MRI compatible video cameras
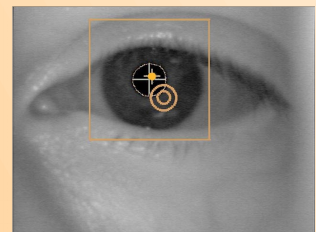# Eye-tracking solutions

MRC Systems GmbH was founded in 1995 as a spin-off of the University of Heidelberg and the German Cancer Research Center (DKFZ). MRC is an independent company with its main office in Heidelberg, Germany.

Since 25 years we develop, produce and sell our innovative products for various fields in laser and medical technology.

Our technical developments benefit from our ambitious and experienced staff in the fields of optics, laser technology, electronic engineering, software development and mechanical design.

With our innovative strength, our precision and our reliability we became a leading innovator in different product areas. We always focus on the ideal solution for the end user.
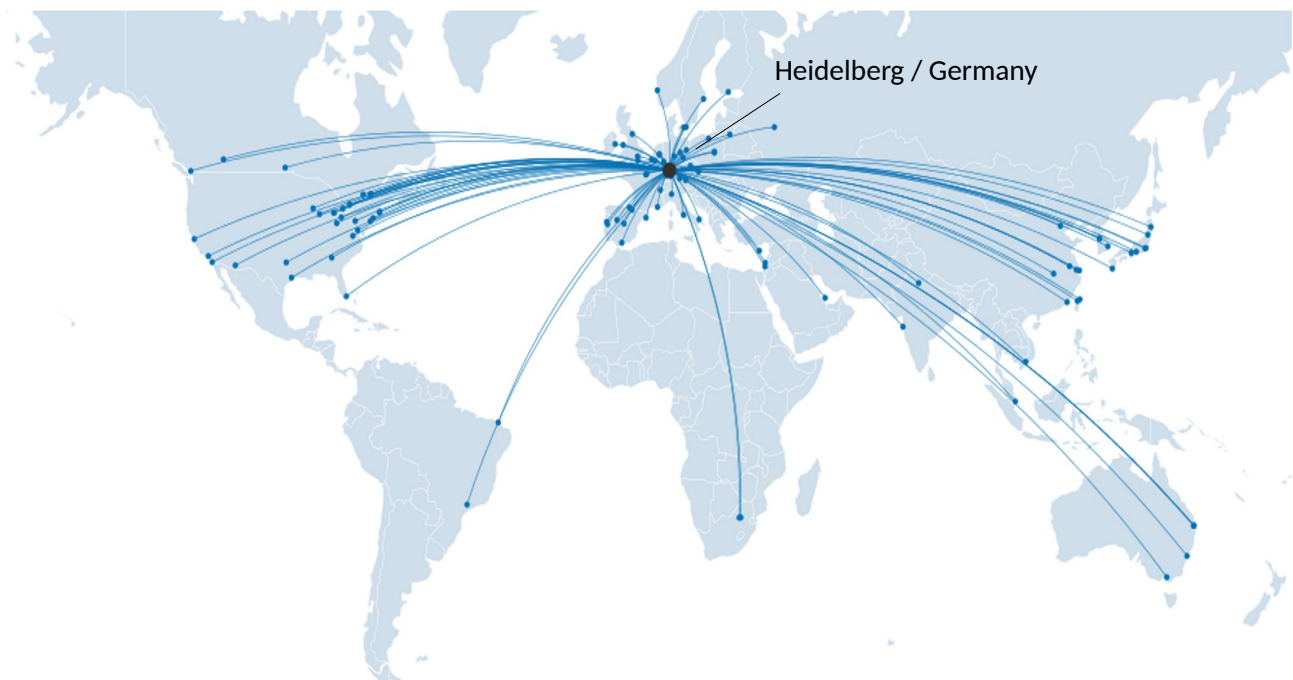
Our products are designed for international markets and are in use all over the world. We guarantee the highest quality and offer our comprehensive service over the complete product life cycle.

We established long-term collaborations with many universities, research institutes and manufacturing partners.

We introduced a total quality management system in 1998 and continuously refine it. All our processes are in conformity with ISO 13485.

We are looking forward to hear from you and your specific task and would be pleased to assist you in your projects.

Our customers across the world

Heidelberg / Germany

We are looking forward to hearing from you!
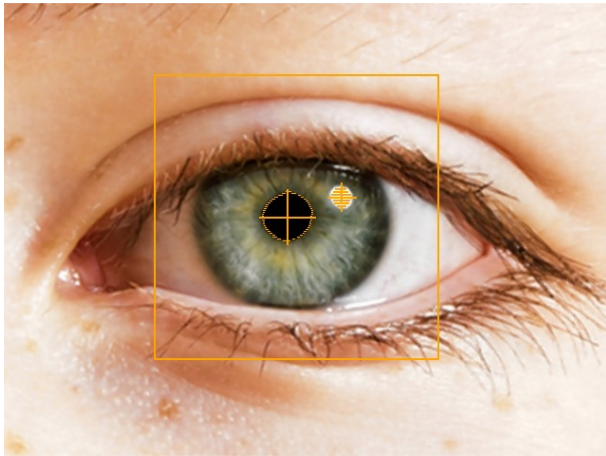
MRI compatible cameras

Our MRI compatible video cameras are in the market since more than 15 years. They are characterized by their high quality, compact size, and easy installation.

We have different lines of cameras. Most of them can be used inside the bore of the scanner. They work without interference of MR images or fMRI.

Due to their widespread use in many applications they define the state of the art of video imaging with MRI. You can find our cameras in scanners with field strengths ranging from 0.3 to 9.4 Tesla.

There is a variety of fascinating applications that can not all be covered in this overview. We can just show a brief selection of typical applications.

Eye tracking

Face monitoring

Room observation
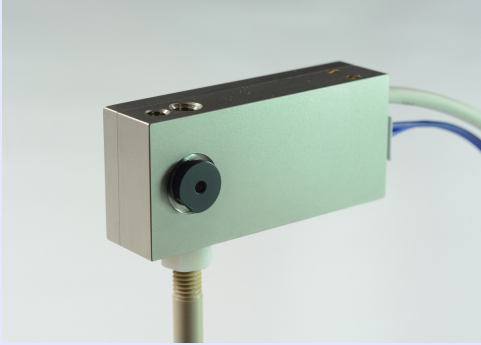

Motion tracking

You can download a list with research publications from our customers all over the world from www.mrc-systems.de. We can also provide you with references as well as detailed information and support for specific applications.

If you are working with our cameras and have published your research but are not included in the list, we would be pleased if you would inform us.

Digital cameras

Model	Photo	Specification
MRC High Resolution		• Interference-free use inside the MRI bore • HD resolution: 1280x960 pixel @43Hz, 1280x720 pixel @60Hz, … (adjustable) • Sensor type: CMOS, colour, global shutter • Focal length selectable • Interface: Gigabit Ethernet / GigE-Vision
MRC HiSpeed		• Interference-free use inside the MRI bore • Very high frame rates: 1076Hz / 256x256 pixel, 488Hz / 640x240 pixel, 250Hz / 640x480 pixel, … (adjustable) • Sensor type: CMOS, b/w, progressive scan, global shutter • Focal length selectable • Interface: Gigabit Ethernet / GigE-Vision

Our line of digital cameras makes use of the widely used GigE Vision protocol. The video streams are transferred via gigabit ethernet on standard network equipment. You only need a network adapter in your PC or laptop. Alternatively, we can also provide you with a hardware converter which allows you to directly view the video streams on a display without a computer.

The cameras are safely powered through a filter box and the signals are transferred on optical fibres. This design guarantees the best video quality and the interference-free operation in the MRI.

Download information:

LED light

For applications like eye-tracking or sleeps studies we also offer a small and lightweight LED light which can be easily connected to the cameras or placed independently.

The LED light is eye-safe and can be used to illuminate the eye, the face, or any other objects with infrared or white light. It allows you to take videos in dark environment.
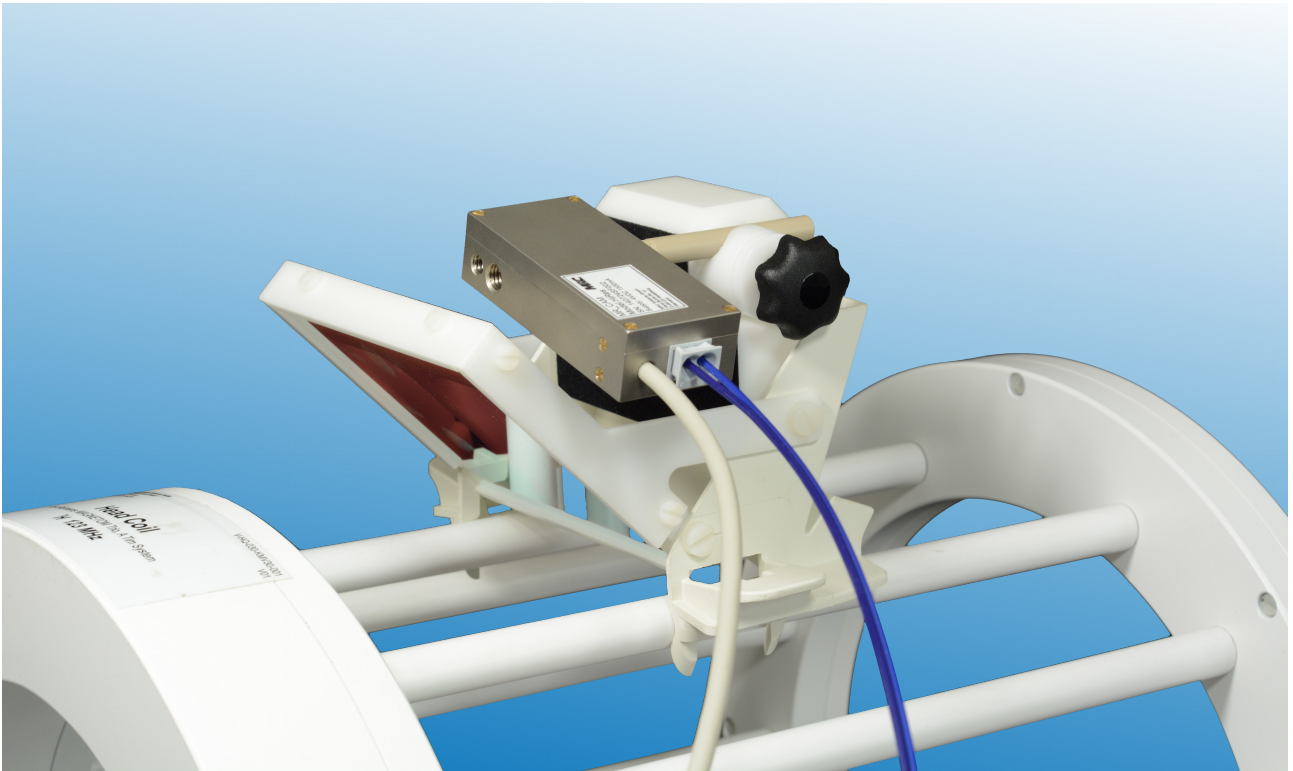
Analog cameras

Model	Photo	Specification
12M		• Interference-free use inside the MRI bore • Available with b/w or colour sensor • Focal length selectable • VGA resolution • Very small size, low weight
12M-i		• Interference-free use inside the MRI bore • Integrated LED light, adjustable intensity • Infrared or white light • Available with b/w or colour sensor • Focal length selectable • VGA resolution • Compact size, low weight
CS		• Camera with vario lens • Monitoring from a distance • Wide-angle or telephoto lenses • Focal lengths: 6-52mm or 2.8-12mm (others on request) • C-mount lens connector • Available with b/w or colour sensor • Including wall mount

All analog cameras come with dedicated filter boxes and opto-isolation which guarantees an undisturbed video quality and an interference-free operation. The installation of the filter box is very straightforward.

Our line of analog cameras delivers a video stream as a composite video signal. To display or record the videos you need a frame grabber in your PC or laptop. Alternatively, it is also possible to directly view the videos without a computer on a display.

For eye-tracking in the MRI we offer a precise, reliable, and easy-to-use **"all-in-one"** solution. It is based on a modular design with different camera versions, infrared light sources, specific camera/mirror mounts, and software.
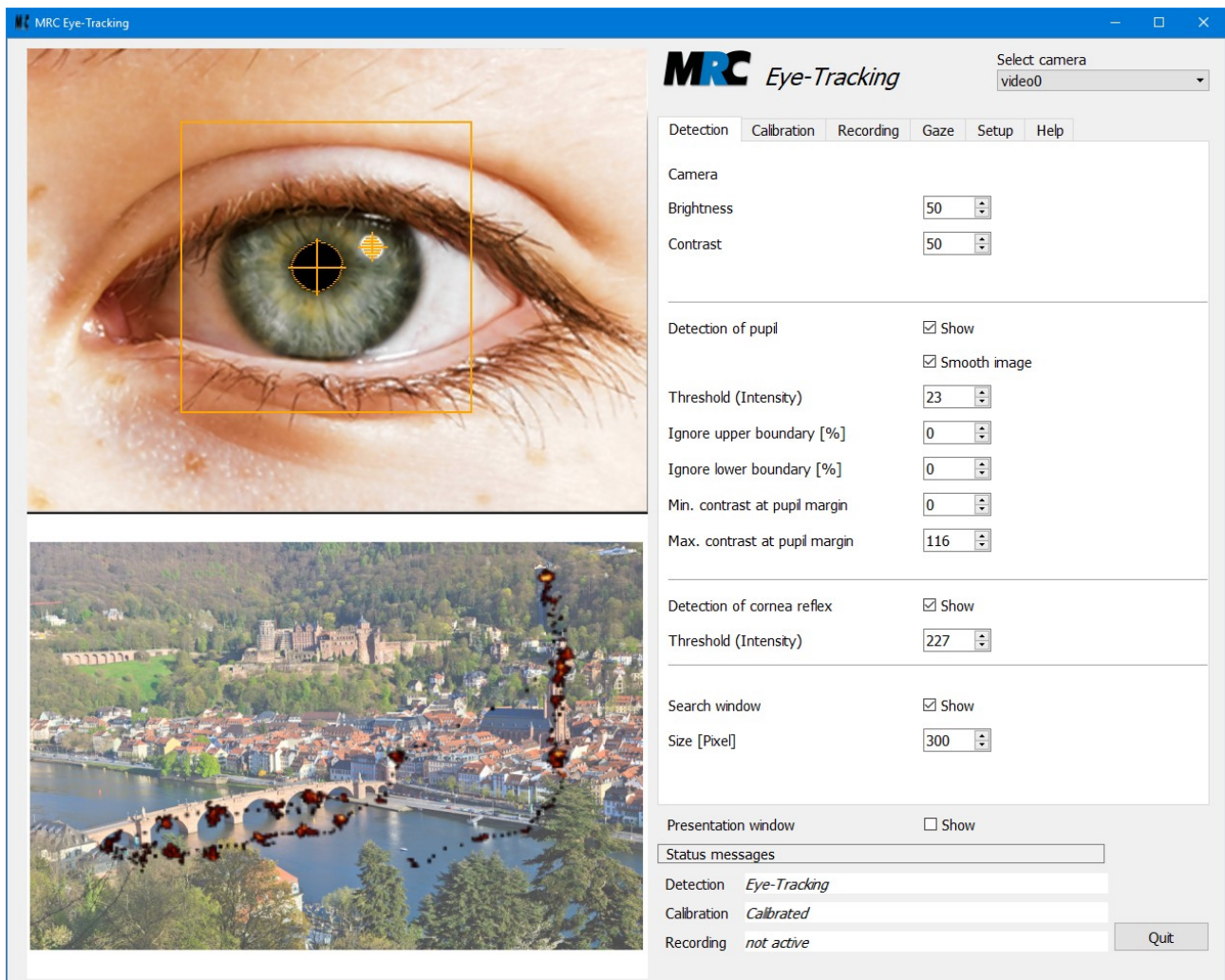
You can download video samples and the user manual of the eye-tracking software from www.mrc-systems.de/en/products/mr-compatible-camera.

Advantages:

✔ Fast and easy operation. Set-up in a few steps. No need for permanent installation.
✔ High accuracy due to excellent camera resolution.
✔ Standard and high speed version.
✔ Monocular and binocular.
✔ Semi-transparent mirror combines easy adjustment with unobscured view onto presentations.
✔ High-grade optical mirror quality.
✔ Hardware and software from one hand.
✔ Interfaces for synchronisation with hardware and software.
✔ No noise.

Eye-tracking software

The "MRC Eye-Tracking" software is an easy-to-use and very accurate software for the tracking of gaze directions and monitoring of pupil sizes. It is ideal for monitoring the fixation of subjects during fMRI sessions.

"MRC Eye-Tracking" is available in different versions including hi-speed, monocular and binocular configurations, and with flexible options for interfacing with third party software, your own software, and hardware triggers.

✔ Highest accuracy.*
✔ Live view and real-time data output.
✔ Different calibration screens. Visualisation of gaze points in control screen.
✔ TCP/IP socket for interfacing with Matlab, Presentations, E-Prime, etc.

  * Typical accuracy for gaze detection is 0.4° (depends on focal length and distance from eye to calibration screen).

Eye-tracking bundles

MRC Eye-Tracking 60-M

- Monocular
- 12M-i eye-tracking camera (60Hz)
- Integrated infrared LED light
- Semi-transparent mirror
- Camera/mirror mount for your head coil
- Frame grabber
- MRC Eye-Tracking software (variant A-M)

MRC HiSpeed Eye-Tracking HS-M

- Monocular
- HiSpeed eye-tracking camera (250Hz)
- Separate infrared LED light
- Semi-transparent mirror
- Camera/mirror mount and LED holder for your head coil
- MRC Eye-Tracking software (variant GigE-M)

MRC Eye-Tracking 60-B

- Binocular
- Same as 60-M but ...
- Two 12M-i eye-tracking cameras
- Additional camera holder
- MRC Eye-Tracking software (variant A-B)

Options:
- TCP/IP software interface
- Digital I/O, synchronisation with TTL triggers

MRC HiSpeed Eye-Tracking HS-B

- Binocular
- Same as HS-M but ...
- Two HiSpeed eye-tracking cameras
- Additional camera and LED holder
- MRC Eye-Tracking software (variant GigE-B)

Options:
- TCP/IP software interface
- Digital I/O, synchronisation with TTL triggers
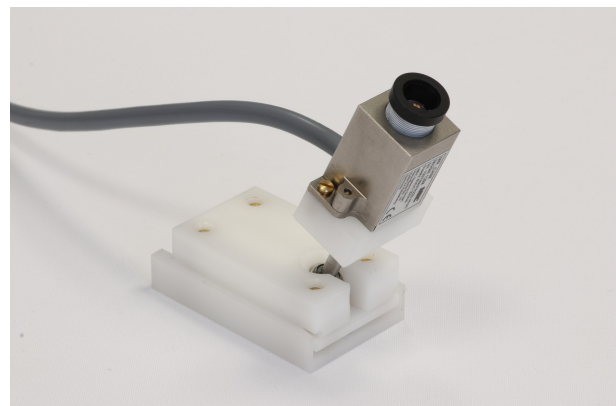
"Mounting is easy"

Camera holders (selection)

Articulated arm

- Very flexible solution with universal clamp
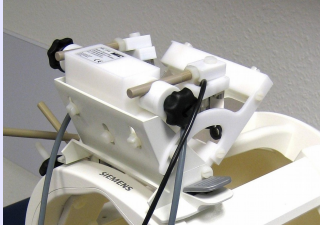- Can be attached to rods, rails, coils, etc.

Ball-joint mount

- Compact solution
- Can be attached to the magnet's cover

Camera/mirror mounts

The following list displays some available camera/ mirror mounts for the shown head coils. All of them are available with one or two adjustable camera holders for e.g. monocular or binocular eye-tracking.

The mounts are equipped with a semi-transparent mirror which reflects visible and transmits infrared light. A camera can look through the mirror onto the face in the infrared range whereas the subject sees a normal mirror and can view a presentation.

Original coil	Camera/mirror mount	Original coil	Camera/mirror mount
Siemens 12-channel		Siemens 20-channel	
Siemens 32-channel		Siemens 64-channel	
Invivo 8-channel		Invivo 32-channel	
GE 21-channel		GE 32-channel	

We have more mounts for Siemens, Invivo, Nova Medical, MRI Instruments, etc.

If your head coil is not displayed here, just let us know. Maybe we have updated our portfolio or can provide you with a customised solution.

Monitoring of subjects

In many applications it is necessary to monitor a subject's face, the hands or the entire body. Our cameras are also regularly used to monitor devices and instruments in the scanner bore or elsewhere in the MRI suite. The cameras are available with black&white or colour sensor.

Our cameras are universal tools and can be equipped with different lenses to optimise the field of view for any application.

We offer various mounting solutions to support your application in the best way.

Evaluation of face expressions

Sleep monitoring

Position monitoring

Recording of hand movements

Animal scanners

In addition to the cameras for human scanners we also have specific models for animal scanners with smaller bore diameters. The cameras are used in scanners with strengths of up to 9.4 Tesla.

It is possible to combine them with infrared light which is not visible for the animal but illuminates the dark space in the scanner.

Patient and room observation

The MRC High Resolution camera as well as the CS camera are used for patient and room observation from a distance. Wide-angle and telephoto zoom lenses can be selected to fit to your specific needs.

The cameras are based on the same electronic platform as the in-bore cameras and do thus produce **no noise or interference**. They can be easily mounted to the wall or the ceiling.
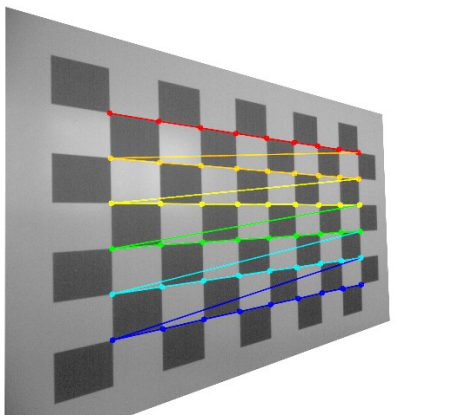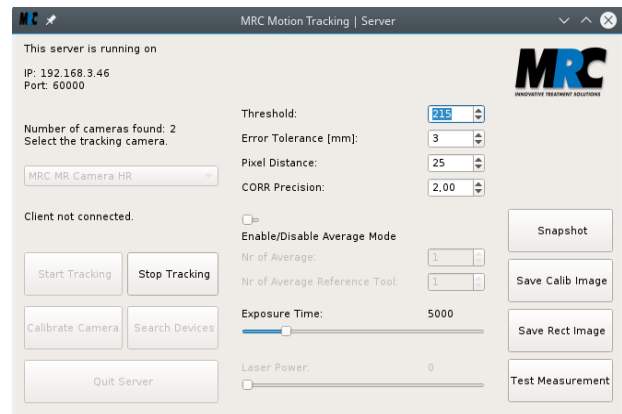

Motion tracking

We have solved different motion tracking tasks and can not only support you with our cameras, but also with software modules based on Open CV. We are eager to support you with our long years experience in eye and motion tracking.

Both, the digital and the analog cameras can be configured in compact and variable stereo setups for triangulation. The flexible designs can be used to detect different kinds of markers or patterns with the envisaged resolutions and frame rates.

Calibration tools

Motion tracking control panel

MRC-0519-200-1-e