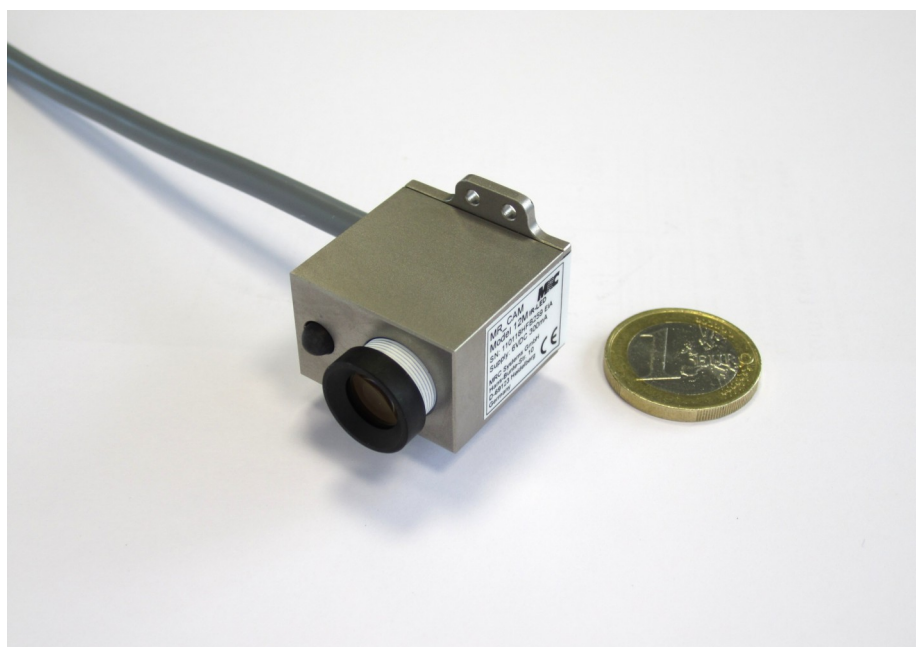# MR-compatible camera "12M-i"
# with integrated LED light

## User manual



## 1. Intended use

Our MR compatible cameras are designed to view and record video images of subjects in an MR scanner. They can also be used for the monitoring of objects and instruments. The cameras can be used inside the bore of the scanner. They can be equipped with different exchangeable lenses. The correct orientation of the cables, the correct installation of the filter box, and the correct grounding should be checked before the application. Respective descriptions can be found in this user manual.

In the 12M-i models, an LED for different illumination purposes like face monitoring or eye-tracking is integrated. It is based on a single light-emitting-diode (LED) which is embedded in the titanium housing and emits diffuse light.

The cameras are not equipped with an automatic alert in case of an interruption of the video stream. That is why they are not intended to identify critical states or situations.

## 2. System components

- Camera
- LED
- Filter box (with optical isolation of video signal)
- Camera connection cable (length: 10 m, 2 m at the camera + 8 m elongation cable)
- Power supply (length: 1.8 m)
- BNC cable (length: 2 m)
- BNC/Cinch adapter
- Earth ground cable for provisional installation

There are different types of LEDs that can be used with the camera. It is possible to provide both, visible or infrared light.

## 3. Video camera, lens and LED light

Figure 1 shows the camera housing with the LED and a connected lens.
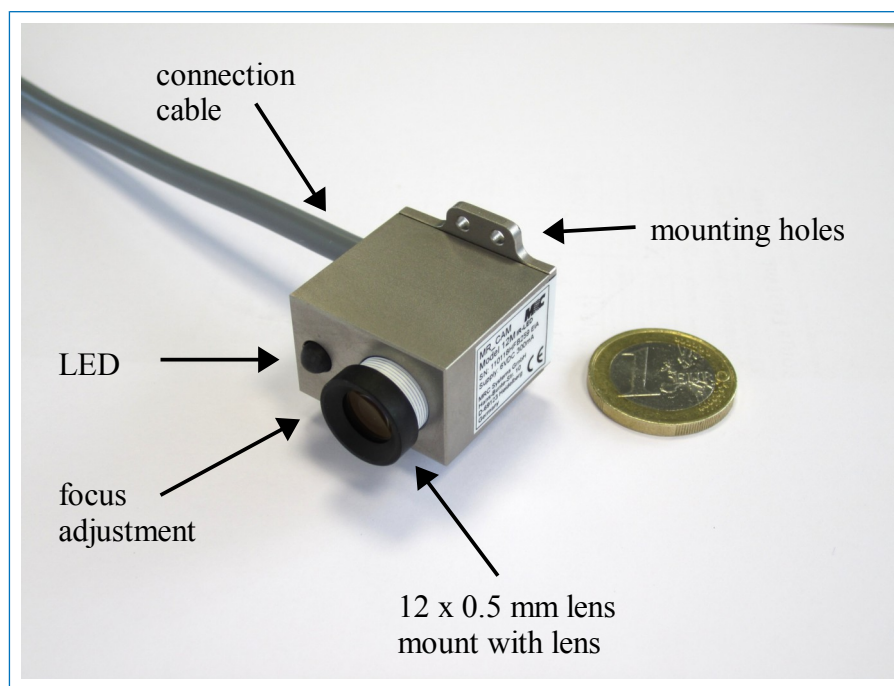


*Figure 1:*
*Video camera with LED and lens*

The lens is connected to the standard **M12 mount** in the housing.

- The **focus adjustment** is done by screwing the lens in and out. Care should be taken not to screw out the lens too far, as the lens may fall out of the thread.

The LED light is embedded in the camera housing. The distance to the lens is chosen in order to avoid undesired shadowing effects.

The device is connected to the filter box via a connection cable which must be plugged into the **"MR CAM Signal IN"** connector.

# 4. Mounting options

The device can be mounted directly to any suitable object via the two 2 mm holes in the backplate.

Standard mounting options are:

1. direct mounting of the camera using the mounting holes
2. use of an articulated arm (optional accessory) for mounting the camera e.g. to the head coil
3. use of a ball joint mount (optional accessory) e.g. for use inside the MR bore
4. use of a tripod adapter (optional accessory) for mounting the camera on a tripod

You can find photos of the optional accessories in section 11 of this manual.

# 5. Connection of camera/LED to filter box

The powering of the camera and the LED is arranged via the filter box. The camera/LED is connected to the filter box with the shielded camera connection cable which includes the power and the signal lines.

The filter box prevents the transmission of disturbing signals into the MR cabinet. It avoids interferences in the video signals and the MRI imaging.

The filter box includes a low pass filter that suppresses frequencies higher than 1 MHz with over 100 dB. This filter prevents damage and interferences caused by the high frequency signals of the MR scanner. In addition, the filter box includes an optical isolation of the video signals. In that way a full separation of the MRI equipment from the external power network is guaranteed.

**Note:** The filter box is only suitable for the camera 12M-i with integrated LED. Connecting the standard 12M or CS camera to the filter box will destroy the integrated electronics!



camera connector

*Figure 2: Filter box (front side)*

# 6. Filter box installation

For a permanent installation, the filter box should be screwed onto the panel board by means of the feed through **camera connector** (see figure 2). Figure 3 illustrates the recommended configuration:

· A 12 mm through hole in the panel board is required.

· The **camera connector** is guided through this hole.

· The camera connector provides the ground connection to the shielding of the MR cabinet.

For temporary use, the camera cable can be brought into the MR cabinet by other means, e.g. through a service entry hole ("waveguide"). In this case, an additional grounding cable should be used to connect the camera connector to the shield panel grounding. The camera connector must completely protrude into the MR cabinet and the video cable must not jut out.
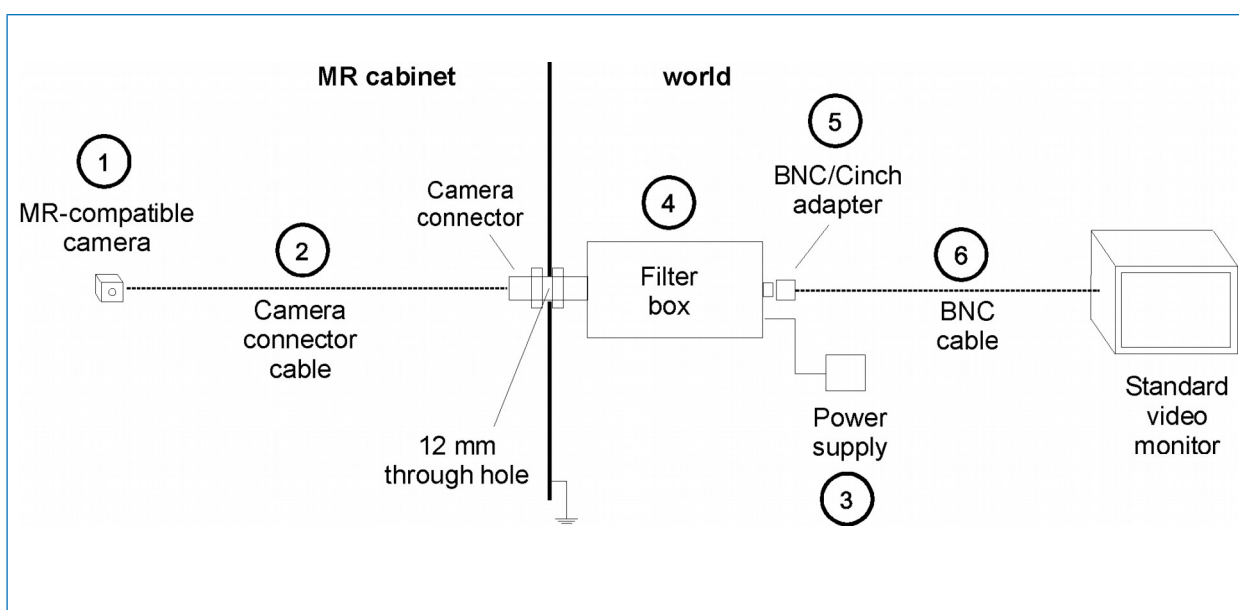


*Figure 3: Device and cable configuration*

# 7. Connection of power supply, light intensity adjustment

The power for the camera is transmitted via the video cable. Therefore, the power supply is connected to the filter box (see figure 4). Next to the video connector is a green "active" signal which shines when the device is powered and the LED on the front side of the camera is turned on. By pushing the button of the "active" signal the LED can be switched off. The intensity of the LED light can be adjusted by means of a potentiometer at the filter box.

## 7.1. Eye safety

The infrared LED in the camera is eye-safe. The peak wavelength is 950 nm. We recommend to keep a distance between the light source and the subject's eye of 50 mm or more. With the white-light LED you should avoid to shine directly in the eye. Please be aware that the lid-closing reflex of babies can be unincisive.

*Figure 4:*

*Filter box (rear side)*

# 8. Connection of TV set, VCR, frame grabber, or video card

A BNC/Cinch adapter and a standard BNC cable are used to transfer the video output signal to a TV set, VCR, frame grabber, or video card. The BNC/Cinch cable is plugged via the adapter to the video connector at the filter box (see figure 4).

The video signal can be directly viewed with a TV set or recorded with a VCR. To view and store the images with a PC, the BNC/Cinch cable must be connected to a frame grabber or video card within the PC. Any software for analog video viewing should be appropriate to process the signals.

# 9. Maintenance and cleaning

Light-emitting diodes (LEDs) are subject to an ageing process which is accelerated if the LEDs are driven at highest powers. In order to increase the lifetime of the product we recommend not to drive the light source with highest intensity and to disconnect it from mains whenever it is not in use.

The device should be applied in dry environments. It is not sealed against splash water and rinsing liquids.

The housing and the lens can be cleaned with a dry cloth. If this is not sufficient, the cloth can be moistened with clear water or alcohol.

# 10. Technical data

### Video camera

| | |
|---|---|
| Sensor Type: | B/W or color CMOS Sensor 1/3 inch |
| Output: | EIA(NTSC) video signal with 60 Hz half frame rate |
| | or CCIR(PAL) video signal with 50 Hz half frame rate |
| Sensitivity: | 0.2 Lux for f#1.2 (B/W) |

## Spectral sensitivity (B/W camera)
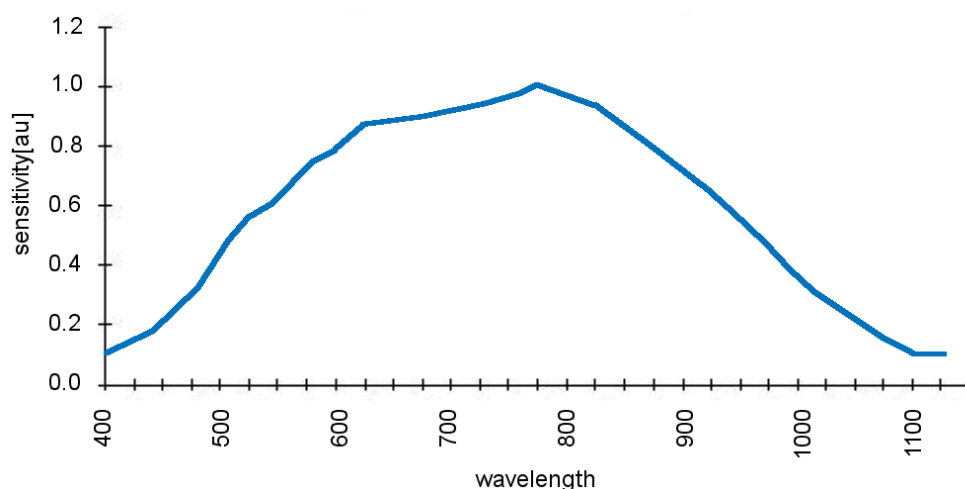


## Housing dimensions

| | |
|---|---|
| Dimensions: | 27 mm x 18 mm; height ≈ 27 mm + lens (without mounting bracket) |
| Connector for lens: | 12 x 0.5 mm mount |
| Mounting holes: | two pairs of holes, 2 mm Ø, distance 23 mm |
| Weight: | 45 g (without cable) |

## LED

| | |
|---|---|
| Spectrum | white or infrared (diffused) |
| Current: | 10-100 mA |

## Lenses

| | |
|---|---|
| Type: | fixed focal length with fixed aperture, exchangeable |
| Mount: | 12 x 0.5 mm |
| Focal length: | a big number of different focal lengths are available |
| Standard delivery: | focal lengths: 4.3 mm, 6 mm, 8 mm (other lenses on request) |
| Aperture: | e.g. 2.4 |
| Sensor format: | 1/3 inch |
| Minimal object distance: | 50 mm (typical, depending on the chosen lens) |

## Electronics

| | |
|---|---|
| Power supply: | 300 mA, 6 V DC |
| Output impedance: | 75 Ω |
| Type: | Friwo FW7555M/06, 6 V (medical power supply) |

## Filter box

| | |
|---|---|
| Dimensions: | 80 mm x 120 mm x 80 mm |
| Weight: | approx. 700 g |

# 11. Camera holders (optional accessories)

We offer different camera holders for the MR compatible camera. Examples are shown in the photos below. More information can be found in the specific product descriptions. We can also produce customised solutions.
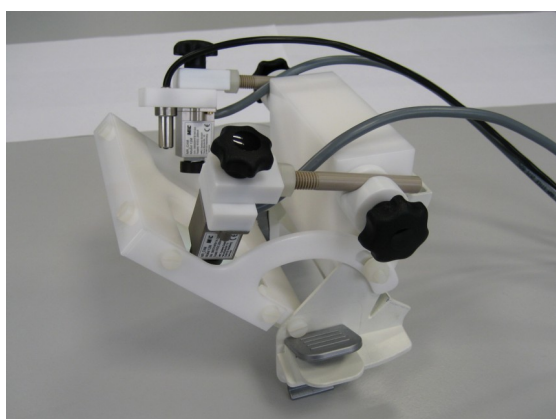
On request, we can offer additional equipment like displays or video cards.
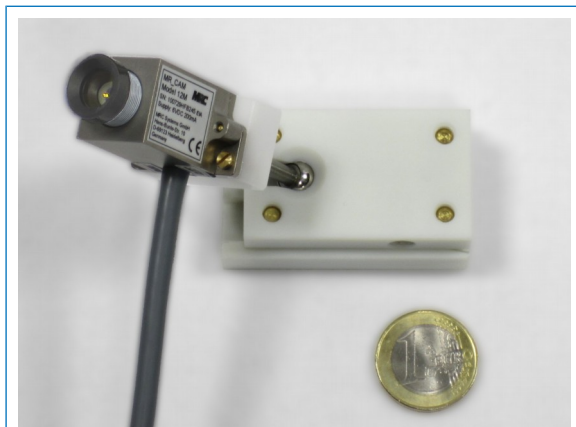


*Camera holder with ball joint for easy alignment*
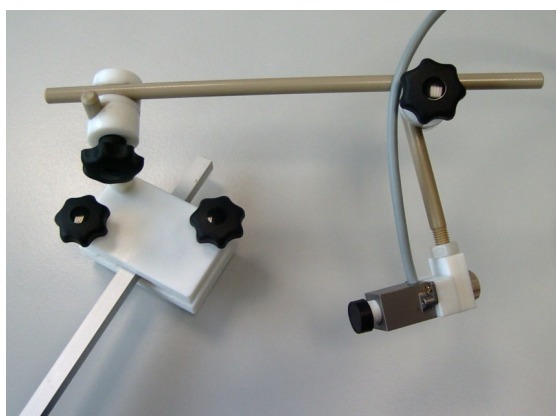


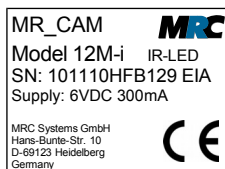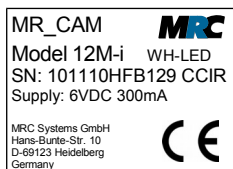*Flexible camera holder based on articulated arm*
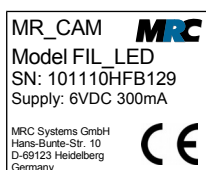


*Camera holder at head coil*

*Figure 5: Selection of MR compatible camera holders*

*(The cameras shown in the photos are the standard 12M cameras without integrated LED.)*

## 12. Labelling

A label on the camera housing includes the information about the integrated LED (white or infrared) and the embedded video sensor (CCIR or EIA). The following copies are enlarged:

| MR_CAM **MRC** | MR_CAM **MRC** |
|---|---|
| Model 12M-i  WH-LED | Model 12M-i  IR-LED |
| SN: 101110HFB129 CCIR | SN: 101110HFB129 EIA |
| Supply: 6VDC 300mA | Supply: 6VDC 300mA |
| MRC Systems GmbH<br>Hans-Bunte-Str. 10<br>D-69123 Heidelberg<br>Germany  CE | MRC Systems GmbH<br>Hans-Bunte-Str. 10<br>D-69123 Heidelberg<br>Germany  CE |

In addition, there is a label on the filter box:

MR_CAM **MRC**
Model FIL_LED
SN: 101110HFB129
Supply: 6VDC 300mA

MRC Systems GmbH
Hans-Bunte-Str. 10
D-69123 Heidelberg
Germany  CE

## 13. Contact

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