

World's most compact and powerful Weigh-In-Motion Enforcement System and the first to be certified to OIML R134-1



**From 5 km/h to 120 km/h for HGVs (Heavy Goods Vehicles)
and from 5 km/h to 140 km/h for LGVs (Light Goods Vehicles)**

With only 3 rows of OIML-certified Lineas® sensors

Temperature range -30°C to $+75^{\circ}\text{C}$ with up to 85 % RH

Rugged design for harsh (hot and cold) environments

Certified by:



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Institute of Metrology METAS

**Traffic Data Systems**
Innovative Technologies

www.traffic-data-systems.com

FUNCTIONAL DESCRIPTION TMCS-IP

The TMCS-IP (Traffic Monitoring and Classification System) is a complete TLS remote monitoring station with control module, integral function groups FG1 (traffic monitoring/classification with inductive loops), optional FG2 (Weigh-In-Motion) and FG6 (operational messages and control) in compliance with TLS 2012.

All data versions for short and long-term data according to TLS 2012 for 8+1 vehicle classification are supported. Additions to the TLS for the transmission of vehicle data with SWISS10 classification have been defined and are already implemented.

Operational messages from FG6 can be monitored and processed by means of integrated analogue and

digital inputs. Appropriate sensors are easily connected via a terminal block TLS_TB_FG6 similar to the loop connector unit TLS_TB_4/8.

The TMCS-IP can be connected to a field bus modem for top-hat-rail mounting via an RS232 connector. Alternatively, it can be operated as an EAK (loop detection and classification unit) on a control module via an RS485 interface, or can communicate with a TLS central control room via the integral modem or ethernet interface using TLS-over-IP. A touch display with a resolution of 800 × 480 pixels is provided for easy configuration and function checks and a PROFIBUS® interface is available as an option.



Figure 1: TMCS-IP with integral WIM-DSP 32.

The TMCS-IP is supplied in a solid all-aluminium enclosure with the same degree of protection against dust and water as the well-known WIM-DSP 32. New with the TMCS-IP are professional M12 connectors and cables for an extended temperature range and harsh environments. A 4.3" touch display with a resolution of 800 × 480 pixels is provided for easy configuration and function checks and a PROFIBUS® interface is available as an option.

Second-generation inductive loop detector technology

Second generation TMCS loop detectors are distinguished by their compact and modular design. Up to eight detector modules can be accommodated in the TMCS-IP enclosure.

The loop signals are evaluated directly on the detector modules. All real-time processes such as measurement, decimation, normalisation and cross-correlation are fully decoupled from administrative processes (data management, communication, user interface).

The modular design enables the unit to be configured to the customer's specification. This has an impact on the energy consumption as well as the investment and operating costs. In addition, the detector modules are fitted with a power-saving FPGA, which in future will enable deep-learning processes to be used for classifying the signatures of passing vehicles.

The 8 real-time detector modules for double loops provide precise and reproducible vehicle signatures and are used as a basis for traffic volume detection,

speed measurement and vehicle classification. Use is made of a continuous measuring process which is free from the negative effects of discontinuous measuring processes.

This technology enables a large number of adjacent loops to be operated without faults occurring due to the shared use of lead-in cables. Fixed loop frequencies, which are arranged in a narrow channel spacing of the permissible frequency band, are used.

As a result of the mode of operation with fixed loop frequencies, the frequency bandwidth required for fault-free operation of the inductive loop/detector combination is small, particularly compared with frequency-agile detectors which monitor vehicles based on frequency modulation.

The real-time modules can be operated with different loop geometries and cable lengths between the TMCS-IP and loop of up to 300 m. Tuning and sensitivity adjustment are carried out automatically. Possible faults in the loop circuit (breakage, short-circuit) are continuously monitored and appropriate alarms transmitted to the central control room.

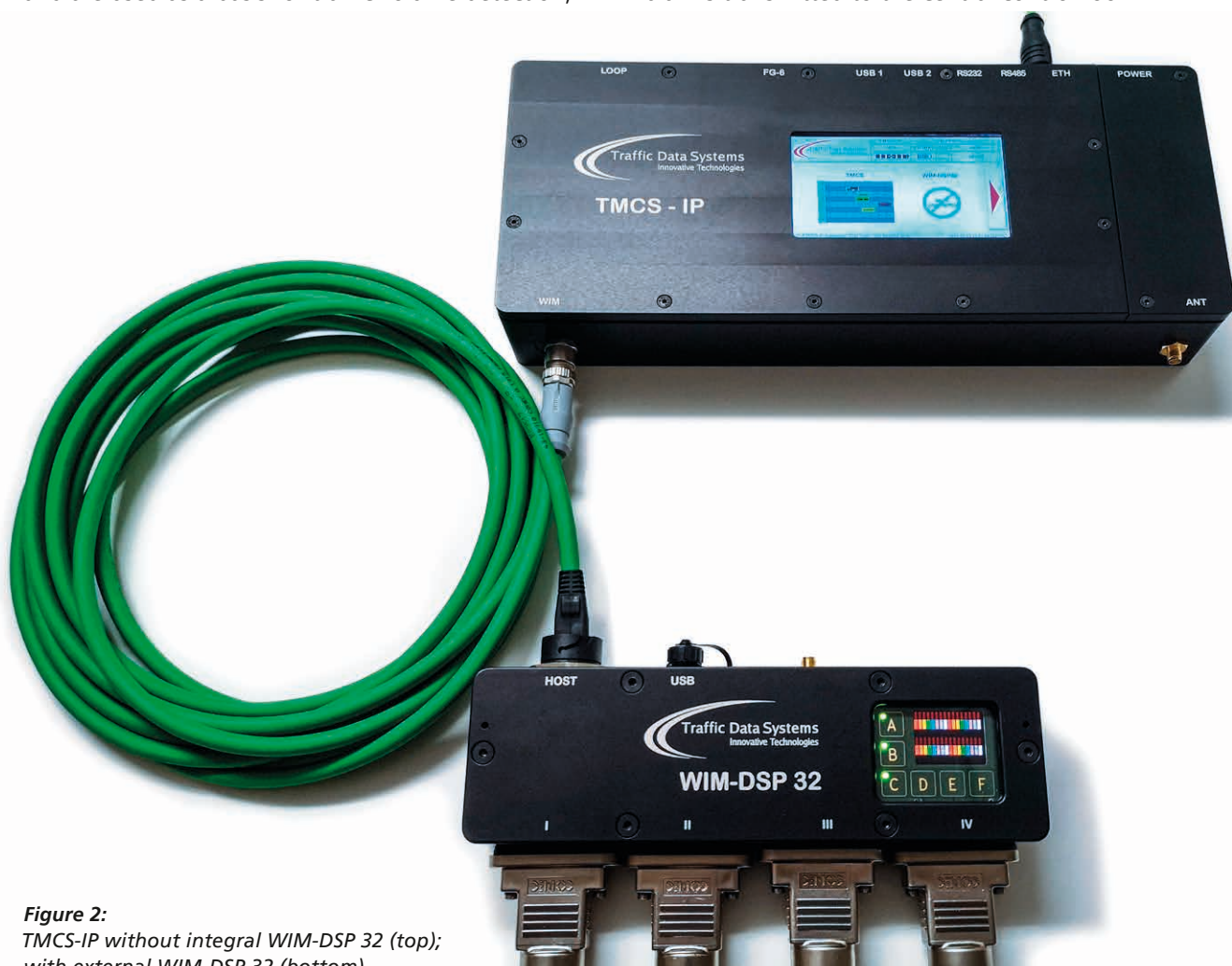


Figure 2:
TMCS-IP without integral WIM-DSP 32 (top);
with external WIM-DSP 32 (bottom).

FUNCTIONAL DESCRIPTION WIM-DSP 32

WIM-DSP 32 is the world's first and only OIML R134 certified weigh-in-motion system that has PSHC (Piezo Sensor Health Care) long-term sensor monitoring. An integrated colour graphics display and a control panel consisting of touch keys are available for carrying out simple function checks. When the WIM-DSP 32 is an integral part of the TMCS-IP, the larger 4.3" touch display is available for easy configuration and function checks.

WIM-DSP 32 supports up to 32 inputs from Kistler 5163A10x charge amplifiers, and is supplied in a sealable all-aluminium enclosure with a high degree of protection against dust and water for use under stringent environmental conditions. The pin assignment of the four D-Sub connectors on the WIM-DSP 32 is compatible with that of the D-Sub connectors of the 5163A10x charge amplifiers.

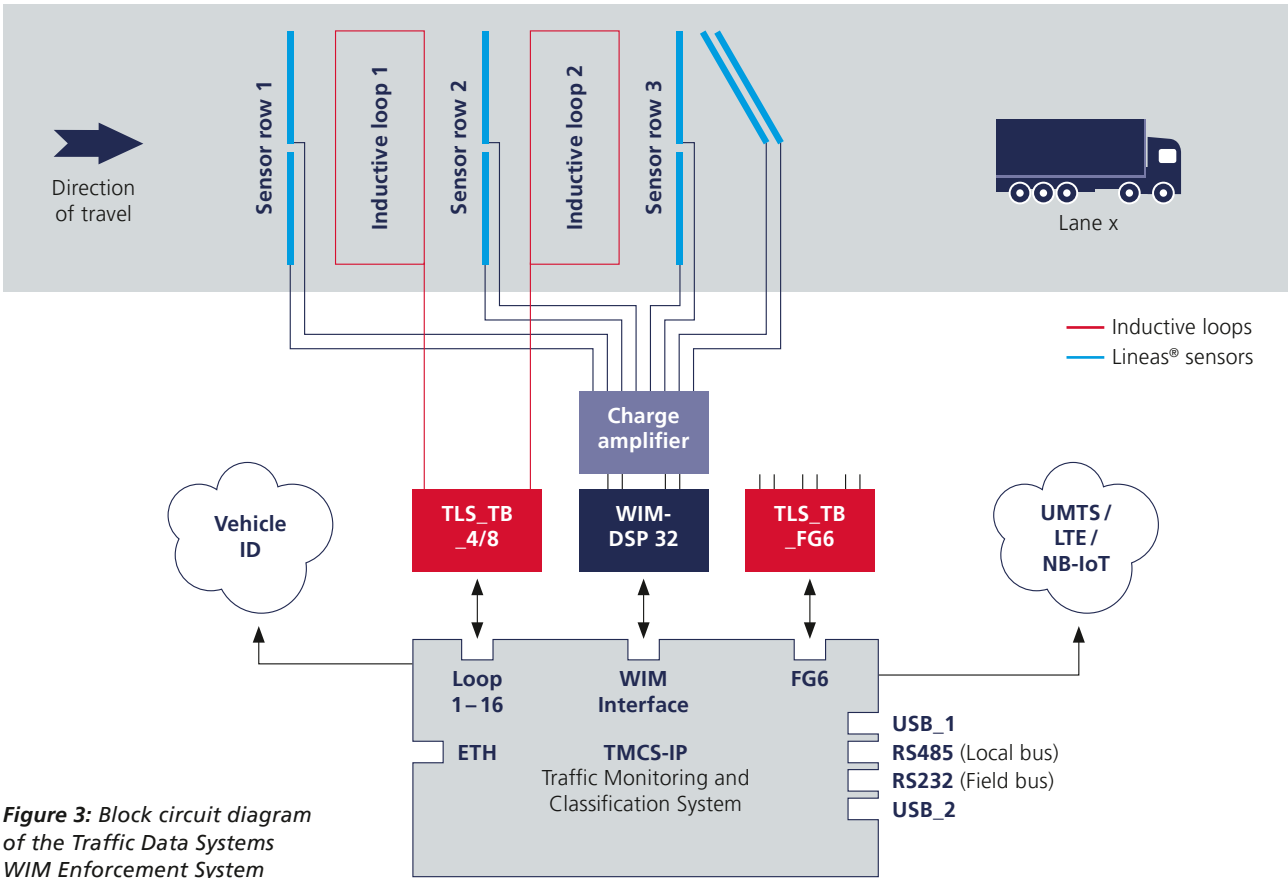


Figure 3 shows three rows of Lineas sensors per lane and two sensors installed at an angle. These are connected to the WIM-DSP 32 and to the TMCS-IP TLS remote monitoring station

For statistical applications, two rows of Lineas sensors together with one sensor installed at an angle for checking the wheel position within the lane and the type of tyres fitted (single or twin tyres) are sufficient.

Three rows of Lineas sensors are required for Weigh-In-Motion Enforcement systems in order to satisfy a higher accuracy class in accordance with OIML R134.

The sensors that are installed at an angle are used to preserve evidence of the position of the vehicle in enforcement systems, and to distinguish between single and twin tyres. The second angled sensor can be used to determine the tread surface of the tyre, and therefore indirectly calculate the inflation pressure.

Weigh-In-Motion Enforcement (WIM-E) also requires an RWIS station (details on request) in order to suspend measurements in weather conditions/ situations with impacted snow covering, slush or icy roads.

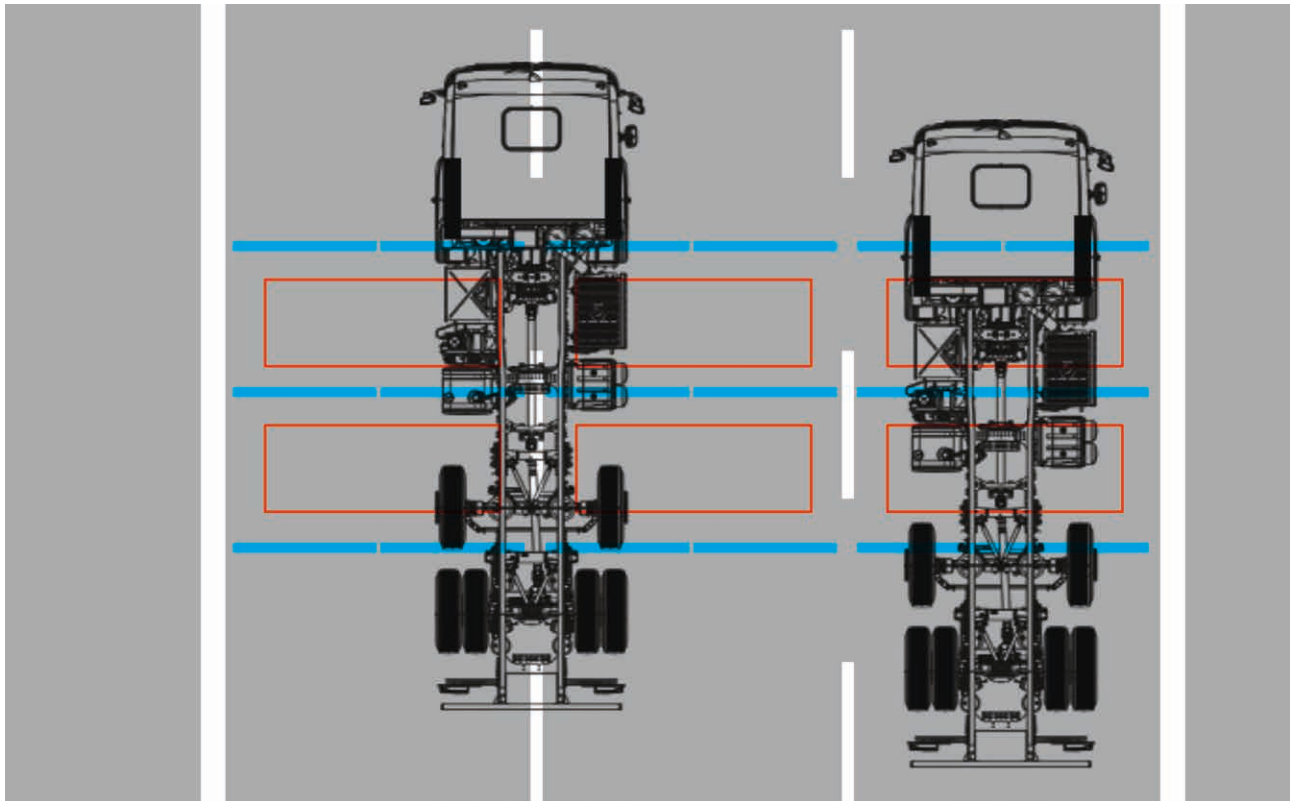


Figure 4: Sensor arrangement for Weigh-In-Motion Enforcement, lane changing (left), correct traversals (right)

— Inductive loops — Lineas® Sensors

In addition, ANPR and overview cameras are required to document correct traversals and the number of rolling and raised axles, and to automatically filter out overloaded vehicles for checks.

WIM-DSP 32 is the world's first system with PHSC long-term sensor monitoring on a 32-channel sensor array, which will soon be obligatory in WIM enforcement systems.

The improved time and spatial resolution of the overall system enables adjacent wheel tracks to be used in the evaluation. Distances between axles can be determined with high accuracy thanks to the precise time synchronisation. Figure 4 shows the sensor arrangement for Weigh-In-Motion Enforcement for normal traversals and lane changes.

The WIM-DSP 32 supports an array of up to 32 Lineas sensors which can be arranged in any configuration. Known sensor geometries enable different wheel tracks to be combined – in the simplest case, the left and right neighbouring tracks.

The speed and weight can be displayed on Variable Message Signs (VMS) or transmitted to a central office or control station in encrypted form.

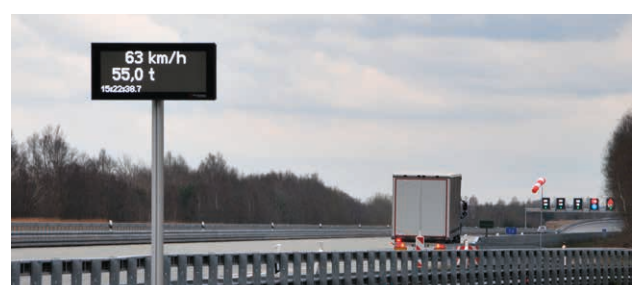


Figure 5: Three traversals of the sensor array by an identically loaded articulated truck at three different speeds shows a variation of just ± 0.1 tons.

TECHNICAL DATA

TMCS-IP

- ▶ Toradex Colibri module iMX6 NXP/Freescale
- ▶ Embedded Linux
- ▶ 16 loops (8 detector modules with FPGA)
- ▶ 16 fixed frequencies can be imposed without restriction with lead-in cables up to 300 m
- ▶ Up to 300m lead-in cable between TMCS-IP and the ext. loops
- ▶ Continuous measuring process, i.e. free from the disadvantages of discontinuous measuring processes
- ▶ No manual setup switches (DIP-switches)
- ▶ Automatic calibration and frequency selection
- ▶ Continuous monitoring of broken or shorted loops
- ▶ 4.3-inch touch display 800 × 480 pixels (optional)
- ▶ UMTS/LTE/narrowband IoT modem (Internet of Things)
- ▶ IP67 SMA sockets for modem and vehicle communications (ID)
- ▶ Internal SIM card holder for nano SIM
- ▶ Integral TLS function groups FG1, FG2 and FG6
- ▶ RS232, RS485, Ethernet, USB_1, USB_2 interfaces (USB 2.0)
- ▶ WIM-DSP 32/BIKE interface (internal or external)
- ▶ Integral UPS with lithium ion battery, capacity 8 Wh
- ▶ Battery-backed real-time clock with calendar and time zones
- ▶ DST/Standard Time changeover
- ▶ Time synchronisation via PTP (Precision Time Protocol) or NTP (Network Time Protocol)
- ▶ Temperature range –30 °C / +75 °C; with lithium ion battery –20 °C / +60 °C
- ▶ Power supply 24 VDC (12–36 V) or PoE (Power over Ethernet)
- ▶ Mean power consumption 6W
- ▶ IP67 industrial connectors M12 and D-Sub
- ▶ All cables for extended temperature range –20 °C / +60 °C
- ▶ Top-hat-rail mounting on 19-inch/2U component shelf
- ▶ Dimensions (L × W × D) 315 mm × 128 mm × 45 mm (without connectors and fixing clamps)
- ▶ Weight 2.7 kg (without cables)

WIM-DSP 32

- ▶ Voltage 24VDC ±20 %
- ▶ Current consumption (typical) @ 24V 150mA incl. 4 charge amplifiers 5163A108
- ▶ Temperature range (WIM-DSP 32) –30 °C / +75 °C
- ▶ Protection class EN 60529/IP67
- ▶ Dimensions (L × W × D) 214 mm × 64 mm × 45 mm (without connectors and fixing clamps)
- ▶ Fixing EN 60715/TS 35 (top-hat rail)
- ▶ Weight 0.8 kg (without cables)
- ▶ Measuring range (axle loads) 0 ... 50 t
- ▶ Speed range (total) 5 ... 254 km/h
- ▶ Speed range for Weigh-In-Motion (axle loads) 5 ... 120 km/h
- ▶ Conformity assessment in accordance with OIML R134
- ▶ Weight measurement accuracy (confidence level) 95%
- ▶ Measuring error with 3 sensors/lane and one or two sensors installed at an angle ±5% (initial verification); ±10% (in-service inspection) (depending on quality and flatness of road surface)
- ▶ Number of measuring channels 32
- ▶ Charge amplifier Kistler 5163A104 or 5163A108
- ▶ Lineas sensor with charge output Kistler 9195GC

Subject to technical changes.

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