Axle Classifier (RAKTEL 8010) Product Specification

MS001-53010-40

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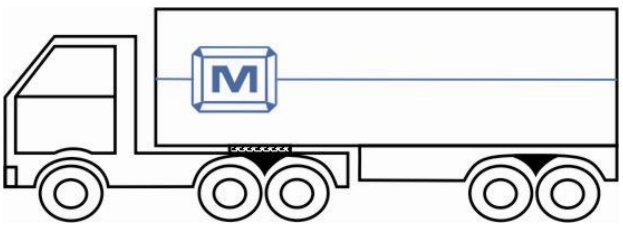
Issue 2



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Revision History

Issue	Author	Date	Reason for Change	Authorised
1	RS	20 Oct 2009	Initial copy	CS
2	RS	19 Aug 2012	Revision page added	CS

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Introduction

The main components of the Mikros Systems Axle Classifier system are the following:

The Mikros Systems RAKTEL-8010 is a major upgrade from the RAKTEL-8000 enhancements includes:

- Increased loop sensitivity
- Improved piezo axle detection
- Enhanced classification
- Expanded sensor diagnostics
- New power management

- A RAKTEL 8010 traffic data logger (illustrated on the cover)
- Inductive loops (two per lane)
- Piezo Class II axle sensors (one or two per lane). MSI Roadtrax® BL Piezos are normally used.
- Interface for Sensor Line fiber optic axle detectors is available.

The Mikros Systems RAKTEL 8010 is the primary traffic data logger used for all the Mikros Systems road traffic data logging options, ranging from simple single loop traffic volume counts to complex High-Speed-Weighing-In-Motion applications.

The RAKTEL 8010 comes in a standard 19" 3U rack mount. Modular card configuration allows for flexible configuration and ease of use.

Normally the primary sensor of the RAKTEL 8010 is a high performance eight-channel digital loop detector. This detector is cross-talk free and can be used over a wide range of inductances. Each RAKTEL 8010 can accommodate up to two of these loop detectors. Vehicle volumes can be monitored for eight lanes using one loop detector, if the single loop per lane configuration is used. When vehicle speeds are also required, two loops per lane must be used. With two loop detectors installed up to eight lanes can be monitored (vehicle volumes and speeds).

By adding secondary sensors to the RAKTEL 8010 more information is recorded and more detailed classification can be undertaken. The classification of information is limited to vehicle length and inductive profile parameters when only loops are used. By adding axle detectors, classification schemes based on axle spacing parameters can be added. Mikros Systems uses an advanced sensor performance tracking algorithm to ensure stable long-term axle detector response.

Traffic data is recorded for each individual vehicle and stored in a non-volatile memory in either the complete individual vehicle record or in a fixed summary format. It is also possible to store individual records and data summaries together. Data on all heavy vehicles can be stored as individual records and data on light vehicles can be summarized in hourly speed-volume-headway bins. The RAKTEL allows the user to select and suppress information to be stored.

The RAKTEL 8010 reports and stores comprehensive diagnostics on the logger performance and all the sensors connected to the logger.

Communication to the RAKTEL 8010 is primarily provided through two serial ports that function completely independently from each other. The RAKTEL 8010 is controlled and configured via the serial ports. RAKTEL 8010 can be addressed in a party line configuration where one line can be daisy chained to a number of loggers. The RAKTEL 8010 can also be used in L/WAN configurations using TCP/IP.

RALTEL 8010 is supported by a suite of programs that communicates with the logger. The programs are used to control the logger and to process the collected data.

Inductive loops are normally used as primary sensors with Mikros Systems' Axle Classifier traffic logging equipment. This is because loops are the most reliable presence sensors available.

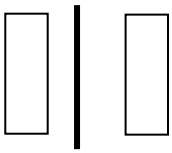
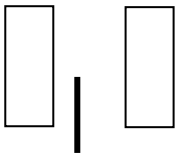
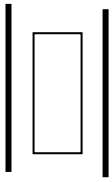
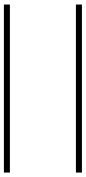
Major advantages of the Axle Classifier Traffic Logging system

The Mikros Systems Axle Classifier Logging system has the following features to its advantage:

- A modular design.
- Active lightning protection.
- Flexible configuration.
- ***High performance cross-talk free digital loop detector.***
- Digital chassis height detection.
- ***Coincidence detection (lane straddle).***
- ***Tidal flow and reverse direction recording.***
- Advanced axle sensor performance tracking.
- Comprehensive system performance monitoring.
- Detail sensor diagnostics capability.
- User-friendly set-up and complete diagnostics.
- Full range of classification algorithms.
- Provision for most popular data formats.
- User-modifiable parameter sets.
- Comprehensive software support.
- Low power consumption (solar charging supported).

Sensor configuration options

It should be noted that the configuration options chosen for a specific logger determine the sensor configuration. Each logger is configured for a specific application; therefore not all the interfaces are automatically included. Typical loop dimensions are 100cm x 300cm, spaced apart 200cm (other dimensions can also be used).

Sensor Configuration	Remarks
	▪ ***Standard recommended configuration*** ▪ Dual Loop plus single (full width) piezo axle sensor. ▪ Classification is based on axle spacing profiles. ▪ Up to 8 lanes can be monitored. Information on individual vehicles and/or time sliced summaries is available.
	▪ Dual Loop plus single (half width) piezo axle sensor. ▪ Classification is based on axle spacing profiles. ▪ Up to 8 lanes can be monitored. Information on individual vehicles and/or time sliced summaries is available.
	▪ Single Loop plus two piezo axle sensors. (Normally not recommended, as improved vehicle integrity is achieved with a loop-piezo-piezo-loop configuration) ▪ Classification is based on axle spacing profiles. ▪ Up to 8 lanes can be monitored. Information on individual vehicles and/or time sliced summaries is available.
	▪ Dual axle detectors. ▪ Classification is based on axle spacing profiles only. ▪ Up to 8 lanes can be monitored. ▪ Information on individual vehicles and/or time sliced summaries is available. ▪ This layout reduces pavement cuts but data integrity is not as high as that of dual loops plus axle detector. Adding a single loop improves vehicle separation detection.

Typical configurations and optional extras

The following is typical configurations and optional extras for the RAKTEL 8010 Axle Classifier:

Standard interfaces:

- CPU
- RAKMAN power supply card
- Loop detector card (8 channel) – up to two cards per system.
- External memory card.
- Piezo axle detector card (8 channel) – up to two cards per system.
- Fiber optic axle defector card (8 channel) – up to two cards per system.

Memory options: (all memory is battery backed-up)

- 128Kb – 917Kb on the CPU card only.
- External memory (2,4Mb or 8Mb)

Optional extras:

- Tamper alarm.
- Modem power control card.
- Incident output.

Short descriptions of interfaces:

CPU

The CPU card contains the processor, optional data storage memory. The memory on the CPU cannot be used with the external storage memory.

RAKMAN power supply

The power supply card can be used from 110V – 220V and also controls solar charging. The system is a 12V dc system.

Loop detector

The loop detector card is a high performance digital 8-channel unit. Up to two can be installed in a system.

External memory

The external memory card is a battery backed-up mass memory card that is available in 2,4Mb or 8Mb.

Piezo axle detector

The piezo axle detector card is an 8-channel unit for detecting axle events. Up to two can be installed in a system.

Fiber optic axle detector

The fiber optic axle detector card is an 8-channel unit for detecting axle events. Up to two can be installed in a system.

Tamper alarm

A tamper alarm can be fitted in the housings. The status can be monitored remotely if the alarm is triggered.

Modem control card

The modem control card supplies power to an external modem. The power to the card can be software controlled and can be set up in a number of selectable time-slots. This feature optimizes power consumption and prolongs battery life.

TCP-IP Ethernet

A UTP type TCP-IP Ethernet connection is available to the RAKTEL 8010 for LAN/WAN applications.

USB2 interface

A standard USB2 interface is available to the RAKTEL 8010 for fast data extraction.

Incident output

Incidents such as speeding can be flagged and output triggers generated. An optional 'Flash' unit is available.

Termination

All terminations of cables to the RAKTEL are done via terminal boxes. Comprehensive active lightning protection is provided on all relevant inputs.

Communication to the RAKTEL 8010

A number of communication connections (and combinations thereof) to the RAKTEL 8010 are possible. A party line is available and is handy when only one remote line is available for a cluster of RAKTEL 8010's. Each RAKTEL 8010 in the line can be assigned a unique address. It can then be remotely accessed. The limitation is that only one logger can be accessed at a time. Once the contact has been established, the control is the same for all the methods mentioned below.

A: Direct on-site communication via laptop

The RAKTEL 8010 can be set up, controlled and its recorded data extracted through the TelWin program. The communication is done via a serial port or USB port.

B: Remote communication via dial-up modem

The RAKTEL 8010 can intelligently control a dial-up modem connected to it. The RAKTEL 8010 can control the power to the modem via the COMTEL interface. This feature is especially helpful when cellular modems are used that cannot go into a low power standby mode.

C: W/LAN connection via fiber optic, using TCP/IP

The RAKTEL 8010 can communicate to the TelNet program using TCP/IP. In this configuration more than one RAKTEL 8010 can be accessed at once. This can also be achieved by running more than one TelWin program.

Real-time monitoring

The following illustrates the integrated video camera function of TelWinPro.

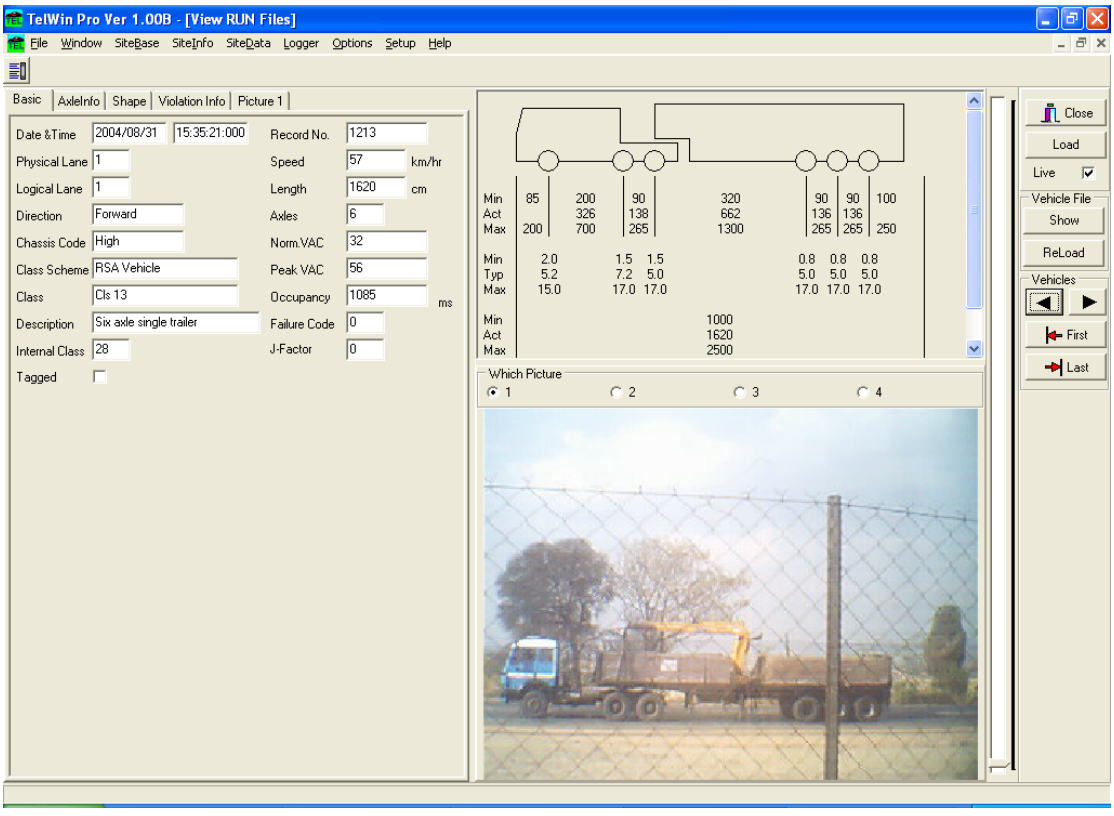
TelWinPro can handle up to 4 cameras as synchronized input. The limitation is the actual performance of the PC that runs the program and the available hardware (frame grab cards). Cameras can be positioned to take overall and lane views and to zoom in on number plates or any configuration required.

The illustration was made using a laptop-running Windows 2000 Professional. The simple USB Web cam was used as camera. The purpose of this application was to check and verify a 'loop-piezo-loop' site.

Currently the camera is triggered by the loop activation.

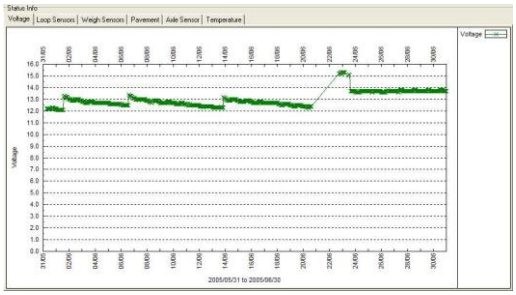
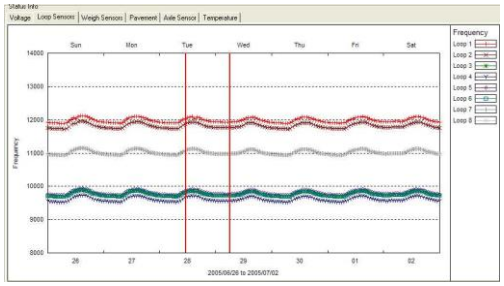
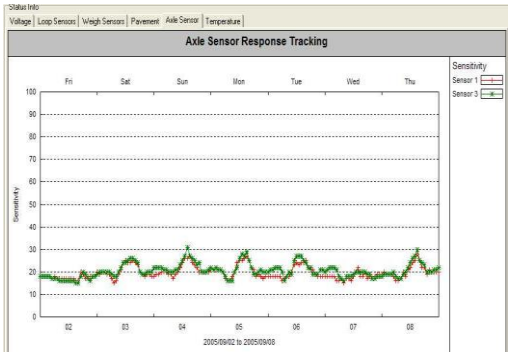
The complete vehicle-by-vehicle information is synchronized with each picture. The following TelWinPro display serves as illustration:

Note. Axle's masses won't be displayed as this information is not available with the axle classifier RAKTEL 8010.



Comprehensive system performance monitoring

One of the most powerful features of the Mikros Systems RAKTEL loggers is that it provides a continuous and visual status monitor of system and sensor performance. This greatly enhances the integrity of the recorded data. The user can see at a glance that all systems are functioning correctly. By having a long-term trace of the important system and sensor status instantly available any possible anomalies are detected immediately.

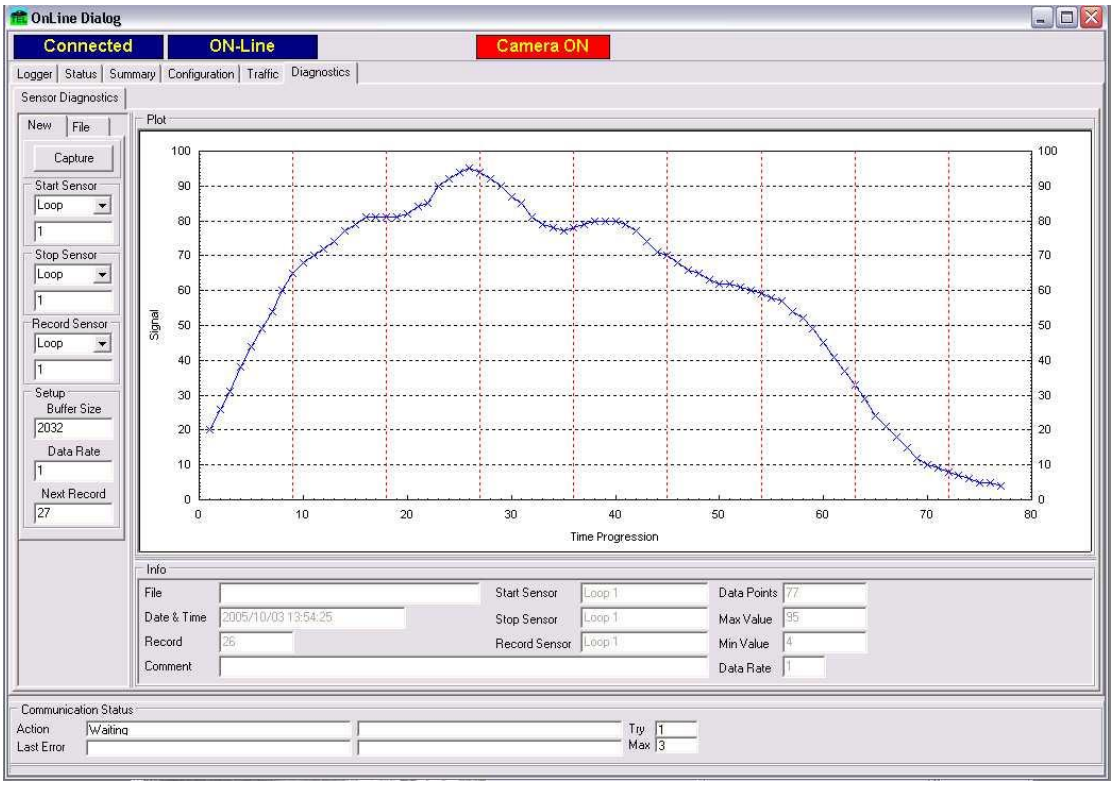
Status trace:	**Comments**
	Continuous battery status monitored for a month. In this plot it can be clearly seen when batteries were changed and mains power permanently connected. The Y-axis indicates the current voltage.
	Continuous inductive loop stability (frequency) monitored for one week. The plot shows the normal daily fluctuations with loop errors indicated by the vertical lines.
	Continuous axle sensor sensitivity monitored for one week The plot shows how the sensitivity of the axle detector sensors varies normally. Any determination of axle sensor performance will clearly be indicated as a abnormal drop or erratic trend.

Detailed sensor diagnostic mode

This mode is a digital scope mode that allows the user to capture detailed sensor response profiles on all of the sensors connected to the RAKTEL.

This function is used to verify the correct signals response from each sensor.

A digital trace is plotted of the response of a sensor as a vehicle passes over it. This profile can be stored for quality assurance purposes.



A typical sensor response of a light vehicle over a loop.

Digital vehicle chassis height determination

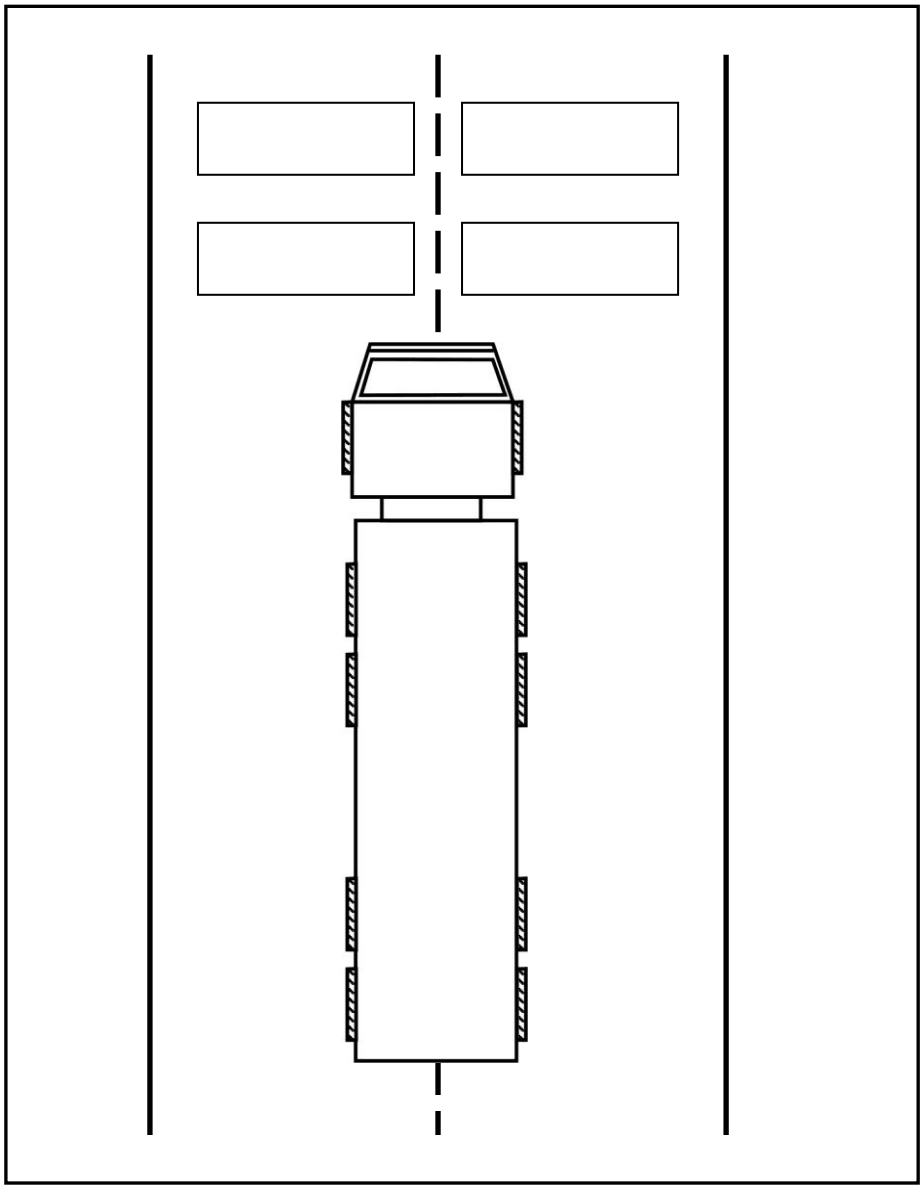
The loop detector provides in addition to the presence and timing signals a vehicle chassis height indication. This parameter is an automatically scaled value that is divided into three categories. The boundary values of these height categories are user selectable.

The chassis height parameter is used in the classification and coincidence algorithms of the logger.

Coincidence detection (lane straddling)

The cross talk free loop detector of the RAKTEL allows for close loop spacing between adjacent lanes (500mm typical). This makes it possible for the logger to detect a vehicle that straddles between two adjacent lanes. A requirement for this is that loops are installed abreast of each other.

This reduces double counting of vehicles on sites where lane discipline is a problem.



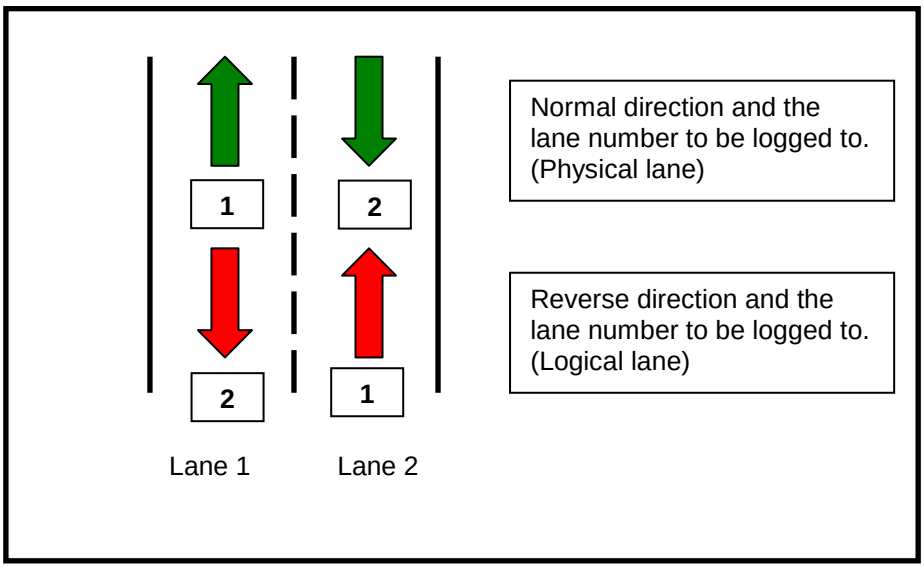
- Close loop separation allowed for.
- User selectable parameters to optimize for local conditions.
- Default standard parameter values installed.

Tidal flow and reverse direction logging

By assigning the reverse direction travel on a lane to a other than the physical lane in which a vehicle is traveling, separate logical lanes can be specified to record these incidents.

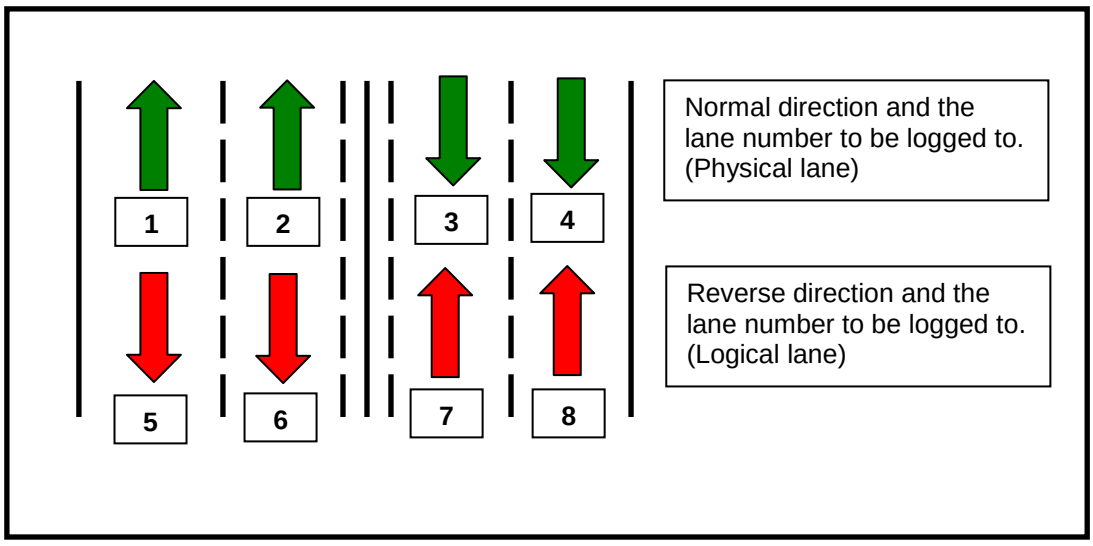
There are normally two cases where this is applicable:

1. For an undivided roadway where overtaking vehicles can drive in the reverse direction on the oncoming lane(s).



   In this case a vehicle traveling in the reverse direction on lane two will be logged to lane one, and vice versa.

2. When tidal flow (or contra flow) is allowed, this can automatically be recorded by assigning separate lanes for reverse direction flow.



Up to a maximum of 8 physical lanes can be re-assigned for a total of 16 logical lanes.

The RAKTEL 8010 data structure

Mikros Systems uses a binary file structure in the RAKTEL 8010. Information on this structure is generally not published for two main reasons. Firstly, it allows Mikros Systems to add to the data without having to keep track of backward compatibility. It therefore simplifies configuration control. Secondly, the binary information can be used as an integrity check on the recorded data. The recorded binary data contains the complete record of the recorded traffic data as well as the complete set-up information of the logger and comprehensive hardware status information (sensors, power, memory and communications parameters). In addition to this, any error that may occur during logging is added into the recorded data when it occurs.

The binary recorded data is translated into the most popular standard text formats (e.g. the US Federal Highway Association's card types and the RSA Standard Traffic Data Collection Format). Mikros Systems also provides standard formats (TXT and XTX). These formats are completely documented.

Data recording modes

The basic data recording mode is the recording of individual vehicle-by-vehicle (VBV) information.

The following basic information is typically recorded:

- Departure date and time to the nearest 1/10th of a second
- Physical Lane of travel
- Re-assigned Logical Lane of travel
- Direction in the lane of travel (forward/reverse)
- Vehicle class (for selected scheme)
    - Primary class (axle spacing)
    - Secondary class (loop information)
- Chassis height code
- Vehicle length (1/10th meter)
- Vehicle speed (km/h)
- Number of axles
- Axle spacing (cm)
- Bumper (nose) to 1st axle & last axle to tail distances (cm) (on special order firmware)

The data recording modes allow vehicle information to be recorded by:

- Vehicle type (light/heavy)
- Lane number
- Violation

This means, for example, that the logger can be configured so that only individual vehicle information of heavy vehicles is recorded.

The following information summaries can also be recorded in addition to individual vehicle information:

- Class summaries
- Speed bin summaries
- Vehicle length bin summaries
- Specialized summaries

This can be recorded per time interval (1- 60 minutes, in whole fractions of 60 minutes).

Classification schemes supported by RAKTEL 8010

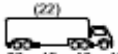
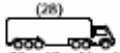
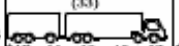
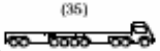
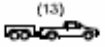
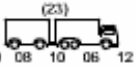
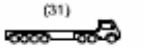
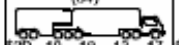
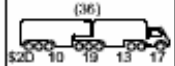
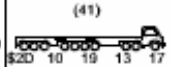
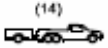
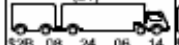
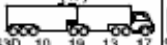
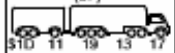
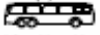
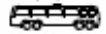
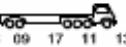
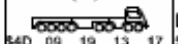
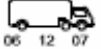
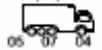
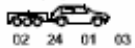
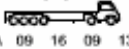
The Mikros Systems Axle Classifier system supports most of the popular classification schemes namely:

- US FHWA (FH in symbol map)
- Australian Roads Department (AU in symbol map)
- United Kingdom (UK in symbol map)
- European (EU in symbol map)
- South African (SA in symbol map)
- Hungarian
- Indian

In addition to these standard schemes, the expert user can also adjust parameters to adapt to local conditions.

RAKTEL 8010 officially supports the following classification schemes:

Composite Table of Vehicles

2 Axles	3 Axles	4 Axles	5 Axles	6 Axles	7 Axles	8 Axles	9 Axles	10 Axles	11+ Axles
(1)  $21 01 02 01 01	(6)  $32 02 04 01 03	(12)  $42 02 04 01 03	(22)  $19 08 15 10 12	(28)  $1A 09 17 11 13	(30)  $1D 11 19 13 16	(33)  $1D 11 19 13 17	(35)  $3D 10 19 13 17	(40)  $1D 11 19 13 17	(45) Double Road Train $4D 11 19 13 17
(2)  $22 01 02 01 02	(7)  $53 01 02 01 02	(13)  $53 02 04 01 03	(23)  $39 08 10 06 12	(29)  $2C 09 25 11 15	(31)  $3A 09 19 13 16	(34)  $2D 10 19 13 17	(36)  $2D 10 19 13 17	(41)  $2D 10 19 13 17	(46) Triple Road Train $5D 12 19 13 17
(3)  $43 01 02 02 02	(8)  $43 02 04 01 03	(14)  $73 02 04 01 03	(24)  $2B 08 24 06 14	(59)  $3C 09 16 09 15	(32)  $2D 09 19 13 16	(47)  $3D 10 19 13 17	(37)  $1D 11 19 13 17	(42)  $3D 10 19 13 17	
(4)  $54 03 18 12 04	(9)  $64 04 18 12 06	(15)  $84 05 23 12 06	(25)  $69 08 16 09 12	(60)  $4C 09 17 11 13	(56)  $4D 09 19 13 16	(63)  $4D 09 19 13 17	(38) Double Road Train $4D 11 19 13 17	(43) Double Road Train $4D 11 19 13 17	
(5)  $35 03 05 02 05	(10)  $28 06 12 07 09	(16)  $37 05 07 04 08	(26)  $42 02 24 01 03	(61)  $5A 09 16 09 13		(64)  $5D 09 19 13 17	(39) Triple Road Train $5D 12 19 13 17	(44) Triple Road Train $5D 12 19 13 17	
	(11) $16 04 06 03 08	(17) $28 04 06 10 09	(27) $53 02 24 01 03	(62) $6C 10 16 09 15		(65) $6D 11 19 13 17			
	(58) $38 06 08 05 07	(18) $97 05 07 04 08	(53) $64 04 18 12 10	(53) $64 04 18 12 10					
	(48) $78 04 19 13 08	(19) $18 07 13 10 09	(57) $29 08 10 06 11						
	(50) $64 04 18 12 06	(20) $A8 07 08 05 09	(54) $79 08 09 05 12						
	(49) $88 06 18 12 06	(21) $68 07 08 05 07							
		(51) $64 04 18 12 06							
		(55) $64 04 18 12 06							
		(52) $B8 07 21 06 08							
KEY (I Code) Symbol FH AU UK EU SA									

Typical housings

A number of housings are available to suit the local conditions. Since the RAKTEL 8010 is a standard 19” rack, it can be housed in any standard 19” rack system. The picture below serves as illustration:

A more secure housing can be used at sites where security is a concern. The picture below serves as illustration:

Internal heating is provided in cold climates where condensation is a problem. The following picture serves as illustration:

Summary of RAKTEL 8010 specifications

• Sensor inputs Primary sensors Secondary sensors	8 Channel self tuning loop detector (up to 16 channels) - 8 Channel axle detector (up to 16 channels) - 8 channel I/O card
• Multiple Logging Modes Individual and/or data summaries (in metric or imperial units) Data summaries	Basic information captured: - Arrival time (one tenth of a second) - Lane on travel - Direction in lane (reverse direction logging) - Vehicle speed - Chassis profile - Vehicle length - Axle spacing - Number of axles - Classification code (Selectable, FHWA, and other) - Variable logging period (1 to 60 minutes) - Lane summaries - Classification bins - Speed bins (up to 20) - Headway bins (up to 20) - User pick list and data suppression table
• Memory options	- Up to 8Mb battery backed-up RAM
• Control, data extraction and communication	- Two RS232 ports (300 – 19 200 baud) - Local via laptop - Remote via modem, network or direct fiber links
• Diagnostics	- Complete local and remote sensor & system status - Dynamic sensor diagnostics
• Power management	- High efficiency solar charge regulator - Mains power supply and charger (110V – 220V) - 12V DC - <1.4 Watt (nominal) - External power (300mA) to ancillary devices (2) - Hot-swap battery plugs
• Temperature and humidity range	- - 20°C to 65°C – 90% non-condensing
• Weight and dimensions	- Standard 19” 3U rack - 490mm x 320mm x 140 mm - 7,8kg - 10 slots maximum
• Options	- Modem control & lightning surge protection - Expanded memory - Contact closure outputs from loops - Violation outputs
• Support software	- TelWin & TelWinPro for logger setup, control and data conversions to popular data formats such as FHWA card types. Also exports to data bases and spread sheets. - TelNet for network applications (incident detection and ramp metering) - TelDial automatic list dialer - TrafBase extended data validation, storage, archiving and reporting program.

Mikros Systems reserves the right to change product specification at any time without prior notice.