Railway Communication via GSM-R

Portfolio
Service and Maintenance
Quality Assurance

Dipl.-Wirt.-Ing. (FH) Norman Wenkel
Portfolio

GSM-R made by Funkwerk
Funkwerk's Success -
Cab Radio, MT and TEQoS
- Austria
- Belgium
- Bulgaria
- China
- Czech Republic
- Denmark
- Finland
- France
- Germany
- Great Britain
- Hungary
- India
- Italy
- Luxembourg
- Morocco
- Netherlands
- Norway
- Russia
- Slovenia
- Slovakia
- Spain
- Sweden
- Switzerland
Market and Projects

Cab Radio

- **Funkwerk as main supplier of GSM-R mobiles**
  - Germany
  - Switzerland
  - France
  - Norway
  - Belgium
  - Sweden
  - Austria

- **Vehicles with GSM-R by Funkwerk**
  - Italy
  - Great Britain
  - Luxembourg
  - Bulgaria
  - Netherlands
  - Denmark
  - Spain
  - India
  - Finland
  - Slovakia
  - Czech Republic
  - Slovenia
  - Hungary

- **Test with GSM-R by Funkwerk**
  - Russia
  - China
Market and Projects

### MT² and TEQoS

#### Radio Modules MT²
- Netherlands
- Czech Republic
- China

#### TEQoS
- Germany
- Belgium
- Italy
- Spain
- Sweden

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TEQoS2
(Terminal Environment Quality of Service)
is used during the start-up phase of a new GSM-R network, as well as in the ordinary operation and optimisation process, wherever measurements need to be performed to guarantee the quality of the GSM-R subsystem.
Structure of MESA23 Dual Mode (450MHz / GSM-R) System
Range of Products

Selected Examples
MESA 23

Device Overview

Variants

<table>
<thead>
<tr>
<th>MTRS x BS</th>
<th>MTRS x BSH</th>
<th>MTRS x RIH</th>
<th>MTRS 1 BC</th>
<th>GTM / GTM+</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTRS x RS</td>
<td>MTRS x RSH</td>
<td>MTRS x RI</td>
<td>MMIS / MMIE</td>
<td></td>
</tr>
</tbody>
</table>

Available Interfaces

- MMI
- Power Supply
- Antenna / Diplexer
  - GSM-R and/or analogue
- UIC line
- RS 422
- Digital in- and outputs
- Service and diagnostics
# MESA 23

## MESA 23-01: MTRS 1+A BSH

### Technical Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>External dimensions</td>
<td>300 x 530 x 280 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>max. 31 kg</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 54 acc. to EN 60529</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20 °C to +55 °C</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>24, 36, 48, 72 or 110 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Power input</td>
<td>max. 365 W</td>
</tr>
</tbody>
</table>

### Interfaces

<table>
<thead>
<tr>
<th>Interface</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 for MMIs</td>
<td></td>
</tr>
<tr>
<td>2 for antenna GSM-R and analogue</td>
<td></td>
</tr>
<tr>
<td>1 for digital in- and outputs</td>
<td></td>
</tr>
<tr>
<td>1 to connect radio module 2-70</td>
<td></td>
</tr>
<tr>
<td>1 for service and diagnostics</td>
<td></td>
</tr>
<tr>
<td>1 for UIC line (optional)</td>
<td></td>
</tr>
<tr>
<td>2 RS 422 (optional)</td>
<td></td>
</tr>
<tr>
<td>1 power supply</td>
<td></td>
</tr>
<tr>
<td>1 protective earth</td>
<td></td>
</tr>
</tbody>
</table>
# MESA 23

**MESA 23-02: MTRS 1+A RSH**

## Technical Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>19“ construction:</td>
<td>6 U / 84 HP</td>
</tr>
<tr>
<td>External dimensions:</td>
<td>482.6 x 266 x 243 mm</td>
</tr>
<tr>
<td>Weight:</td>
<td>max. 12 kg</td>
</tr>
<tr>
<td>Protection class:</td>
<td>IP 20 acc. to EN 60529</td>
</tr>
<tr>
<td>Operating temperature:</td>
<td>-20 °C to +55 °C</td>
</tr>
<tr>
<td>Input Voltage:</td>
<td>24, 36, 48, 72 or 110 V&lt;sub&gt;dc&lt;/sub&gt;</td>
</tr>
<tr>
<td>Power input:</td>
<td>max. 240 W</td>
</tr>
</tbody>
</table>

## Interfaces

- 2 for MMIs
- 2 for antenna GSM-R and analogue
- 1 for digital in- and outputs
- 1 to connect radio module 2-70
- 1 for service and diagnostics
- 1 for UIC line (optional)
- 2 RS 422 (optional)
- 1 power supply
- 1 protective earth
**MESA 23**

**MESA 23-03: MTRS 1+A RIH**

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### Technical Parameters

- **19" construction:** 9 U / 32 HP
- **External dimensions:** 167.7 x 423.5 x 233.5 mm
- **Weight:** max. 11 kg
- **Protection class:** IP 20 acc. to EN 60529
- **Operating temperature:** -20 °C to +55 °C
- **Input Voltage:** 24, 36, 48, 72 or 110 V<sub>DC</sub>
- **Power input:** max. 240 W

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### Interfaces

- 2 for MMIs
- 2 for antenna GSM-R and analogue
- 1 for digital in- and outputs
- 1 to connect radio module 2-70
- 1 for service and diagnostics
- 1 for UIC line (optional)
- 2 RS 422 (optional)
- 1 power supply
- 1 protective earth
# MESA 23

## MESA 23-04: MTRS 1 BS

<table>
<thead>
<tr>
<th>Technical Parameters</th>
<th>Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>External dimensions: 300 x 430 x 280 mm</td>
<td>2 for MMIs</td>
</tr>
<tr>
<td>Weight: max. 22 kg</td>
<td>1 for antenna GSM-R</td>
</tr>
<tr>
<td>Protection class: IP 54 acc. to EN 60529</td>
<td>1 for digital in- and outputs</td>
</tr>
<tr>
<td>Operating temperature: -20 °C to +55 °C</td>
<td>1 for service and diagnostics</td>
</tr>
<tr>
<td>Input Voltage: 24, 36, 48, 72 or 110 V\textsubscript{DC}</td>
<td>1 for UIC line (optional)</td>
</tr>
<tr>
<td>Power input: max. 290 W</td>
<td>2 RS 422 (optional)</td>
</tr>
<tr>
<td>1 power supply</td>
<td>1 protective earth</td>
</tr>
<tr>
<td>1 protective earth</td>
<td></td>
</tr>
</tbody>
</table>
### Technical Parameters

- **19” construction:** 3 U / 84 HP
- **External dimensions:** 482.6 x 132.6 x 243 mm
- **Weight:** max. 6 kg
- **Protection class:** IP 20 acc. to EN 60529
- **Operating temperature:** -20 °C to +70 °C
- **Input Voltage:** 24, 36, 48, 72 or 110 V<sub>dc</sub>
- **Power input:** max. 165 W

### Interfaces

- 2 for MMIs
- 1 for antenna GSM-R
- 1 for digital in- and outputs
- 1 for service and diagnostics
- 1 for UIC line (optional)
- 2 RS 422 (optional)
- 1 power supply
- 1 protective earth
## MESA 23
### MESA 23-06: GTM+

### Technical Parameters
- **Construction:** closed housing
- **External dimensions:** 316 x 276 x 345 mm
- **Weight:** max. 15 kg
- **Protection class:** IP 42 acc. to EN 60529 excl. handset and loudspeaker
- **Operating temperature:** -20 °C to +55 °C
- **Input Voltage:** 24 ... 110 V\(_{DC}\)
- **Power input:** max. 165 W

### Interfaces
- 1 for remote MMI
- 1 for antenna GSM-R
- 1 for service and diagnostics
- 1 RS 422
- 1 for charging unit
- 1 power supply
- 1 protective earth
# MESA 23

## MESA 23-08: MTRS 1 RI

### Technical Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>19” construction:</td>
<td>6 U / 32 HP</td>
</tr>
<tr>
<td>External dimensions:</td>
<td>167.7 x 307.7 x 233.25 mm</td>
</tr>
<tr>
<td>Weight:</td>
<td>max. 7 kg</td>
</tr>
<tr>
<td>Protection class:</td>
<td>IP 20 acc. to EN 60529</td>
</tr>
<tr>
<td>Operating temperature:</td>
<td>-20 °C to +70 °C</td>
</tr>
<tr>
<td>Input Voltage:</td>
<td>24, 36, 48, 72 or 110 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Power input:</td>
<td>max. 165 W</td>
</tr>
</tbody>
</table>

### Interfaces

<table>
<thead>
<tr>
<th>Interface</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 for MMIs</td>
<td></td>
</tr>
<tr>
<td>1 for antenna GSM-R</td>
<td></td>
</tr>
<tr>
<td>1 for digital in- and outputs</td>
<td></td>
</tr>
<tr>
<td>1 for service and diagnostics</td>
<td></td>
</tr>
<tr>
<td>1 for UIC line (optional)</td>
<td></td>
</tr>
<tr>
<td>2 RS 422 (optional)</td>
<td></td>
</tr>
<tr>
<td>1 power supply</td>
<td></td>
</tr>
<tr>
<td>1 protective earth</td>
<td></td>
</tr>
</tbody>
</table>
## MESA 23

### MTRS 1 BC: Box Compact

### Technical Parameters

- **19" construction:** 3 U / 51 HP
- **External dimensions:** 260 x 133.5 x 200 mm
- **Weight:** max. 5.5 kg
- **Protection class:** IP 54 acc. to EN 60529
- **Operating temperature:** -20 °C to +70 °C
- **Input Voltage:** $24\,V_{DC}$ (via external PS)

### Interfaces

- 2 for MMIs
- 1 for antenna GSM-R
- 1 for digital in- and outputs
- 1 for service and diagnostics
- 1 for UIC line (optional)
- 1 for UIC line (optional)
- 2 RS 422
- 1 power supply
- 1 protective earth
MESA 23
Operating Unit MMIS

Technical Parameters

- External Dimensions:
  > above mounting level: 296 x 116 x 13 mm
  > beneath mounting level: 263 x 108 x 105 mm
- Weight: max. 3.5 kg
- Protection class: Front IP 54 / Back IP 41 acc. to EN 60529
- Operating temperature: -20 °C to +55 °C
- Input Voltage: 24V\(_{dc}\) (from central unit)
- Display (black/white):
  > visible area: 360 x 128 pixels
  > 171 x 61 mm

Interfaces

- 1 to central unit
- 1 to handset
- 1 to loudspeaker / microphone with PTT
- 1 RS 422
- 1 for digital in- and outputs
- 1 for charging unit for GPH
- 1 protective earth
- 1 for Service (optical)
- 1 Brightness sensor
### MESA 23

**MMIC: Colour MMI**

- Colour TFT display to show fundamental colours according to CENELEC and UIC 612
- Assembly dimensions compatible to MMIS
- Ring tones acc. to CENELEC

#### Technical Parameters

- **External Dimensions:**
  - > above mounting level: 296 x 116 x 13 mm
  - > beneath mounting level: 263 x 108 x 105 mm
- **Weight:** max. 3.5 kg
- **Protection class:** Front IP 54 / Back IP 41 acc. to EN 60529
- **Operating temperature:** -20 °C to +55 °C
- **Input Voltage:** 24V<sub>DC</sub> (from central unit MTRS)
- **Display:** Colour

#### Interfaces

- to central unit
- to handset
- to loudspeaker / microphone with PTT
- RS 422
- digital in- and outputs
- charging unit for GPH
- Brightness sensor
- for Service: WLAN, USB and Bluetooth as option
RM26-A
Remote Radio Module acc. to UIC 751 VEI

Technical Parameters

- Construction
  - Rack: 19" rack
  - Box: closed housing
- External dimensions
  - Rack: 43 HP x 3 U x 244 mm
  - Box: (300 x 144 x 285) mm
- Protection class
  - Rack: IP 20
  - Box: IP 54
- Operating temperature: -20 °C to +55 °C
- Input Voltage: 13.8 V$_{DC}$ (via DC/DC converter)

Interfaces

- Central unit MTRS
- RS 422
- Port AR
- Antenna
- Service
- Power Supply
Port AR

Connecting Analogue Train Radio Devices

Technical Parameters

- Construction: closed housing
- External dimensions:
  - Port AR-U: (243.4 x 51.3 x 108) mm
  - Port AR-A: (193.4 x 51.3 x 108) mm
- Protection class: IP 54 acc. to EN 60529

Interfaces

- Central unit MTRS
  - Port AR-U
    - to FM 2-70
    - to further analogue devices (e.g. Koliber)
  - Port AR-A
    - to ZFM90

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Company Presentation
Portfolio
Service / Maintenance
Quality Assurance
KA 21.23

Adapter from ZFM21 to MESA 23

- Adaptation from the existing ZFM21 cabling to MESA 23 have been successfully tested and put into operation, e.g. on type series 185.1 from Bombardier.

### Technical Parameters

- **Construction:** closed housing
- **External dimensions**
  - KA 21.23.MTRS: (70 x 120 x 85) mm
  - KA 21.23.MMI: (70 x 165 x 80) mm
- **Weight**
  - KA 21.23.MTRS: 0.75 kg
  - KA 21.23.MMI: 1.5 kg
- **Protection class:** IP 20 acc. to EN 60529

### Interfaces

- **KA 21.23.MTRS**
  - to Central unit MTRS
- **KA 21.23.MMI**
  - to MMIS
KA 2D.23
Adapter for Wire Reduction

**Technical Parameters**
- Construction: closed housing
- External dimensions: (243.4 x 51.3 x 108) mm
- Protection class: IP 54 acc. to EN 60529
- Operating temperature: -20 °C to +70 °C
- Input Voltage: 24 V\text{DC}

**Interfaces**
- to MTRS or MMIS
- to two wired connection
- Power supply

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Company Presentation
Portfolio
Service / Maintenance
Quality Assurance
GSM-R Solution Poland - Migration Process

MESA 23 with Koliber VHF

### Technical Parameters

- **External Dimensions (W x H x D)**
  - e.g. MTRS 1 BC: (260 x 133.5 x 200) mm
  - MMIS: (296 x 216 x 115) mm
  - Adapter Box: (193.4 x 52.3 x 111) mm
  - KT-01 / KZ-01: (185 x 80 x 180) mm

- **Nominal Input Voltage**
  - e.g. MTRS 1 BC: 24, 36 to 48 or 72 to 110 V<sub>DC</sub> via external power supply
  - KZ-01: 15 to 220 V<sub>DC</sub>

### Interfaces

- **e.g. MTRS 1 BC:**
  - 2 MMIs, antenna GSM-R, service and diagnostics, digital I/O, UIC, 2 RS 422 / AF, power supply, protective earth

- **MMIS:**
  - Central unit, handset, loudspeaker, service, RS 422, digital I/O

- **VHF Radio KT-01:**
  - Antenna VHF, antenna GPS, service/date, control interface

- **Power Supply Unit KZ-01:**
  - Power supply from loco and to KT-01
# GSM-R Solution Austria - Migration Process

## MESA 23 connected to ZFM90

![Diagram of devices connected to MESA 23](image)

### Technical Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Example 1 BC:</th>
<th>Example MMIS:</th>
<th>Example Port AR-A:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Dimensions</strong> (W x H x D)</td>
<td>(260 x 133.5 x 200) mm</td>
<td>(296 x 216 x 115) mm</td>
<td>(193.4 x 51.3 x 108) mm</td>
</tr>
<tr>
<td><strong>Nominal Input Voltage</strong></td>
<td>24, 36 to 48 or 72 to 110 V&lt;sub&gt;DC&lt;/sub&gt; via external PS</td>
<td>24 V&lt;sub&gt;DC&lt;/sub&gt; via central unit MTRS</td>
<td></td>
</tr>
</tbody>
</table>

### Interfaces

- **e.g. MTRS 1 BC:**
  - 2 MMIs, antenna GSM-R, service and diagnostics, digital I/O, UIC,
  - 2 RS 422/AF, power supply

- **MMIS:**
  - Central unit, handset, loudspeaker, service, RS 422, digital I/O

- **Port AR-A:**
  - Central unit MTRS, ZFM90
## PortBox Ultralite

**Portable Cab Radio**

<table>
<thead>
<tr>
<th>Technical Parameters</th>
<th>Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Dimensions:</strong></td>
<td>1 for GSM-R antennae</td>
</tr>
<tr>
<td>252 x 75 x 391 mm without QuickFix</td>
<td>1 for service</td>
</tr>
<tr>
<td><strong>Weight:</strong></td>
<td>1 for external loudspeaker</td>
</tr>
<tr>
<td>about 7 kg</td>
<td>1 for voice recorder</td>
</tr>
<tr>
<td><strong>Protection class:</strong></td>
<td>1 for DSD</td>
</tr>
<tr>
<td>IP 54 acc. to EN 60529</td>
<td>1 contact „external alarm“</td>
</tr>
<tr>
<td><strong>Operating temperature:</strong></td>
<td>1 for power supply</td>
</tr>
<tr>
<td>-20 °C to +70 °C</td>
<td>1 protective earth</td>
</tr>
<tr>
<td><strong>Input Voltage:</strong></td>
<td></td>
</tr>
</tbody>
</table>
Service and Maintenance
Support offered by Funkwerk
Service around the Cab Radio

- Project Management
- Engineering
- Training
- Homologation
- Documentation
- Delivery of Accessories
- Add-on Equipment
- Installation
- Commissioning
- After Sales Service
Standard After Sales Service

First Level → Local Workshops

Second Level → Local Workshops → Hotline Support

Third Level → On-Site Support

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- Company Presentation
- Portfolio
- Service / Maintenance
- Quality Assurance
Translation, Adaptation and Amendment

- User manual (incl. in offer)
- Installation manual
- Commissioning manual
- Maintenance manual (incl. in offer)
- System description
- Description of all components
Quality Assurance
Quality Management

- Certified according to DIN EN ISO 9001:2000
- EC-Certificate from Eisenbahnbundesamt (federal railway administration)
- Certificated through DB AG as Q1-supplier
- Certificated through DB AG as A-supplier
- IRIS certification in preparation
Thank you for your attention

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