DATARAIL 100
WHY WEIGH IN MOTION?

Weighing of a train is a difficult and time consuming operation normally requiring manpower dedicated to the task. This often results in the necessity to have staff available 24 hours a day, 7 days a week. In motion weighing at normal operating speeds of the train results in automatic weighing of the train in a matter of minutes.

As static weighing of a train is time consuming it is often necessary that only the gross weight of the train is measured and that the historical tare weight of the empty wagons be used to determine the weight of the contents. Although some people claim that in-motion weighing is less accurate than static weighing, in reality, correct usage can result in higher system accuracy.

The DATARAIL 100 in motion weighing system requires no weighbridge structure. The transducer rails are installed directly into the track. Standard profile sections of rail are equipped in the factory with strain gauges, tested and calibrated by skilled technicians. A stringent quality control program has been implemented to ensure the required accuracy and durability demanded by the application and the environment in which it will function.
Environmental control

The transducers are sealed to IP65 so that they can operate in the industrial environment without special consideration. Surge protection is supplied as standard. The design ensures that the user can rely on the operation in all conditions. The system can even be installed on electrified track provided the manufacturer guidelines are followed.

Inexpensive Installation

**DATARAIL 100** requires no civil construction, foundations or weighbridge structure. The installation of the transducer rail is performed by the customer's track layers. A section of rail is simply cut and replaced by the **DATARAIL 100** transducer rail. The transducer is fish plated into position depending on the duty that the track will perform.

![Datarail 100 at a loading facility](image)

Operating Benefits

**DATARAIL 100** can be installed without major construction works and without major disruption to the normal flow of traffic. The line need only be shut while the transducers are being installed. As the **DATARAIL 100** accurately measures each and every wheel of the train extensive information on load imbalances, overloading or under loading can be rapidly and effectively
obtained enabling proper management of equipment and resources. Train reports can be available instantly instead of historically as with conventional weighbridge systems.

The DATARAIL 100 is designed to be an integral component of the information management system. The DATARAIL 100 can be easily integrated into the user computer network with associated benefits. Standard or customized reports are available which can be integrated into your business systems.

Reliability

DATARAIL 100 has been designed to operate automatically and reliably without interruption and with a minimum of downtime. On a busy rail network an enormous amount of information can be gathered in a very short time. Unless the system works effectively under all operating conditions the system may fail to perform when it is most needed. Our system has been successfully tested under various difficult operating conditions.

Often these operating conditions are unique to a particular site. SA Automation has a reputation of dedication to delivering a system to the satisfaction of the customer even under these circumstances. The DATARAIL 100 is a fully automatic in-motion weighing system utilizing strain gauge technology. The strain gauges are bonded directly onto two or more 3-meter sections of rail. The advantage of this technology as opposed to the conventional load cells type weighbridge is as follows:

- High Accuracy
- Elimination of costly civil work
- No bypass tracks are required during construction
- Minimal installation time
- Minimal down time

The DATARAIL 100 is designed to operate in harsh mining environments and can be customized to suit the application.

Basic DATARAIL 100 Theory

The rail is made into precision strain gauge loadcell by bonding strain gauge sensitive to forces in the shear plain about the neutral axis.

As the sensitivity of the strain gauge bridge is directly proportional to the deflection, it would be desirable for the supports to be as far apart as possible. That means that the sleeper positioning should be as far apart as possible. In practical terms, the sleepers are placed 900 mm apart with the center of the DATARAIL 100 at midpoint between the sleepers. The performance of the measurement is relatively insensitive to the movement of the rail and sleeper on the rail as the strain gauge used measures the shear forces and not compressive or tensile forces. The measurement bridge is compensated for temperature in the range of -20 °C to +50 °C. The system can tolerate even higher temperature swings electronically by automatic software techniques. The bridge sensitivity is lower than that of a normal loadcell. However, the transducers are sufficiently sensitive for the high accuracy weighing which is required. The transducer is robust in construction and can be handled just like a standard rail with a few eliminatory precautions. The characteristic and accuracy will be maintained provided the rail is not overloaded or subjected to excessive wear due to overloading or wheel spin by locomotives. To ensure that the accuracy is maintained, periodic calibration should be performed.

DATARAIL 100 Output Characteristics
An ideal transducer would have an instantaneous transition from the insensitive region to the measurement region of the rail. The measurement section would be completely insensitive to position. The exact commencement and end of the measurement cycle would be simple. This is obviously impossible. The design of the DATARAIL 100 produces a rapid transfer region and a relatively linear region. Measurements are taken while the wheel is in this linear region. If the speed is high the number of readings taken is restricted. Therefore with higher speeds multiple DATARAIL 100 sections are used in series.

![Actual Wheel Profile](image)

### Calibration of Transducers

During manufacture the transducer is calibrated over the length of the measuring section in a specially designed test rig. All transducers are guaranteed to be within specification. No on-site calibration of the measuring circuit is necessary. A static calibration of the individual rails can be carried out once the rails have been installed using a hydraulic test rig, which is capable of exerting a force of approximately 10 tons on the weighing section. This jig can be hired. The dynamic calibration is achieved by weighing a span of vehicles on a static weighbridge and passing the span over the DATARAIL 100 a number of times in both directions. The mass readings from the DATARAIL 100 are then compared to the static mass figures and adjustments are made to the system parameters to achieve the correct dynamic response.

### Accuracy

Accuracy is certified to be accordance with Trade Metrology Act No 77 of 1973 Regulations G.N.R.2362/1977 clause 61. The Datarail 100 is fully approved for use in trade under approval number SA 1221.

### Useful applications

The DATARAIL 100 was chosen as the product name because it is more than just a measuring tool. It is a very useful tool to capture process data. For example each individual car can be monitored with respect to the load on each and every wheel. If required side to side as well as end to end loading can be measured. This information can be coupled to the loading facility to automatically correct for incorrect profiles. The data can be easily processed into whatever formats best suites the application. The data is easily fed to process control system or the accounting system.
# DATARAIL 100 SERIES OF IN-MOTION CONTROLLERS - TECHNICAL SPECIFICATIONS

| **Hardware Platform** | Pentium/AMD processor with 4Mb RAM or higher  
Solid state disk emulation 2 Mb or higher |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A/D Conversion</strong></td>
<td>multiple channel 16 bit 100kHz</td>
</tr>
<tr>
<td><strong>Digital Inputs</strong></td>
<td>Opto Isolated 5-30VDC - hardware interrupt generation</td>
</tr>
<tr>
<td><strong>Digital Outputs</strong></td>
<td>Opto Isolated, OPTO22 or SPDT relays if required</td>
</tr>
<tr>
<td><strong>Serial Communications</strong></td>
<td>RS232/RS422/RS485 option</td>
</tr>
</tbody>
</table>
| **Data Logging + Reporting** | Last XX reports  
Database DBF  
Transmission  
Report formatting |
|                       | User defined storage of reports subject to memory constraints. Additional memory for up to 16MB of data logging. Reports on batch, shift daily or monthly basis.  
All data stored in standard DBF format.  
Transmission via hardwired, or radio or network.  
User defined formats for reports and ticket printing |
| **Operator Input**    | Customers/Products  
Weighment Details |
|                       | Databases in standard DBF format hold customer and product information  
User defined input screen for the manual input of weighment details |
| **Limits and alarms** | Busy OK  
Speed Marginal  
Speed > Max. Limit  
Over Capacity  
Diagnostic |
| **Modes of operation** | Manual  
Automatic  
Train detectors  
AVI  
Master/slave Tare/Gross & In/out |
|                       | Operator definition of a complete weighing cycle.  
Use of weighing system or sensors to start and end weighments.  
Optional detectors used to detect presence and direction of train.  
Optional Automatic Vehicle Identification using transponders for locomotive elimination and/or vehicle tracking.  
Several controllers can be linked to provide a common database of vehicle information so that complete weighments (both gross and tare) can be performed on a single or any number of bridges. |
| **Calibration**       | Static  
Dynamic  
Offsets  
Directional  
Speed |
|                       | Initial settings are determined by DIP switches on the loadcell amplifier.  
Final calibration is performed digitally.  
In motion calibration performed using a train of known mass as per the assize regulations.  
Dynamic offsets can be set for both directions of travel.  
Dynamic correction factors can be set for any number of desired speed bands. |
| **Diagnostics**       | The following routines can be used to test the controller:  
Digital I/O, Analogue I/O, Printer, Serial ports, Keypad Display and status LED |
| **Overvoltage/Lightning protection** | Surge protection at the rail and/or the control room depending on the distance. |
| **Loadcell amplifier** | 2 channel isolated standard |
| **Enclosure**         | Powder coated steel IP65 with bottom cable entry 400Hx600Wx250D |
| **Optional Extra Features** | VGA VDU, 101 keyboard, laser printer, Networking, Modem connections |