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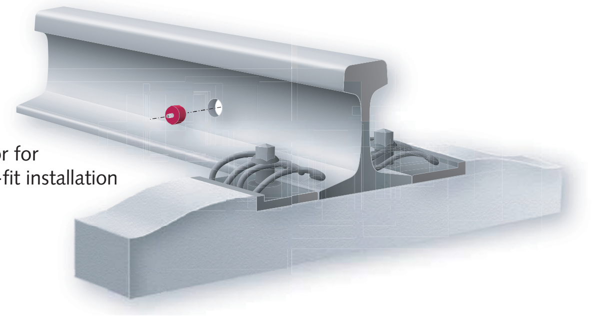
Rail WIM

Type 9192A64

Railcar Weighing System for Mainline Tracks

The Kistler Rail WIM is a dynamic weighing system which is installed in mainline railroad tracks and designed for detecting railcar weight and load imbalance at normal running speed.

- Quartz technology
- Extremely precise wheel force measurement
- Not affected by temperature changes (no temperature compensation required)
- Speed independent (from low- to high-speed)
- Quick and easy to install, without interruption of normal traffic
- No modification to rails, ties, ballast, or substructure is required, excepting a single through-hole for each sensor
- Maintenance-free due to long-term stability
- No fatigue or ageing effects



Sensor for
Press-fit installation

Description

Base system hardware includes (a) a set of 12 force sensors designed and manufactured specifically for in-rail mounting, (b) a cable and conduit set for carrying sensor output signals to a trackside bungalow, and (c) an electronics set for signal processing. Optionally available is an RFID antenna for automated equipment identification (AEI). Accessories include power conditioner, a wall-mounted cabinet and a toolkit. Kistler does not supply the trackside bungalow, the power supply and the communication and control unit (railways operator unit).

Application

Rail WIM provides rail freight carriers with weight measurements of individual cars while they are en-route on mainline track. With real-time weight and imbalance data, railroad companies can improve the safety and economy of freight operations:

- Detection of dangerous imbalances due to shifted loads provides warning to stop or reduce train speed pending corrective action
- Overloaded cars are detected and reported and can be sorted out at earliest convenience. Track damage is avoided and potential violations by blanket-contract shippers identified
- Reporting of aggregate weight of train allows optimal train speed and spacing for most economical operations
- Weight detection for train access charges

Technical Data

System		
Measuring range wheel load	tons	0 … 27
Operating temperature range	°C	–40 … 70
Speed Range	km/h	5 … 350
Weight measurement accuracy (dynamic error on railcar weight)	%	≤±2 at 95 % confidence level
Sensor and Conduit/Cable Set		
Sensor insert (stainless steel)	ø mm	25,4 (1")
Sensor temperature range	°C	–70 … 120
Temperature coefficient	%/°C	–0,02
Linearity	%FSO	±0,4
Shock resistance	g	5 000
Conduits (EMT, galvanized steel)	ø mm	12,7 (½")
Sensor cables (Teflon® jacketed)		coaxial
Analog Signal Conditioner		
Input channels (sensors)		(16) BNC neg.
Output channels (sensors)		25 pin D-Sub
(AEI antenna)		Banana connector
Supply voltage	VDC	24 (20 ... 28)
Dimensions (WxHxD)	mm	355x205x100
Weight	kg	2,3
Degree of protection (EN60529)		IP50
Digital Processing Unit		
Input interface (sensors)		25 pin D-Sub
(AEI antenna)		COM
Output data interface		Ethernet, TCP/IP
Output data format		XML
Supply voltage	VDC	24 (20 ... 28)
Dimensions (WxHxD)	mm	220x200x85
Weight	kg	5
Degree of protection (EN60529)		IP50

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Rail WIM Product Details

Fig. 1 shows a block diagram of a typical WIM system. Components in blue are supplied by Kistler.

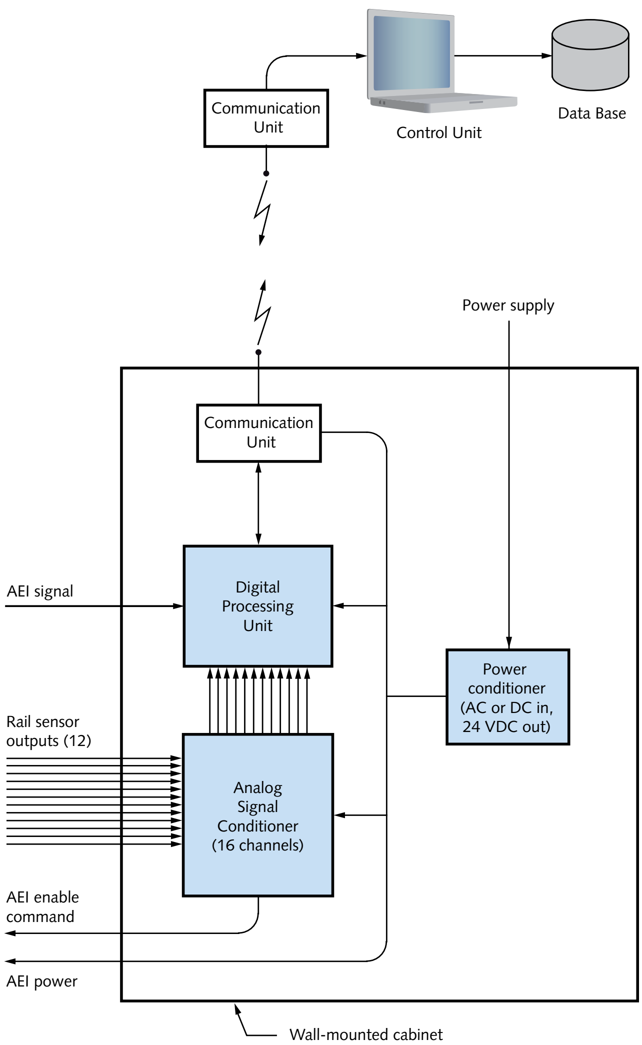

Fig. 1: Block diagram of Rail WIM system

Sensor and Cable/Conduit Set

The sensors are based on quartz technology and specially designed for detecting vertical wheel forces. They measure only the compression of the rail, without being influenced by other force components like shear force or bending moment. The rail-mounted sensor inserts of stainless steel are press-fitted into a 25,4 mm (1") diameter hole drilled through the vertical web of the rail. The front enclosure and the back cover with elastomer seals protect the sensor and provide an interface to a ½" steel conduit that carries sensor output cables to a trackside junction box.

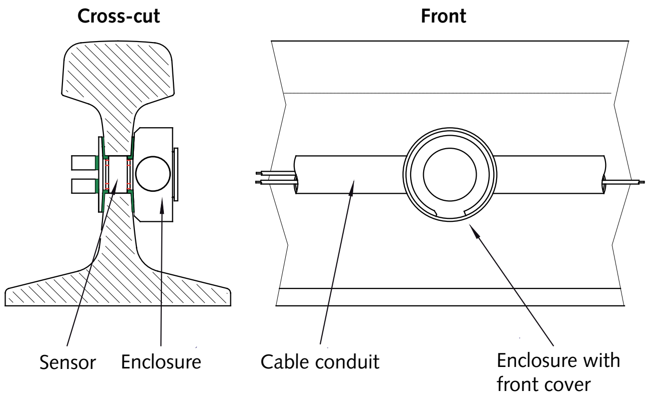

Fig. 2: Sensor assembly with conduit

From there, a PVC pipe runs below grade to a signal bungalow to bring the sensor cables into a wall-mounted electronics cabinet. Junction Box and PVC pipe are not supplied by Kistler.

Electronics

The electronic equipment consists of an analog signal conditioner and a digital processing unit.

Analog signal conditioner:
The analog signal conditioner has 16 sensor input channels. It provides power to sensors and receives and conditions sensor output signals before sending them to the digital processing unit. Additionally it also controls the power to the AEI antenna switching between enable and stand-by mode. LED's on the front panel show the status of each sensor channel, of the antenna and of the power supply.

Digital processing unit:
The digital processing unit – also called remote unit – acquires analog sensor signals and processes them into wheel and axle loads, car weight and imbalance data. It also acquires the ID's from the AEI antenna and combines them with the weight information. Data in XML-format can be retrieved via Ethernet interface with TCP/IP protocol.

AEI Antenna (Optional)

This set includes a RFID antenna which reads car ID's, a mounting bracket and a pre-wired connector for antenna power and output signal. The antenna will remain in stand-by (low-power) mode until a train enters the measuring site, at which time the system computer will command the antenna transmitter to power-on and remain on until the train has left the site. The Rail WIM system can operate also without antenna.

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System Output Data

System output data contain general information on the WIM site, data associated with the entire train and all individual car weights and load imbalances, correlated to the car ID's. All output information available is listed below including an example of a Rail WIM report. The data in form of XML-train files can be retrieved via Ethernet interface with TCP/IP protocol. Additionally, such data is also stored on the local hard drive of the remote digital processing unit. The control unit (interface to the user which displays the data) is not delivered by Kistler. This unit – usually located in the railways office or data collection facility – accesses the Kistler remote digital processing unit, retrieves the necessary data and generates reports and alarms, according to the end user specifications.

List of data which is retrievable from the remote unit (Kistler digital processing unit):

General information
- Rail WIM site ID number and location
- Date
- Train passage time (site entry)

Train information
- Direction of travel
- Average speed of passage
- Duration of passage
- Total train length
- Total number of cars, including engines
- Total number of axles, including engines
- Total consist weight, including engines

Rail car information
- Individual wheel loads
- Individual axle loads
- Individual car gross weight (= GRL "Gross Rail Load")
- Confidence level indicator for axle weights
- Confidence level indicator for car weights
- Axle speed
- Car speed
- Axle sequential number
- Distance between axles
- Car sequential number
- Car identification (only with AEI antenna)
- Longitudinal railcar imbalance (front end total weight as % of GRL)
- Transversal railcar imbalance (left side total weight as % of GRL)
- Transversal axle imbalance (left wheel load as % of axle load)

System Health Information
- Health status of sensors
- Health status of electronic units

Example of Rail WIM Report

The control unit retrieves the data from the Kistler digital processing unit and generates reports like the one shown below.

Site number xxx at location milepost xxx
File name: ABCD-1234-DEFG-5678

Date:	25-Dec-08
Speed, entry/exit/avg (km/h):	88 / 75 / 83
Total axles incl. engines:	510
Total length incl. engines (m):	2 125
Time of train entry to site:	1:23:45 PM
Direction:	Eastbound
No. of cars incl. engines:	127
Transit time (s):	91,4

Car number (incl. engines)	Car ID (per AEI)	Axles per car	Car gross weight (tons)	Front end weight (% of gross)	Left side weight (% of gross)
1	xxxxxx	6	186,9	51	54
2	xxxxxx	6	190,3	52	53
3	xxxxxx	4	174,6	49	54
4	xxxxxx	4	157,3	52	55
5	xxxxxx	4	174,4	53	52
6	xxxxxx	4	172,3	51	51
7	xxxxxx	4	176,0	49	56
8	xxxxxx	4	166,6	53	53
9	xxxxxx	4	156,9	47	53
10	xxxxxx	4	175,3	49	51
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
120	xxxxxx	4	174,6	50	54
121	xxxxxx	4	157,3	52	53
122	xxxxxx	4	174,4	53	54
123	xxxxxx	4	172,3	51	55
124	xxxxxx	4	176,0	49	52
125	xxxxxx	4	166,6	53	51
126	xxxxxx	4	156,8	47	56
127	xxxxxx	4	175,3	49	53

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Site Layout

The standard system is composed of twelve force sensors, six of which are mounted in each rail at intervals of 4 m. This layout or array of sensors respectively was optimized to mitigate the effects of car dynamics. Sensor signals are collected and routed via cable to a junction box at the trackside. From there the cable runs to the electronics located in a trackside bungalow.

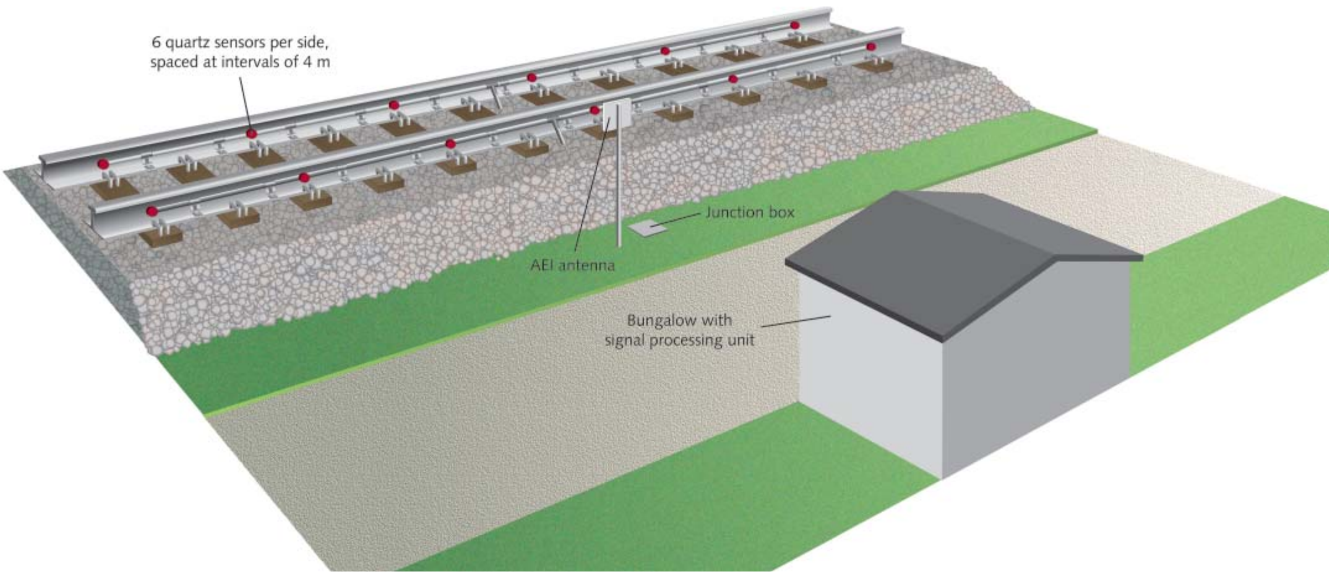

Fig. 3: Rail WIM system – standard layout

Included Accessories	**Type/Art. No.**
• Rail WIM system includes six sensor pairs (12 sensors total), cable and conduit set, one analog signal conditioner and a pdigital processing unit	9192A64

Optional Accessories	**Type/Art. No.**
• Power conditioner, AC input	5768A01
• Power conditioner, DC input	5768A02
• AEI antenna	5768A03
• Electronics cabinet	5708
• Installation toolkit	1308

Ordering Key

Type 9192A ☐☐

Sensors	
Setting with 6 pairs	**6**

Cable	
40 m cable length	**4**

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