THE MOST ADVANCED
TRAFFIC RADAR TECHNOLOGY

Engineered and made in Germany.
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smartmicro designs, develops, and manufactures radar sensors and solutions for traffic management and automotive applications. Safer roads, an optimized flow of traffic, autonomous driving and the transformation of today’s urban areas into smart cities are the key motivations for the company. Worldwide market presence, a strong engineering team and an excellent support team are backing the growth in the ITS business. Today, smartmicro belongs to the largest manufacturers of traffic management radar sensors.
COMPANY
The company was founded in November 1997 by Prof. Dr. rer. nat. Hermann Rohling and Dr.-Ing. Ralph Mende as a spin-off of the Institute for Communications Engineering at the Technical University of Braunschweig.

Prof. Hermann Rohling recently retired from being Vice President of the Technical University of Hamburg-Harburg (TUHH) and head of the Communications Department at this university, while Dr. Ralph Mende is the Managing Director of smartmicro.

FACTS
More than 100 employees, most of them scientists, PhD-graded or highly specialized engineers form the outstanding staff of smartmicro. We work in over 3,600 m² offices and labs, and another 1,000 m² test field and production labs in two very modern company buildings close to the Technology Campus at Braunschweig Airport. More than 10 million vehicles run on smartmicro radar technology. smartmicro is an ISO9001-certified company, and maintains the highest standards in product hardware and software quality.
MULTI-LANE SENSOR
Detects up to 256 individual objects, and measures their position and speed. Lane-specific on up to 8 lanes. Up to 450 m.

REPLACES LOOPS, OUTPERFORMS VIDEO DETECTORS
One single sensor allows up to 64 virtual loops, and has higher detection performance compared to video detectors.

DETECTS MOVING AND STOPPED TRAFFIC
Detects vehicles, no matter if stopped or moving. Up to 320 km/h. No matter what traffic direction.

WORKS UNDER ALL CONDITIONS
Radar is the most robust sensing technology and is not affected by dirt, smog, sunlight, wind or sandstorms. Rain and snow have only small impact on performance. smartmicro radars are derived from automotive technology. Almost unbreakable. IP67, from −40 to +85 °C.

FIELD-PROVEN
smartmicro traffic radars are in field since 2009. Tens of thousands are deployed worldwide.

MAINTENANCE-FREE
The sensors undergo a sophisticated end-of-line test and calibration procedure, as well as a burn-in stage after production. The sensors maintain high accuracy by means of built-in self-calibration functions throughout the entire design life.
FORWARD FIRING – THE BETTER TECHNOLOGY

Unlike older side firing sensors with narrow beams, the modern smartmicro radars use multiple forward firing beams. This has many advantages. Vehicles remain inside the field of view for a much longer time, their position and speed vectors are measured with much higher quality.

Looking along the road, the mounting position is much more flexible. Either on the roadside, at the corner of an intersection, at the median of a highway or on a gantry, whatever sensor position: forward firing provides the best coverage. No setback is required for roadside pole mount, existing infrastructure like traffic light poles or street light poles can be used. Other than for older side firing radars which usually need a very high mounting position, moderate heights are sufficient.

The wide angle and the long range allow the user to define up to 64 counting or trigger zones inside the field of view. Since vehicles are tracked over a longer period when they drive in the field of view, occlusion rarely happens.

A high detection performance at intersections, and an excellent counting accuracy can be achieved. The driving behavior of vehicles can be analyzed, changes in speed can be monitored, which are often an indication for incidents.
UMRR-0C is the highest performance traffic radar available today, it has a wide field of view of up to 100 degree, and at the same time a range of up to 320 m or 450 m (long-range version). It can be used for up to 8 lanes. The multi-lane 4D object tracking sensor provides (X, Y, Z) Cartesian coordinates or polar coordinates range, azimuth, elevation angle, as well as the speed vector simultaneously for up to 256 objects.

4D/UHD capability provides highest resolution capability in scenarios where many vehicles are closely spaced, i.e. in many lanes, dense traffic, traffic jams, stop-and-go situations. smartmicro is the only company which has this new 4D/UHD technology available in production, it outperforms any other traffic radar.
UMRR-11

HIGH DEFINITION TRAFFIC RADAR

UMRR-11 features a range of up to 180 m and a coverage of up to 6 lanes. By default, the sensor provides (X, Y, Z) Cartesian coordinates or polar coordinates range, azimuth, elevation angle, as well as the speed vector of up to 126 objects simultaneously in the field of view.

Most other radar sensors on the market separate objects by one parameter, e.g. range or speed. Smartmicro’s 4D/HD technology UMRR-11 High Definition sensors separate objects by both speed and range. This leads to robust performance especially in dense traffic conditions. UMRR-11 is a very cost-efficient sensor.

4DHD
- Measurement in 4 Dimensions
- Separation in Speed
- Separation in Range

smartmicro sensors can handle curved roads
One Single Radar for Both Stop Bar and Advance Detection

Lane-Specific Advance Detection

Possibility to Add ETA, Counting, Traffic Statistic and Other Applications

STOP+ADVANCE DETECTION

The three statements above summarize the key differences to other detection products, and explain why smartmicro sensors outperform competitors at intersections. Stop+Advance saves costs both in terms of hardware and installation, by integrating many functions in one.

smartmicro HD and UHD sensors allow adaptive control strategies for intersections, because lane-specific advance detection is possible. Therefore, they represent the most universal detection technology on the market. Covering a wide field of view, the sensor provides presence information at the stop bar and at advance zones.

Stop bar, approach, advance and system loops can effectively be replaced. In addition to simple presence detection, the integrated Event Trigger Module can be used to realize dilemma zone protection, signal priority, signal phase extension and other concepts for modern actuated intersections.
**CONNECTION OPTIONS**

In order to integrate smartmicro traffic radars with intersection controllers, several interface options exist. For NEMA TS1 or TS2 compliant controllers, smartmicro offers TMIB interface cards, which can be installed in any T-170 detector rack. Vehicle detection data are routed through the back plane (TS1 mode) or through an SDLC link to the controller (TS2 mode). smartmicro also offers a general purpose relay module (Sensor Relay Option), which is directly attached to the back of the sensor. Its 8 output channels can be wired to any controller which accepts relay or Loop Detector outputs. All sensors feature physical RS485, CAN and 10/100 Ethernet interface.

**PRODUCT SELECTION**

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<th>STOP+ADVANCE</th>
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<td>Ultra-High Definition Model:</td>
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<td>☑ UMRR-0C Type 42/43 up to 340 m (1,115 ft) and covering up to 8 lanes</td>
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<td><strong>4D/HD</strong></td>
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<td>High Definition Model:</td>
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<tr>
<td>☑ UMRR-11 Type 44/45 up to 180 m (590 ft) and covering up to 6 lanes</td>
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<tr>
<td><strong>3D/UHD, 4D/UHD</strong></td>
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<td>☑ UMRR-0C Type 40 up to 450 m (1,476 ft) and covering up to 6 lanes</td>
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<tr>
<td>☑ UMRR-11 Type 45 up to 180 m (590 ft) and covering up to 4 lanes</td>
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Forward+ combines counting and classification, with incident- and wrong-way detection. smartmicro Forward+ traffic radars feature the most advanced 4D object tracking radar technology in the market today. The sensor projects a low power microwave beam on the road and captures all objects inside the field of view. The patented radar principle allows real-time direct measurement of range, speed and azimuth angle (lane position) of all vehicles simultaneously even in complex conditions. Detection happens many times per second, and an object tracking algorithm monitors all vehicles over time. As a result all objects in the field of view will be reliably detected and reported with excellent precision for position, speed vector and lane index. smartmicro Forward+ sensors deliver the highest speed accuracy available today and can detect stopped vehicles or wrong way driving.
TRAFFIC COUNTING AND CLASSIFICATION

Forward+ sensors deliver traffic statistic data. Looking along the road in a forward firing configuration, up to 8 lanes are covered, dual direction. For all traffic objects simultaneously, it provides instantaneous x, y position, and speed vector along with classification, lane index and other information. Such object data can be streamed in real time to any traffic operations centre. Alternatively, traffic statistic data can be collected and reported on demand (polling mode), or in push mode for pre-defined time periods.

The traffic statistic data (per lane) are as follows:

- Volume / Class
- Occupancy
- Average Speed
- 85th percentile speed
- Headway
- Gap

Installation and alignment are quick and simple, typically using a pole mount position at the road side on standard infrastructure (light poles or traffic signs) – no setback needed. This saves hardware- and installation costs. smartmicro Forward+ is the only multi-lane traffic counting sensor which can optionally be gantry-mounted. Due to the very low power consumption, the sensor can be supplied by solar panels or batteries. This makes it the perfect sensor for mobile counting stations. Because of the modular application software design principle, the applications counting and classification, incident- and wrong-way detection can be combined.
WRONG-WAY DETECTION

Wrong-way driving is one of the most dangerous situations, such events can be detected quickly and reliably by smartmicro traffic radars. Measuring the speed vector of every individual vehicle very accurately, for both driving directions, for up to 8 lanes, the radar’s application software will find and report wrong-way drivers immediately. On-/Off-ramps can be monitored. The sensor can easily be integrated into existing systems.

INCIDENT DETECTION

For incident detection applications, using Event Trigger Module, zones of interest can be defined and can be combined with a specific event. If, for example, a car stops in the middle of a road or at the hard shoulder, the sensor can send a trigger message. Because of the excellent speed accuracy, and with vehicles being tracked over a long period, the driving behavior of vehicles can be analyzed. Changes in speed will be detected immediately, vehicles slowing down are often an indication for possible incidents. No other sensor technology, not even loops, is able to provide this information. The transmission to the control center of real-time occupancy, and the very precise average speed parameters make it possible for freeway monitoring systems to determine if and where an accident has happened.

PRODUCT SELECTION

FORWARD+

3D/UHD, 4D/UHD
Ultra High Definition Model:
UMRR-OC Type 42/43 up to 340 m (1,115 ft) and covering up to 8 lanes.

3D/HD, 4D/HD
High Definition Model:
- UMRR-OC Type 40 up to 450 m (1,476 ft) and covering up to 6 lanes.
- UMRR-11 Type 44/45 up to 180 m (590 ft) and covering up to 6 lanes.
BENCHMARKS

APPRECIATED BY CUSTOMERS
In a customer benchmark test on a German highway, one of smartmicro’s international OEM partners highlighted the outstanding out-of-the-box performance of the UMRR-0C 3D/UHD ultra-high definition traffic radar product line. One sensor Type 42 was mounted on a busy 4-lane highway in Bavaria near Munich. For the evaluation, the radar data were compared to a reference detection rate of 98.7%. Beside the excellent performance, the customer especially liked the straight-forward and quick setup, and installation of the radar.

CERTIFIED BY INDEPENDENT TEST LABS
During certification testing at renowned Swiss test lab METAS, tests with speed references have proven a speed accuracy of over 99%. As a result, 3D/UHD are OIML-R91- and OIML-D11-certified.

SMART CITIES WITH FILERADAR
Everybody talks about Smart Cities. And smartmicro’s traffic management radar sensor technology is an enabler for such Smart Cities, providing precise real-time data for the traffic flow on arterials and intersections. Together with our innovative partner Fileradar, smartmicro supplied hundreds of Advance+3D/HD long-range radar sensors for queue length estimation at many intersections in Utrecht, Rotterdam and other cities in the Netherlands.

Each radar sensor covers maximum 6 approach lanes and has a range of up to 450 m. Vehicles which are slowing down, or which are stopping, can be reliably detected. The data are fed real-time into Fileradar’s innovative and proprietary queue length algorithms to precisely determine the length of the waiting queue. The equipped intersections have become fully adaptive, and control the traffic flow decentrally, based on the queues of several intersections. Fileradar created a web interface to visualize the radar-based queue length situation country-wide, along with other sensor data. The solution is being adopted by more and more cities in the Netherlands.

FORWARD+3D/HD BENCHMARK WINNER
smartmicro’s Forward+3D/HD was the winner of an independent benchmark in Finland, and showed outstanding performance. The target was to compare various non-intrusive detection technologies with loop detectors, in terms of detection rate, all-weather performance and total cost of ownership. The testing period was selected in the challenging winter time in Finland between October 2016 and January 2017, and the sensors were mainly used for Stop Bar and Advance detection.

Among all sensors tested, Forward+3DHD is the only sensor doing Stop Bar and Advance detection in one single device. According to the test authority: “smartmicro detectors have unlimited possibilities to define multiple detection areas and collect traffic data easily. This ability enables traffic departments to control the traffic flow based on live data.” Rough weather conditions have almost no effect on the performance of the sensor. The counting results as well as the Stop Bar performance both showed accuracy values of 99%. Radar detectors in general have lower lifecycle- and investment costs than loops.
ENFORCEMENT

- Stationary Speed Enforcement
- Red Light Enforcement
- Mobile Speed Enforcement
- Certified by Independent Test Labs
The most advanced 4D/UHD object tracking radar technology provides certified, highly accurate and reliable speed and position data for enforcement applications. For many vehicles and multiple lanes simultaneously. No matter if approaching or receding. More than 20 times per second from 0.1 m/s to 88 m/s (320 km/h).

Built-in redundancy is another advantage. In fact, there is double redundancy: 1) having two independent receive antennas, the values measured by both must be perfectly matching to enable a reported speed; 2) the speed is measured firstly by the Doppler shift and secondly by the range progress over time, the two measurements being independent and redundant.
JUNCTION BOX

The smartmicro Junction Box (JBOX) offers a simple and reliable way to connect any UMRR sensor to any home run cable, which connects the sensor to the cabi-net. It can accommodate a wide range of customer cables, which are run through a water tight sealing, then connected to a terminal block. The JBOX directly attaches to the sensor, IP67 protection level is retained. No soldering and no external connection box is required. In addition to providing ease of installation, the JBOX also protects the radar from voltage surges and overvoltage.

TMIB – DETECTOR CARD

The Traffic Management Interface Board (TMIB) connects up to 4 smartmicro traffic radars of an intersection and interfaces those to all common intersection cont-rollers. For the US market, there is NEMA TS1/TS2 compliance and SDLC interface available. For other markets and controller types, there are 16 opto-isolated contacts available. The data of all 4 radars are available at one single Ethernet interface. The configuration of the complete intersec-tion, virtual loops, ETA triggers and more happens conveniently through this Ethernet port, using the EASY MODE software. TMIB also provides surge and overvoltage protection for all connected sensors.
RELAY OPTION

The Sensor Relay Option (SRO) is an add-on module. It can be attached to the back of the sensor. The SRO offers 8 hardware relays and surge protection in addition to the UMRR’s CAN or RS485 or Ethernet communication interface. With the Sensor Relay Option, you can implement your relay-based applications without the need of an additional controller unit.

Features:
- No additional controller needed
- 8 configurable solid state relays
- Available as normally-open (NO) or normally-closed (NC) contacts

BRACKETS

Straight brackets and advanced brackets are available for every sensor model. The straight bracket is intended for poles, while the advanced bracket supports adjustment in two axes.

INTERFACE TO NEMA TS2 TRAFFIC CONTROLLER

UMRR

TMIB

PC WITH EASY MODE SOFTWARE

NEMA TS2 TRAFFIC CONTROLLER
smartmicro offers a demo kit which can be used to test the radar performance under real-world conditions, and to get hands-on experience. The demo kit typically consists of:

- UMRR Radar Sensor
- RS485 Serial to USB Adaptor
- Test Cable
- Mounting Bracket for Poles or Tripods

The kit comes ready-to-run, just a power supply is required, as well as the installation of the EASY MODE software, which can be loaded from the smartmicro website. A quick guide document is available, and the smartmicro support team is always there for questions and support.
The Easy Mode Installation Wizard makes planning and field installation of sensors simple, as an intuitive step-by-step guide, starting with site planning over sensor selection, and configuration to physically installing the radar at an intersection. Just one simple window for settings, and a map for the visualization, Easy Mode helps and explains all settings. Remarkable features are „local awareness“ and „guided alignment“, meaning that the sensor itself provides feedback to the installer about where it is mounted and how well it is physically aligned/ pointed towards the area of an intersection which shall be covered.

7-STEP SETUP PROCESS
After the location has been chosen (1), a satellite image is automatically fetched from a number of map providers and scaled to the correct dimensions (2). Lanes and Stop Bar position may also be loaded from the (high resolution) map if available. Detection zones are configured by drag & drop (3). When basic setup is complete, the mounting positions for one or more radar sensors are proposed/selected (4). Next, detection zones are assigned to the appropriate radars (5). The radar is then connected using the Interface Wizard (6). In the field at an intersection, the guided alignment feature will help to physically adjust the radar correctly (7).
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