IP30 housing protection rating

Also available as **Heavy-Duty monitor MD3073** with IP67 housing protection rating.

MD3072B-Quad Heavy-duty monitor

The MD3072B-Quad is specially designed for mobile machinery with several cameras installed. Its **integrated video control unit** allows the monitor to display four camera images at the same time. An integrated menu function and control lines for automatic camera control allow for rapid image switching.

Features:

- 7" monitor (17.8 cm screen size)
- PAL/NTSC video system
- Direct connection of up to 4 cameras
- Split screen (up to 4 video sources simultaneously)
- Manual or automatic camera selection
- Image mirroring (per camera)
- High shock and vibration resistance
- Integrated video control unit
- IP30 housing protection rating

MD3074A-Quad Heavy-duty monitor

The MD3074A-Quad is specially designed for mobile machinery with several cameras installed. Its **integrated video control unit** allows the monitor to display four camera images at the same time. Its housing protection rating ensures that this monitor is both watertight and suitable for cold storage environments. An integrated menu function and control lines for automatic camera control allow for rapid image switching.

Features:

- 7" monitor (17.8 cm screen size)
- PAL/NTSC video system
- Direct connection of up to 4 cameras
- Split screen (up to 4 video sources simultaneously)
- Horizontal image mirroring separately configurable
- Interval-controlled image switching possible
- Heated panel – seamless images even at low temperatures
- Watertight and suitable for cold storage environments
- IP66 housing protection rating

MD3100 Heavy-duty monitor

With its powder-coated metal housing, the MD3100 is a durable **10" LCD monitor** for industrial environments. The monitor front complies with housing protection rating IP54 (dust and splash water).

Features:

- 10" monitor (25.9 cm screen size)
- Picture-in-picture function (PiP)
- Robust metal housing
- For very challenging operating conditions
- Power supply via MVCU
- IP54 front protection rating

Mobile video control units

Overview



MB1405-Quad Video control unit

The MB1405-Quad **video control unit** allows up to four camera images to be displayed simultaneously in so-called quad-split mode. It includes a remote control unit that allows the various camera images to be controlled automatically or switched manually.

Features:

- Integrated quad-split function: Display of up to 4 camera images
- Selection of the camera to be activated via control lines or operating unit
- Power supply for TFT monitor and 4 heavy-duty cameras
- Separately adjustable image mirroring
- Automatic trailer recognition in articulated trains

MVCD1000 Video control unit

The MVCD1000 is a **digital heavy-duty multi camera-video control unit**, that can process up to 4 camera images in parallel, can consolidate additional sensor data, and can display this data via an analogue monitor output or via an Ethernet video stream.

Features:

- Video input up to 4 cameras (PAL/NTSC)
- Integration in vehicle electronic via bidirectional control lead, CAN interface or Ethernet connection
- System expandable with active sensors such as radar or ultrasound
- Altera FPGA (SoC) with 925 MHz dual-core ARM Cortex-A9 MPCore processor, 1GB RAM, 4 GB flash (expandable)
- Prepared for future requirements thanks to software updates

MVCU1300 Video control unit

The MVCU1300 is a smart, CAN-controlled **heavy-duty multi-camera video control unit** that combines video data with information from additional sensors (e.g. distance data) and displays it on up to two monitors.

Features:

- Connection of up to 12 analogue or digital single-wire sensors
- Connection of up to 10 sensors to the CAN bus
- Connection of a LASER (I/O) via control line
- Control via CAN bus (MSB 2.0) and/or 4 control lines
- Output of read sensor data via CAN data bus
- MVCU serves as power supply

MVCU1400 Video control unit

The MVCU1400 is a smart, CAN-controlled **heavy-duty multi-camera video control unit** capable of processing up to 4 camera images and displaying them on up to 2 monitors in a range of different modes.

Features:

- Connection of up to 4 heavy-duty cameras or 3 heavy-duty cameras and 1 motorzoom camera
- Control via CAN bus (MSB 2.0), a monitor toggle line and/or 4 control lines
- Main monitor output as single, split, triple, PiP (freely configurable)
- Quad and OSD in 4 colours
- Second monitor output (single, split, quad)

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