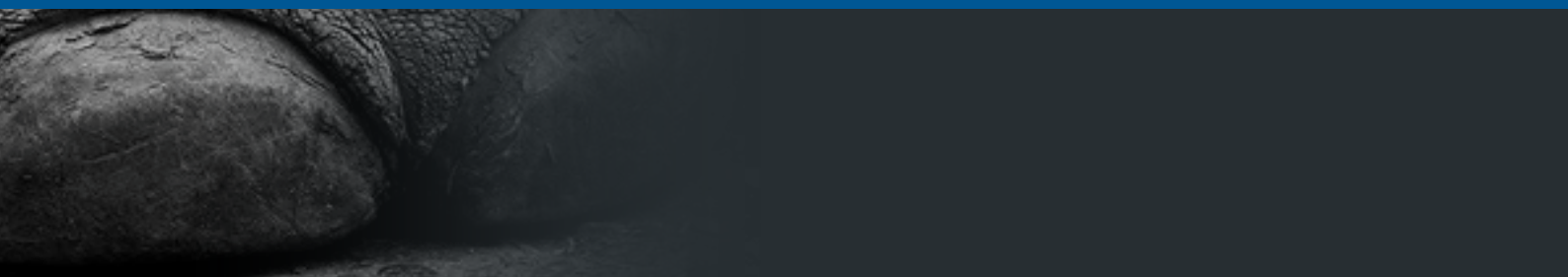




Motec Camera Monitor Systems
for Rail Vehicles and Machinery
Safety on rails



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.



Motec camera monitor systems for rail vehicles

Motec camera monitor systems support operators of large rail vehicles and machines in completing their tasks more safely and more efficiently. Using extremely robust heavy duty camera monitor systems, the driver can monitor grinding, cleaning or compaction processes and detect persons and objects in danger zones of the machine at an early stage. We protect lives by making mobile machinery and their surroundings safer. We make machine operator's work easier by reducing stress and uncomfortable body postures. And we help companies in becoming more successful by accelerating processes and avoiding damages.

Motec is certified with ISO 9001:2008 and ISO 14001 OEM/ODM and Motec cameras meet the EN45545 standard "Railway applications - Fire protection on railway vehicles".

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

Phone +49 6433 9145-9888
 Fax: +49 6433 9145-9877
 motec.service@ametek.com



Robust modular hardware and intelligent software

- High housing protection class
- Shock- and vibration-resistant
- High temperature range
- Modular components
- In-house cable production
- Digital technology for superior image quality
- Development, validation and integration of algorithms
- Real-time image processing
- Top view projections 270°/360°
- Sensor fusion (ultrasound/radar)
- Stereo cameras (object detection)
- Driver assistance system (collision warning)

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Rail grinders

Efficient grinding process

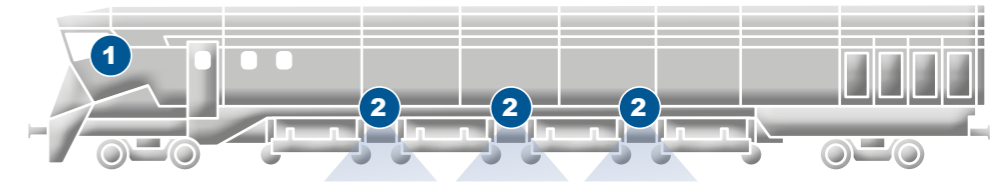
One camera for each side of the track is used for monitoring the rail track grinding and milling processes. The operator can see persons in front of and behind the machine as well as the grinding wheel, the rails and the exhaust system. The operator monitors the grinding and milling processes, recognises the degree of wear on the rails and the degree of wear on the milling tools. In this way, the operator can control the use of the tool and determine precisely the intervals when to change the tool.



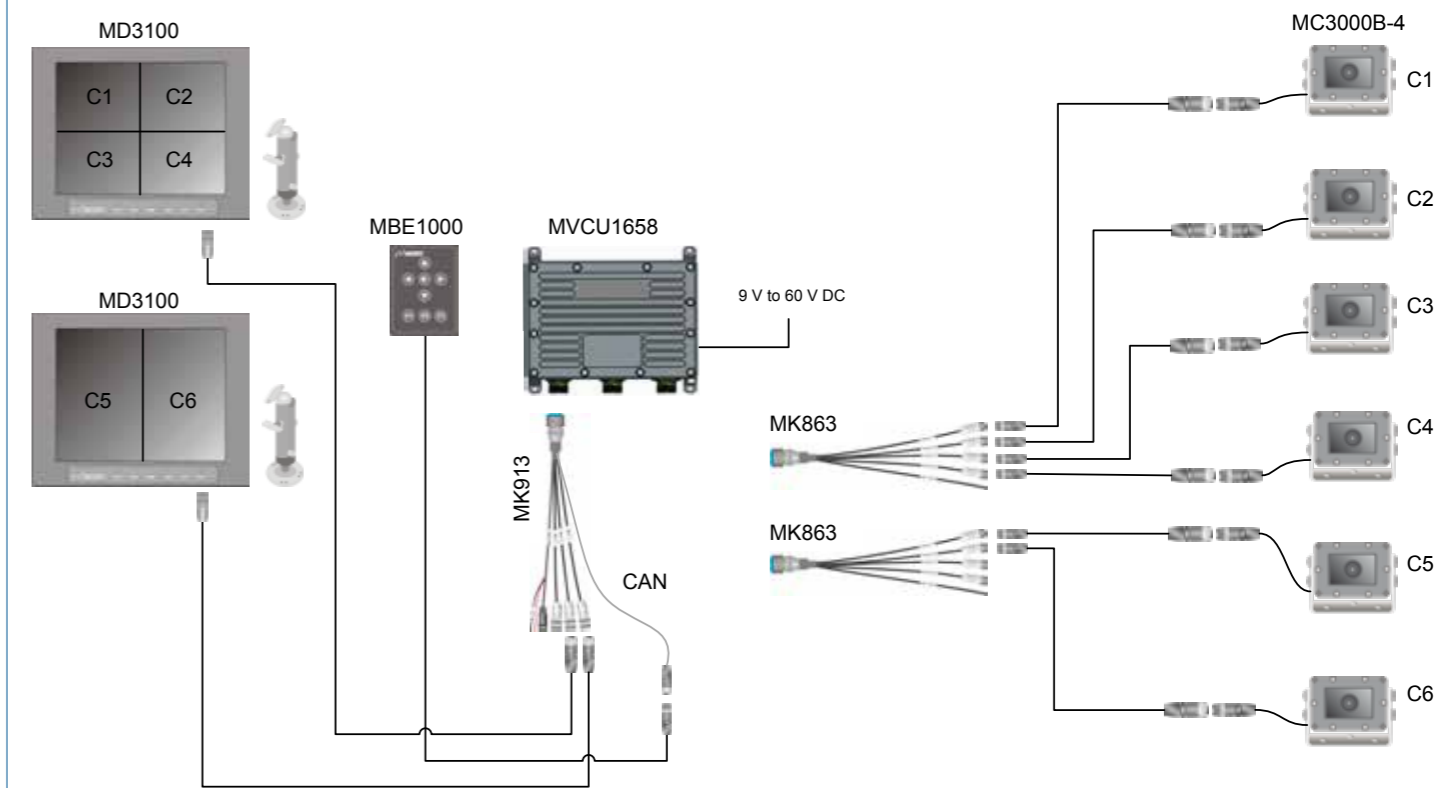
Preventive rail grinding – without interrupting regular rail traffic.



EXAMPLE OF SYSTEM: Rail grinder



- 1**
MD3100
 Heavy-duty monitor
- MVCU1600**
 Video control unit
- 2**
MC3000B
 Heavy-duty camera



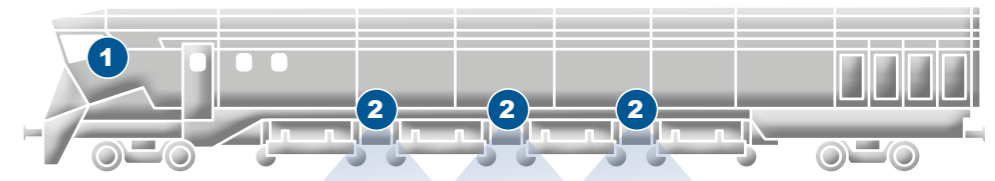
Tunnel cleaning train Inspection of cleaning units

Cameras facilitate the control of the cleaning units or the working area. The operator can keep a constant eye on the extraction equipment. He can detect and eliminate faults and blockages at an early stage.

Additional cameras in front of and behind the machine provide more safety while driving and shunting. This allows the operator to see persons or objects in front of and behind the machine. This helps to effectively prevent accidents and save costs.



The "tunnel cleaners" regularly remove fine dust and coarse dirt from tunnels. Cameras monitor the cleaning units.



EXAMPLE OF SYSTEM: Tunnel cleaning train

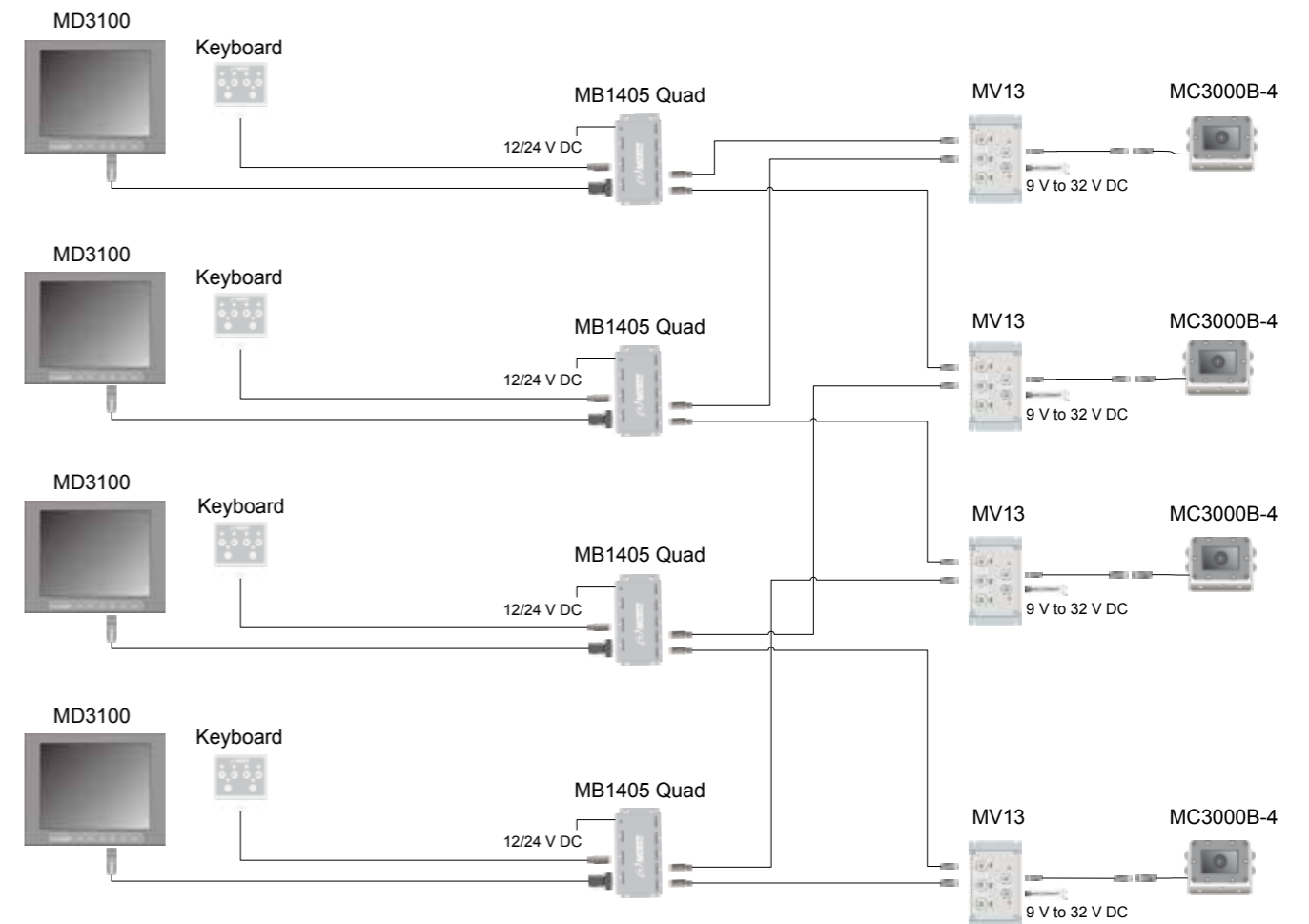
MD3100
Heavy-duty monitor

MB1405 Quad
Video control unit

MC3000B
Heavy-duty camera

1

2



Ballast tamping machine

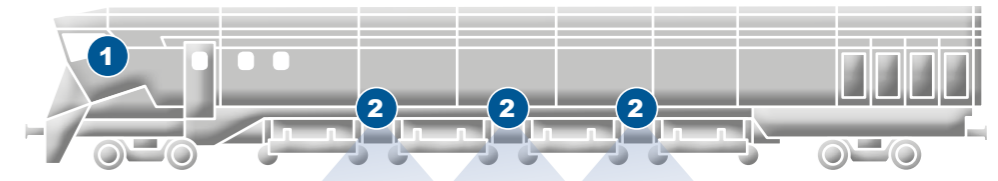
Monitoring of tamping process

Systems with 6 or more cameras ensure an efficient and safe work process and help prevent accidents with people in front of and behind the machine.

The cameras are installed underneath the machine, and aligned with the carriage and the tamping units. Thus, the operator always has control of the ballast bed tamping process.



Camera-monitored tamping units pack the ballast bed and ensure the correct track position.

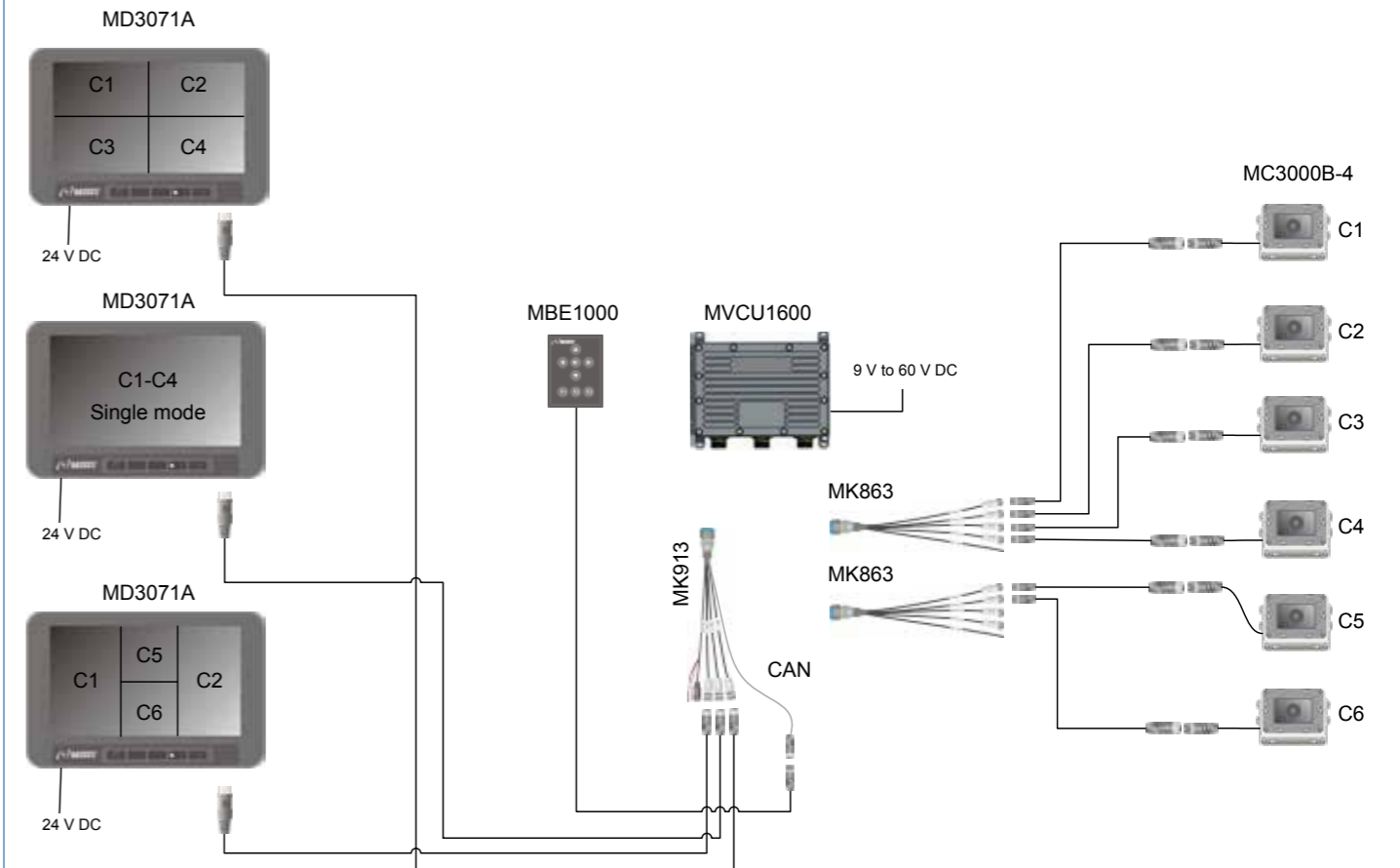


EXAMPLE OF SYSTEM:
Ballast tamping machine

MD3071A
Heavy-duty monitor

MVCU1600
Video control unit

MC3000B
Heavy-duty camera



Rescue and fire-fighting trains

Safe deployment

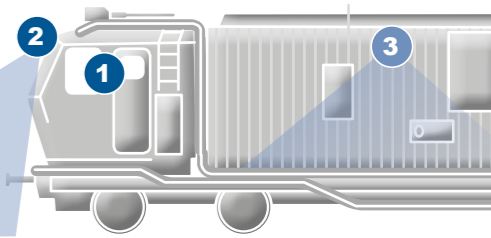
6 and more cameras installed on rescue and fire-fighting trains form a compact unit and ensure maximum safety.

The operator recognises persons or detects objects in front of and behind the train in good time and thus can prevent accidents. Furthermore, he can monitor the interior and initiate appropriate measures in the event of danger.

Additional thermal imaging cameras at the front and rear of the train provide the operator with high-contrast images in case of heavy smoke or dense fog.

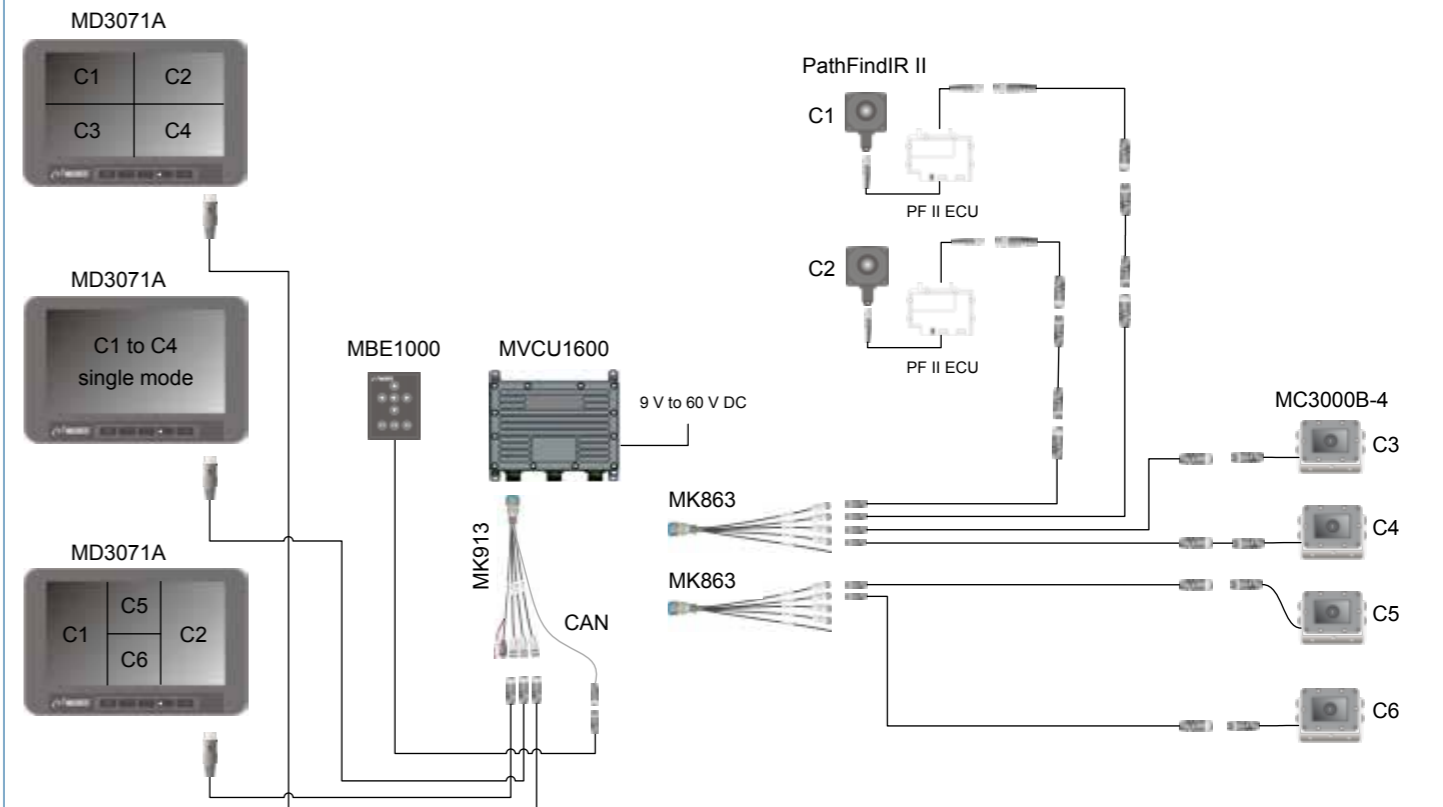


Rescue and fire-fighting train:
Camera monitoring of exterior and interior.



EXAMPLE OF SYSTEM: Rescue and fire-fighting trains

- 1
MD3071A
Heavy-duty monitor
- 2
MVCU1600
Video control unit
- 3
PathFindIR II
Thermal imaging camera
- 4
MC3000B
Heavy-duty camera



Transport trains

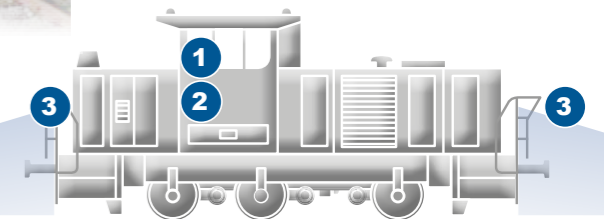
Safe shunting

Camera systems facilitate the shunting as well as the coupling and decoupling of transport wagons. Wide view angles capture the close range immediately ahead and behind the train. Radio-based or hard-wired systems are used along the track as required.

The operator can keep a constant eye on people and objects in front of or behind the machine and the track. The coupling processes can be closely monitored.



Transport locomotives with 3 or 4 axes:
Camera-monitored shunting.

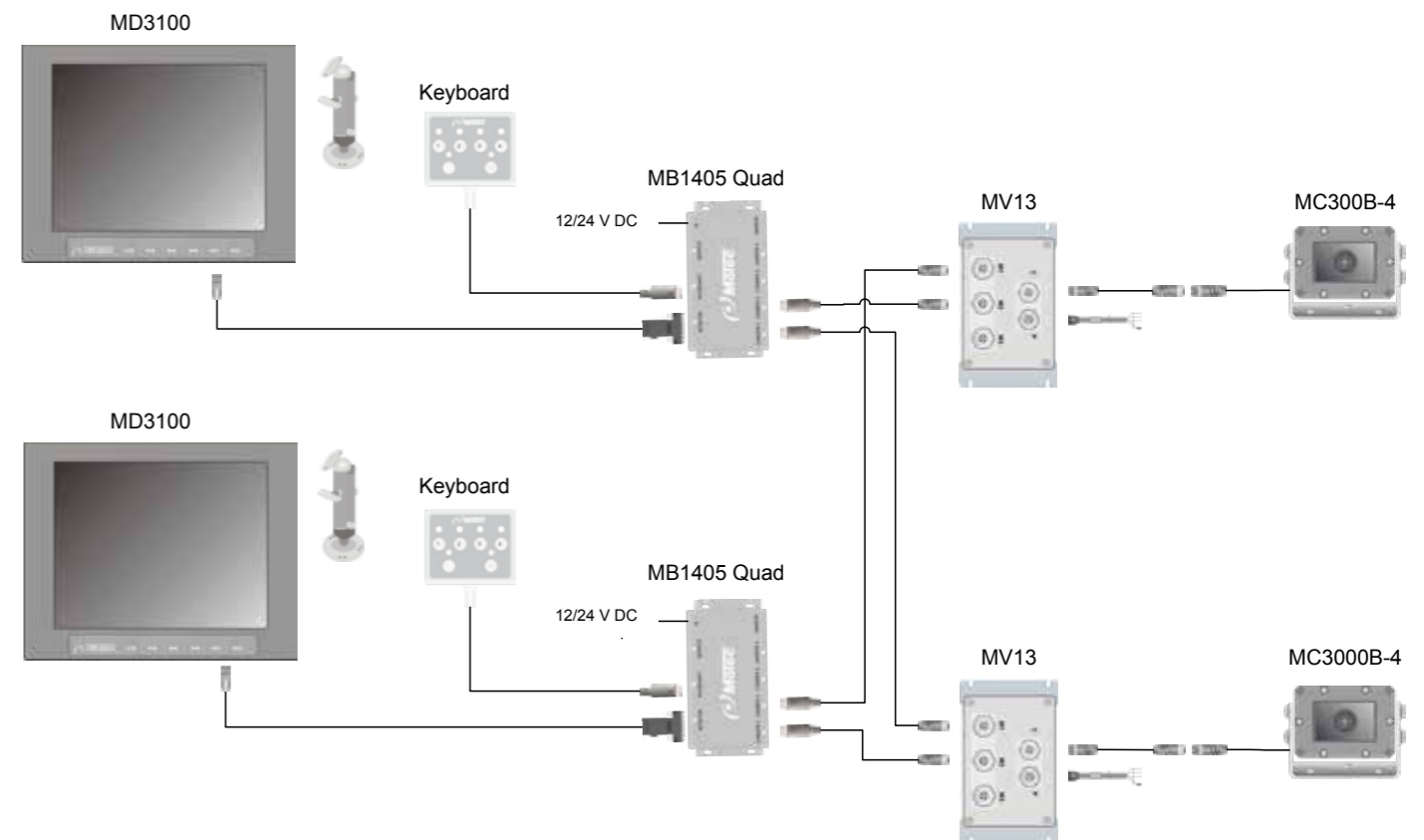


EXAMPLE OF SYSTEM: Tracks

1 MD3100
Heavy-duty monitor

2 MB1405 Quad
Video control unit

3 MC3000B
Heavy-duty camera



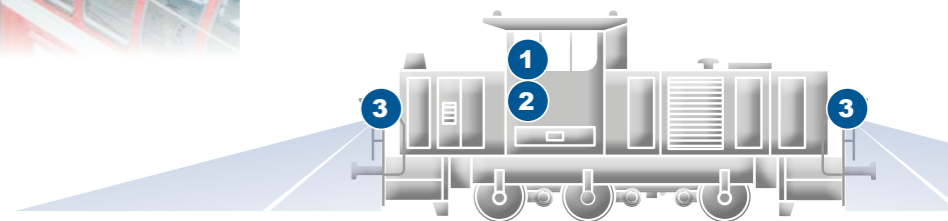
Shunters

Unobstructed view of track

Having 4 cameras installed on the shunting locomotive, the train operator can watch both the path ahead as well as the one behind. The driver can also check the "Berner Raum" (a safe space between 2 touching ends of a railway car in order to couple/uncouple the vehicles) in front of and behind the locomotive. This effectively prevents accidents during the coupling and uncoupling procedure.

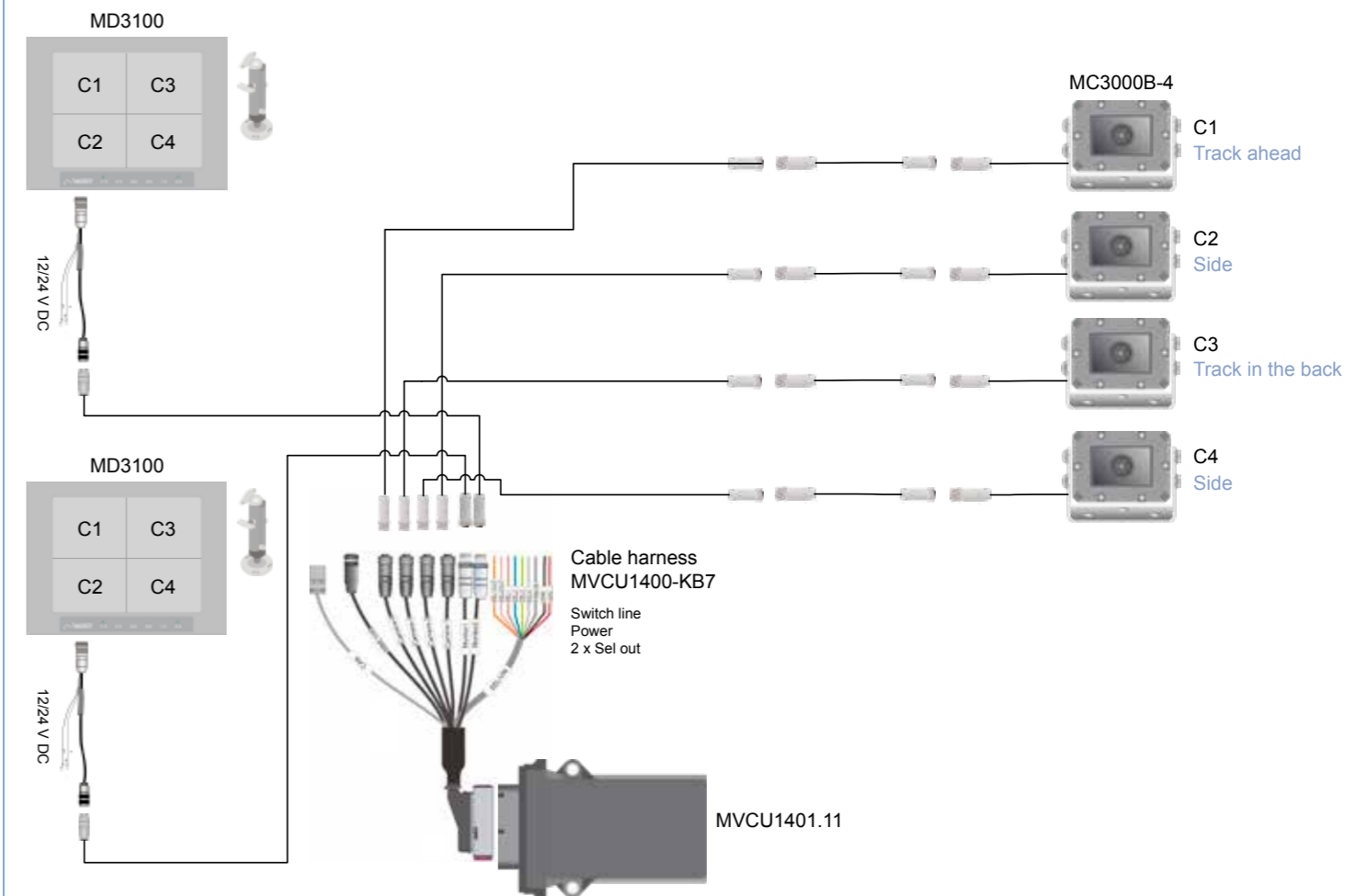


Motec camera – focusing on the "Berner Raum".
Shunting locomotive when moving a local train.



EXAMPLE OF SYSTEM: Shunter

- 1
MD3100
Heavy-duty monitor
- 2
MVCU1400
Video control unit
- 3
MC3000B
Heavy-duty camera



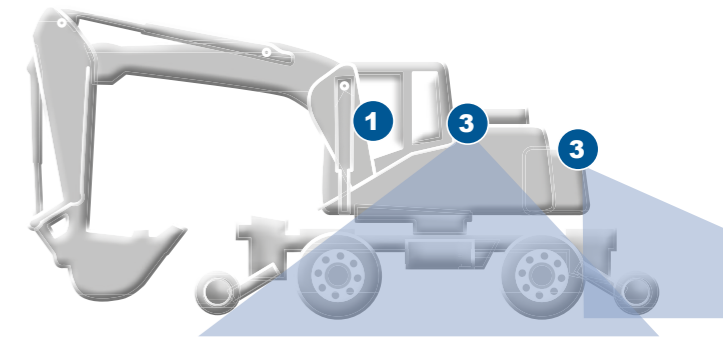
Road-rail excavator

Effective monitoring of excavator rear and sides

Camera systems are mandatory for rail-mounted machines. A camera mounted on the top of the vehicle captures almost the entire area behind the excavator (rail centreline). The driver can handle track transfer or coupling operations much quicker and safer. He can see persons and obstacles and react accordingly due to the standardised representation of structures.



Rail-bound machines have to be equipped with camera systems.

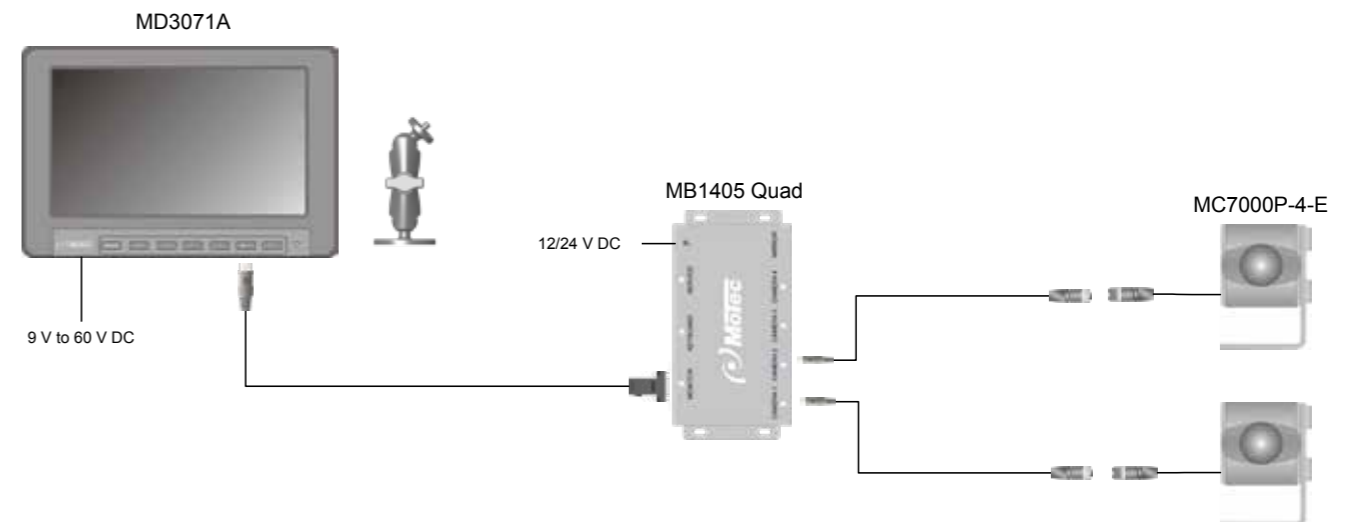


EXAMPLE OF SYSTEM: Road-rail excavator

MD3071A
Heavy-duty monitor

MB1405 Quad
Video control unit

MC7000P
Heavy-duty camera



Mobile Vicinity Scout (MVS) Top view system road-rail excavator

The 270° top view system provides the driver of a mobile road-rail excavator with an unobstructed top view of the sides and the rear of the vehicle.

An additional camera on the excavator arm allows the optional monitoring of the working tool and the load.

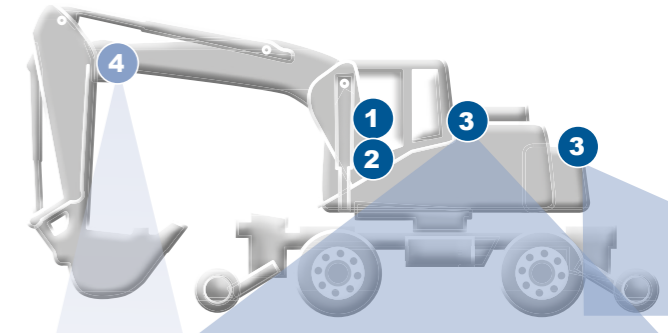
This ensures the ergonomic, efficient and cost-effective completion of work. Accidents and dangerous situations with construction vehicles or persons can thus be avoided.



Safe track construction – for man and machine.



Reversing camera on a road-rail excavator, the MC3000B is shown here.

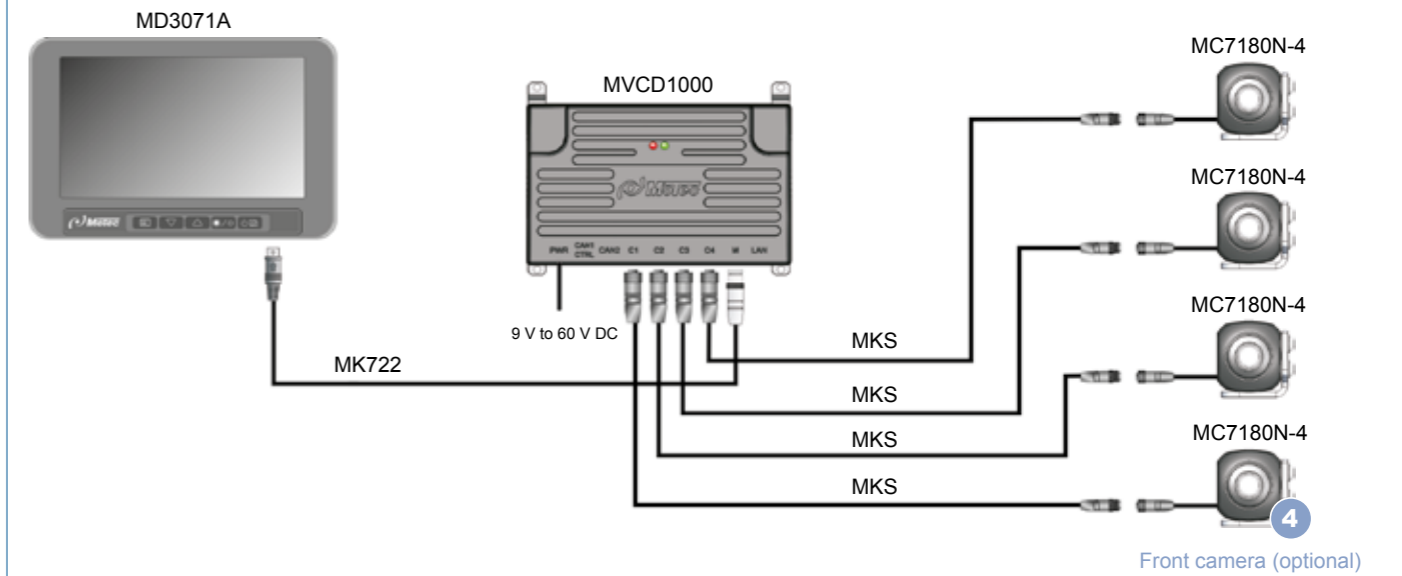


EXAMPLE OF SYSTEM: Top view system road-rail excavator

1 **MD3071A**
Heavy-duty monitor

2 **MVCD1000**
Video control unit

3 **MC7180N**
Wide angle camera



(Road-rail) milling train

Efficient visual inspection during milling procedure

One camera on each side of the track is used for monitoring the rail track milling process. The operator can watch the milling tools and can assess their degree of wear. In this way, the operator can control the use of the tool and determine precisely the intervals when to change the tool. In addition, he has the extraction system in view and can control the filling level of the chip bin. Thus, the systems are adapted to the respective requirements.

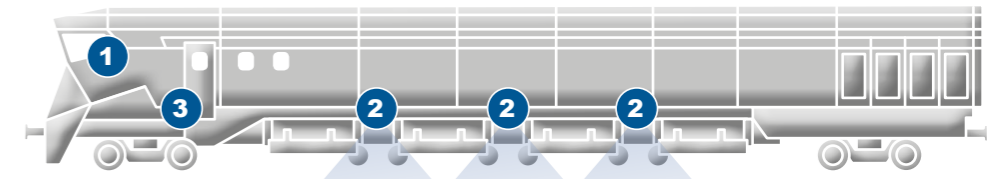
The additional cameras for monitoring the rear and front of the vehicle prevent potential hazards, and avoid placing persons or vehicles at risk.



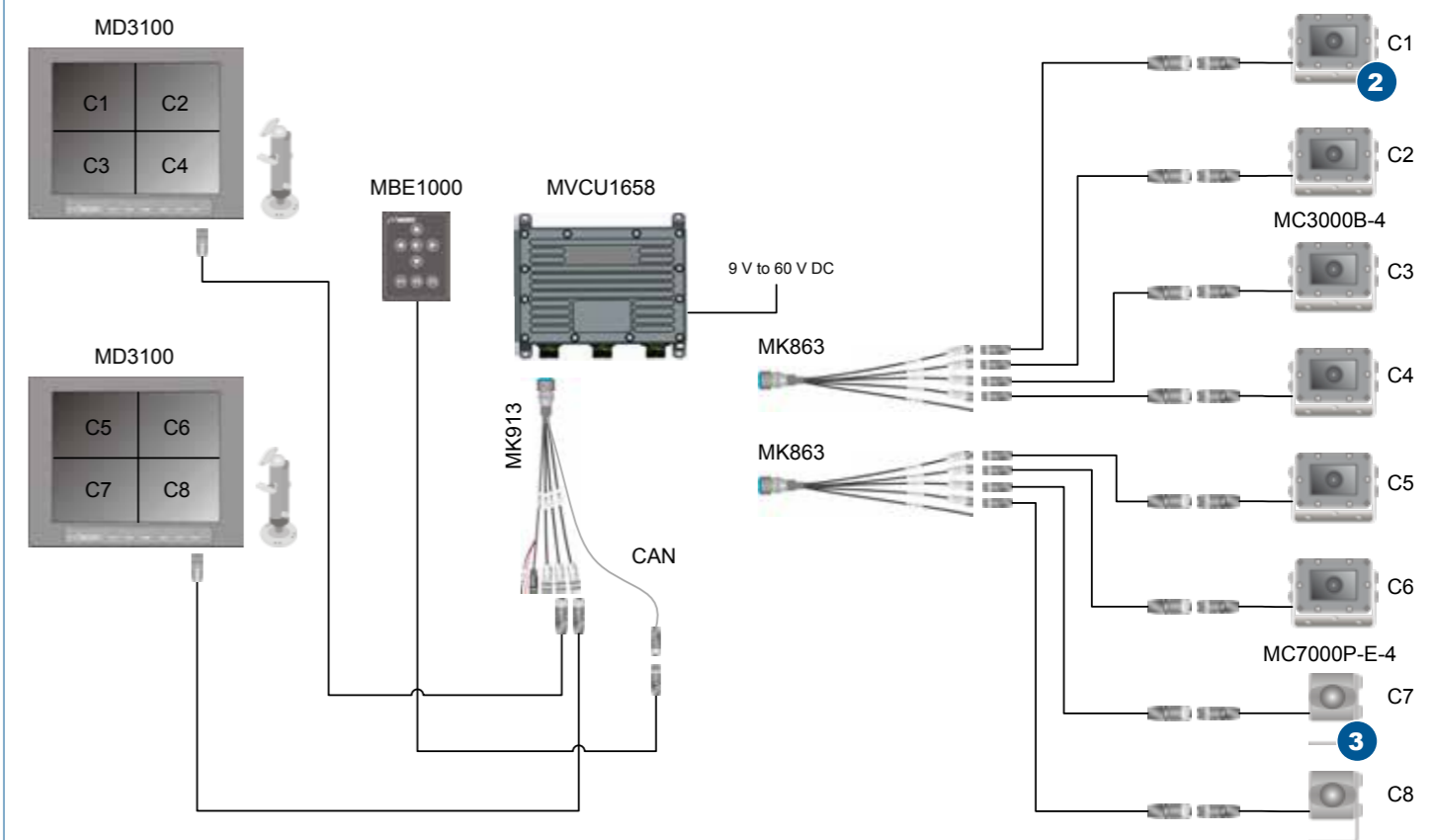
Camera-monitored rail track processing units.



EXAMPLE OF SYSTEM: Milling train



- 1** MD3100 Heavy-duty monitor
- MVCU1600 Video control unit
- 2** MC3000B Heavy-duty camera
- 3** MC7000P-E-4 Heavy-duty camera



Track motor cars for railway inspection

Monitoring and documentation of work process

Cameras in the work area allow the operator to visually check and document the work process.

The operator can watch the area behind the vehicle and has view of the work area associated with the lifting platform. This helps effectively prevent accidents and save costs.

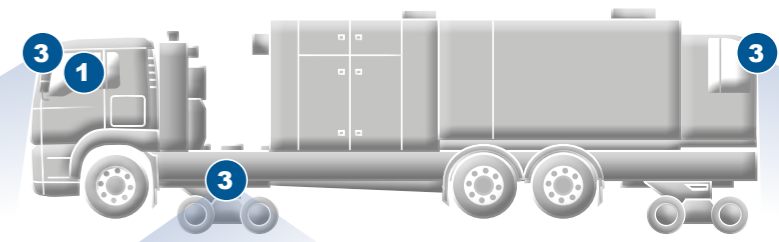
For use on a lifting platform, the option of galvanically separated image transmission via fibre optic cable can be made available.



Visual inspection by the operator is possible thanks to cameras in the work area.



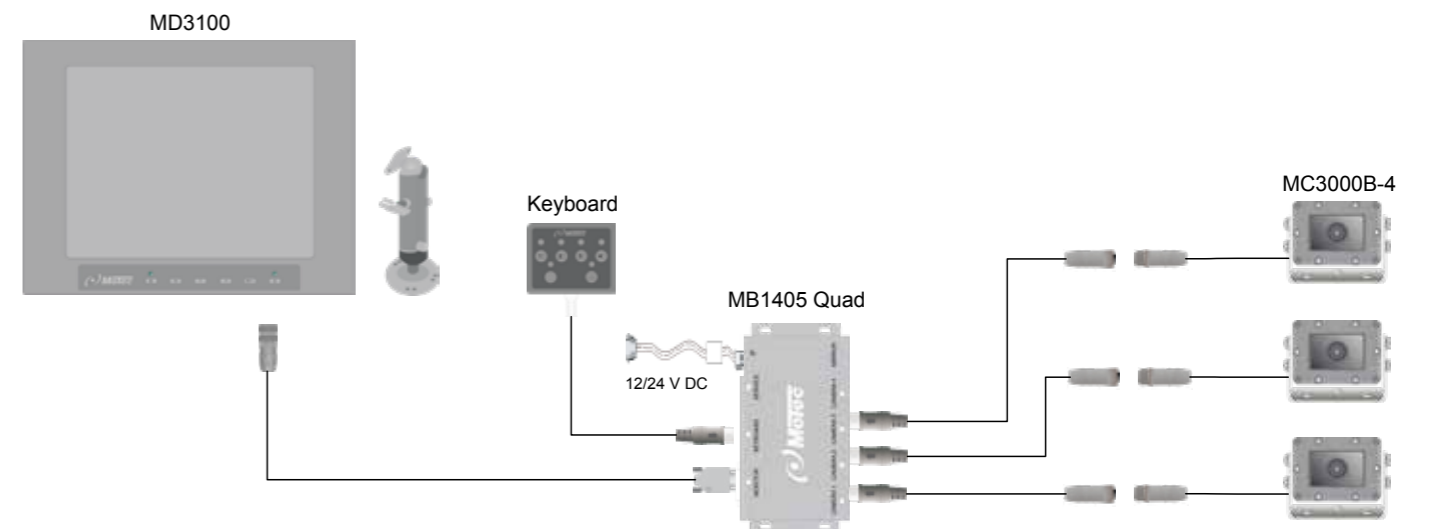
EXAMPLE OF SYSTEM: Track motor cars for railway inspection



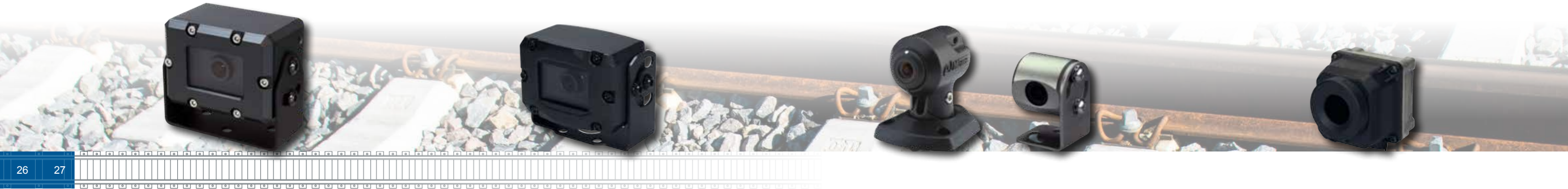
1
MD3100
Heavy-duty monitor

3
MB1405 Quad
Video control unit

3
MC3000-B
Heavy-duty camera



Cameras Overview



MC3000B Heavy-duty camera

Thanks to its design and equipment, the MC3000B is a **heavy-duty camera** that can be used in a wide range of applications. Multiple angles of view and the robust aluminium housing make this design the optimum camera for large view-obstructing mobile machines that are subject to extreme weather and environmental conditions. The MC3000B is also available as EX 1 model.

Features:

- . Housing made of machined aluminium
- . Automatically controlled camera heating
- . Automatic brightness adjustment
- . Energy-efficient automotive CMOS sensor
- . Permafrost-capable to -60 °C
- . Salt mist resistant
- . High degree of shock and vibration resistance
- . Waterproof if submerged in water or if subjected to high-pressure cleaners (IP68 and IP69K)
- . 20°, 40°, 70°, 90°, 100° and 115° horizontal angle of view (other angles upon request)

MCDE3000-HD Heavy-duty Ethernet camera

The MCDE3000-HD is a **mobile, heavy-duty Ethernet camera** that can be used in networks compliant with IEEE 802.3 (LAN). Fitted with intelligent image processing and dynamic overlays, the camera functions as a smart sensor in a variety of applications, e.g., integration into video monitoring systems or video streaming.

Features:

- . Full HD resolution (1920x1080)
- . HDR sensor (high dynamic range)
- . Integrated, FPGA-based video processing for customer-specific functions such as:
 - Image processing
 - Object tracking, active overlay fading
 - Inspection and measurement of objects
 - Reading of coded information (QR codes, OCR)
 - Binary image processing
 - Augmented reality
- . Fully digital image/video transmission (30 fps)
- . Video output format motion jpeg
- . Configurable video resolution, compression rate and image refresh rate

MC7000P Heavy-duty camera

Thanks to its **miniature design**, the MC7000P meets minimum space requirements for installation on mobile machines. Owing to the individually adjustable lens, the camera can be installed vertically, horizontally, at an angle, or overhead. Elastomer or stainless steel housings enable versatile use of this heavy-duty camera.

Features:

- . State-of-the-art image electronics (CMOS image sensor)
- . Fast adaptation to ambient lighting
- . Sharp, high-contrast images
- . High shock and vibration resistance
- . Highest protection class IP69K
- . 70°, 90° and 115° horizontal angle of view

PathFindIR II Heavy-duty thermal imaging camera

The PathFindIR II is a **thermal imaging camera** made for use under conditions of 100% darkness, in areas with heavy smoke concentration, and in foggy or snowy weather. The operator receives a clear image and can see 5 times farther than with conventional floodlights and, therefore, can detect persons, animals and objects at an early stage.

Features:

- . Image sensor of uncooled microbolometer
- . Resolution H 320 x V 240 pixels
- . View angle H 24° x V 18°
- . Operating temperature -40 °C...+80 °C
- . Highest protection class IP69K

Monitors

Overview



MD3071A Heavy-duty monitor

Owing to its design and accessories, the MD3071A is a **heavy-duty monitor** that can be used in all industry sectors. The images of the display are crystal clear, even under the most severe ambient conditions. The software update option helps ensure that the MD3071A is up-to-date and thus prepared for future requirements. The vertical design is available as MD3071A-V.

Features:

- . 7" monitor (17.8 cm, measured diagonally)
- . PAL/NTSC video system
- . Supply voltage: 9 V...60 V DC
- . Up to 2 cameras and an additional external video controller (for up to 4 additional cameras) can be connected
- . Auto dimmer function
- . Illuminated keyboard
- . Deep, light-weight protection cover (impact-protected) as standard
- . Made in Germany

MD3072B Quad Heavy-duty monitor

The MD3072B-Quad is designed especially for mobile machines, fitted with several cameras. When using the **integrated video monitoring module**, 4 camera images can be simultaneously displayed on the monitor. The integrated menu function and control lines for the automatic control system of the cameras ensure quick screen changes.

Features:

- . 7" monitor (17.8 cm, measured diagonally)
- . Instant connection of up to 4 cameras
- . Split screen (up to 4 video sources simultaneously)
- . Manual or automatic camera selection
- . Image mirroring (by camera)
- . High shock and vibration resistance
- . Integrated video control module

MD3074A Quad Heavy-duty monitor

The MD3074A-Quad is designed especially for mobile machines, fitted with several cameras. When using the **integrated video monitoring module**, 4 camera images can be simultaneously displayed on the monitor. The monitor is watertight and suitable for use in cold stores due to its protection class. The integrated menu function and control lines for the automatic control system of the cameras ensure quick screen changes.

Features:

- . 7" monitor (17.8 cm, measured diagonally)
- . Instant connection of up to 4 cameras
- . Image mirroring
- . Water-tight and suitable for cold store monitoring
- . Split screen (up to 4 video sources simultaneously)
- . Horizontal image mirroring can be configured separately
- . Interval-controlled image feed change possible
- . Heated panel – smooth image display at low temperatures
- . Protection class IP66

MD3073 Heavy-duty monitor

The water-proof and dust-tight MD3073 has been specially developed for mobile machines and applications where moisture, cold and dust are involved, for example at construction sites or in cold rooms. The displayed images are crystal clear, even under difficult ambient conditions.

Features:

- . 7" monitor (17.8 cm, measured diagonally)
- . Up to 2 cameras and an additional external video controller (for up to 4 additional cameras) can be connected
- . Water and dust-proof
- . Horizontal and vertical image mirroring
- . PAL-480 representation (no image distortion)
- . Automatic brightness adjustment
- . Administrator and user rights
- . Advanced expert settings function
- . Protection class IP67

Monitors Overview

Accessories Overview



MD3100 Heavy-duty monitor

The MD3100 is a **10" LCD Monitor** with a powder-coated metal housing for industrial use. The front panel of the monitor meets IP54 protection class requirements for dust protection and splash resistance.

Features:

- . 10" monitor (25.9 cm, measured diagonally)
- . Picture-in-Picture display (PiP)
- . Sturdy metal housing
- . Front panel meets IP54 protection class requirements
- . For ultra-severe environmental conditions
- . Power supply via MVCU

17" LCD Metal housing monitor

Thanks to its large 17" diagonal screen, the TFT17 monitor enables the representation of complex image combinations as they frequently occur in industrial and stationary applications. Owing to its high resolution, this monitor, with a front panel that meets IP65 protection class requirements, delivers detailed and sharp images.

Features:

- . 17" monitor (43.2 cm, measured diagonally)
- . Industrial and stationary applications
- . Rugged and strong metal housing
- . Front panel meets IP65 protection class requirements

Further sizes available:

- 12" LCD monitor**
- 15" LCD monitor**
- 19" LCD monitor**

MBE1000 Operator control unit

The MBE1000 is a CAN bus capable control unit for the activation and/or configuration of various Motec video control units (MVCUs). The MBE allows the camera monitor system to be set according to various operating conditions.

MV13 Signal amplifiers/distributors

The MV13 is used to distribute an analogue video signal (camera, switchbox etc.) to up to 3 outputs (monitor, DVR etc.).

Video control units

Overview



32

33

MB1405 Quad Video control unit

With the MB1405-Quad **video control unit**, up to 4 camera images can be simultaneously displayed in a so-called “quad split mode”. Automatic or manual control of the various camera images is possible with the supplied remote control.

Features:

- . Integrated quad split function: Display of up to 4 camera images possible
- . Selection of the camera to be activated via control lines or operator control unit
- . Power supply of TFT monitor and 4 heavy-duty cameras
- . Separate setting of image mirroring
- . Automatic trailer detection of articulated trains

MVCU1400 Video control unit

The MVCU1400 is an intelligent, CAN-controlled **heavy-duty, multi-camera video control unit** capable of processing up to 4 camera images and displaying these on up to 2 monitors in various modes.

Features:

- . Connection of up to 4 heavy-duty cameras or 3 heavy-duty cameras plus 1 motor zoom camera
- . Control via CAN bus (MSB 2.0), a monitor toggle line and/or 4 control lines
- . Single, split, triple or PiP monitor output (freely configurable)
- . Quad and OSD in 4 colours
- . 2nd monitor output (single, split, quad)

MVCD1000 Video control unit

The MVCD1000 is a digital, **heavy-duty, multi-camera video control unit** for the parallel processing of up to 4 camera images, merging them with other sensor data and outputting via an analogue monitor output or Ethernet video stream.

Features:

- . Integration into vehicle electronics via bidirectional switch line, CAN interface or Ethernet connection
- . System is expandable for active radar or ultrasonic sensors
- . Altera FPGA (SoC) with 925 MHz dual-core ARM Cortex-A9 MPCore processor, 1GB RAM, 4 GB flash (expandable)
- . Video input for up to 4 cameras (PAL/NTSC)
- . Prepared for future requirements thanks to software updates

MVCU1600 Video control unit

The MVCU1600 is an intelligent, CAN-controlled, **high-end and heavy-duty multi-camera video control unit**. It can process as many as 8 camera images and display these images on up to 5 monitors in a variety of modes and with individual overlays.

Features:

- . Connection of up to 8 heavy-duty cameras
- . Display on up to 5 monitors
- . Monitor output with flexible display options
- . Showing of symbols, logos and images possible

Cables and cable harnesses

Tailor-made solutions

Motec GmbH has more than 25 years of experience in the production of high-quality, customised cable systems in Germany. We are currently producing roughly 1000 different cables of various lengths and designs.

Individually customised solutions are our speciality: We use all standard plug-in connectors and we can produce even complex cable harnesses and cable sets.

We process all types of wires and cables with diameters from 0.013 mm² (AWG36) up to 107.2 mm² (AWG 4/0), and without limitations as to the number of wires.

Certified quality

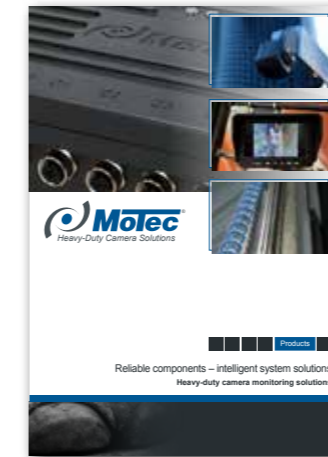
for the most sophisticated requirements

- Pull testing
- Micrograph laboratory
- Crimp height measuring
- Automatic crimping force monitoring
- 100% semi-automatic, logged final test for correct functioning
- EDP-supported merchandise management and production planning and control system
- Operational data recorded via bar code
- 100% traceability (via batch and serial numbers)

System solutions

Customised solutions for a wide range of other industries

- Product range
- Construction machinery
- Transport and municipal vehicles
- Logistics, port and industrial applications
- Agricultural machines
- Logistical and tactical vehicles



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