Digital and analogue Train Radio Systems

Innovative Solutions from a Single Source
Funkwerk AG

Traffic & Control Communication

Funkwerk distinguishes itself as a medium-sized business in the area of the professional communication systems by flexibility and quick reaction to the market.

Funkwerk has single-mindedly developed and expanded three segments, Traffic & Control Communication, Automotive Communication and Security Communication.

In the Segment Traffic & Control Communication - Business Unit: Rolling Stock we operate for many years as a specialist for communication systems for the railway companies.

In Europe, Funkwerk is now at the forefront of professional radio equipment featuring the digital mobile radio standard GSM-R (Global System for Mobile Communication), holding a market share of over 50%, and delivers best performance recognised on a global scale.

By integrating pioneering technologies in our developments, taking into account state of the art standards, complete system solutions are created by Funkwerk which satisfy future expectations too through their modularity.

History

1945
Foundation of Neutrowerk GmbH
Manufacturing of consumer durables (Lamps, cooking pots, radios)

1948
Nationalisation to the VEB Funkwerk Kölleda
Specialist public address technology, hearing aids and intercom systems

1981
First train radio system

1990
Funkwerk Kölleda GmbH under the umbrella of the „Treuhandanstalt“, the German privatisation agency following reunification

1992
Foundation of Hörmann Funkwerk Kölleda GmbH
Integration into the Hörmann Group

2000
Foundation of Funkwerk Aktiengesellschaft and flotation on the stock market

2012
Merger of Hörmann-Funkwerk Kölleda GmbH (FWK) with and into Funkwerk AG
Quality assurance is an integral part of our business policy and is a process which penetrates the whole company.

Regularly performed audits ensure the effectiveness and updating of the control and inspection processes. All the necessary processes are defined in the quality management manual (QMH).

Our quality management system makes project progress transparent and continuously documents all steps in the collaboration with our customers. It has a process-oriented structure and integrates the related requirements of occupational and system safety. It is understood to be a priority corporate task and was introduced, implemented and is monitored under the responsibility of the executive management. External organisations are involved in the form of services to provide expert support. The procedures practiced within the company implement the DIN EN ISO 9001 process model.

Since 2010 we are certified according to IRIS (International Railway Industry Standard)

Service and documentation

In the after-sales department we offer our customers a competent and comprehensive service / customer service for our communications systems. This includes sound technical product documentation and training.
GSM-R: The analog radio network reached its limits due to the rapidly growing communications traffic volume and the demand for increased economy, efficiency and safety of railway traffic.

Against the background of a merging Europe and increasing globalisation, the European rail network management bodies undertook to introduce the digital communication network GSM-R and to ensure European interoperability.

Funkwerk can proudly call itself European market leader in the mobile GSM-R train radiotelephony systems (cab radio) segment.

GSM-R (Global System for Mobile Communication for Railways) is the new standard for information transfer within European rail traffic. As part of the ever-faster progressing European harmonisation and the associated demand for railway traffic interoperability, 32 European railway companies have decided to introduce this forward-looking technology.

With this revolutionary technology change, Funkwerk is utilising its lead as the main supplier of mobile telephony terminals in the railway sector. This position has been single-mindedly developed in recent years with an emphasis on the Europe-wide introduction of voice and data communication via GSM-R (GSM-R voice and ETCS).

Development of the new generation of mobile railway radio telecommunications terminals is an important technological innovation and the driving force behind our success. For railway traffic the new single and dual mode terminals and the resulting possibility of radio-based operations mean a quantum leap with respect to safety and efficiency.

As a provider and supplier of GSM-R system solutions for radio telephony equipment, Funkwerk has various product versions, which we specially develop and produce tailored to customers’ wishes. With the further development of our device generation, based on the latest GSM-R standard and the many years of experience of our team of employees, we offer an individual system solution which can be adapted to the needs of its users.
The “mobile radio systems” centre of excellence develops and sells professional radio equipment throughout Europe. This makes us the market leader in Europe.

Our train radio systems conform to European standards and have top service quality parameters. The modular structure makes adaptation to customer-specific types possible. For example, Funkwerk develops and produces product variations of GSM-R terminal devices tailored to customer wishes and dual mode devices (analog-digital) for the changeover phase.

Our GSM-R mobile radio systems transfer voice and data signals. A large number of additional applications such as train control and safety (ETCS), telematics applications, information services through to on-board ticket sales and electronic seat reservation make our GSM-R systems even more attractive for every user.

As part of the GSM-R train radiotelephony system, the operating device has been especially conceived for use in rail vehicles and is intended for menu-controlled operation of the digital and analogue train radiotelephony in Germany and abroad.

The optimum display size and the logical function allocation of the soft-keys allow comfortable operation during the trip.

Funkwerk has been developing and producing analog train radiotelephony since 1982, which is in use in railway operations in Germany and further locations abroad.

Thanks to these experiences and expert’s knowledge Funkwerk has taken part in the introduction of the digital mobile radio standard GSM-R (Global System for Mobile Communication - Rail).
The requirements set for train radio devices are numerous and varied. Our product portfolio includes a large number of devices, particularly characterised by functions, mounting dimensions, class of protection and interfaces which fulfil the various requirements due to the spatial and technical conditions on rail vehicles as well as conforming to national requirements.

Apart from the realisation of different types, we attach particular importance to consistent quality and a high degree of reliability. Current reliability figures relating, e.g. in the case of the MESA 23 to 11,000 devices in service for more than 3 years, verify the success of our concept.

**Customised IP**

Electronic systems are classified in IP (ingress protection) protection classes with respect to their suitability for various environmental conditions. Our systems fulfil different protection classes depending on their intended use and specification.

**Interfaces from A to Z**

Depending on the device type, the following are supported: Ethernet, Bluetooth, RS 232, RS 422, RS 485, Infrared, UIC, ZUB/IBIS, VACMA/DSD, NULOC, MV B, digital inputs and outputs ...

**Dual-Mode / Triple-Mode**

A combination of GSM-R device and UIC analogue radio device is a dual-mode-device. These and the country specific analogue radio (e.g. 2 m or 70 cm radio) is covering a triple-mode-device. The whole system is controlled centrally via the MMI and therefore standardizes operation.

**RIU-ETCS**

ETCS (European Train Control System) is an element of the harmonised European railway traffic management system (ERTMS), which will replace the various systems used in Europe with a uniform technology.

The mobile solution from Funkwerk for ETCS implementation, the data radio device RIU-ETCS consist of 2 independent radio modems with GSM-R mobile terminations MT and power supplies.

For the GPS and balise data recording of the mobile terminations MT Funkwerk offers a Datalogger. One Datalogger is needed for each mobile termination MT.
Funkwerk’s MMIs are specially designed for use in rail vehicles and enable convenient use of digital and analog train radio according to specification and European standards.

**Operator philosophy**

Apart from continuously available hard key functions the operating devices are mainly controlled using softkeys. This makes operation easier and flexible without hardware costs. Often repeating and safety-relevant features are realized with Hardkeys.

**Hardkeys**

Hardkeys are keys with a fixed function assignment independent of the current menu level and realise, e.g. the following functions:

- Emergency call
- Call to the station inspector
- Call to the train guard
- Call for train announcements
- Train – train call
- Directional keys, up and down
- Confirm the selection made
- Reset the train radio-telephony system
- All other user functions are activated using softkeys.

**Softkeys**

The functional assignment is displayed in the area immediately adjacent to the display and depends on the radio system set and the current menu level.

**Colour display**

Certain operatively important events must be displayed to the engine driver particularly clearly and unmistakably. Attention can be gained through acoustic or visual stimuli. Our colour displays using state of the art display technology support the display of coloured texts and pictograms.
GSM-R test environment TEQoS2

Terminal Environment Quality of Service

TEQoS2 is a GSM-R test environment for use during the start phase of a new GSM-R network and during the normal operational and optimization process, to ensure the quality of the GSM-R subsystem.

The GSM-R MT2 radio module is the heart of the TEQoS2 and represents the interface between all railway applications used for the GSM-R network and the fixed network infrastructure.

The main functions of TEQoS2 are:
- Tracing GSM layer 2+3
- Measurement and graphic display of quality and field strength
- Coverage tests
- Measurement of adjacent cells
- Power level and quality
- GPS position finding and data reference

As a link between the GSM-R network and mobile train radio devices, the MT2, MT3, MT3++, MT5 and MT6 (MT=Mobile Termination) is compatible with the first generation of GSM-R mobile terminations (MT) and provides two serial ports and the antenna connection on the front and a 96-pin connector at the rear.

The result of this design approach is a continuous and reliable radio service which helps the railway operator to cut maintenance costs substantially. The highly modern electronics with a very compact design are enclosed in a robust die cast housing which withstands even the most adverse conditions in the rough environment of a train.
The focX®-products have been designed for the specific market needs of the European railway operators. Based on the design concept a highly efficient technological platform for GSM-R can be offered.

All focX®-handhelds are already prepared with a transceiver that supports the future use of the GSM-R frequency band extension from 4 to 7 MHz.

Transceiver minifocX®

The product family focX® is based on a new transceiver MinifocX® that has been specifically developed by Funkwerk in order to serve railway applications. This new transceiver generation covers the following innovations:

Fast network registration due to preferred scanning of band segments (GSM-R, GSM900, DCS1800, PCS1900)

Hardware readiness for GSM-R frequency band extension up to 35 RF channels (Uplink: 873.2 – 880 MHz / Downlink: 918.2 – 925 MHz)

focX® family

The focX® handhelds are offered as shuntfocX® with the shunting software application module of GSM-R, dedicated for shunting operations in Point To Point or group calling mode and as railfocX® without the shunting function.

The dualfocX® with or without shunting software application ensures with the added transceiver the operation in 2 networks (Dual-Mode). Ideally this handheld is either suitable for railway operators who did not yet launch GSM-R throughout their whole service areas or for railway operators who want to use Direct Mode (simplex) based on the UIC 450 MHz frequency band in GSM-R traffic hot-spots where no additional GSM-R frequency resources are available (e.g. big shunting yards). Optionally the focX handhelds is also available with a GPS receiver, RF monitoring application, Geo-fencing application and lone worker function (tilting sensor).

Desk radio terminal deskfocX®

The deskfocX® is a complete GSM-R radio terminal as a comfortable desk device with handsfree equipment. The hardware and software of these is based on the 2W-GSM-R handheld product line focX®. The handling is so easy, as those of a handheld.

The user has alternatively the possibility to telephone in the GSM-R net by means of the telephone handset or the handsfree equipment (PTT button, gooseneck microphone, loudspeaker)

The focX®-Handhelds are designed for protection class IP65. With their dust and water-jet protection characteristics they are capable to be used under harsh environmental conditions. The transflective display allows a good readability of user information even under direct sunlight exposure.
Manufacturing of high integrated printed circuits

Highly qualified, skilled personnel, optimised logistics, state of the art production lines and control systems are basic requirements for the production of our high-quality and safety-relevant products. From pre-assembly in the warehouse to module production and final installation through to putting into service, we attach the greatest possible importance to care and precision.

Production of printed circuit board assemblies

Printed circuit boards are produced by a flexible, fully automatic SMD assembly line or at semi-automatic assembly workstations. A high quality of the assemblies is granted due to the 100% testing performed using the most modern AOI-systems and computer-aided inspection systems.

With attention to health and the environment, Funkwerk has realised RoHS-conforming printed board assemblies since 2006.

Device assembly

Difficult sub-assemblies, modules, devices and systems are produced at modern workstations using screwed, jointing and crimping techniques.

Special test technologies ensure the quality of the products which are subjected to a burn-in test (continuous running) for increased reliability requirements to remove possible early failures.

Experienced, skilled employees and engineers with a high level of know-how build complex communications systems and put them into service.

The large number of different printed circuit boards of our complex systems requires a high degree of production flexibility and dynamism. Our automatic printed circuit board production line is therefore designed for short retooling times.

The advantage for our customers

Our modern manufacturing systems serve mostly in-house production. At the same time we provide our capacities to demanding customers in Germany and abroad. Due to our technical production know-how we are able to meet also your challenging manufacturing tasks.

As full-service-provider our qualified employees as well as our infrastructure at hand are at your disposal as a matter of course.

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Cab-Radios

In recent years, Funkwerk has supplied **more than 24,000** train radio-telephony terminals (cab radios) of the type **MESA 23, MESA 24 and MESA 25** to European railway companies and vehicle manufacturers. A wide variety of types, large scope of functions, a high level of reliability and customer-focused service are the decisive pillars of our success.

With the successful entry into the world market of GSM-R technology through large orders from Deutsche Bahn AG and railway companies elsewhere in Europe, demand for GSM-R components “Made by Funkwerk” has increasingly risen.

UIC/GSM-R Handhelds focX®

Especially for the rough ambient conditions in railway companies the handheld family **focX®** had we developed on the base of the appropriate regulations for GSM-R as well as UIC 751-3. The **focX®** family provides a highly efficient technological platform for GSM-R.

The handhelds are offered as GSM-R train radio handhelds with and without shunting radio as well as dual-mode devices.

They are in different European countries (e.g., Austria ÖBB) in use.
System Solutions for Communications Technology

Success based on innovation