A T T I N G I M U S
NACHRICHTENTECHNIK

Users guide of Collision Avoidance Radar CRA61

Caution:

Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

Features

- meets ETSI 300 / 440 with 250MHz bandwidth and/or FCC 100 MHz bandwidth
- detection range: 0.2m...20m (configurable)
- truck width: 1m...4m (configurable)
- antenna beam: 11º x 90º (+/-5,5º x +/-45º)
- CAN communication
- readout period: 71ms

General description

The Radar can work as a single collision avoidance Radar installed at a truck, a forklift or a crane. It also can work in a set consisting of 2 Radars communicating each other for more intelligent detection in zones. 2 possible pairs can be configured to have 2 different forms of detection zones: zones like a halve of a circle (mostly for forklifts) or rectengular zones (mostly used at the back of a truck). The purpose is to detect moved or unmoved obstacles behind a truck and to warn the driver on a monitoring system. The Radar gives an information of 6 different danger zones which can be configured from the manufacturer.

Attention

Human shall not stay closer than 20cm for a 100% duty circle when the Radar is switched on. This is only valid for FCC used areas.

Rules of Frequency Bands

The Radar can be set to 2 different frequency bandwith modes: one for FCC USA and Canada and one for general Europa use. Only the manufacturer is allowed to set this. The customer shall inform the manufacturer by ordering where he wants to use the Radars. This Radar can not used in France and UK because of limited bandwidth. It also can not used in countries where a limited bandwidth on the lower band boundary and the upper band boundary is defined.

Absolute Maximum Ratings

Supply voltage:	0V...+30V (security against polarity change)
Output current at CAN output:	short circuit proofed
Operating temperature:	-40...+85°C
Storage temperature:	-40...+100°C

Electrical Characteristics:

Supply voltage:	10...30V
Supply current:	typ. 130mA
max. provided current:	500mA
transmit frequency:	24.000...24.250GHz
transmit power:	10dBm (EIRP)
antenna pattern:	11º x 90º (+/-5,5º x +/-45º)

Mechanical Data:

size of the single Radar housings: 100 x 100 x 42

waterproofed and vibration proofed

Interface:

The interface of the Radar consists of 2 industriell M12 5 pole connectors; one is female, one is male. The Radars can be connected from Radar to Radar in a chain. One end is connected to a monitoring system which reads the informations of the Radar or the Radars on the CAN-bus. The other end has to be connected to a 120 Ohm resistor. Normally the wires of these kind of connectors have standarized colours. The user also can create his own cables with other colours. In the following table the connetion of the Radar is descripted from the standarized colour point of view.

blue: GND
brown: +U
gray: special communication line between 2 Radars working as a pair set
black: CAN bus high
white: CAN bus low

Two kinds of cable can/should be used: a 5-pole cable for connecting 2 Radars working in a pair set; a 4 pole cable outside the pairs for connecting other Radars or also other pairs at the same vehicle.

Cable Specification

The cable shall be shielded. The shield shall be connected to the metal housing of the connectors.

Functional Description

After switching on the power of the Radar a periodic readout will start every 71ms. But the Radar is in an undefined status now. It has to be configured by CAN instructions. All settings are stored in non-volatile memory. The following settings can be done: the ID of the Radar, the type (single, pair master or pair slave,etc..), setting for the zones, the width of the truck and the sensitivity.

The CAN data rate is 250kBit. The CAN specification is 2.0A and 2.0B standard.

The CAN standard of 29 Bit indentifier is used where the last few bit can be variable due to the message type and the ID of the Radar.

The most used message is the normal readout message. It is called

ZIND (zone indication) message:

The head of this message is 0x18FF020y, length 6 bytes.
This message will indicate the status of the sensor, its type and range and will indicate if an object is detected and in which zone. If it is not possible for a Radar to discriminate the distance in 5 zones then the distance zone indication starts from 0 up to the number of zones that can be detected.

0. byte: status byte
1. byte: distance of the closest lying obstacle of the (right) Radar (in dm)(unsigned 8bit integer
2. byte: distance of the closest lying obstacle of the (left) Radar (in dm)(unsigned 8bit integer
3. byte: zone (0...5)(unsigned integer)
4. byte: sensor type
5. byte: range

In the status byte only one bit is used: Bit 0 indicates if something is not OK; for example if a Radar is set as a master and the slave is not seen.

The zones are specified as followed:

0: no obstacle
1: obstacle in 0%...20% of range
2: obstacle in 20%...40% of range
3: obstacle in 40%...60% of range
4: obstacle in 60%...80% of range
5: obstacle in 80%...100% of range

The following sensor types are available and can be set (see next pages):

1: The Radar is a slave of a pair. This means that the CAN ZIND readout is stopped. But the Radar still listens to the CAN instructions. In case of being a slave the Radar has a readout now on the gray wire. This is for a readin of the master to be connected to the slave.
2: The Radar is a master for the truck mode. This means that it listens on the gray wire for the informations of the slave. In case of a truck mode pair the zones are rectangular behind the truck.
3: The Radar is a pair master for the forklift mode. The difference in comparison to the truck mode is that the zones are like a halve of a circle.
4: The Radar is a single working Radar. The zones are now simply divided in distances from the Radar.
5: The Radar is a single working Radar. There is no functional difference to the type 4, the only difference is that this Radar can be installed very closed to another Radar without any influence to each other. Therefore the gray wire has to be connected.

The range is a value in dm (unsigned 8bit integer).

The Radar transmits every 71ms a message if there is new information. If there is no information the Radar transmits this message only every 284ms.

Now the setting instructions are descripted. First a Radar read message is descripted which is only used for reading the current settings of the Radar.

RDRREAD (Radar read) message:

The head of this message is 0x18FF021y, length 8 bytes.

This message is used to read a parameter from the Radar unit.

0. byte: message type=0x00
1. byte: 7eh const.
2. byte: 5eh const.
3. byte: 8eh const.
4. byte: 9eh const.
5. byte: parameter number (0x01...0x07)
6. byte: not used
7. byte: not used

The answer of the Radar of this message is the Radar read responce:

RDRRRESP (Radar read responce) message:

The head of this message is 0x18FF022y, length 8 bytes.

0. byte: message type = 0x00
1. byte: 7eh const.
2. byte: 5eh const.
3. byte: 8eh const.
4. byte: 9eh const.
5. byte: parameter value which has been configured in the Radar
6. byte: not used
7. byte: not used

In the following the different settings are explained. There are 7 setting messages related to the parameter number in the Radar read message. To each of the parameter numbers a parameter value can be set.

The head of all Radar setup messages are 0x18FF021y, length 8 bytes.

The first of the setup messages is used to set the ID of the Radar. This is the y-value which already has been mentioned in the messages above. The Radar only will react if the ID is correct. That means that before installing a big chain of Radars at a vehicle they have to be setup with different IDs so that they can be contacted separately.

RDRSETUP (Radar setup) message:

0. byte: message type = 0x01
1. byte: 7eh const.
2. byte: 5eh const.
3. byte: 8eh const.
4. byte: 9eh const.
5. byte: y parameter (0x01...0x0F)
6. byte: not used
7. byte: not used

The next message is used for the setting of the range:

0. byte: message type = 0x02
1. byte: 7eh const.
2. byte: 5eh const.
3. byte: 8eh const.
4. byte:9eh const.
5. byte: range (20...200dm)(unsigned 8bit integer)
6. byte: not used
7. byte: not used

The next message is used for the setting of the width of a truck in case of using in a truck mode pair:

0. byte: message type = 0x03
1. byte: 7eh const.
2. byte: 5eh const.
3. byte: 8eh const.
4. byte: 9eh const.
5. byte: width of truck (10...40dm)(unsigned 8bit integer)
6. byte: not used
7. byte: not used

The next message is used for the setting of the sensitivity for moving objects:

0. byte: message type = 0x04
1. byte: 7eh const.
2. byte: 5eh const.
3. byte: 8eh const.
4. byte: 9eh const.
5. byte: sensitivity for moving objects (0...100)(unsigned 8bit integer)
6. byte: not used
7. byte: not used

The next message is used for the setting of the sensitivity for non-moving objects:

0. byte: message type = 0x05
1. byte: 7eh const.
2. byte: 5eh const.
3. byte: 8eh const.
4. byte: 9eh const.
5. byte: sensitivity for non-moving objects (0...100)(unsigned 8bit integer)
6. byte: not used
7. byte: not used

The next message is used for the setting of the sensor type:

0. byte: message type = 0x06
1. byte: 7eh const.
2. byte: 5eh const.
3. byte: 8eh const.
4. byte: 9eh const.
5. byte: sensor type (1...5)
6. byte: not used
7. byte: not used

The last message is used for the setting of the frequency band:

0. byte: message type = 0x07
1. byte: 7eh const
2. byte: 5eh const
3. byte: 8eh const
4. byte: 9eh const
5. byte: Radar frequency band (1 = FCC; 3 = ETSI)
6. byte: not used
7. byte: not used

On each of the 7 setup messages the Radar will respond with the Radar setup responce:

RDRSRESP (Radar setup responce) message:

The head of this message is 0x18FF022y, length 8 bytes.

0. byte: message type = 0x01...0x07
1. byte: 7eh const.
2. byte: 5eh const.
3. byte: 8eh const.
4. byte: 9eh const.
5. byte: result: 0=sucess; 1= fail
6. byte: not used
7. byte: not used

This responce only gives the information whether the setting was sucessful in the Radar or not.