Project Documentation | 77 GHz UMRR Traffic Management Sensor Data Sheet

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2  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.

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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 (junction box) or SRO (sensor relay option – both available as accessory) 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.
3 Sensor Data Sheet

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

UMRR-11 T132 is a 77 GHz multi-lane, multi-object tracking traffic Radar and features 4D/HD⁺ capabilities.

For each Radar generation, several different antennas are available - so the permanent fixed field of view and max. range can be selected by the customer.

This data sheet describes the UMRR-11 Type 132 antenna model (all model specific values are highlighted).

Type 132 antenna aims at long range and wide horizontal angular coverage. It features wide beam mode with medium range and long-range mode with narrower field of view.
3.1 Sensor Photograph

Figure 1: Traffic Sensor Type 132 - Front.

Figure 2: Traffic sensor Type 132 - Rear.
3.2 Function Description

The sensor is a robust low cost 4D/HD+ 77GHz Radar for traffic management applications.

It works in adverse conditions, almost unaffected by weather, and independent of sunlight, in a wide temperature interval.

The customer can select from several antenna and housing models which determine the permanent fixed field of view and range. Type 132 Antenna aims at long range and wide horizontal angular coverage. It features a wide beam mode with medium range and a long-range mode with narrower field of view.

One individual sensor measures range, radial speed, horizontal angle, vertical angle, reflectivity and other parameters of multiple stationary and moving reflectors (targets) simultaneously. The following detection principle is integrated:

4D/HD+

4-dimensional Doppler based radial motion detection (> 0.1m/s), including:

a) Direct Doppler measurement
b) Direct Range measurement
c) Direct Azimuth Angle measurement
d) Direct Elevation Angle measurement

Reflectors having a radial speed component of typ. abs. >0.1m/s are detected.

Having multi target capability, the sensor may detect many reflectors at a time (128 or max. 256) (depending on configuration) being within the field of view. Depending on the selected communication interface, the number of reported targets may be limited. Targets are sorted by range and short-range targets are reported first.

Additionally, filter algorithms are implemented for the tracking of all detected reflectors over time, those tracking algorithms are integrated in the sensor. Multiple objects (64 or max. 126) (depending on configuration) are tracked simultaneously. Depending on the selected communication interface, the number of reported objects may be limited. Objects are sorted by range; short range objects are reported first.

The result of the tracking is an object list with the following parameters:
- x position
- y position
- absolute velocity
- heading angle
- other...
Hence the sensor reports such a list of all tracked objects inside its field of view in every measurement cycle of typ. 55ms length (depending on configuration).

The field of view typically covers up to six lanes.

**The sensor can detect stationary objects.**
**Object Separation Performance**

Measuring object co-ordinates of multiple objects simultaneously in 4D, i.e. range speed, azimuth and elevation angle, or x, y and speed vector, is state of the art.

However, what counts even more is the object separation capability where many vehicles are closely spaced, i.e. in multi-lane scenarios with dense traffic, like traffic jams, stop-and-go traffic and busy intersections.

**The sensor provides excellent target/object separation capabilities (4D/HD+).**

Individual reflectors are separated in the detection algorithms by:

a) having a different radial speed value (difference > 0.25m/s) OR

b) having a different range value by 0.66m or 1.8m (depending on selected bandwidth) or

having a different range value by 2.2ft or 5.9ft (depending on selected bandwidth)

Tracking algorithms and data base further support the separation of objects.

![Diagram](image)

Figure 3: Object Separation Capability.

**UMRR-11 features 4D/HD+ technology.** For each reflector, there is a true measurement of the 4 dimensions range, Doppler, horizontal and vertical angle.

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

Figure 3 explains the principle.

Due to the operation at the 76-77GHz band, a significantly wider frequency bandwidth is available, and the Doppler frequency is increased.

As a result, compared to 24GHz (UMRR 11 T44/45) sensors:
- The range separation capability is improved by ~factor 3 (depending on selected bandwidth);
- The speed separation capability is improved by ~factor 3 (due to the higher Doppler frequency at 76-77GHz band).

3.3 Multi-Mode Operation, Adaptive Beams, Multi-Band Operation

The operational mode, antenna selection and frequency band are user-configurable.

3.3.1 Multi-Mode Operation

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

3.3.2 Adaptive Beams

In addition to that, and independently, narrow beam and wide beam operation can be selected.

Narrow beam mode can be selected for long range and wide beam mode can be selected for medium/short range.

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

3.3.3 Multiple Frequency Bands

Long Range mode: 4 frequency bands are available. These frequency bands are non-overlapping so that mutual interference can be reliably avoided.
Medium Range mode: **2 frequency bands** are available. These frequency bands are non-overlapping so that mutual interference can be reliably avoided.

### 3.4 Application Characteristics

#### 3.4.1 Intersection Management
At intersections, the sensor is typically used for combined stop bar and advance detection.

![Figure 5: Stop Bar Detection Type 132](image-url)
The sensor is usually mounted at the corner of an intersection on a vertical pole. Other mounting positions (gantry, mast arm, luminaire) may be possible. The **standard configuration** for Type 132 sensor for intersection applications is shown in Figure 5 and its parameters are given in Fehler! Verweisquelle konnte nicht gefunden werden..

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Direction</td>
<td>Typ. Approaching</td>
</tr>
<tr>
<td>Mounting Height</td>
<td>Typ. 6m (1…10m)&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Typ. 20ft (3…33ft)&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sensor Azimuth angle</td>
<td>Typ. -12° (-15 ... +15 deg.)&lt;sup&gt;II&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sensor Elevation angle</td>
<td>Typ. -6° (-9...0 deg.)&lt;sup&gt;II, III&lt;/sup&gt;</td>
</tr>
<tr>
<td>Stop Bar Distance</td>
<td>Typ. 30m (30m ... 50m)&lt;sup&gt;IV&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Typ. 985ft (66 ... 164ft)&lt;sup&gt;IV&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**Table 1: Standard Configuration for Stop Bar Detection Type 132**

<sup>1</sup> May affect max. detection range. The best performance is typically achieved for mounting heights between 2-8m. Occlusion needs to be considered.

<sup>II</sup> Smaller absolute angles allow longer detection range along a road.

<sup>III</sup> Application specific. Gantry mount: steeper e. angle possible, with limitations of maximum range. Negative elevation angle means sensor pointing towards road.

<sup>IV</sup> Outside the recommended range, vehicle drops are more likely.

Note: Do not use stop bar distances below 30m (at max. sensor elevation mounting angle - 9°).

The cycle time is set to 55ms.

The sensor is typically used standalone. Up to four sensors can usually be mounted at or around an intersection using separate configurable frequency channels, avoiding mutual interference.

**UMRR-11 Type 132 Stop + Advance**

- **Stop bar detection** (true presence detection)
- Lane specific **Advance detection** (exploiting the long range)
- **Loop replacement** (non-intrusive detection)
- **Queue length** measurement
- **Custom trigger** conditions (e.g. location, vehicle speed, classification)
- **ETA** measurement
- **Speed** measurement
3.4.2 Arterial Management
On highways and country roads, the sensor is typically used to count and classify traffic. Usually are selected and reported in configurable counting /statistics intervals.

The sensor delivers the following data:
- Volume
- Occupancy
- Average Speed
- Vehicle Presence

The data can be retrieved in Push Mode
a) in low data volume as aggregated statistics output
b) as per vehicle record (PVR)

c) Figure 6: Standard Configuration Type 132
Because of the forward-looking principle, the sensor provides the significant higher speed accuracy / general speed-based information, compared to other traffic counting equipment.

The sensor is usually mounted at the roadside on a vertical pole. No setback is required. Other mounting positions (gantry, mast arm, luminaire) may be possible. The standard configuration for Type 132 sensor for counting applications is shown in Figure 6 and its parameters are given in the table below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Direction</td>
<td>Typ. Approaching &amp; Receding</td>
</tr>
<tr>
<td>Mounting Height</td>
<td>Typ. 6m (4…10m)(^1)</td>
</tr>
<tr>
<td></td>
<td>Typ. 20ft (13…33ft)(^1)</td>
</tr>
<tr>
<td>Sensor Azimuth angle</td>
<td>Typ. -12° (-15 ...+15 deg.)(^{II})</td>
</tr>
<tr>
<td>Sensor Elevation angle</td>
<td>Typ. -6° (-9...0 deg.)(^{II, III})</td>
</tr>
<tr>
<td>Counting Line Distance (Approaching)</td>
<td>Typ. 30m (20m ... 50m)(^V)</td>
</tr>
<tr>
<td></td>
<td>Typ. 98ft (66 ... 164ft)(^V)</td>
</tr>
<tr>
<td>Counting Line Distance (Receding)</td>
<td>Typ. 90m (50m ... 105m)(^V)</td>
</tr>
<tr>
<td></td>
<td>Typ. 295ft (164... 344ft)(^{IV})</td>
</tr>
<tr>
<td>Setback</td>
<td>Typ. 1m (0... 10m)</td>
</tr>
<tr>
<td></td>
<td>Typ. 3ft (0 ... 33ft)</td>
</tr>
<tr>
<td>Counting Accuracy</td>
<td>Typ. &gt; 95%(^V)</td>
</tr>
<tr>
<td>Classification Accuracy</td>
<td>Typ. &gt; 80%(^V)</td>
</tr>
<tr>
<td>Classes</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 2: Standard Configuration for Counting and Statistics Type 132

\(^1\) May affect max. detection range. Occlusion needs to be considered.
\(^{II}\) Smaller absolute angles allow longer detection range along a road.
\(^{III}\) Application specific. Gantry mount: steeper el. angle possible, with limitations of maximum range. Negative elevation angle means sensor pointing towards road.
\(^{IV}\) Outside the recommended range, vehicle drops are more likely.
\(^{V}\) Typical value when properly installed at suitable location. The counting and classification accuracy typically depend on the following main (and other) factors: mounting height, traffic density

The cycle time is set to 55ms.

The sensor is typically used standalone. Multiple sensors may however be used in close vicinity using separate configurable frequency channels, avoiding mutual interference.

| UMRR-11 Type 132 Forward+ 4D/HD\(^*\) | • Counting and Classification   |
|                                        | • Wrong Way Detection (vehicle moving opposite to the defined direction of traffic) |
|                                        | • Incident Detection supported |
|                                        | • Speed measurement             |
3.4.3 Traffic Enforcement
The high speed and range accuracy of the UMRR sensor makes it very suitable for lane specific speed and red-light enforcement applications. According to the specification of the enforcement application, the sensor can be used either in approaching or in receding traffic mode.

![Image](image-url)

Figure 6: 4 Lane Speed / Red Light Enforcement in Approaching Mode Type 132
The sensor is usually mounted at the roadside on a vertical pole. Other mounting positions (gantry, mast arm, luminaire) may be possible. The standard configuration for Type 132 sensor for speed enforcement applications is shown in Figure 6 and Figure 7. The parameters are given in Fehler! Verweisquelle konnte nicht gefunden werden.3.
### Table 3: Standard Configuration for Traffic Enforcement Type 132

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Approaching Mode</th>
<th>Receding Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Direction</td>
<td>Approaching</td>
<td>Receding</td>
</tr>
<tr>
<td>Mounting Height</td>
<td>Typ. 4m/6m (1...10m)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Typ. 4m (1...10m)&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Typ. 13/20ft (0...33ft)</td>
<td>Typ. 13ft (0...33ft)</td>
</tr>
<tr>
<td>Sensor Azimuth angle</td>
<td>Typ. -12° (-35 ...+35 deg.)&lt;sup&gt;II&lt;/sup&gt;</td>
<td>Typ. 12° (-35 ...+35 deg.)&lt;sup&gt;II&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sensor Elevation angle</td>
<td>Typ. -6° (-9...0 deg.)&lt;sup&gt;II&lt;/sup&gt;</td>
<td>Typ. -6° (-9...0 deg.)&lt;sup&gt;II, III&lt;/sup&gt;</td>
</tr>
<tr>
<td>Measurement Line Distance</td>
<td>Typ. 30m (20m ... 50m)&lt;sup&gt;IV&lt;/sup&gt;</td>
<td>Typ. 45m (20m ... 50m)&lt;sup&gt;IV&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Typ. 98ft (66 ... 164ft)&lt;sup&gt;IV&lt;/sup&gt;</td>
<td>Typ. 148ft (66 ... 164ft)&lt;sup&gt;IV&lt;/sup&gt;</td>
</tr>
<tr>
<td>Speed Accuracy</td>
<td>Typ. &lt;± 0.28 m/s or ± 1% (bigger of) &lt;sup&gt;V&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Track initialization time</td>
<td>Typ. 6 ... 10 cycles</td>
<td></td>
</tr>
<tr>
<td>Traffic Direction</td>
<td>approaching, receding</td>
<td></td>
</tr>
<tr>
<td>Simultaneous Object Tracking</td>
<td>64 Objects&lt;sup&gt;VI&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> May affect max. detection range. Occlusion needs to be considered.

<sup>II</sup> Smaller absolute angles allow longer detection range along a road.

<sup>III</sup> Application specific. Gantry mount: steeper el. angle possible, with limitations of maximum range. Negative elevation angle means sensor pointing towards road.

<sup>IV</sup> Outside the recommended range, vehicle drops are more likely.

<sup>V</sup> Measured on object having const. radial speed, at bore sight.

<sup>VI</sup> Up to 126 objects by special firmware. Please contact smartmicro for more information.

The cycle time is set to 55ms.

The sensor is typically used standalone. Multiple sensors may however be used in close vicinity using separate configurable frequency channels, avoiding mutual interference.

<table>
<thead>
<tr>
<th>UMRR-11 Type 132 Enforcement 4D/HD&lt;sup&gt;+&lt;/sup&gt;</th>
<th>For Speed Enforcement Short distance measurement for both directions possible Certified speed accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMRR-11 Type 132 Enforcement RL 4D/HD&lt;sup&gt;+&lt;/sup&gt;</td>
<td>For Red Light Enforcement For combined Red Light &amp; Speed Enforcement Short distance measurement for both directions possible High speed accuracy</td>
</tr>
</tbody>
</table>
## 3.5 General Performance Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Frequency [GHz]</td>
<td>Long Range Mode: 76 (76...77) 4 center frequencies (bands)</td>
</tr>
<tr>
<td></td>
<td>Medium/Short Range Mode: 76 (76...77) 2 center frequencies (bands)</td>
</tr>
<tr>
<td>Bandwidth [MHz]</td>
<td>&lt;1000</td>
</tr>
<tr>
<td>Max. Transmit Power [EIRP]</td>
<td>&lt;25</td>
</tr>
<tr>
<td>Range(^I)</td>
<td>Min/Max [m](^I): Min: 1.0 Max: 175</td>
</tr>
<tr>
<td></td>
<td>Discrimination[m]: ≤ 1.8&lt;br&gt;Accuracy [m]: &lt; 0.5 or 1% (bigger of)</td>
</tr>
<tr>
<td></td>
<td>Vel: 0.26</td>
</tr>
<tr>
<td></td>
<td>Min/Max [km/h](^II): -320 ... +320&lt;br&gt;Discrimination[m/s]: ≤ 0.1</td>
</tr>
<tr>
<td></td>
<td>Accuracy [m/s]:&lt; 0.26&lt;br&gt;Vel: 0.26</td>
</tr>
<tr>
<td>Range(^I)</td>
<td>Min/Max [m](^I): Min: 0.5 Max: 64</td>
</tr>
<tr>
<td></td>
<td>Discrimination[m]: &lt; 0.66&lt;br&gt;Accuracy [m]: &lt; 0.25 or 1% (bigger of)</td>
</tr>
<tr>
<td></td>
<td>Vel: 0.26</td>
</tr>
<tr>
<td></td>
<td>Min/Max [km/h](^II): -340 ... +170&lt;br&gt;Discrimination[m/s]: ≤ 0.1</td>
</tr>
<tr>
<td></td>
<td>Accuracy [m/s]:&lt; 0.26&lt;br&gt;Vel: 0.26</td>
</tr>
<tr>
<td>Angle(^V)</td>
<td>FoV of Azimuth [°](^III): -16...+16 (narrow beam)</td>
</tr>
<tr>
<td></td>
<td>FoV of Elevation [°](^III): -7.5...+7.5</td>
</tr>
<tr>
<td></td>
<td>Discrimination of Azimuth [°]</td>
</tr>
<tr>
<td></td>
<td>Accuracy of Azimuth [°](^IV): ≤ 0.25</td>
</tr>
<tr>
<td></td>
<td>Accuracy of Elevation[°](^IV): ≤ 0.5</td>
</tr>
<tr>
<td>Initialization Time [s]</td>
<td>&lt; 4</td>
</tr>
<tr>
<td>Update Cycle Time [ms]</td>
<td>≤ 55</td>
</tr>
<tr>
<td>Processing Latency [ms]</td>
<td>2-4 Cycles</td>
</tr>
<tr>
<td>Operating Voltage [V](^I)</td>
<td>8 ... 32</td>
</tr>
<tr>
<td>Power Consumption [W](^VI)</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Max. Transmit Power (EIRP) [dBm]</td>
<td>&lt;25</td>
</tr>
<tr>
<td>Operating Temperature [°C]</td>
<td>-40 ... +85</td>
</tr>
<tr>
<td>Sensor Weight [g]</td>
<td>275</td>
</tr>
<tr>
<td>Dimension (H/W/D) [mm]</td>
<td>94.7 x 84.4 x 26.4 (plus connector)</td>
</tr>
<tr>
<td>Interfaces(^VII)</td>
<td>1xCAN V2.0b (passive)&lt;br&gt;RS485 full duplex&lt;br&gt;Ethernet 10/100</td>
</tr>
<tr>
<td>Connector</td>
<td>Hirose LF10 series</td>
</tr>
<tr>
<td>Model No.</td>
<td>UMRR-11xxxx – 84xxxx</td>
</tr>
<tr>
<td>Housing Identification</td>
<td>03xxxx</td>
</tr>
<tr>
<td>Shock [g(_{ms})]</td>
<td>100</td>
</tr>
<tr>
<td>Vibration [g(_{ms})]</td>
<td>14</td>
</tr>
<tr>
<td>IP(^VIII)</td>
<td>67</td>
</tr>
<tr>
<td>Pressure / Transport altitude [m]</td>
<td>0 ... 10.000</td>
</tr>
<tr>
<td>[ft]</td>
<td>0 ... 32.800</td>
</tr>
</tbody>
</table>

**Table 4: Performance Parameters**

\(^I\) 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.

\(^II\) Measured on object having const. radial speed, at bore sight.

\(^III\) Total field of view is angle interval where reflectors can be detected; 3dB field of view is narrower.

\(^IV\) Typical value; measured at target output level at bore sight, for a point reflector showing >23dB SNR. Error may increase towards larger angles.

**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.
3.5.1 Start-up time
After power up or reset, the sensor readings are within specified performance within <4s.

3.5.2 Self-Diagnose
The UMRR sensor cyclically reports a status message providing the following information

- Sensor run time
- Sensor cycle time
- Sensor mode
- Diagnose information

The sensor features certain self-diagnose to allow limited fail-safe capabilities:
- Detection of sensor blindness
- Detection of rain
- Misalignment in roll- or pitch angle
- Detection and suppression of interference

Note that there is no completely fail-safe operation available.

3.5.3 Sensor Network
The sensor is typically used standalone. At intersections, typically up to four sensors are connected to one TMIB (interface board to intersection controllers, available as accessory) and can be operated interference-free.

Long Range mode: 4 frequency bands are available. These frequency bands are non-overlapping so that mutual interference can be reliably avoided.

Medium Range mode: 2 frequency bands are available. These frequency bands are non-overlapping so that mutual interference can be reliably avoided.

3.5.4 Ethernet connection
The sensor supports UDP over Ethernet in a Local Area Network (LAN). Communication over low bandwidth environments or routed networks e.g. the world wide web is not supported.

Features:
1. Ethernet standards IPv4, ARP, IGMP, IP multicast and UDP
2. Supports DHCP
3. Smartmicro proprietary communication protocol “smartmicro transport protocol” with:
   - IP/UDP Multicast based discovery protocol
   - Client ID based setup
   - Sensor data transmission
3.5.5 Compliance

The sensor model complies with the following EU directives:
- RED 2014/53/EU
- RoHS 2011/65/EU
- EC 1907/2006 REACH

Applied Standards:
- Spectrum Usage:
  - EN 301 091-1 V2.1.1
  - EN 301 091-2 V2.1.1
- EMC:
  - EN 301 489-1 V2.2.0
  - EN 301 489-51 V2.1.0
- Health and Safety:
  - EN 62311: 2008

Regarding spectrum usage, this sensor model was tested and certified by independent test labs:
- EU RED directive (formally approved by test lab or notified body),
- FCC part 95M (formally approved by test lab or notified body),
- ISED RSS-251 (formally approved by test lab or notified body),

Note: This sensor must not be used for non-automotive (stationary) operation in the US.

This sensor model is also generally compliant with the following regional regulations (but may not be formally tested/approved):
- SRRC,
- KCC,
- MIIT,
- NCC.

Note: This statement of compliance means that the sensor device allows operation compliant to the listed standards. However, not all standards are certified through test labs and not for all countries formal frequency approval/registration is accomplished.

In certain countries or regions, a customer-specific local frequency approval is reasonable. Smartmicro supports customers for this process.

*For certain configurations of this sensor the accuracy of the speed (and other) measured values was tested and certified by the Swiss Federal Institute of Metrology METAS (certificates available on request under NDA).*

¹ Available in Q1,2020
3.6 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.

![Type sticker example](image)

The individual sensors are referred to as **UMRR-xxyyzz-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. In addition to that the used DSP board and the RF board got their own unique serial numbers.

The (R) symbol designates that a CAN termination resistor is assembled in the sensor.
3.7 Sensor Dimensions

All values given in mm.

Figure 8: Sensor Front side.

Figure 9: Sensor Top, Left and Right Side.
Figure 10: Sensor Rear Side.
3.8 Connector

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, must be used to connect to the sensor. The pin numbering of the socket is shown in Figure 11 the pin description is given in Table 5.

![Connector Diagram](image)

Table 5: Sensor connector pin out model UMRR-11xxxx

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

Please note that in the standard configuration the sensor does have a 120 Ohms resistor on board (CAN bus termination between CAN L and CAN H). This resistor is required at either end of a CAN / RS485 bus.

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

Several 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.
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