R600V.DAH5 Operating Manual (EN)

Off-Highway Distance Radar Sensor

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1. General Information

1.1. Scope

This manual is intended for the Baumer “Off-highway Distance Radar” family. The sensors and their software configuration are listed below:

Tab 1 Applicable Products

Art. no.	Product	Type	SW Version
11205779	R600V.DAH5-11205779	High accuracy distance radar	R600VSOF_S 1.0.0 (or higher)



Read this operating manual carefully and follow its safety instructions!

1.2. Comments, notes, and warnings



NOTE
Provides helpful operation instructions or other general recommendations.



ATTENTION
Indicates a possibly situation that may lead to damage.



CAUTION
Indicates a possibly hazardous situation. If it is not avoided injuries may occur or the device be damaged.

1.3. Intended Use

1.3.1. General

The “Off-highway Distance Radar” has been developed with the off-highway market (agriculture vehicles, construction vehicles, etc.) in mind. It is intended for use cases in which the distance onto a defined target such as a corner cube, a metal plate or flat and unstructured surfaces in general (e.g. asphalt, concrete) shall be determined. For highly structured surfaces (rough terrain, stubble, etc.) Baumer recommends the usage of “Off-Highway Ground & Crop Radar Sensor” family (R600V.DAE0-11209335, R600V.DAE0-11188367). The 122GHz band can be used in many different applications. The original equipment manufacturer or system integrator must observe local restrictions regarding the usage and/or placing in the market of this product.

NOTE

For highly structured surfaces (rough terrain, stubble, etc.) Baumer recommends the usage of “ground & crop radar sensor” family (R600V.DAE0-11209335, R600V.DAE0-11188367)

The sensor may be integrated into vehicles with 12VDC and 24VDC vehicle power supplies, and provides a CAN SAE J1939 interface with a set speed of 250kbit/sec (may be changed to 500kbit/sec). The output rate defaults to 50ms, but may be varied between 10ms and 1000ms. High visibility LEDs displays the sensor status, even in bright ambient light.

1.3.2. Audience

This manual is intended for original equipment manufacturers (OEMs), or system integrators; but not the end-users of equipment. It is the responsibility of the OEM / system integrator to provide a user manual where relevant information from this manual is passed on, if it either directly affects the safety or indirectly as discovered during a safety assessment of the consequences of this product’s integration. The Baumer “Off-highway Distance Radar” sensors are not intended for safety applications and potentially explosive atmospheres. The OEM or system integrator must ensure the safety of the equipment on which this product is used.

The manual is written based on current information. Baumer reserves the right to update products, documentation and its manuals if better information becomes available.

CAUTION

This product must not be used in safety applications and in potentially explosive atmospheres.

1.3.3. Application Policy

Baumer products are applicable to a wide range of applications and / or end-use cases. Baumer cannot know all possible conditions under which products are installed, used, and operated. Every application and / or use-case is unique. The suitability and functionality of a Baumer product and its performance under different applications and / or end-use cases can only be verified by testing, and shall ultimately be the responsibility of the Baumer customer using a Baumer product. When the product configuration (software version, electronics revisions, mechanical revisions, etc.) is changed the customer needs to validate and verify the Baumer product to ensure the proper function in the application and / or end-use case.

NOTE

The original equipment manufacturer or system integrator must ensure the suitability of this product in the application and / or use case through extensive testing.

Intellectual property rights may exist for some applications and / or end-use cases that may affect the usage and/or placing on the market of machines manufactured by the OEM using a

Baumer product. Baumer does neither implicitly nor explicitly warrant the usage for specific application and / or end use case.

NOTE

The original equipment manufacturer or system integrator must consider third party intellectual property rights. No warranty is given for the application and/or end use case.

The product shall not be used for functional safety applications. Possible malfunctions and failed measurements of the sensor must be intercepted at the system level and shall not lead to unsafe situations in the system. The customer shall perform its own safety assessment to account for sensor behaviour in particular situations (e.g. distance fluctuations in static situations, operator caused distance manipulation by hand or other objects). The product shall not be used in the direct control and modification of the state of function of the vehicle.

CAUTION

This product must not be used in safety applications. A sensor malfunction must not lead to an unsafe situation.

CAUTION

The product shall not be used in the direct control and modification of the state of function of the vehicle.

Baumer ensures the compliance of its products to the specifications and declaration of conformity made available through its website *www.baumer.com*.

All conditions of use provided in the data sheet, top level drawing must be observed. The machines or equipment manufactured by the customer utilizing Baumer product must only be put on the market as covered by the declaration of conformity provided.

CAUTION

The technical documentation provided must be observed.

Some applicable documents are listed below, but are not limited to:

Tab 2 Applicable Documents

Art. no.	Document Type	Document
11205779	Data sheet (DAB)	DAB Radar distance measuring sensor
11205779	Mounting instruction (MAL)	MAL Radar distance measuring sensor
11205779	Declaration of conformity (EU)	Baumer_R600V_DE-EN-FR_CoC_81302233
11205779	Declaration of conformity (US)	Baumer_R600V_EN_DoC_81313208

1.3.4. Maintenance

This product does not require any maintenance. If function is impaired dirt should be removed from the lens.

1.3.5. Mechanical Damage

If the product shows mechanical damage to an exterior part, it should be replaced to avoid undetected malfunction. The product must be replaced by skilled and authorized personnel.

1.3.6. Disposal (environmental protection)

Do not dispose of electrical and electronic equipment in household waste. The product contains valuable raw materials for recycling, which is why an old product must be returned to an authorised collection point for correct disposal / recycling. For further information refer to www.baumer.com.

2. Integration Guidance

CAUTION

Installation, mounting and adjustment of this product must only be executed by skilled and authorized personnel.

2.1. Mechanical Integration

2.1.1. Targets, Blind-range

The sensor shall be mounted with its centre axis approximately perpendicular to the target. The distance output is relative to the tip of the lens. A blind range of 300mm must be considered. No measurement is possible within the blind range of the sensor. For applications where accuracy is to be optimised, a flat metal surface (e.g. a 100 x 100mm metal plate) is recommended. If the target surface is not mounted perpendicular to the sensor centre axis the received signal gets weaker. From experience a good value of angular tolerance for a flat target is less than 2°. Corner cubes are not sensitive to angular tolerances and may be the more robust choice for situations in which accuracy need not be optimized. To ensure proper detection over the full sensing range it is recommend aligning the longitudinal axes of sensor and reflector as shown below. Aligning the axes is especially important to improve the signal at short distances (below 0.5m) when using a corner cube. For a selection of available corner cubes, please refer to Tab 11.

The target material thickness (both flat metal plate and corner cube) must be more than 0.5mm and preferably metal. Coatings on the target may affect the reflectance properties. Non-metal targets may work as well, but sufficient reflectance at radar wavelengths is essential. The reflectance depends on the dielectric constant of the material at the radar wavelength. Sufficient signal must be validated through integration testing.

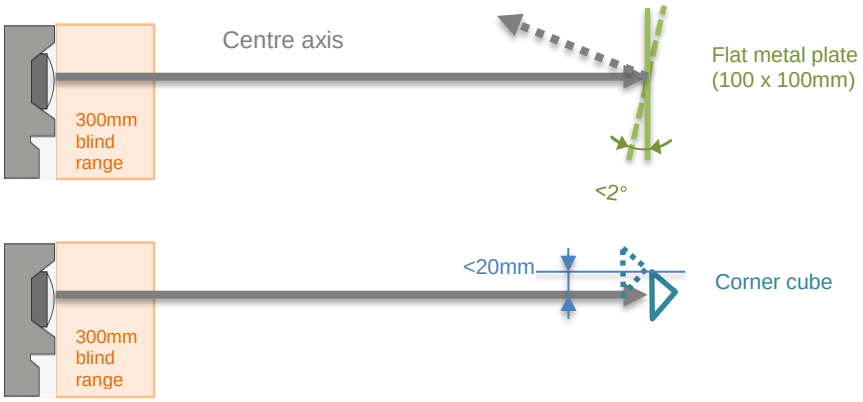


Fig 1 Mechanical Setup (for visualization only)

2.1.2. Reference Target

All data sheet specifications are based on a flat high-reflectance target (a metal plate with dimensions of 100mm by 100mm). The zero point for the measurement is on the tip of the lens.

2.1.3. Mounting

A mounting plate with a flatness of better than 0.2mm per 100mm shall be used. Baumer recommends soft steel as material to match specified mounting torque. For direct mounting (thread in plate) Baumer recommends a thickness of the steel plate of at least 6mm. For mounting on a thinner soft steel plates (≥3mm) flange nuts must be used instead.

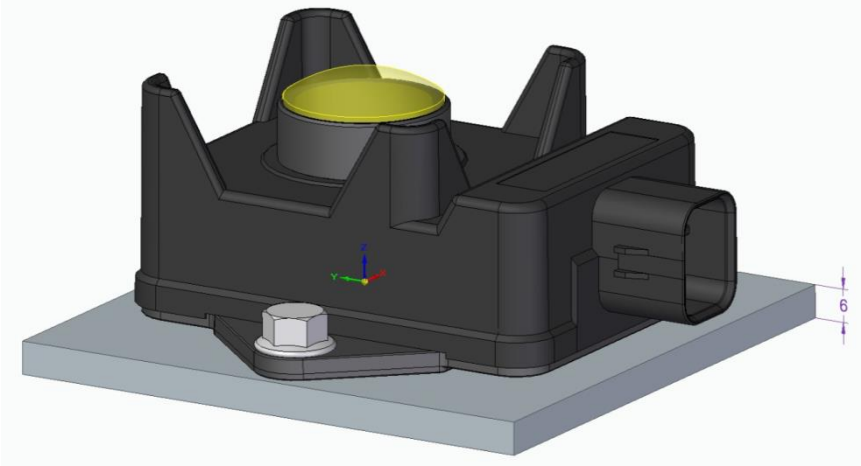


Fig 2 Mounting on a thick soft steel plate (≥6mm).

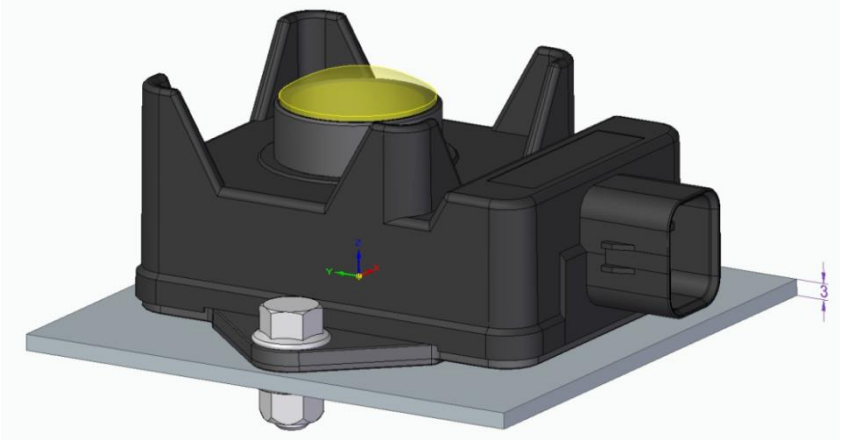


Fig 3 Mounting on a thin soft steel plate (≥3mm)

It is recommended to use M6 screws per MBM 10105. The mounting torque for 10.9 (property class) screws must be within 12Nm…15Nm, and for 8.8 (property class) screws it must be within 10Nm...12Nm. For the mounting pattern and available tool space for tightening the

mounting screws please refer to the Figure below. Enough space must be allowed for the wiring harness to avoid excessive bending of the wires or wire assembly. The wires must also be appropriately secured and be suitable for the application.

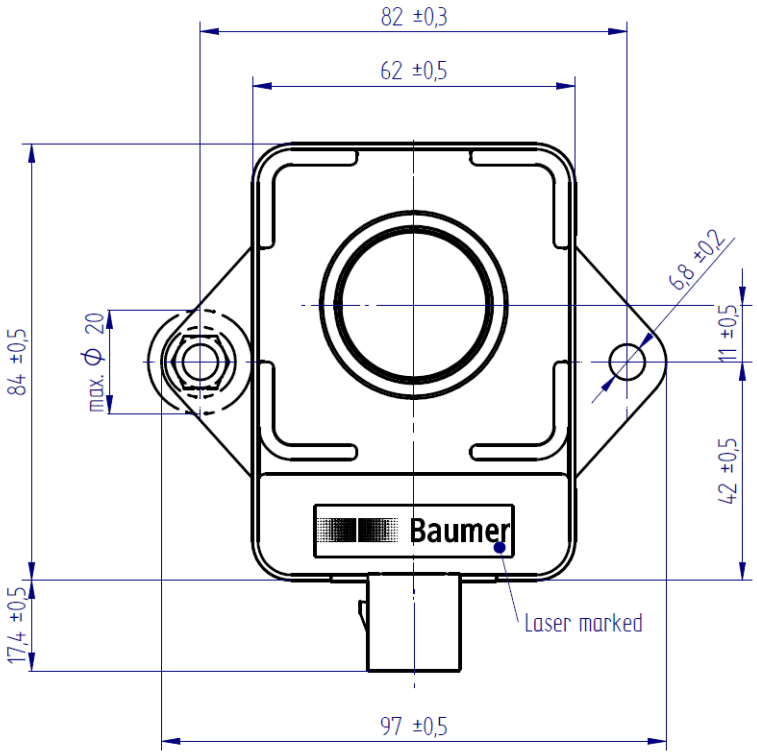


Fig 4 Mounting pattern, tool space.

ATTENTION
Observe mounting torque and tool space to avoid damage.to sensor.

2.2. Rules for Installation

2.2.1. Free Space and Directional Sensitivity

The Baumer off-highway radar distance sensor is a very sensitive device to deliver superior measurement accuracy and speed. The opening angle of the main beam is 6° (for 3dB signal reduction, or approx. 9° for 20dB signal reduction). A typical directional sensitivity is shown below.

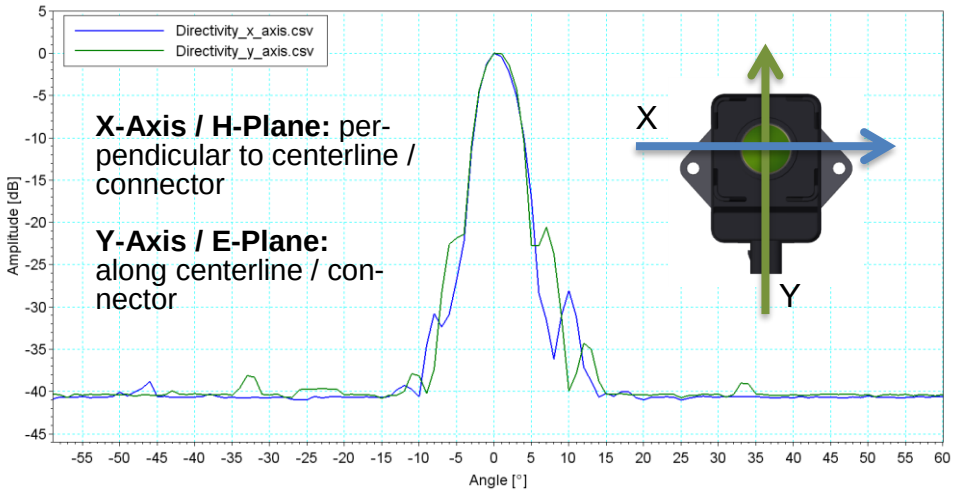


Fig 5 Typical Directional Sensitivity of Sensor

Baumer recommends limiting intrusion of objects, into a rotational cone of approx. 60…70° from the lens for very weakly reflecting targets. Integration testing must be done to ensure that the integration with available free space does not have impact on the measurement.

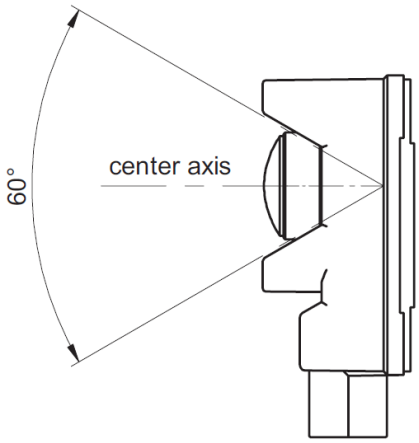


Fig 6 Recommended Free Space for weak targets

For strongly reflecting targets (such as corner cubes and metal plates), the keep out aperture angle is at least +/-3°.

2.2.2. Target area guidelines

Generally it is desirable that the target is the object with the strongest reflection back to the radar sensor. If strongly reflecting objects in the background cannot be avoided the insertion of shields is recommended. As a rule of thumb a shield angle larger than approx. the total opening angle (e.g. >10°) is recommended. Multi-path reflections may need to be considered. The following figure shows the setup schematically. Target selection preference (first, last, strongest target) can be set via CAN commands. For details refer to chapter 3.4.2.

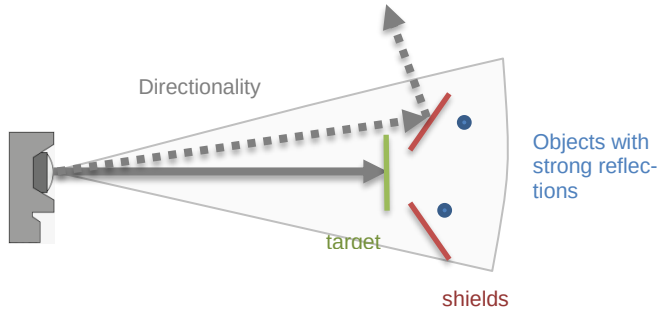


Fig 7 Usage of shields to cover strongly reflecting objects

If strongly reflecting objects in the background of the target cannot be covered by shields the target should be kept at a minimum distance of at least the specified blind range.

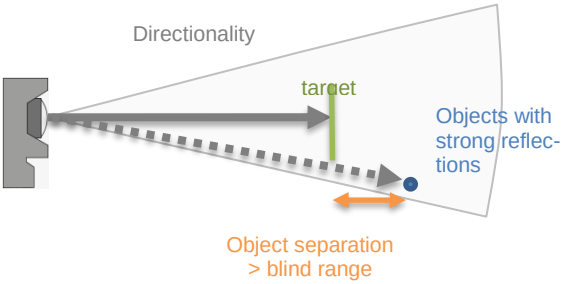


Fig 8 Separate strongly reflecting objects from target

2.2.3. Multi-path beam propagation

Multi-path beam propagation may impact the accuracy of the measurement and should be avoided. Multi-path propagation may occur due a combination of target alignment, existence of a reflective object and side lobes of the sensor. Integration testing is important to understand the impact of the build space on the result.

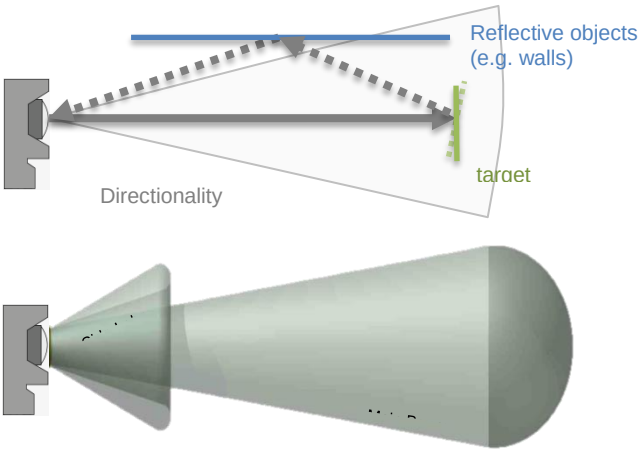


Fig 9 Multi-path beam propagation

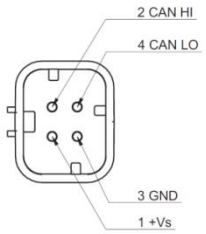
2.3. Electrical Integration

The sensor can be used on direct vehicle power for 12VDC nominal voltage systems and 24VDC nominal voltage systems in the range +VS = 9VDC … 32VDC). A centralized load dump suppression (35V at 12VDC, and 58V at 24VDC respectively) is required. The product shall not be used in the direct control and modification of the state of function of the machine. Please refer to the data sheet for information regarding operation during the engine start phase, and further technical details. Prior to electrical connection of the product the system must be down and not live. Do not exceed permissible bending radius of the cable. The device shall be appropriately protected by an external R/C or fuse. In an industrial environment the device shall be protected by an external R/C or listed fuse, rated max. 100W/Vp or max. 5A below 20VDC, and a UL class 2 power supply be used.

Tab 3 Connector Pin-Out

Connection type	Ampseal 16 4P (776536-1)
Mating connector	Ampseal 16 4P (776524-1)

Pin	Code	Description
1	+Vs	Positive Supply voltage (12VDC / 24VDC nominal)
2	CAN HI	CAN High
3	GND	Ground (supply voltage)
4	CAN LO	CAN Low



This product may be used on vehicle power fulfilling these requirements:

Tab 4 Vehicle Power Electrical Transients

Test pulse (ISO 7637-2, ISO 16750-2)	1	2a	2b	3a	3b	4	5b
Severity level	IV	III	IV	III	III	III	--
Functional status (12 VDC vehicle power)	C	A	C	A	A	C	A
Functional status (24 VDC vehicle power)	C	A	C	A	A	C	A

For test installations a cable with the order code 11213075 (ZCABL-ALL.AMP0300) may be used.

ATTENTION!
The product shall not be used in the direct control and modification of the state of function of the machine.

ATTENTION!
The product shall not be operated during engine start phase.

ATTENTION
The product shall not be used on machines without centralized load dump suppression.

ATTENTION

The product shall be appropriately protected by an extern fuse or R/C.

NOTE

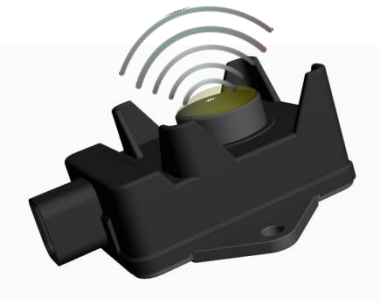
For test installations a cable with the order code 11213075 (ZCABL-ALL.AMP0300) may be used.

2.4. Visual Diagnostic

High luminosity LEDs provide quick feedback on the operational status of the sensor. The LEDs are positioned behind the radar lens and may be observed even in bright ambient light. The following table indicates sensor status and LED blink codes.

Tab 5 Status Mapping (Visual Diagnostic)

Status	Code
Sensor fully operational (object detected)	100ms Green LED ON 400ms LED OFF
Sensor fully operational, (no object detected)	As above 100ms Yellow LED ON in “LED OFF” interval
Hardware fault	50ms Red LED ON 50ms LED OFF
CAN bus Off (malfunction)	50ms Magenta LED ON 150ms LED OFF
Address claim failed	50ms Magenta LED ON 50ms LED OFF
Waiting for Master ECU address claim	500ms Magenta LED ON 500ms LED OFF
Other	Blue LED



2.5. CAN Interface (Physical Layer)

The CAN physical layer is according to SAE J1939-15 (reduced physical layer). Some base parameters are shown in the table below.

Tab 6 CAN Interface

Parameter	Value
Bus Speed	250 kbit / sec (1)
Bus Termination	External termination
Bus Voltage	5V
Wiring	Unshielded twisted pair (UTP)
Cable impedance	120 Ohm (+/- 10%)

(1) may be parameterized to 500 kbit/sec. (see below)

The bus termination resistor is not included in the device. The bus setup is shown in the figure below:

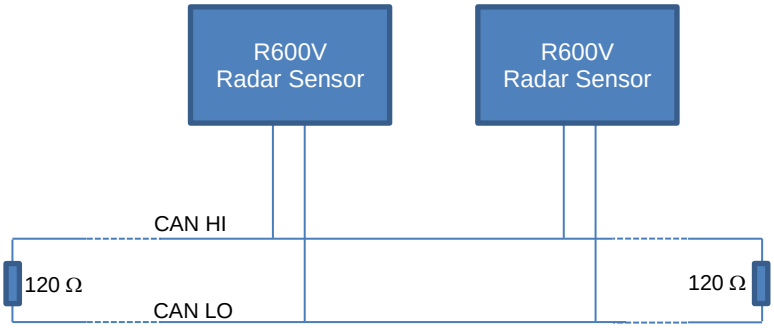


Fig 10 CAN connection setup diagram

For further information please refer to the CAN Protocol chapter.

3. CAN Protocol

The physical layer of the 2-wire interface is specified according to SAE J1939-15. The wires are protected against short-circuit.

The implementation of the protocol stack follows the SAE J1939 standards and is visualized in the OSI network model as follows:

Tab 7 SAE J1939 in the OSI reference model

OSI Layer	Implementation	Network Management
Application Layer	SAE J1939-71 (Vehicle) SAE J1939-73 (Diagnostic)	SAE J1939-81
Presentation	N/A	
Session	N/A	
Transportation Layer	SAE J1939-21 (Data Link Layer)	
Network Layer	SAE J1939-31	
Data Link Layer	SAE J1939-21	
Physical Layer	SAE J1939-14 SAE J1939-15	

Not all functions listed in the referenced standards have been implemented. The following chapters explain the extent and implemented functions.

DBC files can be downloaded from the respective product page on *www.baumer.com*.

3.1. ISO Name

Manufacturer code	343 (Baumer Group)
ECU instance	0
Function instance	2
Function	255 (nonspecific)
System	127 (nonspecific)
System instance	0
Industry group	2
Arbitration Capable	1

3.2. Device address

3.2.1. Commanded address (PGN 0xFED8)

Supported

3.2.2. Address Claim

The device is arbitrary address capable.

Address range: 0x80...0xCF (adjustable)

Default address: 0x80 (lowest address of set address range)

3.2.3. Address resolution sequence (for default settings)

After reset, the device performs the following start-up sequence:

1. After initialization, send “request for address claimed” message (PGN 0xEE00)
    a. At initialization, initialize the radar sensor sort table with the own ISO name only
    b. Send a request for address claimed. This causes other devices on the bus to claim their addresses
2. Wait 1250 ms. During this time, incoming address claims are evaluated and the own device address is modified accordingly if necessary (e.g. when more than one radar sensors are present on the bus)
3. Send “address claimed” message
    a. Claim the own address, which is derived from the sort table. Address = 0x80 + index of own device name in table (2)
4. Wait 250 ms and handle address collisions.
5. Start transmitting the cyclic target distance message.

Most parameters (times, address, start of transmission, …) of this sequence are adjustable. For details please refer to chapter 3.4.2.

(2) This means that, provided no new sensors are mounted, each sensor will end up with the same device address each time. However, if a new sensor is added to the system, addresses might shift up or down according to the new sort order

3.3. Supported PGNs

3.3.1. ECU Identification Info

PGN:	0xFDC5
Direction:	Transmit
Transmission rate:	On PGN request only

3.3.2. ECU Software Identification

PGN:	0xFEDA
Direction:	Transmit
Transmission rate:	On PGN request only

3.3.3. DM14 Memory access command message

PGN:	0xD900
Direction:	Receive
Transmission rate:	Random

3.3.4. DM15 Memory access reply message

PGN:	0xD800
Direction:	Transmit
Transmission rate:	Reply to DM14 command message

3.3.5. DM16 Memory access binary data

PGN:	0xD700
Direction:	Transmit/receive
Transmission rate:	When needed

3.3.6. Target Distance Message (adjustable)

PGN:	0xC000
Direction:	Transmit
Transmission rate:	50ms
Source address:	Sensor address
Destination address:	Broadcast (0xff)
Initial delay after start-up sequence:	200ms

All values are in little endian format. Bit1 of byte 1 = LSB of first byte

Tab 8 Target Distance Message (main message)

Start bit	Bits	Offset	Scaling	Description
1	2	0	1	Sensor status 0 = No error 1 = Reversible error. (e.g. temperature too high) 2 = Irreversible error. Sensor measurement not available
9	8	0	1%	Target confidence*/** Value 0…100% (higher confidence = detection of target better)
17	24	0	0.1mm	Target distance **
49	16	32768	1mm/sec	Target speed (positive: increasing distance)

*Target confidence is a function of signal strength. Above certain signal amplitude, confidence will always be 100%

**Target confidence and target distance will be “0” if no target is detected

3.4. Sensor Configuration

A number of sensor parameters can be read and written over the CAN bus using the J1939 memory access (MA) protocol.

User level for access = 1

Key for access is equal to the speed generated by the device.

All addresses are direct spatial (is pointer)

The access is similar to the SPN space. Each parameter has an individual size.

The tool shall issue a read or write command with a memory length of 1 (one).

In its “proceed” reply, the device returns the actual number of bytes to be used for the transfer.

3.4.1. Tool ISO name acceptance criteria

The sensor accepts MA sessions from any tool that fulfils all of the following criteria:

- ISO name Function field = 129
- ISO name Industry group field = 0

3.4.2. Adjustable Parameters

The following parameters are available for adjustment:

Tab 9 Adjustable Parameters

Address	Parameter	range	offset	scaling	Default value
	LED settings				
0x07DFAA	Green LED duty cycle (5)	0..100	0	1%	0
0x07DFAB	Green LED period (5)	0..255	0	100ms	0
0x07DFAC	Red LED duty cycle (5)	0..100	0	1%	0
0x07DFAD	Red LED period (5)	0..255	0	100ms	0
0x07DFAE	Blue LED duty cycle (5)	0..100	0	1%	0
0x07DFAF	Blue LED period (5)	0..255	0	100ms	0
	Measurement Settings				
0x07E388	Max. Detection range (4)	300..8500	0	1mm	8500
0x07E389	Min. Detection range (4)	300..8500	0	1mm	300
0x07E3A6	Sensor Sensitivity 0 = lowest sensitivity 1 = normal sensitivity 2 = high sensitivity (6)	0 … 2	0	1	1
0x07E3A7	Output filter mode (only with mode 3 in 0x07E3AB) 0 = tracking filter: moving average 1 = tracking filter: exponential averaging	0 … 1	0	1	0
0x07E3A8	Output filter history length (only for mode 0 as set in SPN 0x07E3A7, together with mode 3 in 0x07E3AB)	1 … 32	0	1	2

Address	Parameter	range	offset	scaling	Default value
0x07E3A9	Output filter number of cycles to bridge (during signal loss, only with mode 3 in 0x07E3AB)	0 … 32	0	1	1
0x07E3AA	Output filter time constant (only for mode 1 as set in SPN 0x07E3A7, together with mode 3 in 0x07E3AB)	0…1000000	0	1us	50000
0x07E3AB	Output distance selection 0 = distance is taken from strongest peak in range (unfiltered) 1 = distance is taken from nearest peak in detection range (unfiltered) 2 = distance is taken from farthest peak in detection range (unfiltered) 3 = filtered output (see 0x07E3A7, 0x07E3A8, 0x07E3A9, 0x07E3AA)	0…3	0	1	1

CAN Settings

0x07E38A	Data PGN transmit period	10..5000	0	1ms	50
0x07E38B	PGN for distance message transmission	0..131071	0	1	49152
0x07E397	PDU transmission start mode. Default enabled main message 0 = start immediately 1 = start after master address claim received (msg transmission starts only when enable flags are set 0x07E38C)	0..2	0	1	0
0x07E38C	Msg transmission enable flags (5) 0 = Main message off 1 = Main message on This SPN can be used to switch message on and off dynamically	0..1	0	1	1
0x07E38D	Default msg transmission enable flags 0 = Main message off 1 = Main message on Use to prevent the sensor from sending data after start up.	0..1	0	1	1
0x07E392	Min time to wait before sending a request for address claimed message	0..5000	0	1ms	100
0x07E393	Range of random time to wait before sending a request for address claimed message	0..5000	0	1ms	100
0x07E394	Time to wait after sending a request for address claimed message before own address claim is sent	0..5000	0	1ms	1250
0x07E39D	Compare mask for “bitwise AND” of ISO name used for Master ECU Detection	0..0xffffffffffffffff	0	1	0

Address	Parameter	range	offset	scaling	Default value
0x07E39E	Compare value for ISO name used for Master ECU Detection (after applying bitwise mask defined in 0x07E39D)	0..0xffffffffffffffff	0	1	0
0x07E395	Delay between detection of master address claim and starting RUN mode	0..5000	0	1ms	250
0x07E396	Delay between detection of master address claim and first PDU1 transmission	0..5000	0	1ms	200
0x07E398	Lowest device address to claim in address resolution sequence	128..209	0	1	128
0x07E399	Highest device address to claim in address resolution sequence	128..209	0	1	209
0x07E39A	CAN Bus speed. 0 = 250k 1 = 500k 2 = reserved (do not use)	0..1	0	1	0
0x07EF40	Reset device to default values Write data in this sequence to re-set all non-volatile SPNs to default values: 0x00, 0xAA, 0x55, 0x12, 0x34	N/A	N/A	N/A	N/A

(4) Detection range can be adjusted to avoid issues with double echo detections.
(5) SPN value is reset to default after a power cycle (volatile)
(6) Accuracy reduced

4. Trouble Shooting

Tab 10 Trouble Shooting Overview

Failure	Action
No function, no LED	Check cables, connections, power supply at pins
Function impaired, thick layer of dirt	Clean lens and remove excess water.
Mechanical damage to housing and/or lens	Replace part by qualified personnel.
Unexplained targets / distance measurement in near range	Check free space (or beyond) for non-stationary objects (such as dangling wires, tubes, water drops on surfaces.
Unexplained targets / distance measurement in far range	Check for double reflections, and limit measurement range
The LED is blinking red (50ms on / 50ms off)	Hardware fault. Replace part by qualified personnel
The LED is blinking magenta	CAN bus error. Check Tab 5 for details.
The LED is blinking blue for a long period.	Try a power cycle. If this does not fix the issue peplace part by qualified personnel
No communication (also magenta blinking)	Check CAN speed (e.g. 250kbit/sec), check 120Ohm termination,
No messages are sent	Check default transmission enable flags (0x0087E38D) Check if master address has been claimed (when required due to PDU transmission start mode setting 0x0087E397)

5. Accessories

The following accessories are available for this product

Tab 11 Accessories

Art. no.	Description	Type	Comment
11213075	ZCABL-ALL.AMP0300	Connector AMPSEAL 16 with PUR-cable	3m cable with AMPSEAL connector and fly-leads
11181700	ZREFL-RAD.CCUBE30	Metal reflector as corner cube, edge length 30 mm	▪ Metal reflector in corner cube design ▪ Material: Steel ▪ Reliable object detection < 6 m
11197315	ZREFL-RAD.CCUBE100	Metal reflector as corner cube, edge length 100 mm	▪ Metal reflector in corner cube design ▪ Material: Steel ▪ Reliable object detection < 20 m

6. Appendix

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6.3. Definitions and Abbreviations

The following definitions and abbreviations are used throughout this manual

Tab 12 Definitions and Abbreviations

Key	Definition
CAN	Controller Area Network
DAB	Data Sheet
DM	Direct Memory
ECU	Electronic Control Unit
ISO	International Standardization Organization
LED	Light Emitting Device
MA	Memory Access
OEM	Original Equipment Manufacturer
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PGN	Parameter Group Number
SAE	Society of Automotive Engineers
TLD	Top Level Drawing
VDC	Volt Direct Current

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8. Document Revision History

Tab 13 Document revision history

Vers.	Date	Note	Author	Checked	Released
0.5	29 Oct 2019	Technical review	wemi	tip, matts, rma, erv	N/A
1.0	15 Nov 2019	Initial Release	wemi	lph, sfri	N/A
1.1	20 Nov 2019	Fix addresses, and details in “Adjustable parameters”	wemi	linz	N/A
1.2	07 Jan 2020	Tab 8 Target confidence / sensor sensitivity / default values changed	rma	wemi	N/A
1.3	17 Jan 2020	Tab 9 correct output distance selection	wemi	N/A	N/A

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