TRANSIT RAIL GRINDERS

Controls Rail Defects Producing

- Correct interface between wheel and rail
- Maximized rail life
- Extended wheel life
- Quiet rail

HARSCO RAIL

Insight onsite.™

Introduction

Harsco Rail is a division of Harsco Corporation and is a major international supplier of track construction and railway maintenance equipment to the world's railways and transit systems.

We are a single source supplier for over 100 types and models of work equipment for track and structure maintenance, track renewal, and new track construction.

Product Line

- Rail grinders
- Stoneblowers
- HY-RAIL® guide wheel attachments (Road/Rail)
- New track construction machines
- Track renewal systems
- Utility track vehicles (UTV's)

Contract Services

- Rail grinding
- Stoneblowing
- New track construction
- Track renewal
- Track and turnout undercutting
- Rail straightening
- Track lifting services and sleeper replacement
- Rail renewal and tie pad change out services

Harsco Rail also provides Technical Consulting Services, Maintenance Management Software, and Training on their products.

Harsco Rail is positioned to develop and deliver new ideas for maintaining track structure around the world. We provide engineering, sales, parts, services, and maintenance from nine main locations including:

- Fairmont, MN USA
- Ludington, MI USA
- Cherry Hill, NJ USA

Head Office & Plant: West Columbia, South Carolina

- West Columbia, SC USA
- Queensland, Australia
- Nottingham, United Kingdom
- Ratingen, Germany
- Rio de Janeiro, Brazil
- Abu Dhabi, UAE

Sales and service support are available in 27 countries covering the globe. Harsco Rail is also certified to ISO 9001-2008. Inquires can be directed to railinfo@harsco.com.

Harsco Rail manufactures a complete line of rail grinding equipment for the international and North American markets, and many configurations / options are available for each grinder. Units are built to meet the local standards of the customer.

Harsco Rail has been grinding rail for over 50 years with the first rail grinder being built in the mid 50s.

Over 160 rail grinders have been manufactured and shipped in the last 25 years, and all rail grinders built by Harsco Rail in the past 10 years are still in service today.

Our rail grinders are currently being operated in over 15 countries including:

Africa	Japan
Argentina	Malaysia
Australia	Manila
Brazil	Mexico
Canada	Singapore
China	Turkey
Colombia	United Kingdom
Germany	USA
Ireland	

Rail grinders are designed to accommodate the varying operating and environmental conditions encountered throughout the world. Our grinding control system has been tested and accepted on DB (Deutsch Bahn) for high-speed application; 300 km/h.

Engineering and manufacturing staff currently on hand has been involved with our rail grinding program for over 20 years.

Our rail grinding continuous improvement technology reflects expertise gained from the operations of our own rail grinding fleet. Annually we grind approximately 10,000 pass miles with our Production / Mainline Grinders and 12,000 switches and crossings with our S&C Grinders.

Harsco Corporation

Harsco Rail's Parent Company

Harsco Corporation Headquarters: Camp Hill, Pennsylvania

Harsco Corporation is a global market leader in providing high-value industrial services and products to selected markets, with operations at more than 400 location in 40 countries.

Harsco's operations are focused in four segments: Infrastructure, Metals and Minerals, Industrial, and Rail (Harsco Rail). Harsco employs over 18,000 people worldwide.

Harsco Operating Companies

HARSCO INFRASTRUCTURE

HARSCO METALS

Infrastructure-Scaffolding at Dubai Airport

Metals-Pot Carrier, Carinox, Belgium

HARSCO INDUSTRIAL Air-X-Changers

HARSCO INDUSTRIAL Paterson-Kelley

HARSCO INDUSTRIAL IKG

Minerals-Black Beauty® Abrasives, Launch pad 39A, Kennedy Space Center

HARSCO MINERALS

HARSCO RAIL

Industrial-IKG-Mezzanine grating at Federal Express-Hutchins, Texas

Industrial-Air-X-Changers, Air Cooler Heat Exchanger on off-shore platform

General Description

Harsco Rail's Transit / Rail Grinder (Model RGHC) is a self-contained machine consisting of:

- Main cabin
- Auxiliary cabin
- Engine and systems enclosure
- Main frame
- Running gear
- Grinding carriage

Machines can be utilized individually as 8 or 10-stone machines or in multiple unit configurations as 8, 16, 20, 24, 30, 32, and 40 stone machines. In any configuration, the entire machine can be controlled by a single operator.

Features

- Diesel engine
- Hydrostatic propulsion system
- Pneumatic braking system
- Hydraulically powered grinding heads
- Filtered dust collection system
- Water spray fire control system
- Comfortable control cabins
- Full computerized control of all functions
- Legal highway transportation in most countries
- Frontal profile fits within most international transit clearance diagrams without modification

Grinding Carriage Design

- Located underneath the machine's mainframe and centered between the axles or bogies
- Left and right side carriages equipped with gauge wheels to center the grinding heads over each rail
- Five grinding units located over each rail on the 10-stone model
- Each unit is attached to its carriage by a mechanism that lifts the grinding unit into the clear and makes adjustments to the unit position when working
- Patented linkage arrangement positions the grinding unit at the angle specified in the grinding pattern selected by the operator

A hydraulically controlled slide mechanism feeds the grinding wheel into the rail. Down pressure on each grinding wheel is controlled by a closed-loop servo valve circuit which maintains constant power to the grinding motor at the selected pattern rate.

Machines are designed to minimize noise levels in the cabins and around the machine. Noise levels in the main cabin and at 25 meters away during normal operation in normal weather conditions meet specified standards.

Cabin

Control Cabin Features

- Insulating materials designed to minimize external vibration and noise
- Tinted, double-pane, argon-filled safety glass windows
- Pressurizers and heating / air conditioning systems
- Intercom system for inside / outside communication
- Full internal control of machine functions
- Two corner doors with handrails and ladders to access cab from left or right
- Third door to survey engine
- Main electrical panel
- Computer control system

The machines are also available at any gauge between 1067 mm (42 in.) and 1676 mm (66 in.), as well as a variable gauge model. RGHC Grinders are typically equipped with a main cabin and an auxiliary cabin located at the ends of the machine. The main cabin is located at the typical "forward" end of the grinding machine.

The auxiliary or "travel" cabin is located at the typical "rear" end of the grinding machine. This cabin provides a control location where the operator can face the direction of travel and have a full view of the track ahead and to either side when the machine must travel in the "reverse" direction. This is especially useful when operating at travel speeds or for an extended distance. The auxiliary cabin is equipped with full travel controls, a systems monitor screen, and engine controls. It features doors on both sides accessible from the walkways on either side of the machine. Convenient access to the engine compartment from the adjacent walkway allows the operator easily move between cabins.

On multiple unit RGHC machines, should it be desired, the auxiliary cabins may be eliminated and the space utilized for additional storage compartments.

Grinding System

The grinding system of an RGHC Grinder is equipped with independent, hydraulically powered grinding units fitted with abrasive wheels.

Grinding Units

- Hydraulic motor powered at 6,000 RPM
- Constant power setting between 0 and 17 kW (23 hp)
- Spindle / Bearing assembly
- Spin-on grinding wheel fitted together and mounted on a linear slide mechanism
- Accommodates grinding wheels of 102 mm (4 in.), 127 mm (5 in.), 152 mm (6 in.), and 279 mm (11 in.) diameters

The inclination angle for each grinding unit is determined by the operator or from the preset pattern control. A patented linkage arrangement rotates the grinding unit at the same time that it translates across the rail. This effectively keeps the grinding contact patch in the center portion of the grinding wheel's periphery.

During the grinding operation, all grinding unit movements—vertical, horizontal, and angular—are computer controlled using a set of rail grinding patterns and speeds which are programmed by the operator to accomplish the grinding method required.

Features

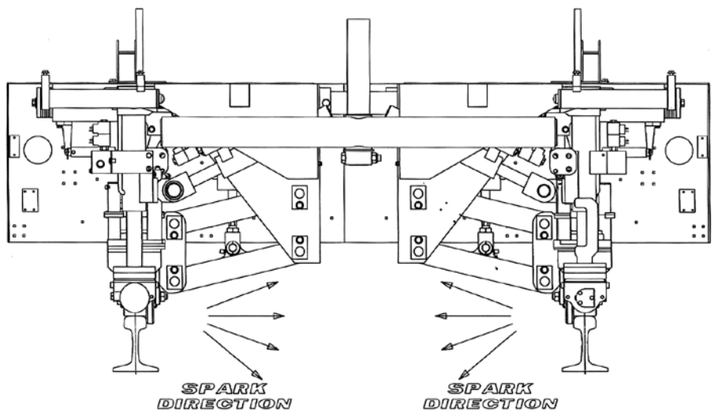
- Computer system stores 99 grinding patterns, each consisting of 5 or 10-stone positions per rail
- Grinding speed is 3 to 16 km/h (2 to 10 mph)
- The grinding head operating range is independently variable from 75 degrees-gauge side to 45 degrees-field side
- An automatic low speed pick-up feature retracts the grinding heads should the machine slow below a preset speed

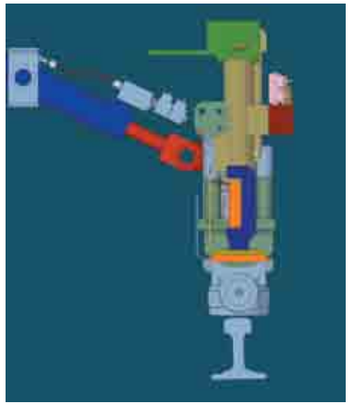
Precision Automatic Stone Sequencing (PASS)

- Standard feature on the RGHC Rail Grinder
- Enables the machine to effectively grind switches, guarded curves, and road crossings
- Allows the operator to set down or pick up all grinding units on one side consecutively at a single point along the track

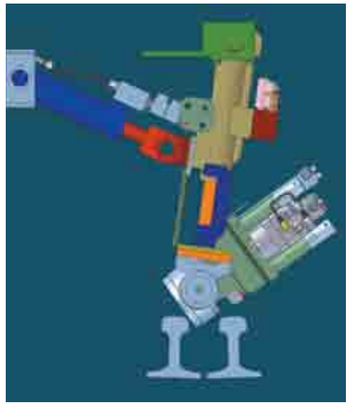
6 in. diameter stone

11in. diameter stone

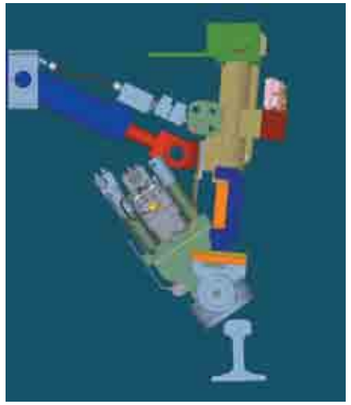




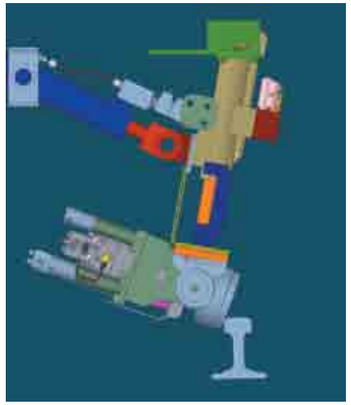
0 degree grinding



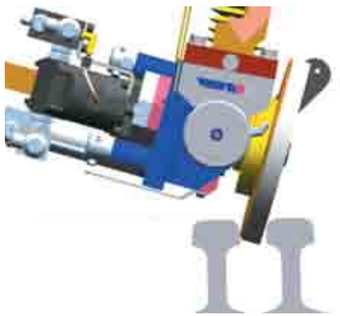
38 degree grinding



45 degree grinding



70 degree grinding



75 degree grinding

11 in. stone layout

Each grinding motor can be independently adjusted and monitored to suit your grinding requirements. Touch screen controls allow the operator to select adjustable horsepower developed by each motor. The control system can be set to accelerate the machine to a preset speed and hold it similar to the cruise control in a car. This gives the machine predictability and repeatability for pick-ups and set-downs.

75 degree grinding

Propulsion / Suspension

Bogie configuration

Propulsion System

- Heavy-duty, axle mounted, two-speed power shift gearbox
- Direct mounted two-speed motor
- Closed-loop hydrostatic drive
- Four-wheel drive on both single axle and bogie configurations

Features

- Each bogie has one powered axle and one idler axle
- Bogies are equipped with chevron-style suspension springs
- Wheels are 30 in. in diameter
- Powered axle is driven by a variable displacement hydraulic motor and is an integral part of the heavy-duty gearbox
- Motors are a part of a closed loop hydrostatic system
- The drive system provides dynamic braking with adjustments to avoid engine over speed

In the travel mode, this system allows an infinite speed range controlled through a lever on the operator's control console. With the grinding carriage deployed, the motor is held in the maximum displacement (maximum torque) position, and the speed is electronically limited. The control system can be set to accelerate the machine to a preset speed and hold it like the cruise control in a car. This gives the machine predictability and repeatability for pick-ups and set-downs

Grade Capabilities

- In the max torque position, the machine is capable of climbing grades in excess of 6.5%
- In the travel mode, the machine is capable of climbing grades up to 1.5% at 50 mph

The propel systems on the two machines (20-stone consist) are controlled together electronically so that they share the propelling load equally. The control system also monitors the speed of all four axles and energizes the four-wheel-drive valves if one axle turns faster than the others, indicating wheel slip

In the case where one machine is inoperable, the remaining machine is capable of towing the other

Braking System

- Four brake canisters per vehicle
- One canister per corner
- Canisters are mounted between the wheels
- Two chambers per canister; one parking and the other service
- The parking chamber is spring-applied and air released
- The service chamber is air-applied

A standard glad-hand coupler is provided on both ends so that a vehicle with railroad brakes can release the parking brakes through the standard brake pipe and then re-apply the brakes by reducing the brake pipe pressure.

Controls

The RGHC Control System utilizes an on-board computer, directed via inputs from the operator in the main cabin and Harsco Rail's own operating system software to provide precise, efficient control of the machine. The operator can quickly and easily utilize any of the Preventive, Maintenance, and Corrective grinding methods that the "C" machine can perform to extend the useful life of a particular area of in-track rails.

Features

- Rugged, industrial computer chassis especially suited for mobile application use
- Touch screen monitor
- Icon-based selection choices and status indicators
- Extensive help menus to resolve any uncertainty
- Help menus and error messages are available in sovereign languages other than English if necessary
- Computer-based diagnostics simplify troubleshooting a machine and reduce downtime

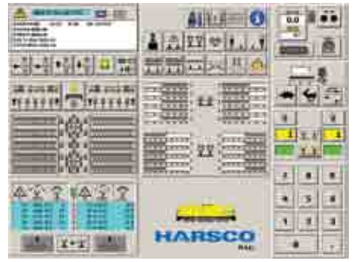
The operator can directly select desired functions or choose from up to 99 pre-programmed "grinding patterns" to set stone positions and power settings for each grinding head for each pass over the rail.

The system constantly monitors all digital and analog inputs and outputs. Should an electrical error on an I/O signal occur, the Smart I/O menu pops out automatically and identifies the error as either an open or short circuit.

Graphic representation of the wire number, the load current, and error occurrences are displayed. Armed with this information, the operator wastes little time in returning the machine to operation.

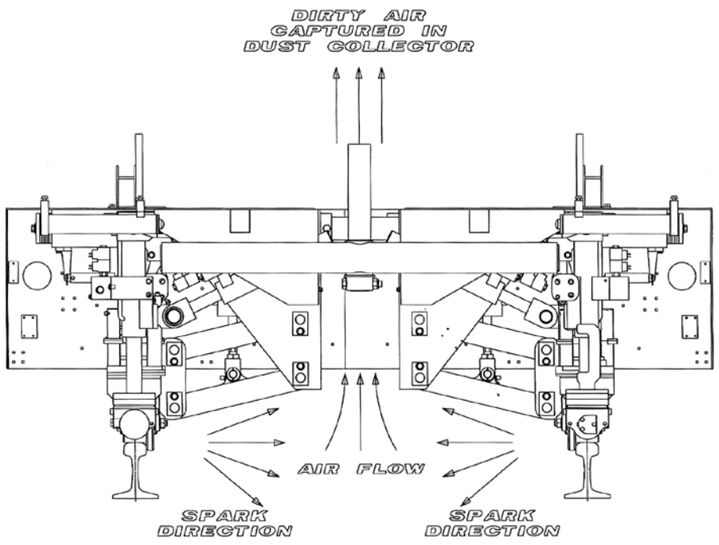
Main Operator's seat and Pilot's seat

Easy Operation via the Touch Screen Control Panel



Cab also has two jump seats mounted against the cab wall

Dust Collection



Each machine is equipped with an integral dust collector to evacuate the enclosure around the grinding units.

Features

- Collects a large portion of the dust generated by the grinding process
- Utilizes eight cartridge type air filters
- Removal of 99.99% of airborne particles greater than .5 microns
- Dust drawers are located at the bottom of the unit for convenient and easy disposal

Grinding switch area

Dust Collector Area

Eight cartridge type air filters remove the airborne particles

Drawers collect trapped dust and can be easily removed for dust disposal

Fire Suppression

The C-Model carriage is skirted with protective shields and spark suppression devices to contain sparks, dust, and possible broken grinding wheels.

Features

- 15 meter hose reel with adjustable spray nozzle for washing and extinguishing minor fires or dampening an area prior to grinding
- Side water nozzles to
- 3,000 liter (790 gal.) water tank on-board for water supply
- Optional unit to inject foaming agents into water spray if needed

A permanently mounted dry chemical fire suppression system, which includes two 40 lbs. chemical tanks, provides additional protection for the machine. The system on a given car is triggered through one of three actuators and discharges through a network of nozzles positioned around the machine. One actuator is mounted inside the cab, and the other two are mounted on either side of the vehicle where they can be reached from the ground. Nozzles are mounted inside the grinding carriage inside the dust collector, and inside the engine enclosure.

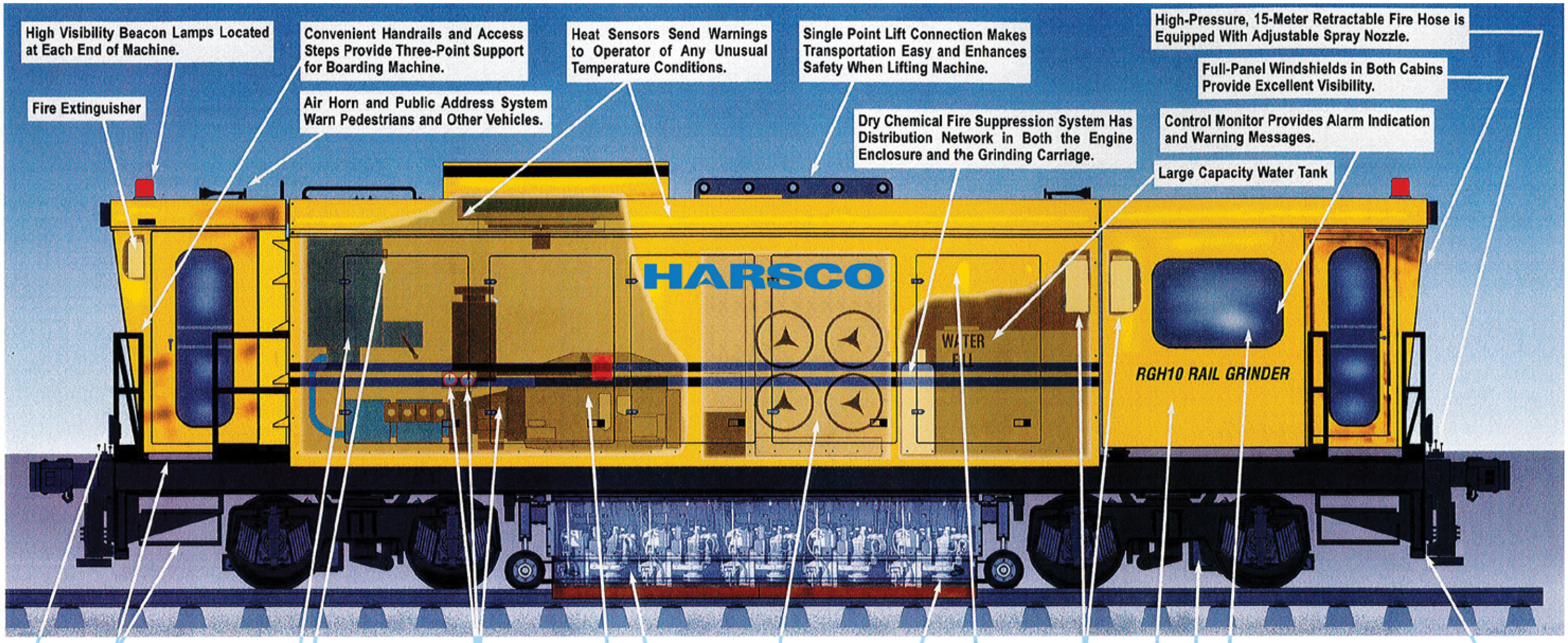
Protective shield (side curtain)

15 meter hose real

Front mounted actuator for dry chemical fire suppression system

Cab mounted actuator for dry chemical fire suppression system

Precision Maintenance Rail Grinder Safety Features



HARSCO
RAIL

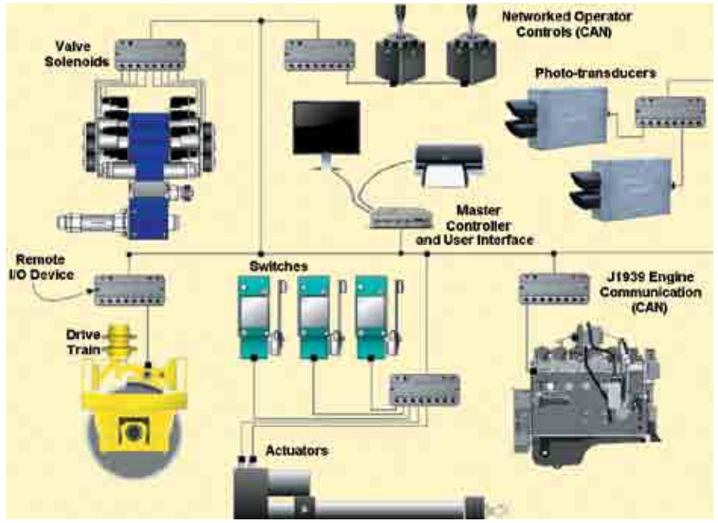
Jupiter II Control System

Jupiter II is a distributed Input/ Output control system developed by Harsco Rail as a state-of-the-art highly successful control system. The system's ruggedness, speed, simplicity, and diagnostic capability meet the demanding controls requirements of today's and tomorrow's railway maintenance equipment.

Features

- Control Area Network (CAN) industrial communication scheme to communicated with full-intelligence I/O modules
- Modules are placed in strategically close proximity to the devices with which they interact
- Designed for exposure to harsh environmental conditions
- Fully potted to provide a high degree of vibration tolerance that allows direct mounting to almost any part of the machine
- Rail grinder modules are often directly mounted to the grinding carriages

Jupiter II goes beyond other distributed I/O systems by genuine I/O application intelligence and processing to the nodes of its control network that completely sidesteps issues of network bandwidth. This capability also enables application aware fallback functionality that provides an unprecedented level of reliability and fault tolerance. All of this is provided while maintaining complete interchangeability of a small set of component parts with plug and play operation. The fully scalable nature of Jupiter II makes it possible to apply this powerful system to the largest and smallest of a wide range of products. This squarely aligns the performance of these products with one of Harsco Rail's greatest strengths: excellence in machine control software.



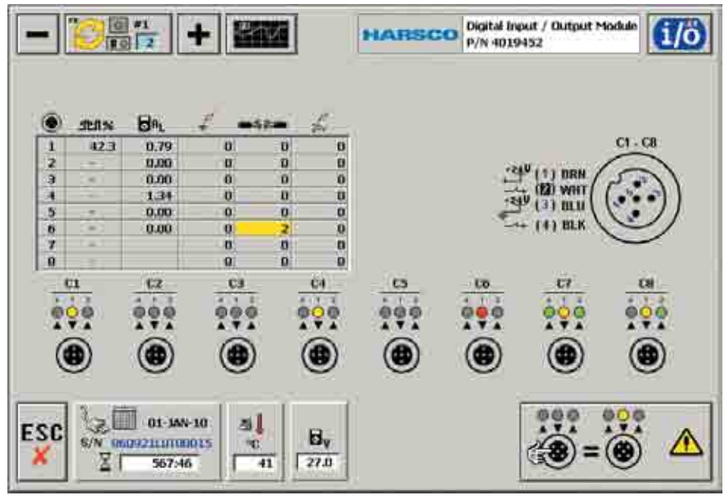
The Jupiter II Control System uses remote I/O devices to simplify railway maintenance equipment's control requirements, improve operator troubleshooting, and ease hardware replacement.

Network Hardware

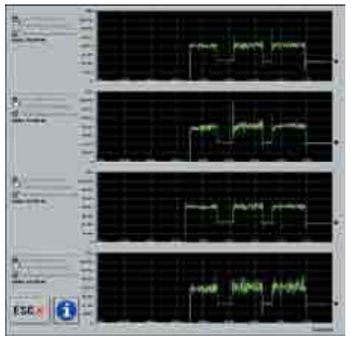
The "plug and play" capability of Jupiter II allows modules to be replaced or exchanged between completely different machines with ease. Installation of a new or moved module results in automatic network addressing and installation of module software at the press of a button. The majority of devices that connect to the Jupiter II system incorporate connectors to facilitate rapid field replacement. Many of the cables in the system are identical and vary only in length. Therefore, only a few spare cables (equal in length to the longest in actual use) need be carried to make it possible to replace any cable on a machine.

The Jupiter II system:

- Combines digital input and output control into a common module type, resulting in only a digital I/O and an analog input as the 2 basic module types for most I/O
- Provides all module connectivity through easy to use and inexpensive M12 quick-disconnects
- Includes high-performance capabilities such as high-frequency digital output PWM, high-speed digital input collection rates, and analog input channel conversion rates, and intelligent modules capable of autonomous operation
- Is compact and scalable, resulting in convenient module placement on machines and commonality across Harsco Rail equipment
- Features industry-leading, on-board and in-office diagnostic, and data-logging capabilities
- Help screens in various languages available



Module Diagnostics Detail View Digital Module shown



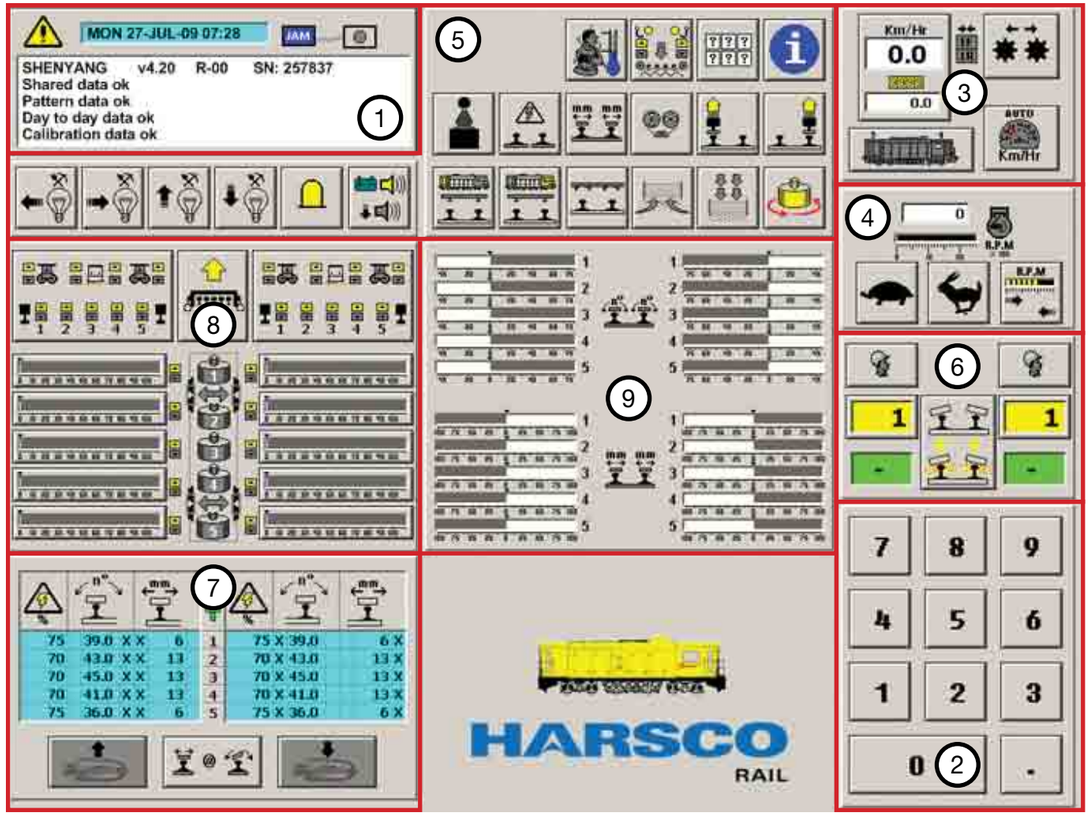
Advanced Diagnostics

Diagnostic Graphing Feature

- Ability to simultaneously monitor any of the I/O channels on the machine (up to four at a time)
- Adjustable graph axes
- Ability to display anywhere between the previous 3 minutes to the previous 3 hours of data for a selected channel
- Numerous channel properties can be viewed in terms of engineering units (as opposed to raw signals)
- All network message data can be logged, retrieved, and viewed for analysis at a later date

Advanced module diagnostics provide the operator with an in-depth view of channel information, including voltage or current readings, channel active and error status, and hardware reference information. The screen also provides the ability to manually activate or deactivate output channels.

Jupiter II Control System



Main Screen - Cab Front

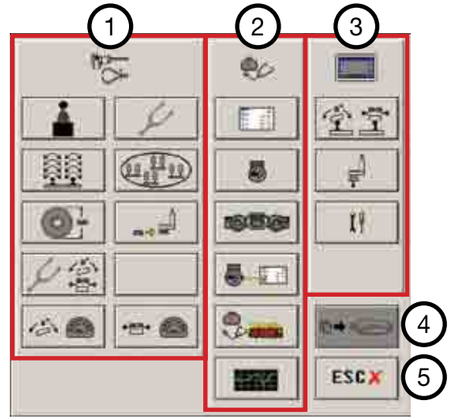
The Main Screen on the Jupiter monitor of the front Cab displays the following:

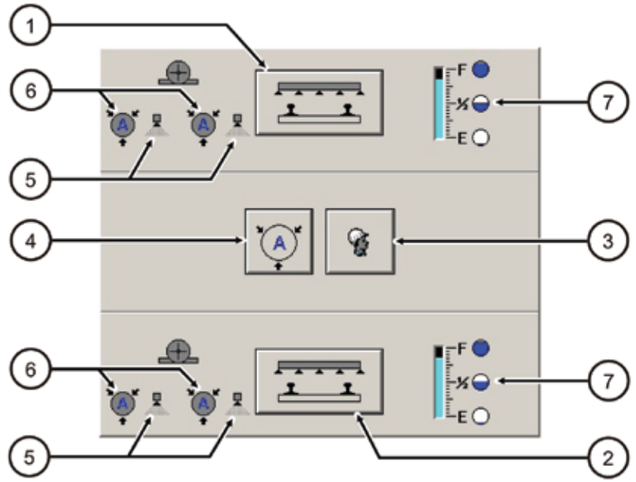
1. Alarm Panel
2. Numeric Panel
3. Speed / Shift Panel
4. Engine Speed Panel
5. Tool Bar Buttons
6. Pattern Control Panel
7. Pattern Information Panel
8. Carriage Control Panel
9. Angle and Lateral Shift Information Panel

Note: The Panels are shown outlined in red on the Main Screen for identification only. The Grinding Heads on the panels are labeled #1 thru #5 from left to right and/or from top to bottom.

Miscellaneous Control Panel

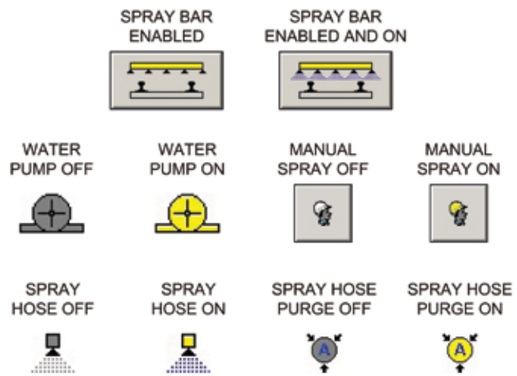
1. Calibration Sub-Panel
2. Diagnostic Sub-Panel
3. Q-Term Sub-Panel
4. File Transfer Button
5. Escape Button



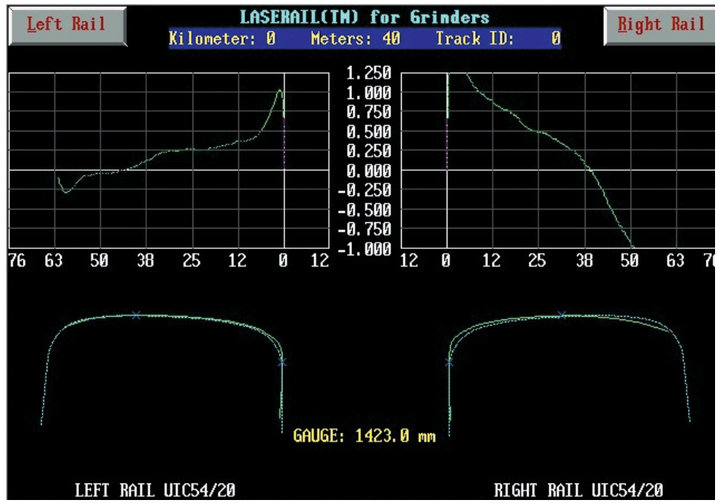


Water Spray Control Panel

1. Forward End Spray Enable / Disable
2. Rearward End Spray Enable / Disable
3. Manual Spray Mode On / Off
4. Air Purge Button
5. Front / Rear and Left / Right Spray Hose Indicators
6. Front / Rear and Left / Right Spray Hose Purge Indicators
7. Water Level Indicators



Laser Profile Measurement System

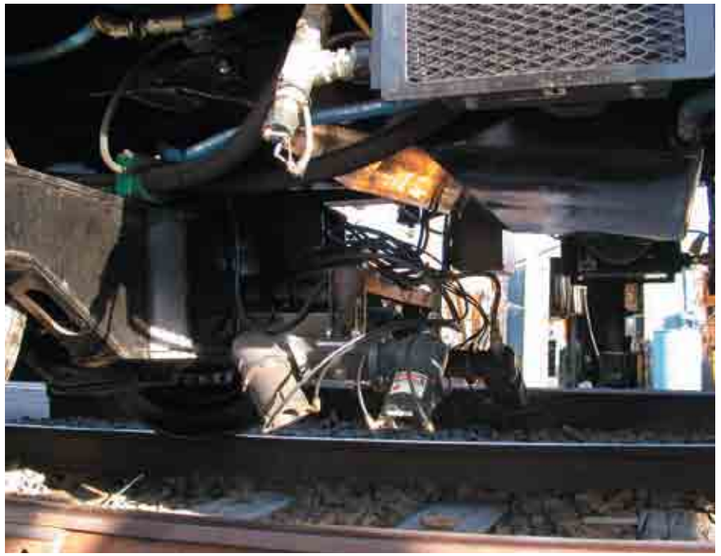


Features

- Laser-based system
- Accuracy ± .1 mm
- Measurements taken once per meter
- Top measurement speed: 18 km/h (11 mph)
- Provides real-time display of both left and right rail profiles plus track gauge
- Each profile generated with 600 data points storage of profiles for records and planning

The Laser Profile Measurement System (LPMS) is a rail cross section measuring device. Its function is to provide accurate and reliable measurement of rail profiles in real time. The system is designed to function on board a grinding train with minimum operator intervention. Difference between the standard reference profile and the measured rail head shape can be calculated from the profile data.

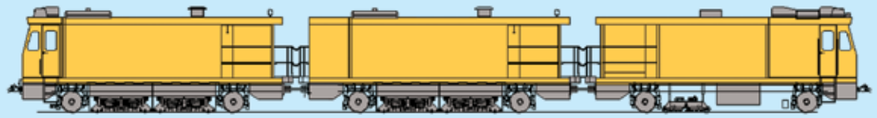
Also available: Corrugation Measurement



Transit Grinder

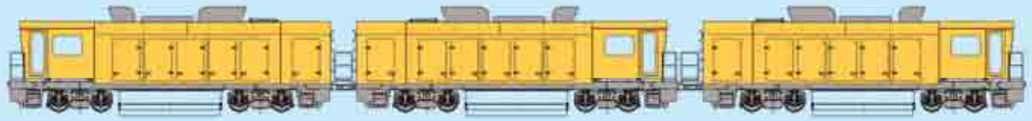
Switch and Crossing / Transits C Models

10 Stone



16 Stone, Equipped with liquid cooled electric grinding motors

20 Stone



30 Stone

10 Stone

Transit Grinder
Benefits and Features

Benefits

- Available in various gauges, including an adjustable gauge version
- Low noise levels
- Features Harsco Rail's Jupiter II Control System to simplify maintenance and minimize downtime
- Integral dust collection system protected by temperature sensing switch
- Dry chemical fire suppression system has distribution network in both the engine enclosure and the grinding carriage
- Fully independent grinding head control
- Outstanding operator visibility with ergonomically designed operator stations to minimize operator fatigue
- Hydraulic fluid is fire-resistant and biodegradable, and the unit is truck transportable
- Single point lift system connection makes transportation easy and enhances safety when lifting the machine
- Grinding carriages are equipped with non-flammable shields and guards to contain sparks, grinding dust, and flying debris

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Bulletin #HR 2101
Printed in USA, August, 2012

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