

## **Project Documentation** | UMRR Automotive Type 132 Data Sheet

---

**Project Number:**

**SMS Project Number:**

**Project Title:**

Automotive Radar Sensor

**Keyword(s):**

UMRR Automotive Sensor Data Sheet

Collision Warning Radar

Forward Collision Warning

**Date:**

November 27, 2018

**Document:**

UMRR Automotive Type 132 Data Sheet.docx

**PROPRIETARY**

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## Contents

1	User Safety Warning Information .....	3
2	Sensor Data Sheet .....	5
2.1	General Performance Data .....	6
2.2	Applications .....	7
2.3	Function Description .....	8
2.4	Multi-Mode Operation and Adaptive Beams .....	9
2.5	Object Separation Performance .....	10
2.6	Field of View .....	11
2.7	On-board Diagnostics (BIT) .....	13
2.8	Ethernet Connection .....	13
2.9	Compliance .....	13
2.10	Sensor Description and Hardware ID .....	14
2.11	Sensor Dimensions .....	15
2.12	Connector Pin-Out .....	17
3	Multi Sensor Systems .....	18
3.1	Configurations .....	18
3.2	Data Logging and Visualization Tools .....	18
3.3	Single sensor configuration for forward collision warning .....	19
4	Important Legal Disclaimer Notice .....	20
5	Contact .....	21

### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 1 User Safety Warning Information

Read the instructions carefully before you start to work.

### Installation

Please observe the following advices when installing and connecting the sensors:

- Only use provided or approved equipment for installation. Use stainless screws with metric thread M3x8. Screw length must be adapted if the customer uses own brackets.
- Only skilled and instructed persons shall install and connect the devices. Proper experience in working with mains voltage, electrical and electronic devices is required.
- **Don't connect the devices directly to mains voltage, instead** use the voltage given in the manual.
- **Don't wire any connections while power is applied to the device.**
- Ground the devices carefully to prevent electrical shock.
- All connectors are pin-coded and fit in only one position. Also note the arrows indicating the top side of the sensor.
- Only use fully functional equipment (ladders, aerial work platform, ...) **when working** above ground. Staff shall be capable of working at heights.
- Use caution when installing the devices on or around active roadways. Pay attention to moving traffic.
- Mount the devices carefully to prevent them from shifting or dropping.
- The devices must be mounted to a stiff and solid support. Vibration, oscillation or any kind of movement will reduce the sensor performance.
- Make sure that your installation methods are in accordance with local safety policy and procedures and company practices.

### Technical service

Only use provided or approved equipment for operation.

Persons other than authorized and approved electrical technicians shall NOT attempt to connect this unit to a power supply, Traffic Management Interface Board and/or other controllers, as there is a risk of electrical shock by unsafe handling of the power source.

Do not attempt to service or repair this unit.

- No user-maintainable parts are contained within the device.
- To avoid electrical shock, do not remove or open the cover.
- Unauthorized opening will void all warranties.
- Smartmicro is not liable for any damages or harms caused by unauthorized attempts to open or repair the device.

### Radiation

This product has been tested and found to comply with Part 15 Subpart C of the Federal Communications Commission (FCC) or the European RED directive, or other national rules, depending on the country where it may be in use.

#### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This device generates radio frequency energy.

There are strict limits on continuous emission power levels. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

- Human exposure to transmitted waves from this device is generally considered as safe.
- Nevertheless, it is considered good practice that humans are not subject to higher radiation levels than necessary.
- This device may interfere with other devices using the same frequency band.

## **Operation**

Transmission of radio frequency waves starts after the sensor is powered up and stops when disconnecting it from power.

Using a JBOX or SRO does not influence sensor performance.

For testing purposes, the sensor may be laid on its face when it is powered up, given that the surface or connectors will not be damaged by doing so. Please note that this position is not intended for permanent use.

It is recommended that only one connection interface is used at a time.

Do not operate the device if the device itself or any cables are damaged.

The sensors may become hot during operation, so proper hand protection is recommended for maintenance work.

### **PROPRIETARY**

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 2 Sensor Data Sheet

Smartmicro offers a family of automotive Radar sensors called UMRR – Universal Medium Range Radar.

A number of different antennas are available - so the permanent fixed field of view and maximum range can be selected by the customer.

This data sheet describes the UMRR-11 type-132 **4D/UHD** High Definition antenna model.

Type-132 antenna features both long- and medium range modes with both narrow antenna beam and wide beam respectively.



Figure 1: Automotive Sensor Type 132 – front and rear view.

Also available on request:

- Other versions of the housing for OEM integration.
- Other connector options.
- Other physical interface options.

For more details please [contact us](#).

### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 2.1 General Performance Data

Parameter		Specification	
		Long Range Mode	Medium/Short Range Mode
Operating Frequency [GHz]		76 (76...77)	76 (76...77)
Range <sup>I</sup>	Min/Max [m] <sup>I</sup>	Min: 1.0 Max: 175	Min: 0.5 Max: 64
	Discrimination[m]	≤1.8	< 0.66
	Accuracy [m]	< 0.5 or 1% (bigger of)	< 0.25 or 1% (bigger of)
Velocity	Min/Max [km/h] <sup>V</sup>	-400 ... +200	-340 ... +170
	Discrimination[m/s]	< 0.26	< 0.26
	Accuracy [m/s]	≤ 0.1	≤ 0.1
Angle <sup>II</sup>	FoV of Azimuth [°]	-16...+16 (narrow beam)	-50...+50 (wide beam)
	FoV of Elevation [°]	-7.5...+7.5	-7.5...+7.5
	Discrimination of Azimuth [°]	4	15
	Accuracy of Azimuth [°] <sup>III</sup>	≤ 0.25	≤ 0.5
	Accuracy of Elevation [°] <sup>III</sup>	≤ 0.5	≤ 0.5
Initialization Time [s]		< 2	
Update Cycle Time [ms]		≤ 55	
Processing Latency [ms]		2-4 Cycles	
Operating Voltage [V] <sup>IV</sup>		8 ... 32	
Power Consumption [w]		< 5	
Max. Transmit Power (EIRP) [dBm]		<25	
Operating Temperature [°C]		-40 ... +85	
Storage Temperature [°C]		-40 ... +85	
Sensor Weight [g]		≤ 200	
Dimension (H/W/D) [mm]		95x85x34 plus connector	
Interfaces		2xCAN V2.0b (passive) 2xCAN FD (optional) Gbit Ethernet (optional) Ethernet 100Mbit	
Connector		Hirose LF10 series	
Model No.		UMRR-11xxxx	
Shock [g <sub>rms</sub> ]		100	
Vibration [g <sub>rms</sub> ]		14	
IP		67	
Pressure / Transport altitude [m]		0...10.000	

**Table 1: Performance Parameters**

<sup>I</sup> Typical values; may vary to higher or lower values depending on clutter environment. All values given for bore sight. Please note that the Radar system – like any other sensor system – although being well optimized and providing excellent performance, will not achieve a 100% detection probability and will not achieve a false alarm rate equal to zero. Presence detection below is available. Minimum range may be reduced customer specific depending on local frequency regulations.

<sup>II</sup> Total field of view is angle interval where reflectors can be detected; 3dB field of view is narrower. Accuracy specified at bore sight.

<sup>III</sup> Measured for point reflector at bore sight with >23dB S/N. Falls off toward larger absolute angles.

<sup>IV</sup> Measured at connector.

### PROPRIETARY

The information contained in this document may be subject to change without notice.

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 2.2 Applications

It can be used for long and medium range collision warning (CW), adaptive cruise control **(ACC)** applications in **autonomous driving systems**.

One or multiple sensors are specifically integrated into vehicle models of automotive OEMs. Usually there is a certain OEM-specific engineering effort required for the adaptation to specific vehicle models and the test and qualification procedures to be applied. Customer specific connectors, CAN(FD)/Ethernet interfaces, tracking algorithms, warning algorithms or other custom software packages can be included.

Examples:

- **Autonomous driving**
- **Adaptive cruise control (ACC)**
- **Advanced emergency braking (AEB)**
- **Forward collision warning (FCW)**
- **Rear collision warning (RCW)**

Functional Safety:

This sensor can optionally be compliant to ASIL Level B in customer specific projects (requirements and safety concept to be agreed between OEM and smartmicro).

AUTOSAR:

This sensor can optionally be offered with AUTOSAR compliant software in customer specific projects (specification to be agreed between OEM and smartmicro).

### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 2.3 Function Description

The sensor is a small, lightweight, very robust low cost 77-GHz Radar for automotive applications. It is intended for multiple applications and can be used almost worldwide in this frequency band.

It works in adverse conditions, almost unaffected by weather, and independent of sunlight, in a wide temperature interval. The radar withstands high shock and vibration levels, is maintenance free and made for a long lifetime.

Using a patented transmit signal waveform, each individual sensor measures range, radial speed, azimuth and elevation angle, reflectivity and other parameters of multiple stationary and moving reflectors (**targets**) simultaneously. Having multi target capability, the sensor will report many reflectors at a time being within the field of view (**target list**):

- Range
- Az. and El. Angle
- Radial Speed
- Reflectivity
- **Other...**

Additional (optional) filter algorithms are implemented (for certain applications) for the tracking of all detected reflectors over time, those tracking algorithms are integrated in the sensor. Multiple **objects** are tracked simultaneously; the individual reflectors are separated in the detection algorithms by having a different radial speed value and/or different range value and/or by different az. angles, as well as by the tracking algorithms and data base. The result of the tracking is an **object list** with the following parameters:

- x position
- y position
- x component of the velocity
- y component of the velocity
- **other...**

Finally based on all detected targets and tracked objects in the field of view a function/application algorithm can optionally be implemented, like adaptive cruise control or **collision warning** signal.

Hence the sensor optionally reports such a list of all tracked objects, including stationary objects, inside its field of view in every measurement cycle of typ. 50ms length.

In addition to that, status and diagnose data from the sensor are reported.

### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.



## 2.4 Multi-Mode Operation and Adaptive Beams

Note that UMRR-11 type-132 also **allows to switch between medium and long-range mode**. This changes waveform and detection performance.

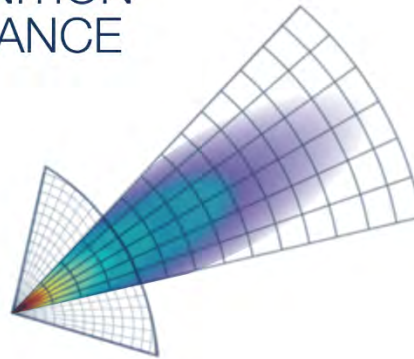
In addition to that, and independently, **narrow beam (ACC) and wide beam (AEB) operation** can be selected.

**Narrow beam (ACC) mode can be selected for long range and wide beam (AEB) mode can be selected for medium/short range.**

### ULTRA HIGH DEFINITION RADAR PERFORMANCE

#### 4D/UHD

- Separation in Speed
- Separation in Range
- Separation in Angle
- High Speed Modulation
- Adaptive Beams



**Figure 2: 4D/UHD graphical illustration for medium/short range mode with wide beam and long-range mode with narrow beam.**

#### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 2.5 Object Separation Performance

UMRR-11xxxx features the latest technology automotive radar sensors: **4D/UHD**. For each reflector, there is a true **4D** measurement of range, Doppler, azimuth and elevation angle.

UMRR-11xxxx can accomplish range gate specific and even angular gate specific detection of moving and even stationary vehicles. In each of these gates a separate Doppler detection is possible, including stationary detectors.

**The sensor provides excellent target separation (UHD).** Individual reflectors are separated in the detection algorithms by:

- a) having a different radial speed value **OR**
- b) having a different range value **OR**
- c) having a different azimuth angular position.

### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

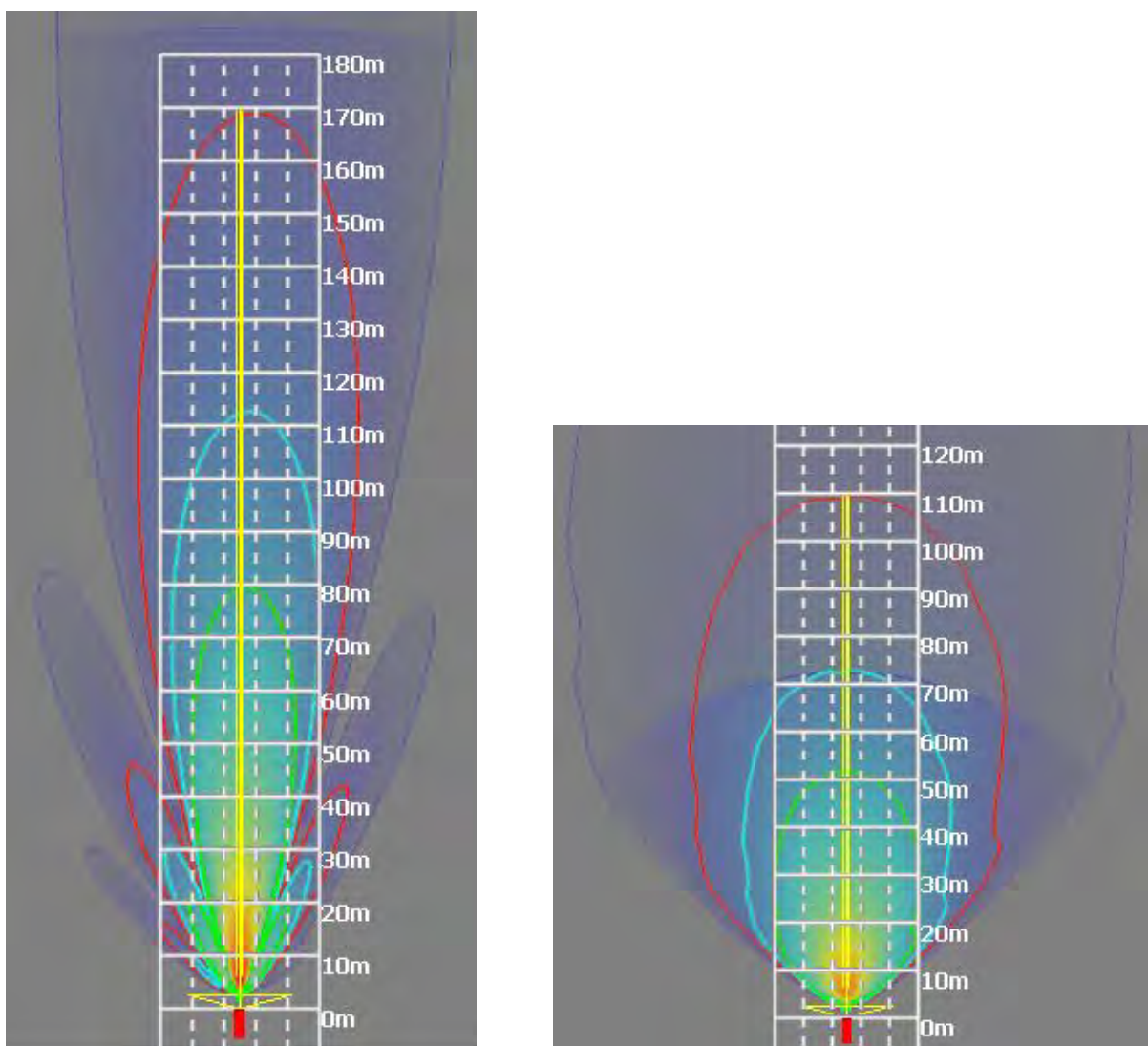
The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 2.6 Field of View

The sensor is equipped with narrow and broad antenna beams. Antenna with narrow beam mode can be used for the applications like ACC/FCW, where antenna with broad beam mode can be used for AEB and RCW applications.

Both antenna modes have their maximum range at bore sight. A typical configuration is shown below.

The figures below show typical sensor configuration with antenna field of view and for rear and forward collision warnings.



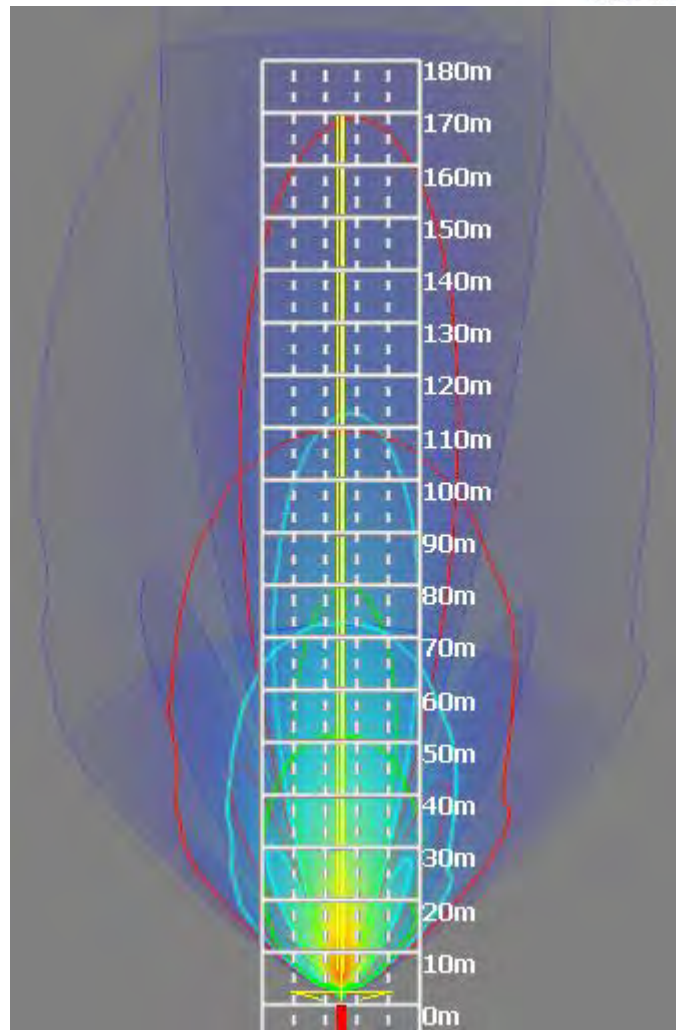
**Figure 3: Front sensor configuration with narrow and broad antenna field of view.**

Colors indicate field of view for **truck**, **passenger car**, **motorbike**, **pedestrian**.

### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.



**Figure 4: Front sensor configuration with combined narrow and broad antenna field of view.**

Colors indicate field of view for **truck**, **passenger car**, **motorbike**, **pedestrian**.

**PROPRIETARY**

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 2.7 On-board Diagnostics (BIT)

The UMRR sensor cyclically reports a status message providing the following information (Continuous BIT)

- Sensor run time
- Sensor cycle time
- Sensor mode
- Other status bits

Initiated BIT is available. Sensor will send BIT results when it receives a command to do so.

## 2.8 Ethernet Connection

The sensor supports point-top-point connection or connections via switches inside an intranet. Connections involving the world wide web are not natively supported.

## 2.9 Compliance

EU RED directive (pending),  
ETSI EN 301-091 (pending),  
FCC part 15.253 (pending),  
RSS-251 (pending)

CE  
ROHS

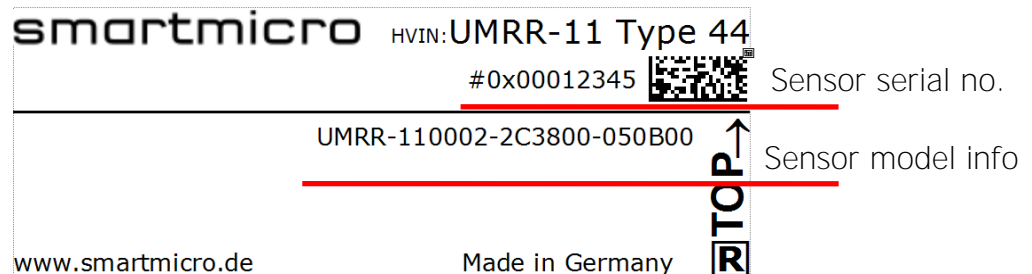
### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 2.10 Sensor Description and Hardware ID

Every UMRR sensor housing is tagged with a type sticker containing the product description and the serial number. It also contains a mark which side of the sensor is top.



**Figure 5: Type sticker example**

The individual sensors are referred to as **UMRR-xyyyz-aabbcc-ddeeff**

- xx** (DSP Board Generation xx)
- yy** (DSP Board Derivative/Version yy)
- zz** (DSP Board Revision zz)
  
- aa** (RF Board (Antenna) aa)
- bb** (RF Board Derivative/Version bb)
- cc** (RF Board Revision cc)
  
- dd** (Housing type dd)
- ee** (Housing Version ee)
- ff** (Housing Revision ff)

UMRR means Universal Medium Range Radar platform developed by Smartmicro.

The number in the top right corner is the unique serial number of the sensor.

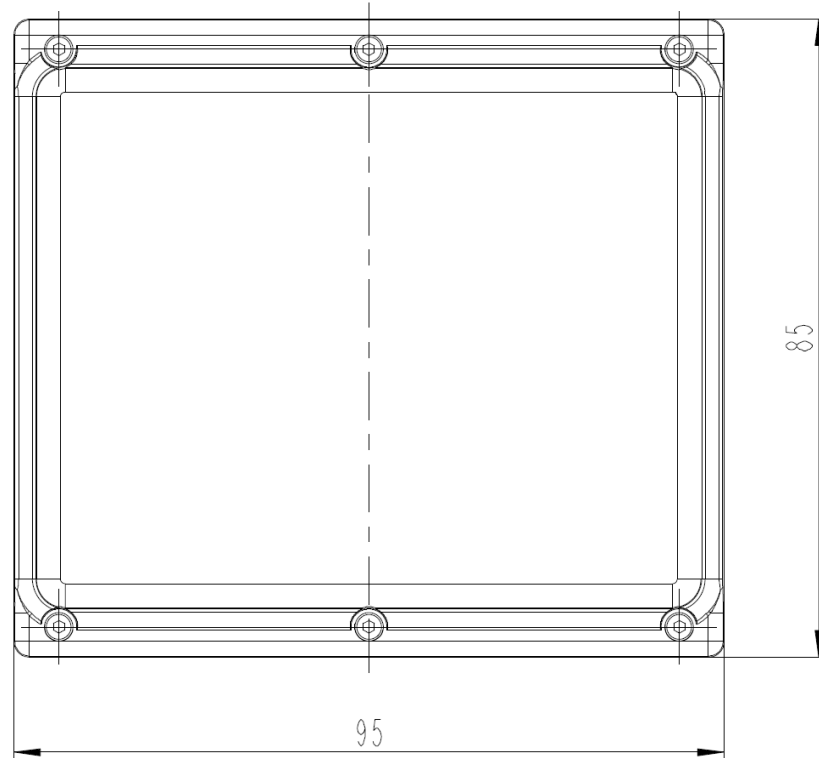
**PROPRIETARY**

**The information contained in this document may be subject to change without notice.**

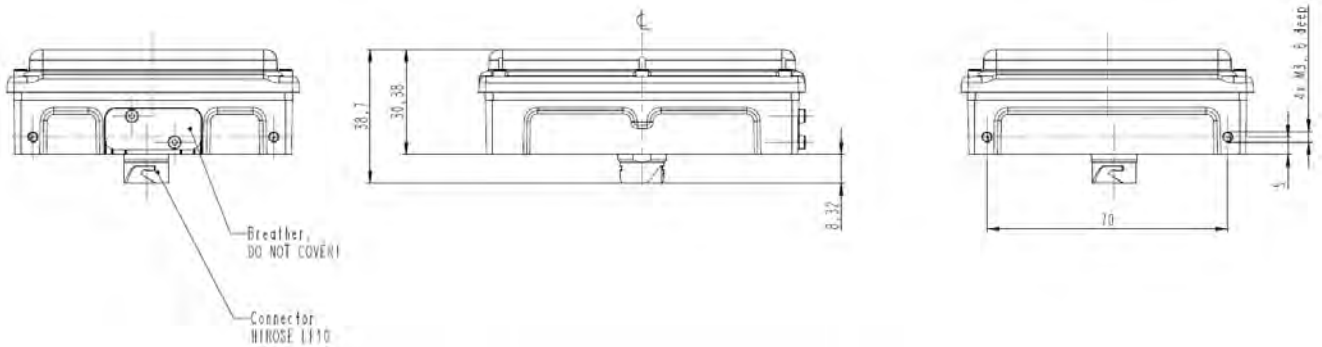
The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 2.11 Sensor Dimensions

All values are given in mm.



**Figure 6: Sensor Front side.**

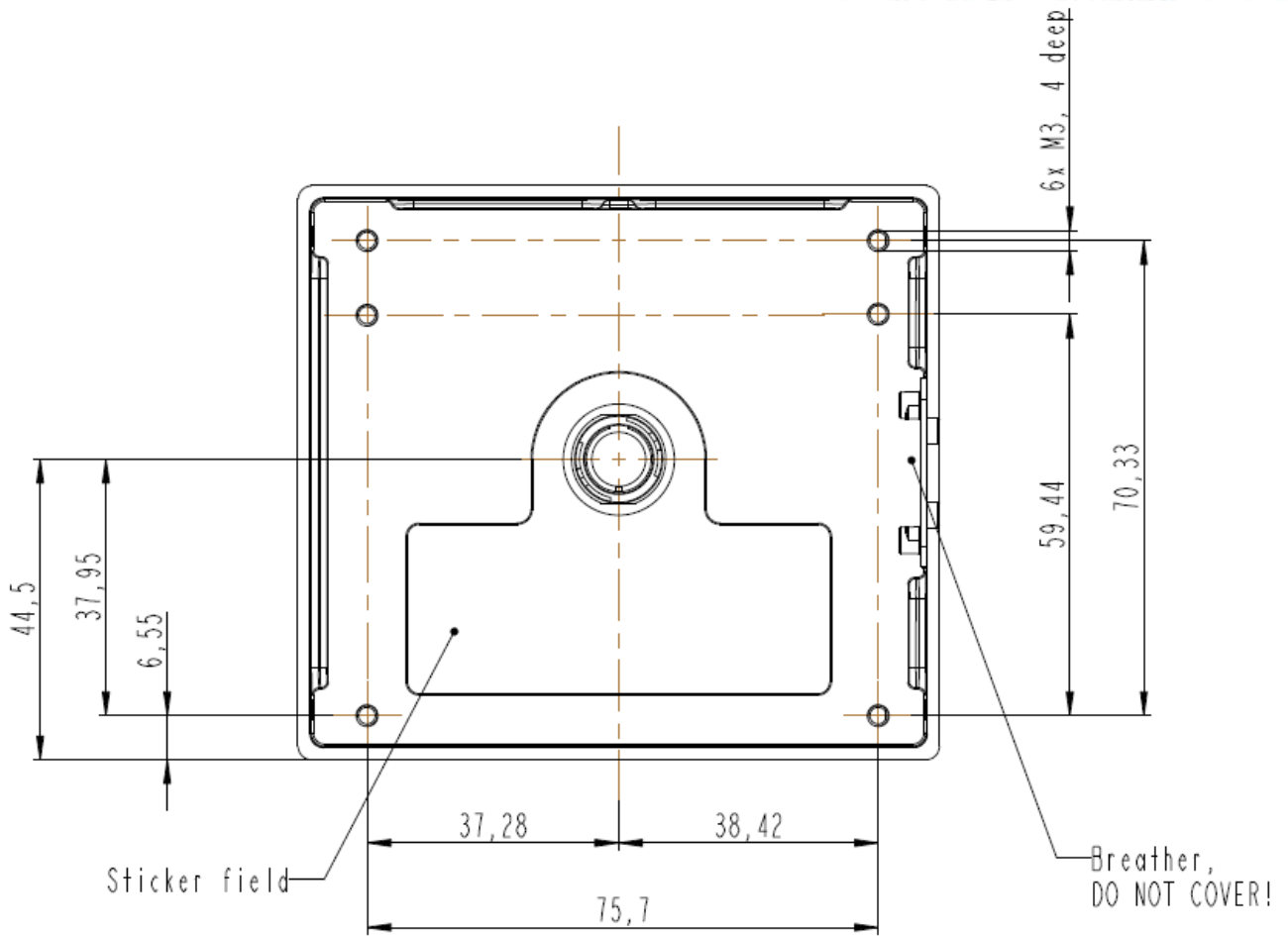


**Figure 7: Sensor Top, Left and Right Side.**

### PROPRIETARY

The information contained in this document may be subject to change without notice.

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.



**Figure 8: Sensor Rear Side.**

**PROPRIETARY**

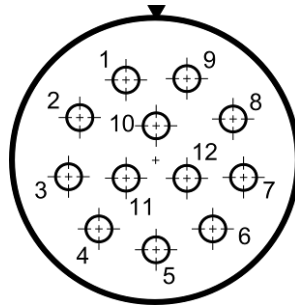
The information contained in this document may be subject to change without notice.

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.



## 2.12 Connector Pin-Out

The sensor connector is a 12-pin male (plug) circular bayonet type connector (water proof IP67, series LF10WBRB-12PD, manufacturer Hirose, Japan). A female counterpart (socket), e.g. LF10WBP-12S, has to be used to connect to the sensor. The pin numbering of the socket is shown in Figure 9. The pin description is given in Table 2.



**Figure 9: View on solder cup side of socket (rear view of female counterpart to be connected to sensor)**

**Table 2: Sensor connector pin out model UMRR-11xxxx**

Pin No.	Function	Wire Color (MEDI type #KU110C12J002)
1	Sensor Ethernet TX H	gray / red
2	Sensor Ethernet TX L	red / blue
3	Sensor RS485 RX L	pink
4	Sensor RS485 RX H	gray
5	Sensor RS485 TX L	brown
6	Sensor RS485 TX H	white
7	Sensor_GND	blue
8	Sensor_Vcc	red
9	Sensor Ethernet RX L	black
10	Sensor Ethernet RX H	purple
11	CAN H	green
12	CAN L	yellow

Please note that in the standard configuration the sensor has no 120 Ohms resistor on board (CAN bus termination between CAN L and CAN H). The resistors are nevertheless required at either end of a CAN / RS485 bus and is in most cases integrated in the cable delivered along with the sensor (if cable is manufactured by Smartmicro).

For the RS485 data interface there is a 120 Ohms resistor on board of the sensor.

A number of cable sets for initial operation and test purposes are offered by Smartmicro, to deliver a fast set-up of a sensor system. Among those preconfigured ready-to-run cables as well as cable stumps (pig tail cables or various lengths) which carry the connector on one side and open wires on the other.

### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 3 Multi Sensor Systems

### 3.1 Configurations

The sensor may be used standalone or multiple sensors can be connected in a network. Such networks are only possible using CAN(FD) interface. Sensors in the network work plug and play, free of mutual interference.

Customer specific configurations are possible.

### 3.2 Data Logging and Visualization Tools

Visualization of all data (i.e. **target lists, object lists**, other) is possible using the [Drive Recorder](#) software on any PC, as well as data logging, associated video documentation, play back and analysis functions and more.

Instead of the [Drive Recorder](#), other customer specific visualization, logging, or **function/application software products may be applied; the radar system's data interface is easy to integrate.**

#### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

### 3.3 Single sensor configuration for forward collision warning

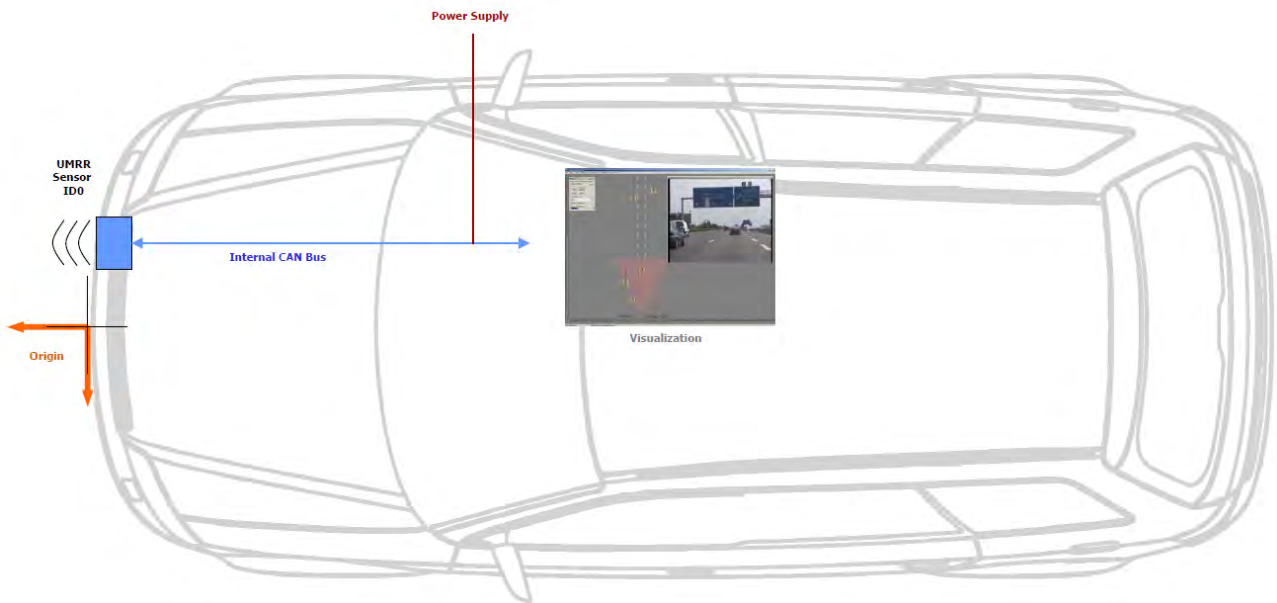


Figure 10: Typical single sensor configuration for forward collision warning (FCW) – one box design.

**PROPRIETARY**

The information contained in this document may be subject to change without notice.

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 4 Important Legal Disclaimer Notice

All Product, Product specifications and data in this project documentation are subject to change without notice to improve reliability, function, design or otherwise.

The statements, technical information and recommendations contained herein are believed to be accurate as of the date hereof. Smartmicro disclaims any and all liability for any errors, inaccuracies or incompleteness contained in this datasheet or in any other disclosure relating to the Product.

To the extent permitted by applicable law, Smartmicro disclaims (i) any and all liability arising out of the application or use of the Product or the data contained herein, (ii) any and all liability of damages exceeding direct damages, including - without limitation – indirect, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of suitability of the Product for a particular purpose.

Statements regarding the suitability of Products for certain types of applications are based on Smartmicro' knowledge of typical requirements that are often placed on Smartmicro' Products in generic/general applications. Such statements are, however, not binding statements about the suitability of Products for a particular/specific application. It is the customer/user's own responsibility to validate that the Product with the specifications described herein is suitable for use in its particular/specific application. Parameters and performance of the Products may due to particular/specific applications and due to particular/specific surroundings deviate from the statements made herein. Therefore, it is important that customer/user has thoroughly tested the Products and has understood the performance and the limitations of the Products before installing the Products for the final applications or before commercialization. Although Products are well optimized to be used for the intended applications stated herein, it must also be understood by the customer/user that the detection probability may not be 100 % and the false alarm rate may not be zero.

The information provided herein, relates only to the specific Product designated and may not be applicable when such Product is used in combination with other materials or in any process not defined herein. All operating parameters, including typical parameters, must be validated for each customer application by the customer/user's technical experts. Customers using or selling Smartmicro products not expressly indicated for use in such applications do so at their own risk.

This Product specification or data sheet does not expand or otherwise modify Smartmicro terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing by Smartmicro, the Products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Product could result in personal injury or death.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Smartmicro Product names and markings noted herein may be trademarks of their respective owners.

Please note that the application of the Product may be subject to standards or other regulations that may vary from country to country. Smartmicro does not guarantee that the use of Products in the applications described herein will comply with such regulations in any country. It is the customer/user's responsibility to ensure that the use and incorporation of Products complies with the regulatory requirements of their markets.

If any provision of this Disclaimer is, or is found to be, void or unenforceable under applicable law, that will not affect the validity or enforceability of the other provisions of this Disclaimer.

### **PROPRIETARY**

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.

## 5 Contact

### Address:

smart microwave sensors GmbH  
In den Waashainen 1  
38108 Braunschweig  
Germany

### Phone / Fax numbers:

Phone: +49-531-39023-0  
Fax: +49-531-39023-599

### Web / Email address:

Web: [www.smartmicro.de](http://www.smartmicro.de)  
Email: [info@smartmicro.de](mailto:info@smartmicro.de)

### PROPRIETARY

**The information contained in this document may be subject to change without notice.**

The information contained in this document shall remain the sole exclusive property of s.m.s smart microwave sensors GmbH.