Annex acc. to FCC Title 47 CFR Part 15
relating to
ADEC Technologies AG
TDC3-X

Annex no. 5
User Manual
Functional Description

Title 47 - Telecommunication
Part 15 - Radio Frequency Devices
Subpart C – Intentional Radiators
ANSI C63.4-2014
ANSI C63.10-2013

DAkkS Deutsche Akkreditierungsstelle D-PL-12053-01-00

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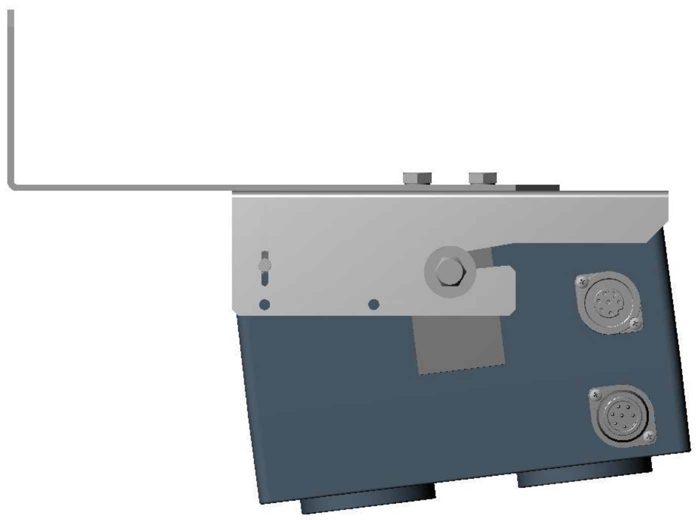
Installation Manual
TDC3 Series
Non-Intrusive Detectors for
Traffic Data Acquisition



TDC3-8-F-B-45 detector with mounting bracket

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Safety Note

All traffic detectors of the TDC3 Series must be supplied exclusively with a limited power source (LPS) that complies with EN 609050-1.

FCC ID 2AKMRTDC3X

Regulatory Statement

FCC Compliance Statement
This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

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

Any changes or modifications to this product not authorized by ADEC Technologies could void the EMC compliance and negate the authority to operate the product.

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Introduction

1.1 Operation Principle of TDC3 Detectors

The TDC3 Series Detectors combine three technologies (Doppler radar, ultrasonic & Passive infrared) into one robust, weatherproof housing. Passing vehicles generate signals in each subsystem. These signals are separately amplified and processed by a microcontroller, providing additional redundancy resulting in increased self-check capabilities and high reliability.

The Doppler radar measures the speed of each vehicle. The ultrasonic part scans the vehicle profile to determine the vehicle classes and to separate vehicles in the traffic stream for accurate volume information. The multi-channel PIR curtain provides lane-selective information and triggers the ultrasonic measurement. Based on the **PIR zones that a vehicle crosses, vehicles travelling between lanes and lane-changing vehicles can correctly be accounted for** and **assigned to the proper lane (all models except TDC3-2)**.

Classification is accomplished using the length and the height profile of a vehicle. Depending on the detector model, vehicles are divided into 2 (TDC3-2), 2+1 (TDC3-3), 5+1 (TDC3-5) and 8+1 classes (TDC3-8). A vehicle, which cannot be assigned to one of the defined classes, is assigned to a separate bin labelled “not identified”. Typically these are vehicles not travelling in the centre of their lane or lane changing vehicles.

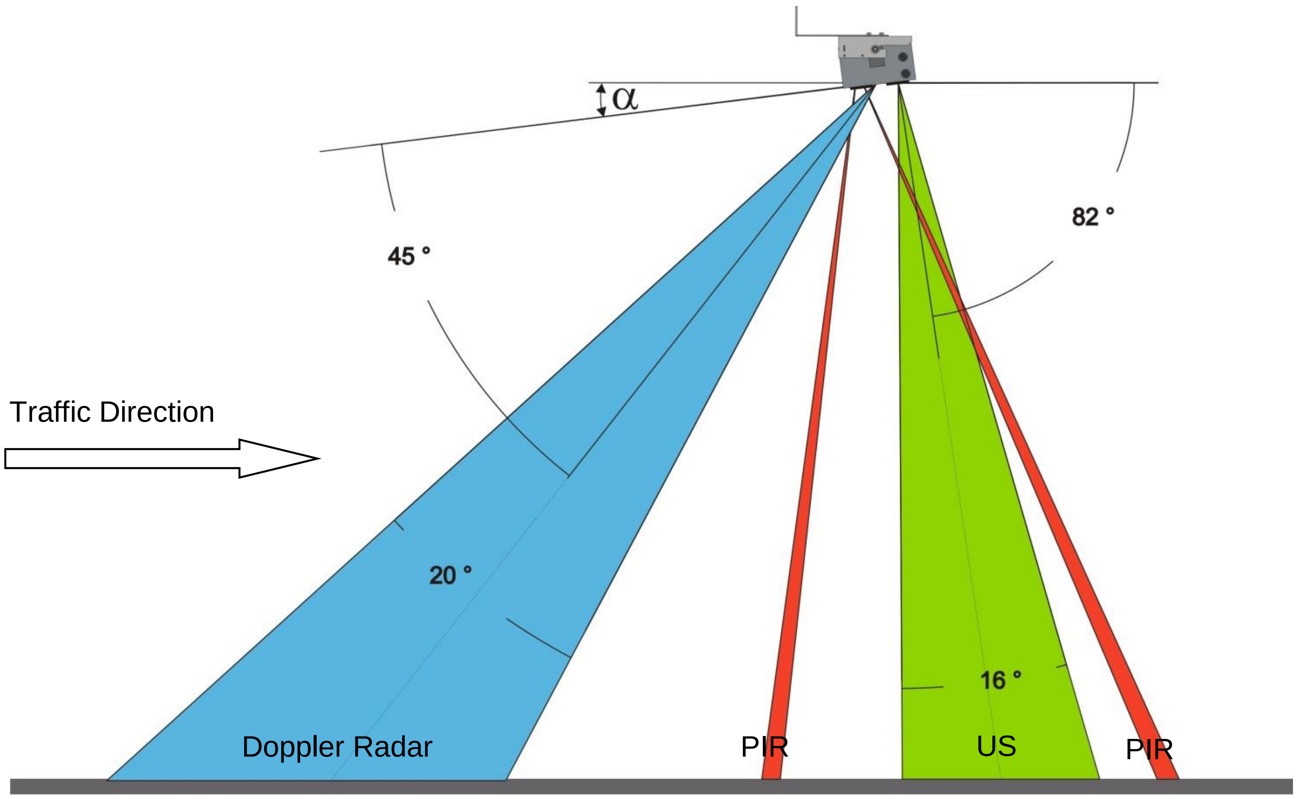
Detection of vehicles driving in the wrong traffic direction (wrong-way driver) can easily be achieved with just one unit per lane. Maximum reliability is achieved through the combination of distinct detection technologies, resulting in lowest possible number of false positives.

2 Detection Areas

The Doppler radar of the detector features a cone shaped detection zone, followed by two multi channel PIR detection curtains that enclose the cone shaped ultrasonic detection zone. The precise geometry and range of these four detection zones depends on the mounting height of the detector. It is designed **to cover one lane** provided the detector is mounted on a bridge or other overhead structure above the centre of the lane (see figure).

The angles between the radar cone, the ultrasonic cone and the PIR curtains are fixed and determine the detection geometry. The distances are interdependent and defined by mounting height and alignment angle of the detector enclosure relative to the lane surface.

The illustration below shows the mounting and setup based on the TDC3-8-F-B-45 model.
For other detector models and setups, please refer to appendix 11.



α = -7° in respect to the road surface

3 Planning the Main Application

The TDC3 Series detectors are designed for the detection of vehicles within short range. If the detector is mounted according to specification, the width of the various detection zones allows for lane-selective detection.

For accurate data, the detector must be mounted firmly on a stable structure. Especially vibrations and movement caused by wind etc. must be kept to a minimum.

The available **original mounting hardware** assists in the process of mounting the detector firmly, while providing the flexibility required for proper alignment.

For details about the models available, their specific mountings and setups, please refer to chapter 11.

3.1 Mounting Tips for Optimal Traffic Data Quality

For the detector to perform optimally, it is mandatory that the vehicles travel through all the detection areas (Doppler radar, ultrasonic cone and PIR curtains) in an orderly manner while at the same time detections from vehicles in adjacent lanes must be kept to a minimum.

The **recommended mounting height** for the **model TDC3-2 is 5 … 7.5 m (16 … 24 ft).**
The **recommended mounting height for the models TDC3-3, TDC3-5 and TDC3-8 is 5 … 6 m** (16 … 20 ft) **depending on the lane width**.

Important:
Applications in which detectors are mounted outside the ADEC-specified mounting height may result in reduced detection quality, detection of vehicles in adjacent lanes and abnormal status messages.

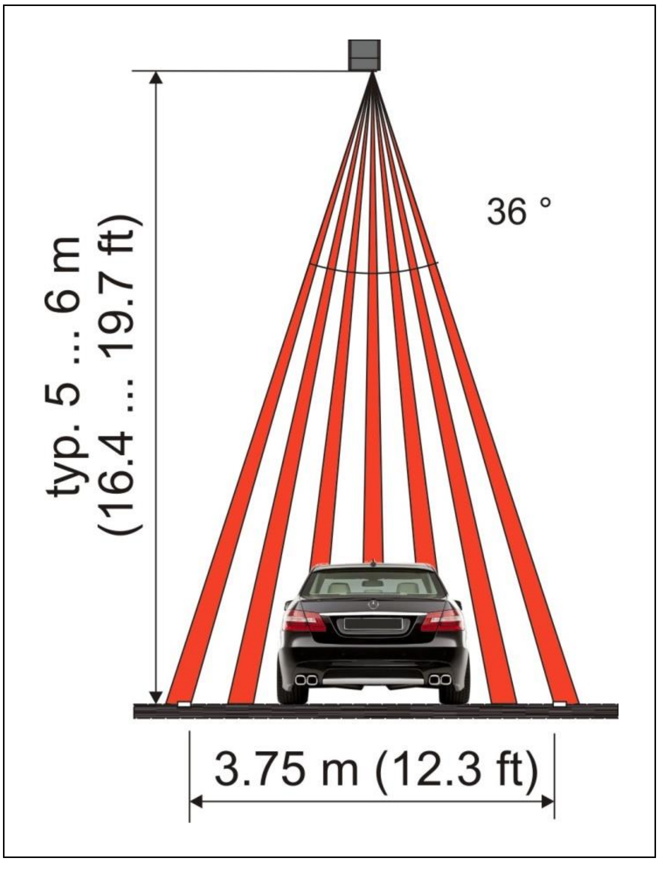
For maximum performance, the detector is operated in the preferred **Frontfire-mode** (mounted behind the sign gantry with the radar cone facing the approaching traffic; see appendix, section 11.1 for more information). This setup provides the **most accurate traffic data**.

- The detector has to be firmly mounted in the required height **above the centre of the lane** and aligned according to the graph above.
- The detector needs to be aimed along the centre of the lane to prevent vehicles in adjacent lanes from affecting the accuracy of the speed information of vehicles travelling in the monitored lane.
- For optimal data accuracy, the detector's angle in respect to the road surface has to be set to 7° according to the above graph. The alignment help on the mounting bracket is specifically designed to assist the installer in adjusting to the proper angle.
- **If the lane to be observed has a slope, the detectors alignment must be adjusted such that the resulting angle between the detector and the road surface remains at 7°**.

If the model TDC3-2 is operated in the Backfire-mode (radar cone is facing departing traffic) the traffic data in dense traffic is likely to be less accurate.

3.1.1 PIR Curtain (models TDC3-3, TDC3-5 and TDC3-8 only)

The detectors TDC3-3, TDC3-5 and TDC3-8 are equipped with a passive infrared curtain. Based on the PIR zones that a vehicle crosses, vehicles travelling between lanes and lane-changing vehicles can correctly be identified, accounted for and assigned to the proper lane. **Please refer to section 8.1 and the protocol specification for details**.



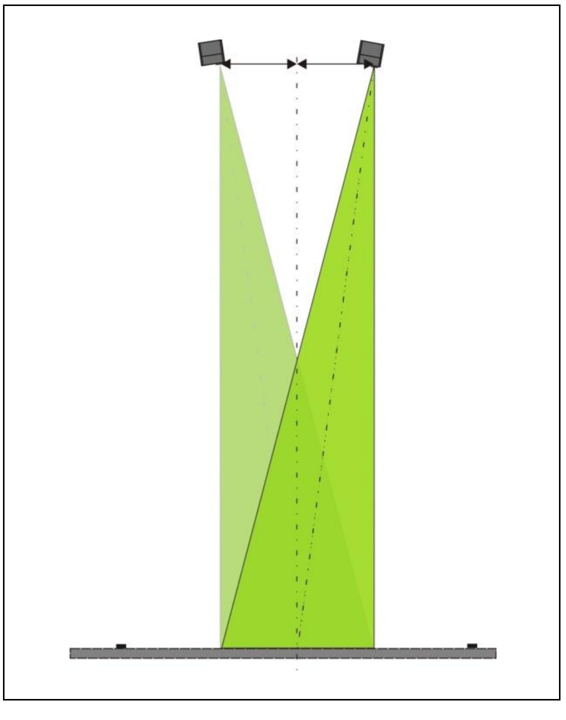
Optimum mounting height in function of the lane width

Lane Width	Mounting Height
4.00 m (13.1 ft)	6.00 m (19.7 ft)
3.85 m (12.6 ft)	5.75 m (18.9 ft)
3.65 m (12.0 ft)	5.50 m (18.0 ft)
3.50 m (11.5 ft)	5.25 m (17.2 ft)
3.35 m (11.0 ft)	5.00 m (16.4 ft)

Important:
Applications in which detectors are mounted outside the ADEC-specified mounting height may result in reduced detection quality, detection of vehicles in adjacent lanes and abnormal status messages.

3.1.2 Mounting of Detector Left or Right of the Centre of the Lane

Deviation from the centre of the lane must be kept below the following **maximum** distances to ensure optimal performance:



TDC3-3, TDC3-5 and TDC3-8: ± 0.1 metres (0.3 ft)

TDC3-2: +/- 0.8 metres (2.5 ft).

Important:
Applications in which detectors are mounted outside the ADEC-specified mounting may result in reduced detection quality, detection of vehicles in adjacent lanes and abnormal status messages.

4 Traffic Data

4.1 Counting / Volume

The combination of the three subsystems ensures highly accurate volume information of all vehicle classes. Occasional over or under counting can occur in special situations such as slow-moving (Stop&Go) traffic.

4.2 Speed

During normal traffic flow, the speed of each vehicle is measured. These individual speed values are subject to some tolerances. Systematic offsets resulting from mounting and alignment inaccuracies can be virtually eliminated **through the corrective v-factor which can be configured remotely** in the installation and commissioning software DET-SOFT, eliminating the need to change the hardware alignment.

To compensate for tolerances in the mounting and alignment of the detectors, which directly affect the length measurement and therefore the classification accuracy, the devices are equipped with a self-learning speed calibration. It compensates average speed inaccuracies within a range of ±3 km/h.

4.3 Vehicle Classification

Each vehicle moving through the detection areas can be detected and classified individually. As classification criteria of the standard models, the German TLS specifications for two classes (car and lorry / truck), 5+1 and 8+1 classes are used as a guideline. The number of vehicle classes provided depends on the detector model as shown in the table below.

In Stop&Go traffic or similar situations the classification accuracy, particularly of detector models designed for more than 2 classes, declines.

<table>
<tr><th colspan="2">Model</th><th>TDC3-2</th><th colspan="2">TDC3-3 ❶</th><th>TDC3-5</th><th>TDC3-8</th></tr>
<tr><th colspan="2">Class Description</th><th>2+0</th><th>2+0</th><th>2+1</th><th>5+1</th><th>8+1</th></tr>
<tr><td></td><td>Car</td><td rowspan="4">32</td><td rowspan="4">32</td><td rowspan="3">32</td><td rowspan="3">1</td><td>7</td></tr>
<tr><td></td><td>Motorcycle</td><td>10</td></tr>
<tr><td></td><td>delivery van</td><td>11</td></tr>
<tr><td></td><td>not identified</td><td>6</td><td>6</td><td>6</td></tr>
<tr><td></td><td>lorry / truck</td><td colspan="3" rowspan="5">33</td><td>3</td><td>3</td></tr>
<tr><td></td><td>lorry / truck with trailer</td><td rowspan="2">4</td><td>8</td></tr>
<tr><td></td><td>articulated lorry / semi-trailer</td><td>9</td></tr>
<tr><td></td><td>Bus</td><td>5</td><td>5</td></tr>
<tr><td></td><td>car with trailer</td><td>2</td><td>2</td></tr>
</table>

❶ The vehicle class data output for the TDC3-3 in 2+1 or 2+0 classes can be selected with the installation software DET-SOFT.

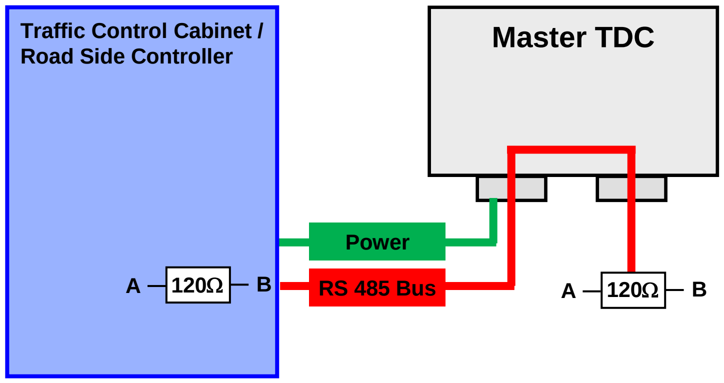
4.4 Self-Check and Status Output

The detector features full self check capability. All signal patterns and timing criteria are permanently checked and adjusted. A failure of any detection subsystem in the unit triggers a fault condition, which is communicated in the status byte of the communications data packet. This status information has to be monitored permanently during operation of the detector. Following error conditions are reported:

Radar
PIR A
PIR B
Ultrasonic
Wrong-way driver
Queue / Traffic jam
Synchronisation fault

5 Wiring

5.1 Single Detector Application



Important:
The communication bus has to be properly terminated with a terminating resistor of 120 Ω between data bus lines A and B. ADEC original part 64014 is recommended to properly terminate the bus on the detector's end

5.2 Operation of Multiple Detectors at the Same Data Bus

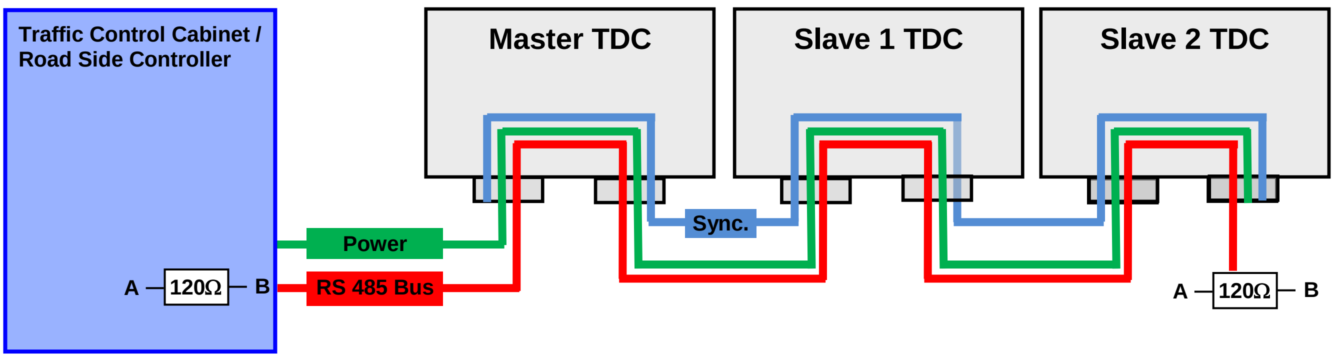
Up to 16 detectors can be operated on the same RS 485 data bus. To ensure proper communication, each detector **needs to be assigned a different address**. Using the DET-SOFT installation software, this can easily be done **prior** to connecting multiple detectors to the bus to avoid data collision or after the installation at any time.

If multiple detectors are mounted in close proximity, **they need to be synchronized** using the master/slave synchronization lead. This ensures that the detectors' ultrasonic range measurement process works properly and the signals from adjacent detectors do not affect each other. In this situation, one detector is configured to operate as the **master**, the others as **slaves**. Please also see the function "auto configuration" of the DET-SOFT software.

The detector with address 1 should be configured as **"master"**. All other detectors are configured as "slaves". This also applies in situations where both traffic directions are monitored from detectors connected to the same bus segment.

Since the "master" provides the synchronisation signal to the "slaves", a failure of the "master" detector all other detectors at this location stop working properly. Through remote configuration, any other detector can be selected as master to allow the data acquisition process to continue. When a slave stops working, it can be removed from the bus leaving the remaining detectors running as long as the two connectors leading to the defective unit are plugged together when this unit is removed.

If the distance between the closest detectors of the two directions is greater than 8 m (26 ft) it is recommended to configure the two directions separately with one "master" detector each.



5.3 Bus-Terminating Resistors

The RS 485 standard requires a bus topology (vs. ring or star topologies). To ensure proper communication, **the data bus must be terminated on both ends.**

The USB IF 485 interface module, available as original accessory features a built-in terminating resistor. This **resistor is factory set** to terminate the bus.

The **last detector on the bus**, on the opposite end of the USB IF 485 interface module, also needs a **terminating resistor of 120 Ω**. This can be accomplished simply by adding a resistor between the **wires RS 485 A** and **RS 485 B**, most easily with the plug with integrated terminating resistor (recommended ADEC accessory 64014).

6 RS 485 Communication

The detector provides the traffic data through its RS 485 data bus connection. The data needs to be actively polled. The traffic data can be acquired and analysed by any data acquisition equipment or by a PC equipped with proper software that implements the protocol specification. **For details see the protocol specification.**

To operate one or more detectors on a PC or any device featuring an USB interface, an interface module USB-IF485 (original ADEC accessory) is required.

Using proper wiring, the two-way RS 485 communication between detectors and the data aggregation module is designed to operate over total distance of up to 1’000 meters (3‘280 ft) according to RS 485 specification.

Protocol: 9600, 8, E, 1

9600	= 9600 Baud
8	= 8 Data Bits
E	= Even parity
1	= 1 Stop Bit

6.1.1 Data Buffer

The internal data buffer of the detector can keep information of up to four vehicles. If more than four vehicles have passed since the last polling event, **only the last four vehicles’** data is transmitted. It is therefore important to select the polling interval short enough to ensure no data is lost, especially in situations with high traffic volume.

7 Interface Module and Software

7.1 Interface Module USB-IF485

The interface module USB-IF485 is an original ADEC accessory for detectors of the TDC3 Series. The interface converts the signals from the detector’s RS 485 to USB compatible levels. The interface is necessary for two-way communication between the detectors and a PC.

7.2 Software for the Detectors of the TDC3 Series

The Windows-based installation software DET-SOFT is a useful tool for the commissioning, configuration and for statistical purposes or fault finding. It supports all models of TDC3 Series. The software for the installation and setup of the detectors is normally supplied with the USB-IF485.

Before starting the program, it is imperative that the detectors are electrically stabilised and have adjusted to the environmental temperature. Allow at least 30 minutes for the thermal stabilisation.

7.2.1 Applications of the Installation Software

The installation software is a very helpful tool for modifying and verifying a detector’s configuration remotely and to verify the alignment. It greatly improves the optimisation process of an installation and reduces the time to accommodate the requirements of a given location. The auto configuration function is a self-calibration process considering the site conditions (mounting height, master-slave wiring) for achieving the optimum settings which are saved into each participating detectors non-volatile memory. **It is mandatory to run the auto configuration for each installation!**

If the detector is commissioned using the “auto-configuration” function in the DET-SOFT software, a log-file is created in the user selected folder. This file contains the actual configuration and the traffic data obtained during the self-configuration process.

Examination and interpretation of the information collected by the installation software greatly assists in identifying the most effective steps to optimize the solution either by adjusting the alignment and/or the settings of the detector or by removing disturbance sources from within the field of view.

The **DET-SOFT** software features a statistical function to collect statistical data from each of the detectors connected to the data aggregation module. The data is stored in text-files on a per day, per detector basis thus allowing for easy long-term data acquisition.

Note: It is recommended to always use the latest available installation software to ensure all detector features and functions are fully supported.

8 Special Traffic Situations

8.1 Wrong-Way Driver (Wrong-Way Vehicle Detection)

The TDC3 Series detectors can detect vehicles driving in the wrong direction. In order for the corresponding status-bit to signal such an event, the Wrong-Way Driver detection needs to be activated in the “configuration” menu of the DET-SOFT.

For the wrong-direction alert to be issued, certain traffic conditions need to be met in order to ensure near error-free operation:

1. No vehicle has travelled through any of the detection zones within the last three seconds
2. The Doppler radar detects a vehicle in the wrong direction
3. The IR channels are triggered in the wrong sequence
4. The ultrasound detects a vehicle event
5. All three conditions are met within a certain timeframe
6. The last few vehicles’ average speed (in the correct direction) is 35 km/h (22 mph) or higher.
7. **Minimum vehicle speed of a wrong-way driver**: **40 km/h**

If all these conditions are met, the corresponding bit in the status byte is set. Subsequent vehicles travelling in the correct direction clear the bit (factory setting). Accommodating other requirements and policies, the detector can be also configured to require the bit be reset using the proper command. **Consult the protocol specification for details**.

8.2 Alternating Traffic (TDC3-2 only)

The detector model TDC3-2 can be used for lanes with alternating traffic flow. During installation, the detector is set up in Frontfire-mode (facing the approaching traffic). This “regular” direction can be switched remotely using the two-way RS 485 communication.

8.3 Queue / Traffic Stand Still

If a vehicle comes to a stop and remains in the ultrasonic detection area for more than 10 seconds (factory setting), the detector sets the status bit “Queue”. The table below illustrates the information issued by the detector at the begin, during and at the end of a traffic stand still for each detected vehicle.

<table>
<tr><th></th><th>Counter</th><th>Speed</th><th>Vehicle Class (2+1, 5+1, 8+1)</th><th>Vehicle Class (2+0)</th><th>Occupancy</th><th>Time Gap</th></tr>
<tr><td>Begin</td><td>unchanged</td><td>0</td><td>6 = not identified</td><td>32 = car</td><td>Time elapsed since queue has been detected</td><td>Time elapsed since last event until begin queue</td></tr>
<tr><td>Queue</td><td>unchanged</td><td>0</td><td>6 = not identified</td><td>32 = car</td><td>Polling interval (Time elapsed since last data poll)</td><td>0.00 seconds</td></tr>
<tr><td rowspan="2">End</td><td rowspan="2">increase by 1</td><td rowspan="2">0 ... 20 km/h
(0 ...12 mph)</td><td rowspan="2">6 = not identified</td><td>vehicle height
≥ 3 m
33 = truck / lorry</td><td rowspan="2">Time since last poll until end of queue</td><td rowspan="2">0.00 seconds</td></tr>
<tr><td>vehicle height
< 3 m
32 = car</td></tr>
</table>

8.4 Stop & Go

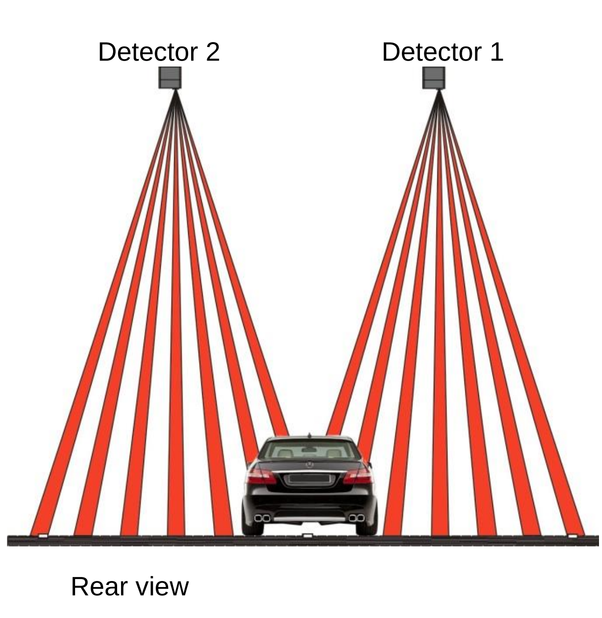
Data acquired in Stop&Go traffic flow is less accurate because vehicles tend to accelerate or decelerate within or between the detection areas resulting in inaccurate speed information. Since speed information is used to determine a vehicle's length, the length information and thus the entire classification information tends to be less accurate compared to free flowing traffic.

8.5 Lane Information

All TDC3 detectors (except TDC 3-2) can be configured through the DET-SOFT software to provide information about which part of the lane a vehicle has crossed the PIR curtain in addition to the other individual vehicle information discussed above. The lane information (left/right) is in reference to the traffic direction:

In order for the data collector to identify a vehicle as a lane-changing vehicle and thus reject it, the detectors provide vehicle-based timing information to the data collector using which it can assign the two resulting events to the same vehicle. **For details refer to the protocol specification.**

8.5.1 Example using TDC3-8 (8+1 classes)



Comments:

Lange-changing vehicle, as
detector 2, class 6 (not identified) with lane info >
(vehicle on the right side of the lane) and
detector 1, class 6 (not identified) with lane info <
(vehicle on the left side of the lane) output is given.

Sync. Timer values are typically within 200 ms for such an event.

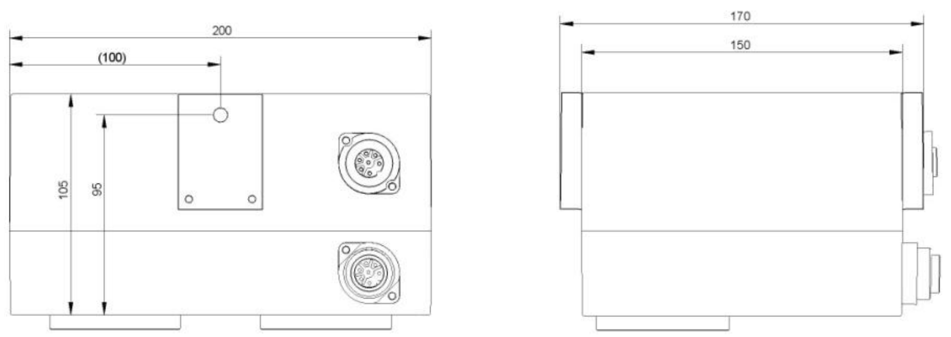
address	time stamp [hh:mm:ss]	speed [km/h] (mph)	vehicle length (dm)	class	lane-info (vehicle position)	occupancy [s]	time gap / headway [s]	status	counter	sync.- timer
2	12:47:20	255	11	6	right	0.03	7.95	0	31264	45.1727
1	12:47:20	126	39	6	left	0.11	22.36	0	57341	45.2412

9 Specification TDC3 Series

Electrical	
Supply Voltage	10.5 … 30 V DC
Power Consumption	max 110 mA typ. 80 mA @ 12 V DC
Output (Data Transfer)	RS 485 (other options on request)
Turn-on Time	typ. 20 s from power on
Mechanical	
Dimensions	see drawing
Case Material	Polycarbonate, dark grey
Mounting Points	M8, stainless steel V4A
Weight	app. 1'700 g (3.75 lbs) without bracket
Detection	
Doppler Radar	K-Band 24.075 … 24.175 GHz
Ultrasonic Frequency	40 kHz
Ultrasonic Pulse Rate	10 … 30 pulses per second
PIR Sensors	2 channel PIR (TDC3-2) 7 channel PIR curtain (TDC3-3 /-5 /-8)
PIR Spectral Response	6.5 … 14 µm
Accuracy*	
Counting	> 99.5%
Speed	< 2.1% (> 100 km/h) < 2.5 km/h (≤ 100 km/h)
Classification*	80 – 99.5%, vehicle classes according to TLS *The specifications refer to free traffic flow, detector operated in recommended setup*
Environmental	
Operating Temperature	–40°C to +70°C (–40 to +158ºF)
Humidity	95 % RH max.
Sealing	IP 64 splash proof** *** applies only to mounted configuration!*

** measured according to TLS and independently verified*

9.1 Mechanical Dimensions



Dimensions in mm

10 Disclaimer

Despite the construction and assembly according to the latest technological advances, absolute reliability and information accuracy cannot be guaranteed due to the nature of the passive infrared, ultrasonic and microwave detection principles.

The traffic data accuracy strongly correlates to the exact alignment and proper configuration, the environmental conditions, in particular the prevalent thermal contrast and to the form and shape of an object’s surface.

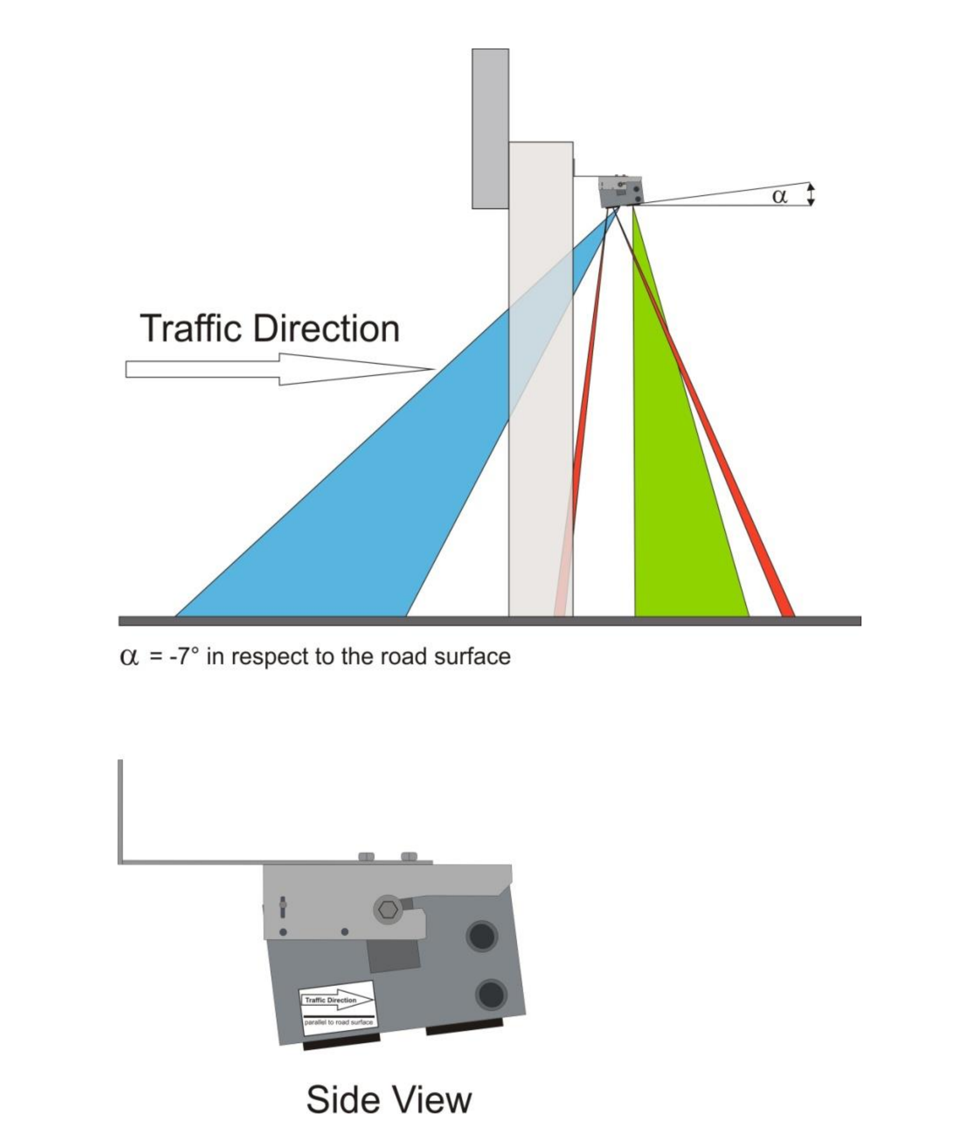
The detectors of the TDC3 Series have been tested under the **recommended mounting conditions as defined in section 11.1** of this manual and in accordance with the TLS 2002 and the conditions defined therein (loose free flow traffic in the centre of the lane). Depending on the real operating and traffic conditions smaller or larger deviations from the true traffic data can occur.

ADEC Technologies assumes no liability, direct or indirect, resulting from the installation or use of any detector of the TDC3 Series. The technical information provided in this product manual is based on a sample population taken from regular production units and is believed to be representative for the entire population. ADEC Technologies reserves the right to change product information and specifications without notice.

11 Appendix to Mounting and Ordering Information

The detectors of the TDC3 Series have been tested under following recommended mounting condition (11.1). Please note that the available models depend on the mounting and setup as stated below.

11.1 Frontfire Setup with Mounting behind Gantry



11.1.1 Available Models for the above Mounting and Setup

Model	Ordering number	Description
TDC3-**2**-F-B-45	11110	**2** Classes, Frontfire, Mounting behind Gantry
TDC3-**3**-F-B-45	11113	**2+1** Classes, Frontfire, Mounting behind Gantry
TDC3-**5**-F-B-45	11115	**5+1** Classes, Frontfire, Mounting behind Gantry
TDC3-**8**-F-B-45	11117	**8+1** Classes, Frontfire, Mounting behind Gantry

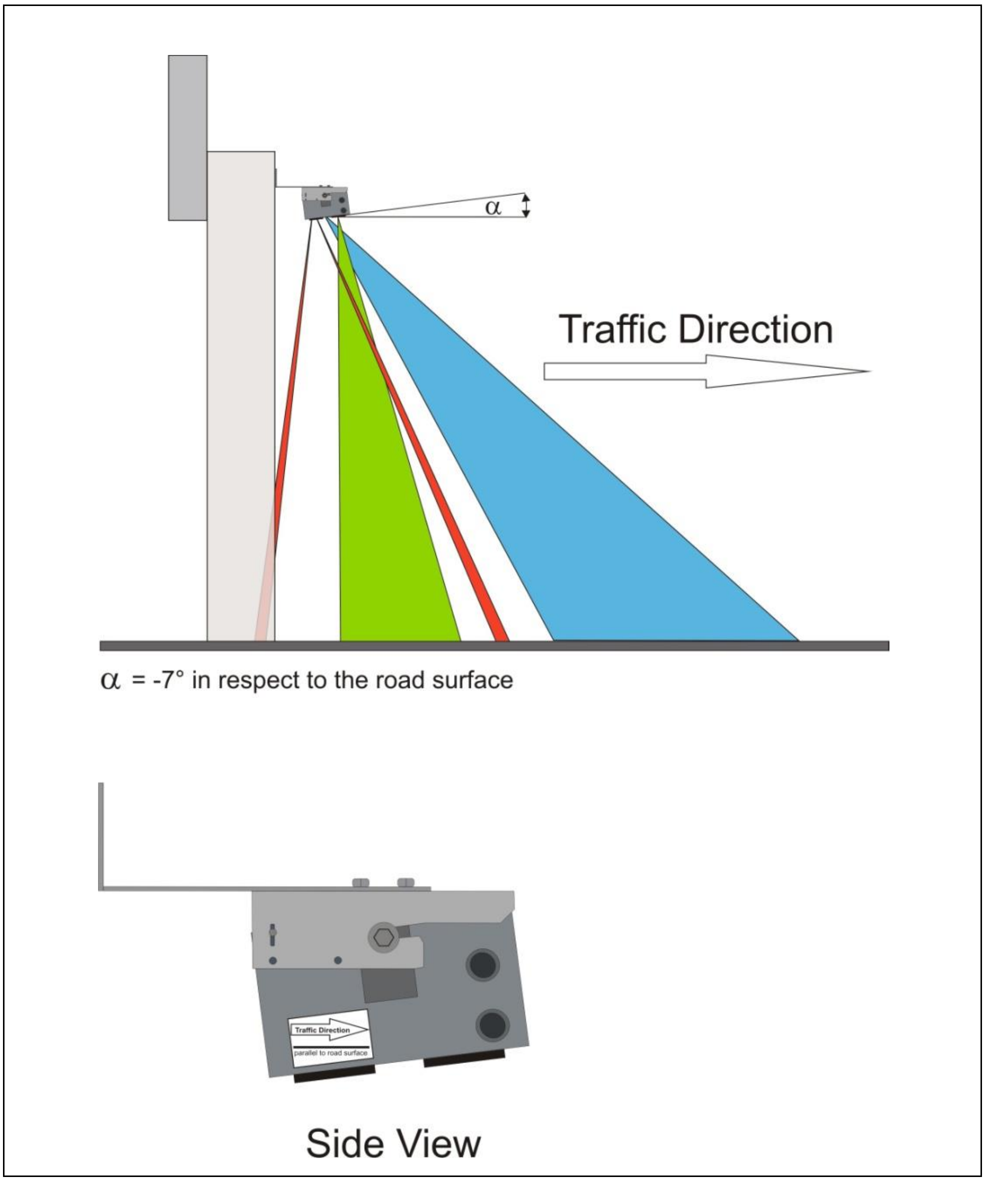
Comments:

The **cone-shaped ultrasonic** detection zone (green) **must** always be **pointed away** from structures such as gantries in order to maximize the accuracy and reliability of the range-measuring sensor by minimizing unwanted echoes.

The arrow as shown in the side view identifies the direction of the traffic flow. In the above example the **radar** (blue) is pointing **towards** the approaching traffic = **Frontfire**.

For the recommended mounting height based on the detector model please refer to section 3.1.

11.2 Backfire Setup with Mounting behind Gantry



11.2.1 Available Models for the above Mounting and Setup

Model	Ordering number	Description
TDC3-**2**-B-B-31	11112	**2** Classes, Backfire, Mounting behind Gantry

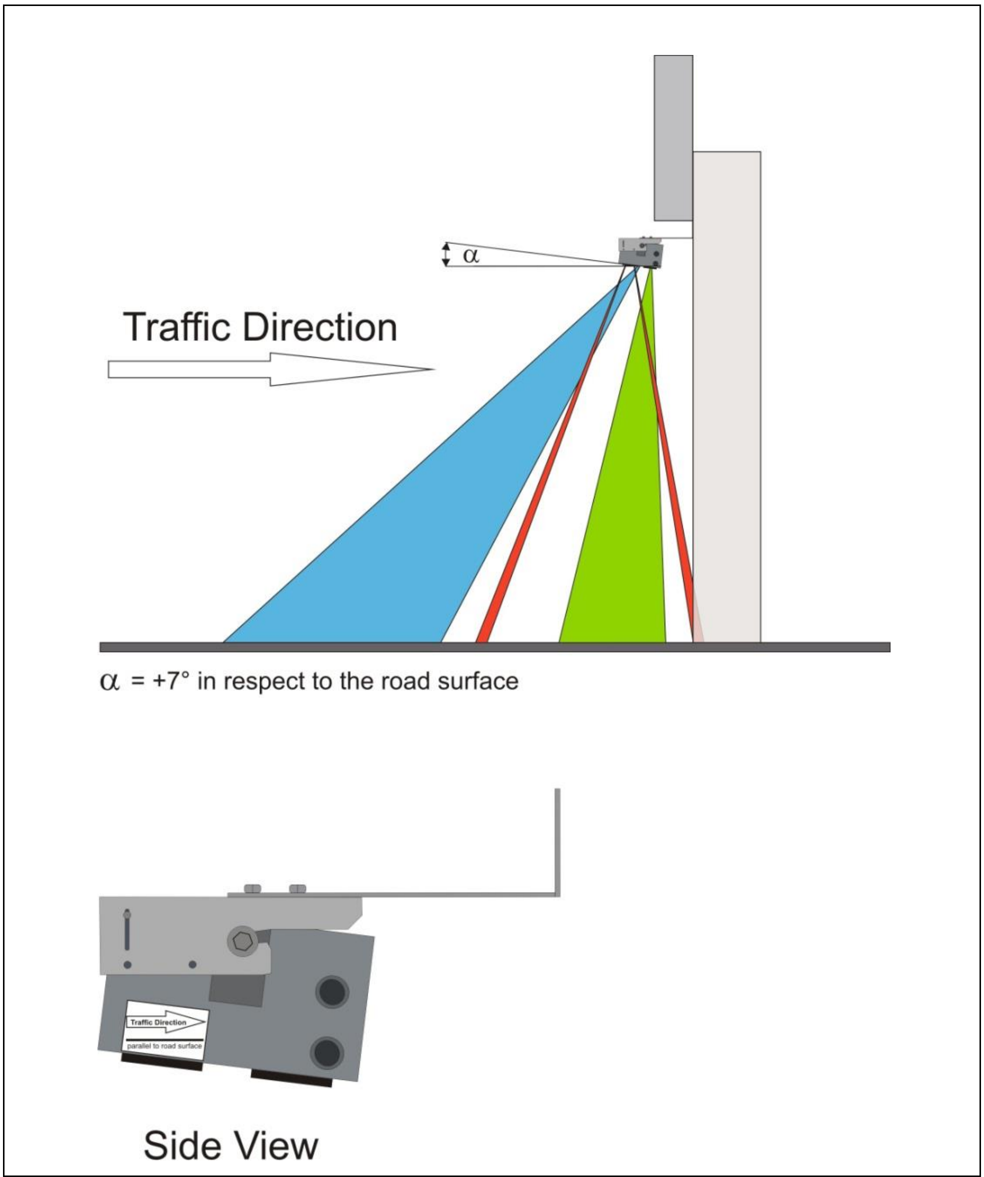
Comments:

The **cone-shaped ultrasonic** detection zone (green) **must** always be **pointed away** from structures such as gantries in order to maximize the accuracy and reliability of the range-measuring sensor by minimizing unwanted echoes.

The arrow as shown in the side view identifies the direction of the traffic flow. In the above example the **radar** (blue) is pointing **away** from the approaching traffic = **Backfire**.

For the recommended mounting height based on the detector model please refer to section 3.1.

11.3 Frontfire Setup with Mounting in Front of Gantry



11.3.1 Available Models for the above Mounting and Setup

Model	Ordering number	Description
TDC3-**2**-F-F-31	11111	**2** Classes, Frontfire, Mounting in Front of Gantry
TDC3-**3**-F-F-31	11114	**2+1** Classes, Frontfire, Mounting in Front of Gantry
TDC3-**5**-F-F-31	11116	**5+1** Classes, Frontfire, Mounting in Front of Gantry
TDC3-**8**-F-F-31	11118	**8+1** Classes, Frontfire, Mounting in Front of Gantry

Comments:

The **cone-shaped ultrasonic** detection zone (green) **must** always be **pointed away** from structures such as gantries in order to maximize the accuracy and reliability of the range-measuring sensor by minimizing unwanted echoes.

The arrow as shown in the side view identifies the direction of the traffic flow. In the above example the **radar** (blue) is pointing **towards** the approaching traffic = **Frontfire**.

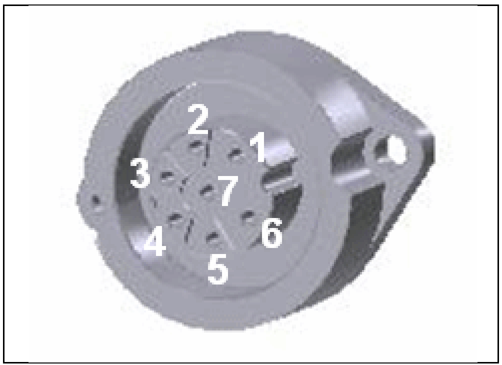
For the recommended mounting height based on the detector model please refer to section 3.1.

12 Appendix to Wiring

12.1 Electrical Connections of the TDC3 Series Detectors

Each TDC3 Series detector is equipped with a male and female connector socket as illustrated in the picture below. Matching connectors are not part of the delivery but available as original accessories. For details refer to chapter 13.

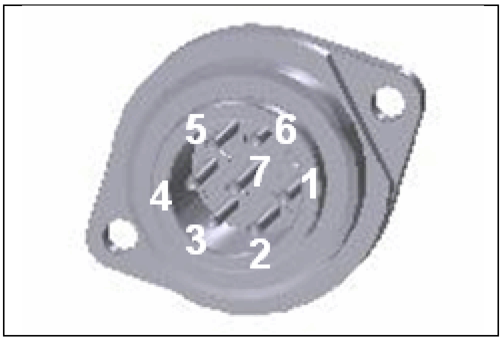
Female Connector Socket



Pin Definition for Male and Female Connector Socket

1 Positive Supply Voltage, Vcc
2 Option Trigger Output (special version, available on request)
3 GND
4 Synchronization
5 RS 485 Signal A
6 RS 485 Signal B
7 Do not use!

Male Connector Socket



12.2 Recommendations for Cabling

- Polyurethane (PUR) Cable with shield and twisted pair wiring
- Wire cross-section: 0.34 … 0.52 mm2 (AWG 22 or AWG 20) braided or twisted filament *)
- Cable entry assembly of plug PG 9: Diameter 6 … 12.5 mm (0.24 … 0.47 inches)
- Maximum wire cross-section of receptacle and plug: 0.75 mm^2
- Supply (11 V DC … 24 V DC nominal): 2 wires
- RS 485 communication: 2 wires, twisted pair
- Synchronization**: 1 wire
- Shield: Connect to ground at the end near the control device. Connecting the shield between the detectors is not necessary due to the short cable length.

- *) The diameter needs to be such that at a current of 110 mA per detector the remaining voltage at the last detector on the bus is at least 11 V DC and the voltage at the first detector in the chain is well within the allowable supply voltage range (30 V DC).

- **) Necessary for installations where detectors are mounted along adjacent lanes, 8 m (26 feet) or closer to each other.

For further information regarding the wiring and cabling please contact the manufacturer.

13 Appendix to Accessories

13.1 Connectors

13.1.1 Male Cable Connector Right Angled

Ordering number: 64012

13.1.2 Female Cable Connector Right Angled

Ordering number: 64013

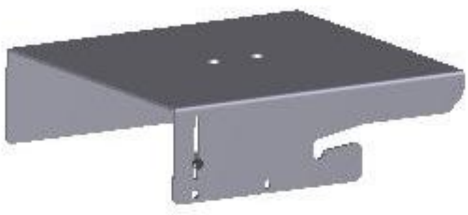
13.1.3 TDC3-Terminating Resistor

Ordering number: 64014

13.2 Mounting brackets

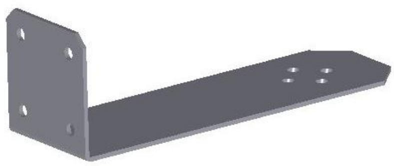
13.2.1 Mounting Bracket TDC-MB

Ordering number: 14010



13.2.2 Mounting Add-On TDC-MA

Ordering number: 14011



13.3 Interface Module RS 485/USB

13.3.1 USB-IF485

Ordering number: 12501