

(UK/0126/0009)



MI-006

United Kingdom of Great Britain and Northern Ireland

**Certificate of EC type-examination of a
measuring instrument**

Number: UK/0126/0009 Revision 6

issued by the Secretary of State for Business, Innovation and Skills
Notified Body Number 0126

In accordance with the requirements of the Measuring Instruments (Automatic Rail-weighbridges) Regulations 2006 (SI 2006/1256) and the Measuring Instruments (Non-Prescribed Instruments) Regulations 2006 which implement, in the United Kingdom, Council Directive 2004/22/EC, this certificate of EC type-examination has been issued to:

**Avery Weigh-Tronix Ltd
Foundry Lane
Smethwick
West Midlands B66 2LP
United Kingdom**

in respect of an automatic rail-weighbridge designated the Weighline TSR4000 and having the following characteristics:

Accuracy class: ≥ 0.5 (coupled wagon weighing)
 ≥ 0.2 (total train weighing)

The necessary data (principal characteristics, alterations, securing, functioning etc) for identification purposes and conditions (when applicable) are set out in the descriptive annex to this certificate.

This revision replaces previous versions of this certificate.

Signatory: P R Dixon
for Chief Executive
National Weights & Measures Laboratory
(Part of National Measurement Office)
Department for Business, Innovation & Skills
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Descriptive Annex

1 INTRODUCTION

This pattern of an automatic rail-weighbridge, designated Weighline TSR4000, for the in-motion weighing of rail wagons, comprises the following:

- two, or more, pairs of Weighline transducers;
- wheel sensors;
- TSR4000 weight processor; and
- printer.

The instrument is designed for the weighing of axles and bogies of:

- coupled wagons in a train formation, pushed or pulled in both directions; and
- entire trains, pushed or pulled in both directions.

2 FUNCTIONAL DESCRIPTION

2.1 Weighline transducers

2.1.1 Two or more pairs of “Weighline” transducers are permanently bonded to each rail. Up to a maximum of 16 transducers (8 pairs) can be connected, via a transducer junction box, to each input channel of the TSR4000. Each Weighline transducer (OIML R60/1991-GB-94.08) has a maximum capacity of 15,000 kg. An MTL LC30 Surge Protector may be used with each transducer.

2.2 Wheel sensors

2.2.1 A number of pairs of wheel sensors are located on the track adjacent to the transducers to monitor the passage of wagons over the system. The wheel sensors can be either the mechanical contacting type or the non-contacting inductive proximity type.

2.3 TSR4000 weight processor

2.3.1 The TSR4000 weight processor (Figure 1) comprises the following:

- Processor card with a Pentium processor or equivalent
- Analogue to digital converter card
- Multifunction card
- PCI backplane
- Graphics type display module
- Inverter module for display illumination
- Power supply unit
- System motherboard
- Up to four pre-amplifier boards
- Keyboard interface board and front panel keypad
- External keyboard connector (optional)
- External VGA monitor connection (optional)

2.4 Printer

2.4.1 See section 4.2.

2.5 Devices

2.5.1 The Weighline TSR4000 is provided with the following devices:

- Automatic detection of over-speed
- Automatic detection of roll-back
- Vehicle identification
- Semi-automatic and automatic zero-setting devices ($\leq 4\%$ of Max.)
- Direction of travel detection
- Measurement of vehicle speed

3 TECHNICAL DATA

3.1 The Weighline TSR4000 has the following technical characteristics:

Accuracy class	coupled wagon weighing	≥ 0.5	Non-approved
	total train weighing	≥ 0.2	≥ 1
Maximum operating speed		≤ 10 km/h	10 to 25 km/h
Minimum operating speed		≥ 0.1 km/h	
Maximum wagon weight		$\leq 120,000$ kg	
Minimum wagon weight		≥ 6000 kg	
Scale interval		≥ 20 kg	
Maximum capacity		$\leq 30,000$ kg (per axle)	
Minimum capacity		$\geq 3,000$ kg (per axle)	
Max. no. of weighline transducers		16 (8 pairs)	
Max. number and type of wagons per train		Determined at verification	
Direction of weighing		Bi-directional (train pushed/pulled)	
Power supply		90/230 VAC, 50 Hz	
Operating temperature range		- 10 °C to + 40 °C	
Climatic environment		Closed, non-condensing (TSR400 weight processor)	
		Open, condensing (Weighline transducers)	
Electromagnetic classification		E1 and E2	

3.2 Documentation and drawings

3.2.1 Documentation

TSR4000 System Manual

3.2.2 Drawings

Drawing No.	Description	Rev. No.
A1-06-2833	TSR4000 system internal wiring (with NuPro-775)	2
A1-06-3527	TSR4000 system internal wiring (with NuPro-796)	1
A3-06-3889	TSR4000 system internal wiring (with PCI-6873)	-
A3-06-3942	TSR4000 internal looms for PCI-6873 Single Board Computer	-
A3-06-3490	TSR4000 NuPro-796 CPU board to keypad interface	1
A3-06-2090	Keyboard interface	5
A1-06-3068	TSR4000 Weighline system block diagram and cable layout	1
A3-06-2774	TSR4000 system motherboard BN041 PCB (5 sheets)	2
A3-06-2651	PCI multifunction board (5 sheets)	1
A3-06-2643	Analogue pre-amplifier (3 sheets)	2
A3-06-2773	TSR4000 DC-DC PSU BN042 PCB	2

3.3 Software

3.3.1 The software is designed to run exclusively on the TSR4000 weighing instrument and enables it to automatically weigh trains that pass across the instrument's sensors. The TSR4000 weighing instrument is based on an embedded microprocessor running proprietary software. The software, its parameters and weighing results are kept on a Flash memory device. The software operates under a multitasking real time kernel (RTK) with pre-emptive task switching for optimal response to external events. Critical events are changes in the wheel sensor's status and the transducer inputs' analogue to digital conversion buffer becoming half full. These critical events generate hardware interrupts which call service routines to collect the data and forward it for processing by the appropriate tasks. All tasks work in isolation with inter-task communication mediated by the RTKs messaging system.

The key data gathering tasks are the track logic task and the weight capture & processing task. The track logic task detects the start & end of trains, identifies vehicles, measures speed and processes any other digital inputs such as AEI tag read inputs. The weight capture & processing task analyses the transducer data. This operates either in a background mode where it can perform zero tracking, calibration or diagnostics or in a train-weighing mode where it identifies wheel weighing profiles and extracts a series of un-calibrated wheel weights for each transducer.

These tasks pass their output to a vehicle analysis task which matches the wheel weights to their vehicles, applies calibration and adjustments and stores the results in an internal database. At the end of the train this task notifies the reporter task that the train is complete. The reporter task then writes the results to the Flash memory. The reporter task is responsible for all the reporting functions of the instrument. There is a multitude of tasks dedicated to device management, including serial communications ports, parallel ports, printers, Flash memory and the user interface.

3.3.2 The software identification is "TSR4000 CIMW" and the approved software version number is 5.xxx-A, where xxx denotes updates & bug fixes that do not affect the metrological characteristics of the software. The version number can be found on the 'System Identification' screen.

3.3.3 The following is a complete list of commands that are available on the instrument.

- Enter “**Ready To Weigh**” state. (Instrument will weigh the next train.)
- Enter “**Standby**” state. (Instrument will not weigh in this state.)
- Set “**Automatic**” mode. (Stays in Ready To Weigh after weighing)
- Set “**Semi-Automatic**” mode. (Returns to Standby after weighing)
- Set “**Manual**” mode. (As for automatic, but trains are treated as a multipart train and concatenated until the standby command is issued.)

4 PERIPHERAL DEVICES AND INTERFACES

4.1 Interfaces

The instrument may be fitted with the following protected interfaces:

- two serial RS232/RS422 ports
- one parallel port (optional)
- transducer and wheel sensor inputs

4.2 Peripheral devices

4.2.1 The instrument may be connected to any peripheral device that has been issued with a test certificate by a Notified Body responsible for Annex B (MI-006) under Directive 2004/22/EC in any Member State and bears the CE marking of conformity to the relevant directives; or

4.2.2 A peripheral device without a test certificate may be connected under the following conditions:

- it bears the CE marking for conformity to the EMC Directive;
- it is not capable of transmitting any data or instruction into the weighing instrument, other than to release a printout, checking for correct data transmission or validation;
- it prints weighing results and other data as received from the weighing instrument without any modification or further processing; and
- it complies with the applicable requirements of Directive 2004/22/EC Paragraph 8.1 of Annex I.

4.2.3 When the instrument detects that a vehicle weighing was over the maximum permitted weighing speed or a wheel weight of that vehicle exceeded the transducer capacity or the vehicle weight was outside the permitted weighing range, then the weight on the printout will be replaced with asterisks ‘*****’ and ‘OverSpeed’, ‘OverCapacity’, ‘AboveMaximum’ or ‘BelowMinimum’ will be printed next to that vehicle, as appropriate. The displayed weight of that vehicle on the instrument front panel will be shown as dashes ‘-----’, and the display title ‘Vehicle Weight’ will be changed to ‘OverSpeed’, ‘OverCapacity’, ‘AboveMaximum’ or ‘BelowMinimum’, as appropriate.

5 APPROVAL CONDITIONS

The certificate is issued subject to the following conditions:

5.1 Legends and inscriptions

The following legends are durably and legibly marked on the TSR4000 weight processor:

- ‘CE’ marking
- Supplementary metrology marking
- Notified body identification number
- Certificate number
- Accuracy classes

5.2 The remaining descriptive information is shown on the TSR4000 display (Figures 2 and 3) when the F1 key on the operator’s interface is pressed. Access to this information is secured.

5.3 The Weighline transducers may only be installed in foundations that restrict any undue movement of the section of rail upon which the transducers are mounted.

6 LOCATION OF SEALS AND VERIFICATION MARKS

6.1 The ‘CE’ mark shall be impossible to remove without damaging it. The rating plate shall be impossible to remove without it being destroyed.

The markings and inscriptions shall fulfil the requirements of Paragraph 9 of Annex I of the Directive 2004/22/EC.

6.2 Access to the calibration and configuration parameters is protected by a slide switch mounted on the top edge of the Multifunction Card. The switch is secured by the application of a tamper-evident sticker.

6.3 Components that may not be dismantled or adjusted by the user, including the Weighline transducer junction box, shall be secured by either a wire and seal or tamper evident label and securing mark. The securing mark may be either:

- A mark of the manufacturer and/or manufacturer’s representative, or
- An official mark of a verification officer.

7 ALTERNATIVES

7.1 Having the ‘Weighline’ transducers replaced by a conventional rail-weighbridge. The weigh-rail length is 1.5 m or 1.6 m, although this may be extended to 3 m or 7.3 m to accommodate bogie and full draught weighing.

7.1.1 Foundation work is required to suit the unique conditions of each installation to ensure stability and correct alignment of the rails. The approach rails on each side of the weighbridge terminate in a mitred cut beneath which is a transverse beam or 2 longitudinal set on the weighbridge pit foundations, and supporting the ends of both approach rails. The weighbridge pit is of reinforced concrete with facilities for drainage and cable access. Anchor bolts are provided for the location of the steelwork, tie-rod fixings and load cell mountings.

7.1.2 Placement of the load cells in the pit is such that the vertical axis of each load cell lies beneath the end of the approach rail. In order to accommodate the load cells, the approach beams are profiled on their undersides. Each live rail, which is mitred to match the approach rail, is supported on a beam along its length. Two transverse members are welded between them so forming an integrated structure. The ends of the main beams are profiled so that they reach under the approach beams and rest on the load cells. Movement of the weighbridge in the horizontal plane is restrained by four tie-bars. Two of these act in the longitudinal direction and two in the transverse direction.

7.1.3 Any compatible load cell(s) may be used providing the following conditions are met:

- There is a respective OIML Certificate of Conformity (R60) or a test certificate (EN45501) issued for the load cell by a Notified Body responsible for type examination under Directive 2009/23/EC or by a Notified Body responsible for Annex B (MI-006) under Directive 2004/22/EC.
- The certificate contains the load cell types and the necessary load cell data required for the manufacturer’s declaration of compatibility of modules (WELMEC 2, Issue 5, 2009, No 11), and any particular installation requirements. A load cell marked NH is allowed only if humidity testing to EN45501 has been conducted on this load cell.
- The compatibility of the load cells and indicator is established by the manufacturer by means of the compatibility of modules calculation, contained in the above WELMEC 2 document, at the time of verification or declaration of EC conformity of type.
- The load cell transmission must conform to one of the examples shown in the WELMEC Guide 2.4, “Guide for Load cells”.

7.1.4 The TSR4000 has the following technical characteristics:

Excitation voltage:	17.5 V DC
Minimum input impedance (per channel):	93.75 Ω
Minimum input signal per scale interval:	17.5 μV

7.2 Having the instrument remotely operated via a permanently installed standard PC. The PC is connected to the instrument using the serial connection and runs a Railweight program allowing the following operations using mouse-operated buttons: Start Weigh, Abort Weigh and End Weigh. The program should not allow any other commands once the instrument has been sealed according to section 6.

7.3 Having the instrument with a maximum capacity of 16,500 kg per wheel (33,000 kg per axle), in which case the Weighline transducers have a maximum capacity of 16,500 kg.

7.4 Having the instrument fitted with an alternative Advantech PCI-6873 motherboard and an Enhance 200W Micro ATX power supply unit.

In this variant the Weighline TSR4000 has the following revised technical characteristics:

Power supply	115V/230 VAC, 47-63 Hz
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8 ILLUSTRATIONS

- Figure 1 TSR4000 controller
Figure 2 Information screen 1
Figure 3 Information screen 2

9 CERTIFICATE HISTORY

ISSUE NO.	DATE	DESCRIPTION
UK/0126/0009 Rev 6	24 February 2011	Section 7.4 added. Addition of new drawing references in 3.2.2 to permit use of PCI-6873 processor board.
UK/0126/0009 Rev 5	13 April 2010	Section 7.3 added. Change of address on front page.
UK/0126/0009 Rev 4	16 March 2009	Section 7.2 added.
UK/0126/0009 Rev 3	23 February 2009	Table in 3.1 updated to include speeds up to 25 km/h.
UK/0126/0009 Rev 2	07 July 2008	Addition of new drawing references in 3.2.2 to permit use of alternative processor board.
UK/0126/0009 Rev 1	21 December 2007	Addition of MTL LC30 to section 2.1.1 and creation of section 7.1.
UK/0126/0009	27 June 2007	Type examination certificate first issued.



Figure 1 TSR4000 controller

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20/06/2007                               15:28:36
----- Metrology Information -----
Electric Power Supply: 240 Volts
                        : 50 Hz
Pattern Approval: -

Accuracy Class... Wagon = -
                  Train = -
Capacity-Transducer Max = 15.00 t
                   Min = 2.000 t
Scale Interval...   d = 0.02 t
Operating speed... Vmax = 10.0 km/h
                  Vmin = 0.0 km/h
Number of wagons.. Nmax = ---
                  Nmin = -
----- :More Data-----

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Figure 2 Information screen 1

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20/06/2007                               15:27:47
----- Metrology Information -----
Manufacturer: Railweight
Importer: -
Instrument: TSR4000
Serial Number: -
Coupled Wagon Partial Weighing
One partial weighing per wheel
Maximum Wagon Weight: - t
Minimum Wagon Weight: - t
Maximum Transit Speed: - km/h
Direction of Weighing: Bidirectional
Wagons pushed/pulled : -
Weigh Liquid Products: -
Static Scale Interval: - t
----- :More Data-----

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Figure 3 Information screen 2