



SMART AUTOMATION PRODUCT SUITE  
**SMART TRAIN LOAD OUT & DUMP  
STATION AUTOMATION**



# SMART AUTOMATION PRODUCT SUITE

## SMART TRAIN LOAD OUT & DUMP STATION AUTOMATION

*The Smart Wagon Product Suite uses laser accuracy to automate and optimise train-based mined materials handling.*

The Smart Wagon Products Suite forms part of a full train load-out or dump station automation solution that can replace an onsite operator or an aged photo-electric (PE) cell solution. These products have been developed and deployed over 15 years and three generations of technology to provide world-class automation solutions using laser-based data collection and modelling.

These products represent a significant upgrade in reliability and efficiency over traditional PE-based solutions that face a number of challenges, including environmental sensitivity, a high failure rate and costly maintenance.

### THE INDIVIDUAL COMPONENTS

**Speed Reader** is a standalone real time monitoring and data logging solution that calculates highly accurate and reliable measures of speed.

**Position Sensor** automates wagon edge detection to set points for trigger control in load-in and chute control for load-out processing at the port and mine site.

**Profile Monitor** automates the detection of hang up in the empty train wagon, the profile of loaded wagons for over or under loading and the potential for derailment.

**Train Speed Indicator** is a module that communicates train speed information to the train operator via TSI.

**Train Wagon Door Detector** automates detection of wagon door status preventing costly material loading mistakes at a train load in and dangerous spillage post load out.

MRA's *Engineering Services Group* is experienced in PLC programming and custom integration and is able leverage a tool-kit of software libraries and test beds to expedite and lower the cost of developing and commissioning solutions.

### THE MRA ADVANTAGE

- Delivering large scale, complex materials handling projects.
- Leveraging key innovations from our engineering and process control consulting practice.
- Pioneering the use of the latest in scanning technologies and analytics, in collaboration with the University of Newcastle (Mechatronics).
- 100% Australian owned and operated.

### KEY FEATURES

- Any mined material including iron ore, coal and bauxite.
- Suitable for brownfield retrofit and greenfield sites.
- Full automation solution.
- Ideal for a multi-site network solution.
- Works with all wagon and locomotive types including distributed power trains.
- Monthly software service fee simplifies approval process.

### KEY BENEFITS

- Increase throughput with optimised loading.
- Reduce fines for overloading.
- No need to under load to avoid fines.
- Remove regular costly maintenance for deteriorated PE-cell based solutions.
- Remotely upgrade the without additional hardware.
- Able to integrate RFID information and weighbridge data.
- Enhance operational control with key information and user-defined tolerances available in open PLC.
- Improve operational oversight and control.
- Third party data sources including, RFID information and weighbridge data can be integrated.

### *The MRA smart Automation Product Suite inclusions*

**Smart stockyard management** is world class and represents a significant advancement in the management of a modern mined material stockyard, its stockpiles and its machines, including job and task management, rich visualisation and machine optimisation.

**Mine-to-port quality management** accurately tracks the age and properties of mined material from the mine site through the train network to the stockyard dump station, conveyor network, stockpile and onto the vessel.

**Machine-to-machine anti-collision** works seamlessly with our Stockyard Management System to provide a SIL-rated functional safety anti-collision solution between machines in the stockyard.

**Ship loader anti-collision system** uses our laser scanning technology and advanced modelling to establish a real-time protection zone surrounding the ship loader's boom and shuttle, its spout or spoon and operator cabin. In three major deployments there has been zero collision incidents in 56 months of active operations.

SWAP FUNCTION	PRIMARY ACTION	KEY DATA
Speed reader	Data logging & real time monitoring	Speed metrics
Speed & position sensor	Real time edge monitoring, chute control, other warnings	edge position, locomotive detection
Profile monitor	Real time detection, hang up/carry back, over & under loading derailment	profile volumes, hang up volumes, derailment variance
Train speed indicator	Train driver notifications	Train speed & direction commands
Wagon door detector	Wagon door open check	Door status

## SNAPSHOT

### Train Load Out

**Anglo American, German Creek** Increased average throughput rates by 7%.

**Glencore, Newlands** Limited fines for train wagon over and under loading by 95%.

### Dump Station

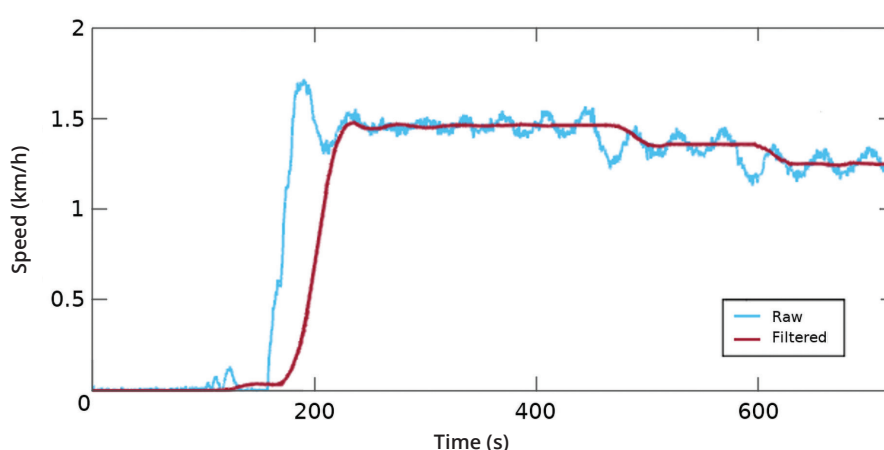
**Port Waratah** De-manned operations across six dump stations.

**Abbot Point** Installed at two dumps stations with automated hang up removal.

## SMART WAGON SPEED READER

The Speed Reader uses a laser and industrial PC to produce highly accurate, reliable measures of speed. These require minimal or no maintenance in the harshest of environmental conditions. It is an ideal standalone solution for data logging or real-time monitoring if on a site network or over the Internet with a 4G connection.

The application includes some basic reports, which can be customised, data logging and a simple visualisation. Example of the visualisation of speed data being logged. – not this one.



## SMART WAGON POSITION SENSOR

The Position Sensor is a marked upgrade in reliability and efficiency over both operator-manned systems and traditional PE-based solutions.

The Position Sensor replaces the need for the standalone Speed Reader. It has two responsibilities: detect train

wagon speed; and, establish the wagon position, or set points for chute or trigger control. Laser information is processed with information routed to the PLC for action and SCADA display.

Two lasers, one on entry, the other on exit, work together to detect train speed

and to set the wagon position edges.

Two wheel counters are affixed to the train track on entry to accurately locate locomotives at key positions within a train. The system works on all wagon types and locomotive positions, including distributed power trains. This helps

protect the loading chutes and floor and wall triggers at the dump station. An additional benefit of such accurate and timely position information is the optimal loading of the train wagon immediately after the locomotive, which is usually underloaded with a PE-based system.

Two additional wheel counters are used at the exit to allow trains to safely reverse back through the train load out or dump station. The wheel counters have the additional benefit of providing a dual safety check for train speed.

Once installed, the Wagon Speed and Position Sensor can be upgraded programmatically to support new wagon and locomotive types, new system functionality, including reports and support for integration into new management systems.

## SMART WAGON PROFILE MONITOR

The Profile Monitor is used in conjunction with the Position Sensor and shares use of the industrial PC. The Position Monitor has three responsibilities: detect the volume and position of material hang-ups or carry back remaining in the empty train wagon; check the profile of the loaded

wagon for over or under loading; and, check for the possibility of wagon derailment. This information is routed to the PLC for action and SCADA display.

At the TLO, a roof laser on entry scans the train wagon to determine the volume and location of any hang up material in the train wagon. A second roof laser on the exit is used to check the profile of the loaded wagon for over or under loading.

In the event of under loading, the chute can be set to open longer and increase the delivered load. In the an overload, the chute open time is reduced or, depending on the excess, the train can be stopped and corrective action taken. This might entail a blade being lowered to remove excess material.

The roof laser, in combination with the wall laser maintains a check on the wagon edge to identify potential derailment due to material on the trail track.

User-defined tolerances can set within the PLC for each of these factors.

## TRAIN SPEED INDICATOR

The Train Speed Indicator enables the following automated radio-based commands to be sent to the train via the PLC as it operates in proximity to the

TLO. These include: finished, decrease speed, proceed, proceed to reverse, increase speed, stop, location, exit road, target speed and a moving speed bar value (speed up/slow down).

Speed tolerances can be set in the PLC and the train driver can receive instructions for speed adjustment, stopping, starting and reversing via the Train Speed Indicator (TSI).

## TRAIN WAGON DOOR DETECTOR

The Smart Wagon Door Detector uses a combination of a camera and laser scanner, to automate the detection of an open wagon door. Being able to detect an open wagon door status can prevent costly material loading mistakes coming into the train load out and on exit.

The Wagon Door Detection solution was first deployed in 2017 using a vision-based pattern matching system and heuristics to identify wagon door status. The next generation of the Wagon Door Detector is based on a more accurate and more easily deployed convolutional neural network. The Wagon Door Detector can be integrated with the site PLC to enable corrective action and be run as a standalone solution.



*Keen to find out more?*

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