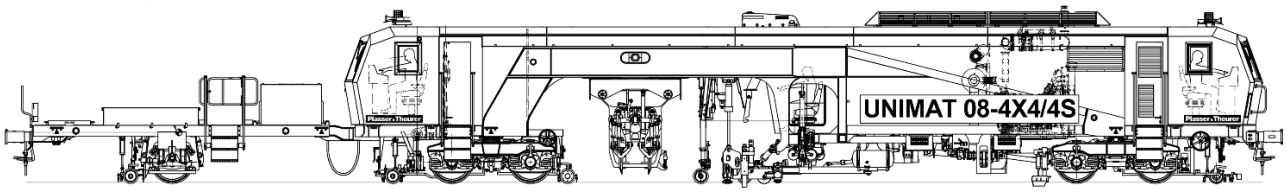
# TECHNICAL DESCRIPTION




# Unimat 08-4x4/4S

**Cyclic action single-sleeper**

**levelling, lifting, lining and tamping machine**

**with integrated Plasser MaterialTrailer**

**for tracks and turnouts**

System Plasser & Theurer
Gauge 1 435 mm
Machine preparation for gauge 1 668 mm

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# 1 GENERAL

The *Unimat 08-4x4/4S* as single sleeper tamping machine is a universal tamping machine, which is based on the working principle of the most modern turnout tamping machine (Unimat 4S).

That means the machine carries out turnout maintenance according to the most up-to-date techniques, like 3-rail lifting without support on the ballast bed and 4-rail tamping to fix the diverging track.

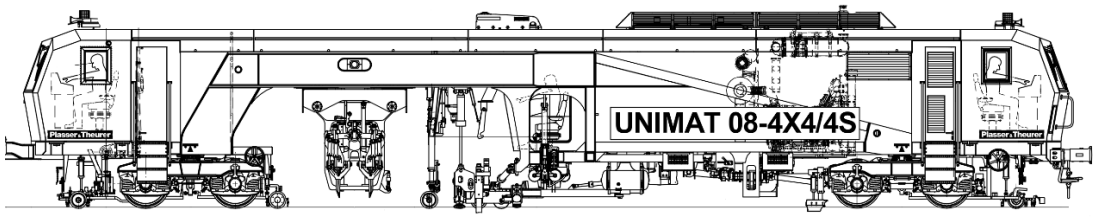
The work processes of levelling, lifting, lining and tamping are combined in one Machine.

**The benefits of the machine are:**

- ✓ Increased output when working in turnouts by using universal tamping units with tilting tines
- ✓ Highest tamping quality in tracks and turnouts *(Plasser & Theurer tamping technology with guaranteed process reliability, 3rd rail lifting, 4th rail tamping)*
- ✓ The frame is designed to meet the special requirements on the heaviest permanent way material, also in turnouts (heavy haul lines)
- ✓ Machine and cabins in state-of-the-art design
  *(ergonomic, user-friendly, clearly arranged, innovative)*
- ✓ High availability of the machine thanks to a top speed of 100 km/h during self-propelled transfer travel
- ✓ Approval for line category C2 (axle load ≤ 20 t)
- ✓ Faster and more favourable approval due to standardised components and systems

## 1.1 Tamping machine Unimat 08-4x4/4S

The tamping machine (main machine [MM]) is mounted on 2 two-axle bogies and carries all 3 cabins and all working units for tamping operations (tamping units, lifting and lining unit and the additional lifting unit for turnouts).

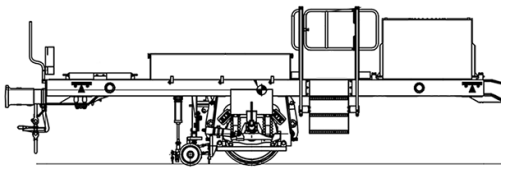



## 1.2 Integrated Plasser MaterialTrailer

The integrated Plasser MaterialTrailer is joined to the main machine at the front by an articulated coupling and is supported on a 1-axle bogie (axle 5) at the rear end. At the end of the frame it is equipped with buffers and draw hooks.

The integrated Plasser MaterialTrailer is equipped with:

- a loading platform
- a fuel tank with 3 000 l
- a measuring trolley for the recording system.

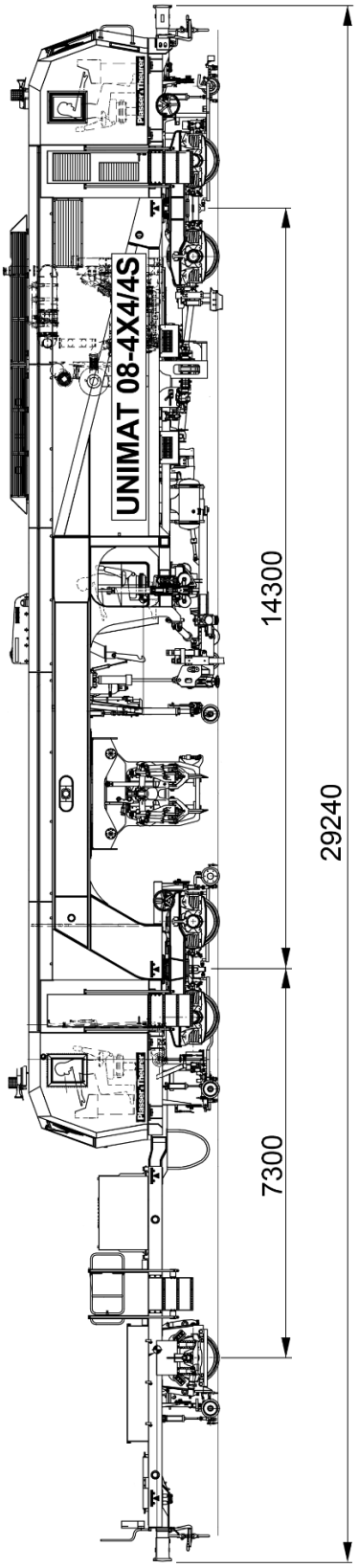



Unimat 08-4x4/4S Example


Unimat 08-4x4/4S Example

# 2 LAYOUT DRAWING

Machine shown may contain optional equipment. We reserve the right to make alterations in line with the further technical development!



# 3 TECHNICAL DATA AND DESIGN FEATURES

## 3.1 Dimensions and weights

(Machine in transport mode)

| | | |
|---|---|---|
| Gauge | 1 435 | mm |
| Length over buffers (LüP) incl. Plasser MaterialTrailer | 29 240 | mm |
| Width, approx. | 3 000 | mm |
| Height over top of rail, approx. | 3 900 | mm |
| Distance between bogie pivots | 14 300 | mm |
| Distance between rear bogie and single axle | 7 300 | mm |
| Axle wheel base in the bogies | 1 800 | mm |
| Diameter of wheels | 920 | mm |
| Total weight, approx. | 99 | t |
| Axle loads (according to line category C2) | ≤ 20 | t |

## 3.2 Frame

Sturdy welded construction of rolled steel profiles and steel sheets assembled according to the most up-to-date welding techniques and manufacturing methods. The frame is designed to meet the special requirements imposed by the lifting and lining forces on the heaviest permanent way material.

The frame is equipped in standard design with a buffer bar and buffers and draw gear on the following points:

- front end of the tamping machine
- rear end of the integrated Plasser MaterialTrailer

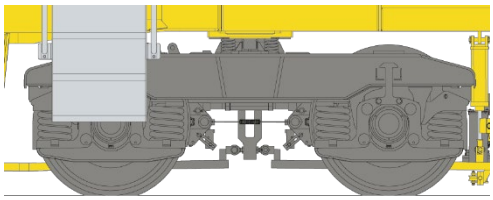
| | |
|---|---|
|  | Buffers and draw gears according to UIC 526-1 and 520 |

### 3.2.1 Topcoat of the machine

- 2 primary layers with anti-corrosion coating and metal primer and multicoloured top coatings
- Lamination of the machine with special films:
  - Ornamental Strip
  - Logos
  - Labelling

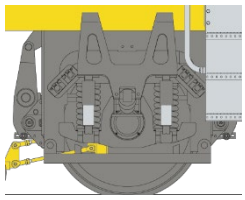
| | |
|---|---|
| ℹ | Painting example see cover sheet. The painting example must not accord with the real painting. |

## 3.3 Undercarriage



Bogie

Example



Single axle

Two two-axled bogies and one-free steering axle with through axles.

### 3.3.1 Wheel sets

Through axles with presser-on solid disc wheels.
Wheels are equipped in Standard with the Plasser&Theurer Wheel Profile.

| | |
|---|---|
| ℹ | Wheel material (solid disc wheels) according to EN 13262<br>Wheel set shaft material according to EN 13261 |

### 3.3.2 Axle bearing

Axle bearing by means of large roller bearings.

### 3.3.3 Suspension

Bogies:

Suspension by coil springs between axle bearing and bogie frame in combination with friction shock absorbers.

Plasser MaterialTrailer axle

The axle bearing housings are fixed to the machine frame by means of vertical coil springs and shackles. They have a longitudinal play on the frame like a free steering

axle. The coil springs together with shock absorbers provide sufficient absorption of vibrations and shocks and guarantee smooth running of the vehicle.

The axle is dampened horizontally by one hydraulic shock absorber and vertically by two hydraulic shock absorbers between axle bearing housing and undercarriage frame on each side.

### 3.3.4 Suspension blocking

During work the suspension of all bogies are blocked hydraulically.
Furthermore, hydraulic supports between bogie frame and machine frame are foreseen. During forward motion are this supports released.

### 3.3.5 Rail guard

In front of each end axle.


Bogie Example

## 3.4 Drive and power transmission

### 3.4.1 Engine

Technical information:

| | |
|---|---|
| Cooling type: | Water cooled |
| Fuel: | Diesel |
| Producer: | DEUTZ |
| Type: | TCD 16.0 / V8 |
| Output: | approx. 480 kW |
| Exhaust emissions regulation: | EU Stage 5 |

### 3.4.2 Location

The engine and auxiliary installations are mounted on the machine frame by means of metal-rubber springs and covered by an engine housing.
The engine is easy accessible.

Engine stop buttons operated from inside the cabins. From the outside they are designed as emergency stop buttons.

### 3.4.3 Fuel tank

The machine is equipped with one fuel tank on the Plasser MaterialTrailer.

| | |
|---|---|
| Tank capacity: | approx. 3 000 l |

#### 3.4.3.1 Reducing agent tank for urea

| | |
|---|---|
| Tank capacity: | approx. 105 l |

#### 3.4.3.2 Gravity refuelling

The filler neck for gravity refuelling is on the diesel tank.
The cover of the filler neck is designed to lock.

#### 3.4.3.3 Pressure refuelling

A connection option for the refuelling system is available on the left and right side of the machine. The connections are lockable.

### 3.4.4 Engine compartment temperature monitoring system

The engine compartment is fitted with temperature sensors.
An optical pre-alarm (blinking light) is triggered by a control unit when the temperature rises in the engine compartment.
When the set temperature threshold is exceeded, an optical and acoustic alarm will go off.

### 3.4.5 Compact sound insulation

The engine housing is completely lined with sound-insulating plates and all suction and exhaust openings are provided with appropriate noise-dampening devices.

### 3.4.6 Drive

#### 3.4.6.1 Drive – transfer travel

Hydrodynamic drive acting on both axles of bogie 1.

CONTROL DURING TRANSFER

The machine is controlled either from the front (cabin 1) or rear cabin (cabin 3).

#### 3.4.6.2 Drive – working travel

Hydrostatic drive cyclic acting on both axles of bogie 1 and one axle of bogie 2.

CONTROL DURING WORK

Semi-automatic in conjunction with the brake control by operating a pedal (forward motion pedal) or by automatic forward motion.

### 3.4.7 Travelling speeds

Max. driving speeds (in both directions):

| | |
|---|---|
| self-propelled: | 100 km/h *), infinitely adjustable |
| hauled: | 100 km/h *) |

*) Subject to the observance of regulations concerning operation, maintenance, conveyance and the pertinent rules of vehicle registration.

## 3.5 Brake system

### 3.5.1 Design

Pneumatically actuated block brakes acting on all wheels, two blocks per wheel.

### 3.5.2 Control

During transfer travel under its own power:
Direct brake via hand level valves.

During work:
Direct brake with own control circuit automatically, hydraulically via forward motion control acting on axles of bogie 1 and bogie 2.

### 3.5.3 Through train brake line

The machine is equipped with a through train brake line.

### 3.5.4 Indirect train brake system with KE valve according to UIC regulations

Equipment of the machine with KE valve and connections for train braking system according to UIC regulations allowing the machine to be braked during transfer by the traction vehicle when buffing and draw gear is mounted.

### 3.5.5 Driver's brake valve (BP Compact - Light [BPC-L])

The machine is equipped with a BPC-L-valve and one hand level valve per driver's desk (cabin 1 and 3) allow the braking of hauled wagons in combination with the indirect train braking system with KE valve according to UIC regulations.

### 3.5.6 Parking brake

Via hand wheel acting on the wheels of at least one bogie.

## 3.6 Pneumatic system

Compressor for pressure air supply of:

- the brake system
- the auxiliary operations (such as lowering and lifting of the measuring trolleys and for lockings)
- the warning system

The pneumatic plant essentially consists of compressor with filter, cooling circuit, pressure regulator, air containers, water separator and brake and control valves. An air dryer is installed in the pneumatic system.

## 3.7 Hydraulic system

Sturdy vane pumps provide the working units and the drive unit with the required pressure oil.

Hydraulic accumulators guarantee a sufficient supply, uniform pressure and smooth functioning of all hydraulic operations.

A special cooling circuit with large oil cooler and thermostat maintains a constant operating temperature.

Modern fail-safe control valves guarantee the exact sequence of all hydraulic operations.

The hydraulic oil tank is provided with suction and return filters with contamination indicators.

### 3.7.1 Fine filters

Installation of fine filters.

### 3.7.2 Emergency hydraulic pump

An emergency hydraulic pump, driven by a separate diesel engine is integrated in the system, for retracting the working units in the event of a main engine failure.

<u>Following operations can be carried out with this facility:</u>

- Lifting and retracting of the tamping units
- Retracting and swinging in of the jib arms
- Lifting of the lifting units and retracting of the lifting hook

| | |
|---|---|
|  | No drive with this facility possible! |

## 3.8 Electric system

24 V d.c. system for starter, lights, signal installations and control circuits.

The electronically components are in modular design. This achieves high reliability of operation and service friendliness.

All electronic elements exposed to weather influences are in splash-proof design.

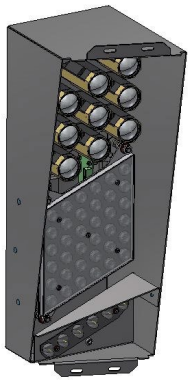
### 3.8.1 Power supply

Three-phase generators (alternators) branched in parallel, powered by the diesel engine.

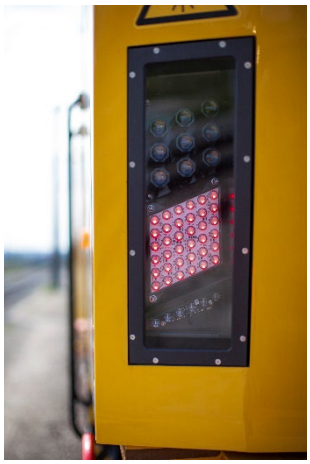
### 3.8.2 Lights

Head and tail lights corresponding to railway regulations including lightning of the machine surrounding.

Head and tail lights are combined in newest LED technique design.



LED-head light



Example

Adjustable reflectors provide sufficient illumination of the working area, the working units, and the track in front and behind of the machine during work in nightshifts.

Lamps on the ceiling of the cabins and instrument lightning foreseen.

All lights are in LED-design.

### 3.8.3 Further lightning and signalling equipment

- Brake lights on both ends (combined design)
- Electric horn (operated from outside and inside the cabins)
- Flashing warning lights on the roof of cabin 1 and 3

## 3.9 Cabins

The machine is equipped with 3 fully enclosed sound- and heat-insulated cabins in the newest design:

- one cabin on the front end of the main machine
- one cabin directly in front of the lifting and lining units
- one cabin on the rear end of the main machine

Large safety glass windows provide a good visibility during transfer travel and work.
The machine has an end-to-end roof from the front to the rear cabin.
The access to the cabins on both ends (cabin 1 and 3) is via steps with handrails and safety platforms.

The cabin with the operator's stand in front of the lifting and lining units (cabin 2) is accessible via the safety platform of the front cabin (cabin 1) and a passageway.
From this passageway you can also get to the most important control units and working units (e.g. diesel engine, hydraulic pumps, hydraulic valves, compressor, etc.)

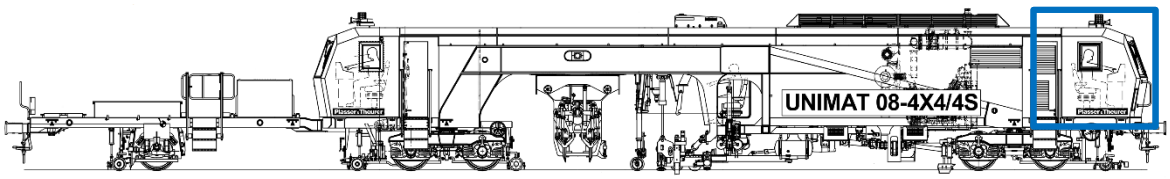
Driver's and operator's seats meet ergonomic requirements. The operators seats are additionally in rotating design to enable easier access.
(air-suspended seats with broad arm rest installation)

The cabin interiors are in the latest designs thanks to the newest cabin design from Plasser & Theurer and meet the highest demands on ergonomics, user friendliness and comfort.

Important operating elements are arranged ergonomically, quickly accessible and recognisable.

| | |
|---|---|
|  | Visibility for drivers and accompanying persons during transfer under own power according to UIC regulations |

### 3.9.1 Enclosed cabin at the front end of the machine (cabin 1)

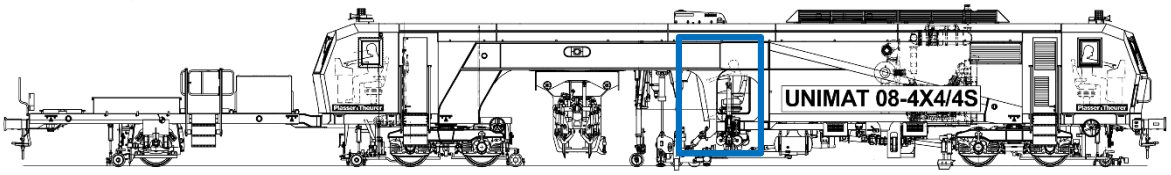



This cabin, equipped with large safety glass windows, contains all controls for travel as well as for the levelling and lining system, the SmartALC and the DRP.

Furthermore, operating screens for the P-IC control system are foreseen in this cabin.

Cabin facilities (Pictures may contain optional equipment) Example

### 3.9.2 Enclosed operator's cabin in front of the lifting and lining units (cabin 2)




This cabin contains all controls for track and turnout tamping operation. The operation is carried out by one operator. It is located directly in front of the lifting and lining units.

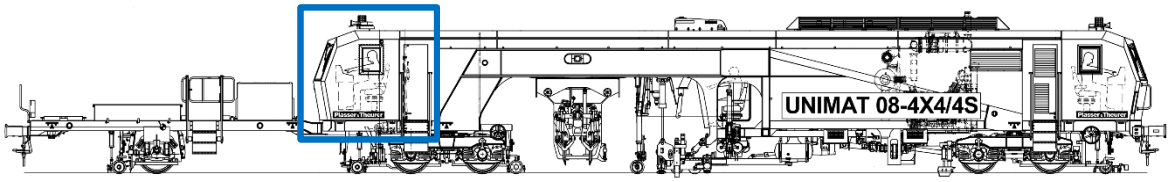
<u>The cabin is equipped with control units for the following working units:</u>

- Combined lifting and lining unit
- 3rd-rail lifting unit
- Independent lateral displacement (left/right) of all 4 tamping units
- Independent tiltable tamping tines

Furthermore, here are also operating screens for the P-IC control system directly in the view of the operator foreseen.

Cabin facilities (Pictures may contain optional equipment) Example

### 3.9.3 Enclosed cabin at the rear end of the machine (cabin 3)




This spacious cabin, equipped with large safety glass windows, contains all controls for travel.
Furthermore, operating screens for the P-IC control system are foreseen in this cabin.

| | |
|---|---|
| | Therefore the machine may be driven in the transfer mode from the front (cabin 1) or rear cabin (cabin 3) as required. |

Cabin facilities (Pictures may contain optional equipment) Example

### 3.9.4 Vibration dampening and sound insulation of the cabins

The cabins are located on a separate frame which is insulated against vibrations and shocks coming from the main machine frame.

The cabins are sound-proofed and insulated by means of:

- Lining with flame resistant sound-insulating material
- Coating of the material with perforated aluminium plates
- Apertures in the floor plates and walls are sealed by sleeves, bellow joints or similar
- Pipes and cables leading to the outside are housed in protective sleeves

### 3.9.5 Intercom system between the cabins

For ideal communication of the crew, an integrated intercom system is installed between the cabins.

### 3.9.6 End windows for transfer travel with safety glass

End windows for transfer travel with safety glass, electrically heated, mounted on the ends of the cabin with special profile frame.

### 3.9.7 Windshield wipers and washers

Windshield wipers on the end windows of cabin 1 and 3.

### 3.9.8 Video and monitor system

For visual checking, following colour cameras are installed:

| | | |
|---|---|---|
| 1 pc. | on the front machine end (MM) | [Forward movement] |
| 1 pc. | on the rear machine end (MM) | [Reverse movement] |
| 4 pc. | rear-view cameras | |
| 2 pc. | for the lifting and lining unit | [le/ri roller lifting clamp area] |
| 1 pc. | for each measuring trolley for the lowering assistance | |

Monitors are installed in all cabins.

Some touch screens of the P-IC control may be used as displays for diverse cameras also.

### 3.9.9 Further cabin equipment

- Cabin ventilation with filter
- Air conditioning unit
- Cabin heating
- Roller blinds

### 3.9.10 Safety kit

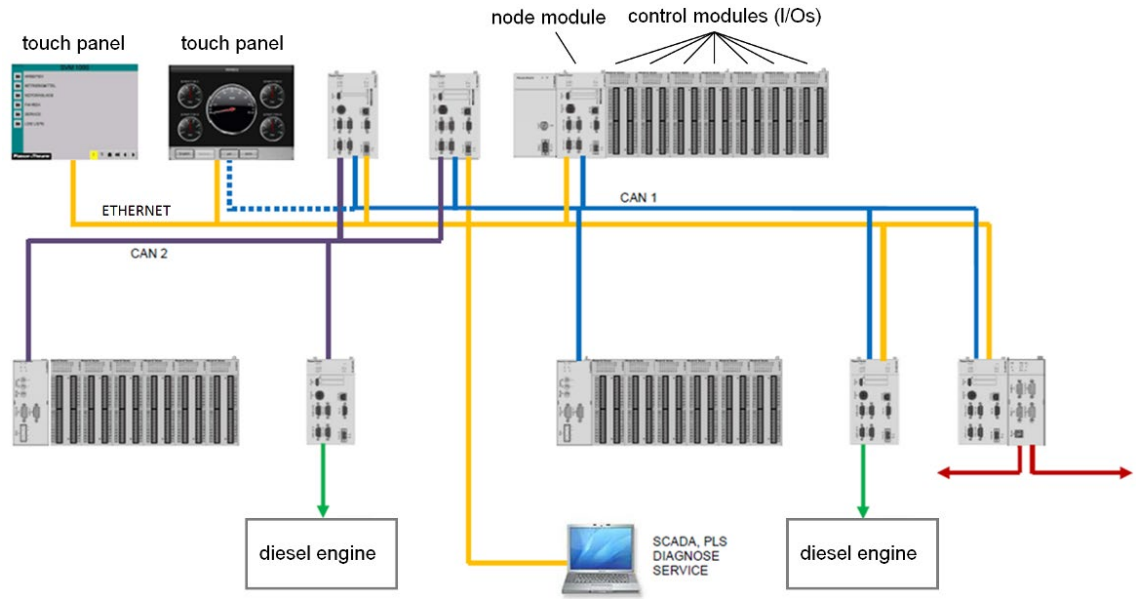
- First-aid kit
- Smoke detector
- Fire extinguisher

# 4 P-IC (PLASSER INTELLIGENT CONTROL)

The Plasser Intelligent Control is an ultramodern control and diagnosis system for track maintenance machines. It offers a wide range of options to operate a complex machine safely and efficiently.


Touchpanel Example

The P-IC consists of one or more central processing units (CPU), peripheral input/output components, communication components and one or more touch panels. Communication between the separate components is made via Ethernet or CAN bus system. The input/output components communicate with the CPU via nodal modules.

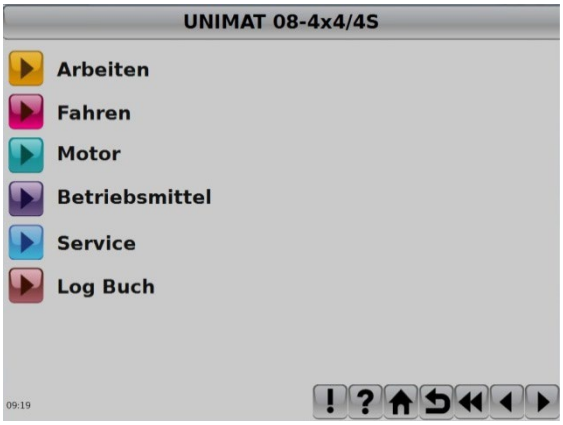



Communication scheme of the P-IC Scheme

| | |
|---|---|
| | The hardware of the control system of the P-IC complies with the standard EN 50155.<br>Basically the software is developed in line with the V-model. The software programming is certified as per EN 50657. |

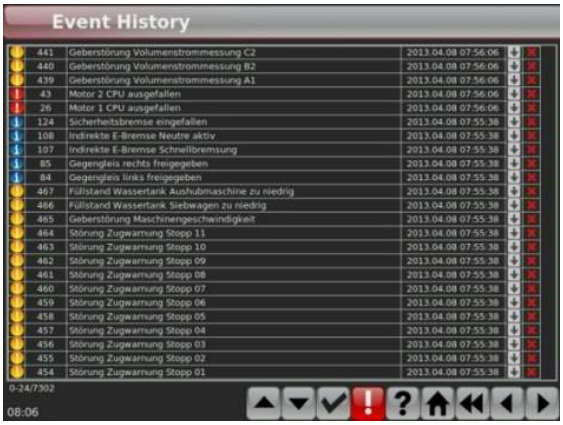
An alarm and event history is available for monitoring the machine functions. The events are displayed as plain text, on separate touch panel pages, in the respective language.

For simpler use, a colour coding system is installed at the touch panel which enables fast and efficient operation.




Colour coding system

Example




Event history

## 4.1 Slewing limitation for the outer tamping units and the 3rd-rail lifting unit

To prevent fouling of the adjacent-track structure gauge, a slewing limiter for the outer tamping units and the 3rd-rail lifting is integrated in the P-IC control.

Lateral limiting devices prevent unintentional entry into the kinematic envelope of the adjacent operating track.

Machine parts which can be moved beyond the lateral limit while working are equipped with a limiting device. This device maintains the necessary kinematic envelope approved by the infrastructure manager for approved train operations without operating restrictions.

# 5 PLASSERDATAMATIC 2.0

## 5.1 Introduction

Plasser Datamatic is Plasser & Theurer's (P&T) fleet management solution for track construction and maintenance machines. The software solution is not only collecting and transferring data from the machine to the back office automatically and wirelessly, but also standardizing and unifying data for evaluation and further use.

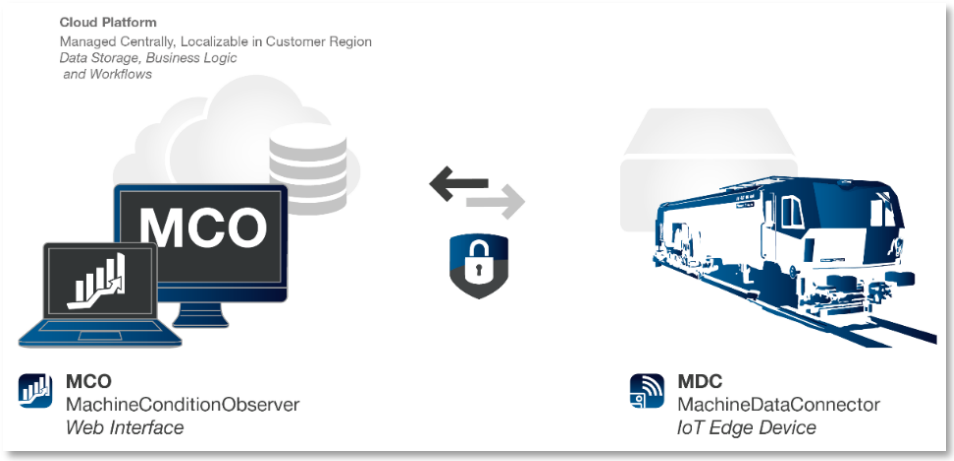
It enables and provides tools for deriving and visualizing meaningful information to support decision-making processes, with the aim of improving efficiency, increasing availability, and boosting productivity of your track maintenance machine. Being a highly customizable platform, Plasser Datamatic can be adapted to your needs. Connecting remotely to the machine allows us to provide online assistance to customers, if needed, for restoring operation in the event of a breakdown or malfunction.

The essential functions of Plasser Datamatic can be summarized as follows:

- Fleet Management
- Data Analytics
- Remote Assistance

## 5.2 System Overview

Track maintenance machines equipped with Plasser Datamatic enable logging, storage, and transfer of data to a centralized platform.




The system consists of the:

- MachineDataConnector (MDC), an industry standard Internet of Things (IIoT) edge device installed on the machine that is fully integrated into the machine control system, Plasser Intelligent Control (P-IC), and
- MachineConditionObserver (MCO), a cloud-based platform running databases, workflows, and back-end services.

## 5.3 System Setup

Device: The MachineDataConnector (MDC), an Industrial Internet of Things (IIoT) edge device, is mounted inside the track maintenance machine. It is fully integrated with the machine control system (P-IC) via the machine network. The device is railway-certified: it complies with the EN 50155 standard and conforms to CE and FCC regulations.

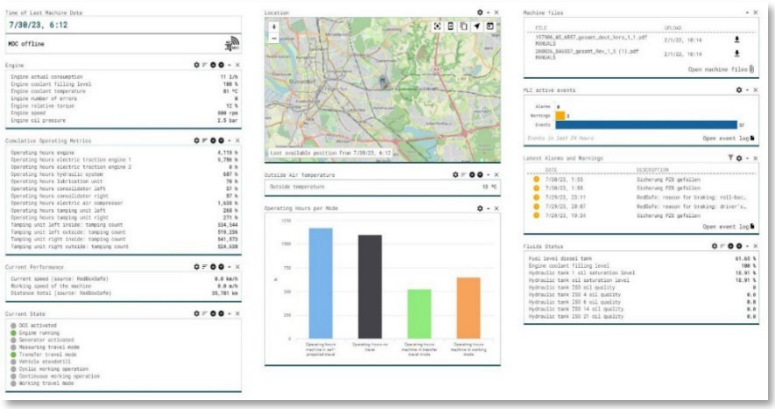
Antennas: GNSS and GSM/LTE antennas are mounted on the track maintenance machine and connected to the MDC for positioning and data transfer.

Connectivity: The MDC is equipped with a P&T SIM card enabling mobile broadband connectivity for machine data uploads and remote access to the track maintenance machine; the latter is a prerequisite for remote assistance and remote services. Optionally, customers may use their own SIM card (Customer SIM).

Platform: The MachineConditionObserver (MCO), a centralized cloud-based platform, processes and stores the received machine data in the back end. It provides access to the data through a web-based front end.

## 5.4 Features and Services

The Machine Cockpit view within the MCO interface offers a summary page for recorded machine data.



Dashboards allow you to quickly analyse time series data up to one year back.


Below is an overview of the available functions and services:

| | **included** (Base Package) | **Add-Ons** (Optional Services) |
|---|---|---|
| License & Support | ✓ | |
| P&T SIM Card | ✓ | |
| Fleet Overview | ✓ | |
| Cockpit for Live Data | ✓ | |
| Dashboard for Historical Data | ✓ | |
| Machine Localization | ✓ | |
| Notification Services | ✓ | |
| Machine Documents | ✓ | |
| File Exchange | ✓ | |
| Reporting Services | ✓ | |
| Machine Data CSV Download | ✓ | |
| Remote Assistance[1] | • | ☐ |
| Machine Data API[2] | | ☐ |
| Second Data Channel[2] | | ☐ |
| Remote Services[2] | | ☐ |
| Shock Detection[2] | | ☐ |
| Customer SIM Card[2] | | ☐ |
| User-Specific Analytics[2] | | ☐ |
| User-Specific Reports[2] | | ☐ |
| User-Specific Services[2] | | ☐ |

[1] *included during the warranty period of new machines*
[2] *individually selectable*

As some features and functionalities require specific machine hardware and build specifications, not all services can be offered for every machine.

## 5.5 Licence Model

In general, all services associated with Plasser Datamatic are designed around an annual subscription model. The Base Package defines the minimum base licence required for using Passer Datamatic services. The standard licence period is 12 months, and the licence renews automatically. For new machines, all Plasser Datamatic hardware comes preinstalled on the machine. The Plasser Datamatic licences (Base Package and Remote Assistance) are included free of charge for the warranty period of the machine. After the warranty period, the base licence (Base Package) and the optional services that have been selected (incl. Remote Assistance) are invoiced and renewed in 12-month cycles until termination.

For Plasser Datamatic retrofits, there will be costs for hardware, programming, and installation which have to be factored. The licences for Plasser Datamatic (Base Package and selected services) are invoiced after installation is complete. For machines retrofitted with Plasser Datamatic, the minimum initial licence period is three (3) years. After this initial period, the renewal cycle resets to the standard licence period of 12 months until termination.

Service cancellations must be submitted in writing at least 90 days before the next renewal date.

## 5.6 Data Upload and Storage

### 5.6.1 Cloud Connection and Data Security

The MDC receives machine signal and event data directly from the P-IC via the local machine network. The collected machine and position data is compiled, packaged, encrypted, and temporarily stored on the MDC. These data packages are continuously uploaded to a centralized back-end storage via a mobile (broadband) data connection.

The data packages are sent via a secure channel using a private APN from P&T's internet service provider. Data packages are encrypted using SSL/TLS for a secure upload to the back-end server hosted by P&T's cloud service provider. Each MDC has a unique SSL certificate. Industrial SIM cards are used for the data upload process.

A cloud-based server architecture provides the central repository for storage of the uploaded data and runs the back-end services for importing and preparing the machine data for further use. Once the machine data has been completely received in the data repository, it provides a durability of 99.999999999% guaranteed by P&T's cloud service provider. Therefore, proven methods of creating backups and taking precautions against malicious and accidental deletion along with secure access authorizations are applied. Additionally, a redundant storage architecture is established, distributed over multiple physical servers in at least 3 geographically separated availability zones within a region. The availability of the data within the repository is 99.9%.

A web-based user application (MCO) provides the business logic and front-end services for accessing and visualizing the processed data and evaluated information.

Data processed and stored on Plasser Datamatic:

- Machine data: signals (time series), events (including warnings and alarms)
- MDC data: Temperature, battery voltage, GNSS position
- Machine metadata: ID, name, description, type, manufacturer, language
- User information data: email address, company, permissions, last login

### 5.6.2 Cloud Service Provider

All data processed by the MCO applications are stored by P&T's cloud service provider, Amazon Web Services (AWS), using the object storage services of Amazon Simple Storage Service (Amazon S3). Its globally distributed and scalable infrastructure provides options for physically storing data locally in the region where the customer resides. Within a local region, the data is distributed across three availability zones.

References:

- https://aws.amazon.com/de/s3/
- https://aws.amazon.com/de/s3/storage-classes/
- https://aws.amazon.com/about-aws/global-infrastructure/

### 5.6.3 Cloud Infrastructure Security

The IT infrastructure of P&T's cloud service provider, AWS, is designed and managed in line with the best security practices and a variety of IT security standards.

References:

- https://docs.aws.amazon.com/whitepapers/latest/aws-overview/security-and-compliance.html
- https://aws.amazon.com/security/

AWS assurance programs and standards compliance:

- SOC 1/ISAE 3402, SOC 2, SOC 3
- FISMA, DIACAP und FedRAMP
- PCI DSS Level 1
- ISO 9001, ISO 27001, ISO 27017, ISO 27018

### 5.6.4 Cloud Application Security

Regular penetration tests of the MCO applications are carried out by an external security company on behalf of the P&T solution provider tmc. The decision on what is tested in detail is based on a risk assessment of the newly introduced features, updates, and enhancements to the MCO applications in terms of confidentiality, integrity, and availability.

| Additional documents regarding data security (e.g. certificates), can be requested separately. |
|---|

## 5.7 General Provisions

**Intellectual Property**

The licensor shall retain the copyright and other intellectual property rights in any and all documentation, drawings, software, and data files made by the licensor ("Documentation").

The licensor grants the licensee a non-exclusive non-transferable licence to use the Documentation supplied under the contract solely for operation, maintenance, and repair of the goods. The licensee shall not – without the licensor's prior written consent – use, copy, or communicate to a third-party the Documentation for purposes other than those permitted under this clause. The licensee shall neither attempt nor allow or cause any third-party to reverse-engineer, disassemble, or decompile any of the goods.

The licensee may use any software supplied by the licensor solely in accordance with the conditions, functions, and on the hardware as defined in the contract. The licensee is aware and agrees that software embedded in the goods might monitor inter alia the goods' performance and operation, and that the licensor will use and process such data to develop the goods and/or its products.

**Data Exchange Policy**

Any data processed by the software, or gathered by the licensor through professional services performed, shall be treated as confidential.

The licensor shall, irrespective of the nature of software or professional services, be entitled to store and process all data gathered for its own purposes, especially for analysing the data to derive new products or to use it as test data for existing products.

Machine data shall be made available and fully accessible to the licensor, via the data processing environment provided, without limitations, at any time. This also applies if the licensee decides not to use it or to use a different data processing environment than the one offered by licensor.

The licensee consents that the recorded machine data remains stored in the data processing environment and that the licensor retains access to it, even if the licensee decides to not further license the services offered by the licensor and no longer has access to it.

The licensee shall not deploy decoders on interfaces of the software or hardware to gather data not covered by the contract. Such decoding or associated reverse engineering of data streams shall result in the cancellation of the granted licence with immediate effect.

The licensee hereby declares that it is in legal possession of, and has obtained all necessary consent and permissions of, any data forwarded from the licensee to the licensor or accessible by the licensor. The licensee shall hold harmless the licensor of any third party claims.

**Warranty**

The licensor warrants the conformity of the software with the specifications valid at the time of effectiveness of the contract, provided that the software is used in accordance with the applicable installation requirements and the applicable terms of use.

The following are requirements for any correction of defects:

- The deviation gives rise to malfunctions
- The deviation is reproducible
- Any adaptions of related hardware have only been executed by the licensor or by persons authorized by the licensor only
- All versions and updates of the software have been installed by the licensor or by persons authorised by the licensor only
- The licensee has installed new versions and updates of the software which are offered to the licensee free of charge within the warranty period
- The licensor receives all documents and information required for the correction of defects from the licensee
- The licensor has access to hardware and software during the licensor's normal business hours.

The licensor does not grant any warranty for:

- Third-party software that is not part of the contract
- The compatibility of software subject to the contract with other software programs that are used or planned to be used by the licensee
- Interruptions or failures of function that are merely short-term or typical for the system.

**Licence Renewal and Right of Termination**

Any licence provided shall be renewed against payment when the hardware is renewed and/or a new software version is applied that goes beyond product maintenance (update) and extends the functional scope (upgrade).

To ensure proper function and availability, the licensor reserves the right to request a licence renewal for a new hardware and/or software version after 5 (five) years of use.

Both parties have the right of ordinary termination at the end of the agreed licence period and within a period of notice of ninety (90) days.

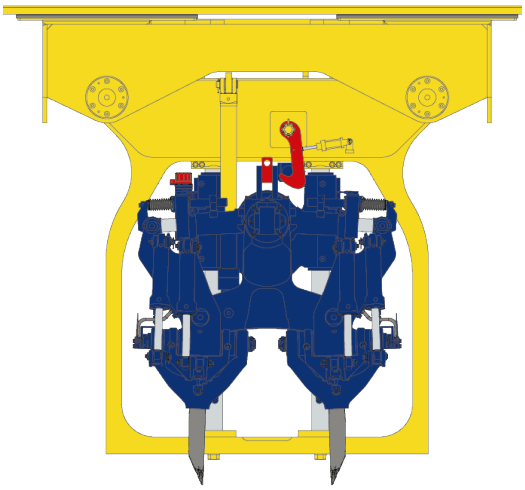
## 5.8 Contact

For any questions regarding Plasser Datamatic, please send an email to:

digital.gcs@plassertheurer.com

Detailed information on the individual functions of Plasser Datamatic, can be requested at any time.

# 6 TAMPING UNITS – 4X4 UNIVERSAL TAMPING UNITS

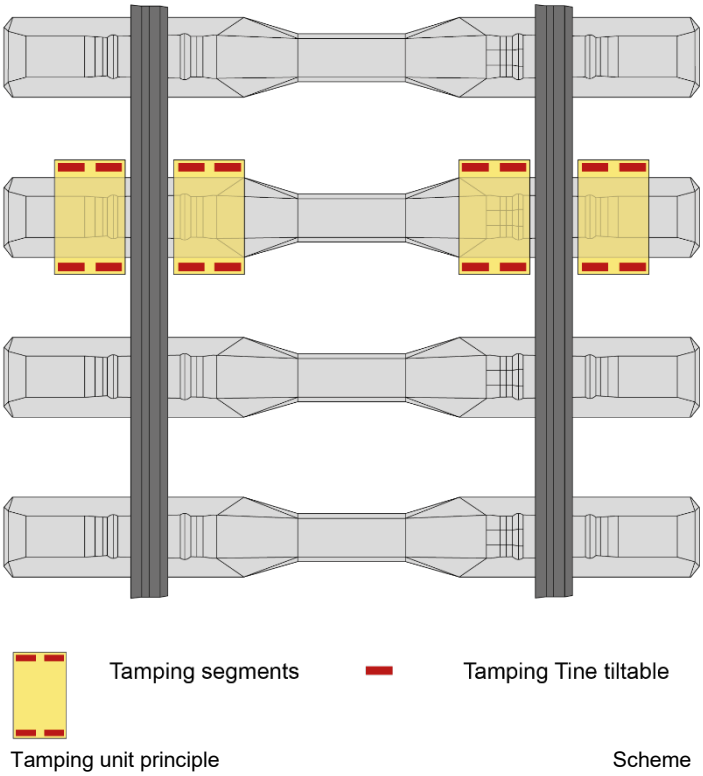


Tamping units Example

The machine is equipped with 4 universal tamping units capable of working on tracks and turnouts in Split-Head-4x4 design.

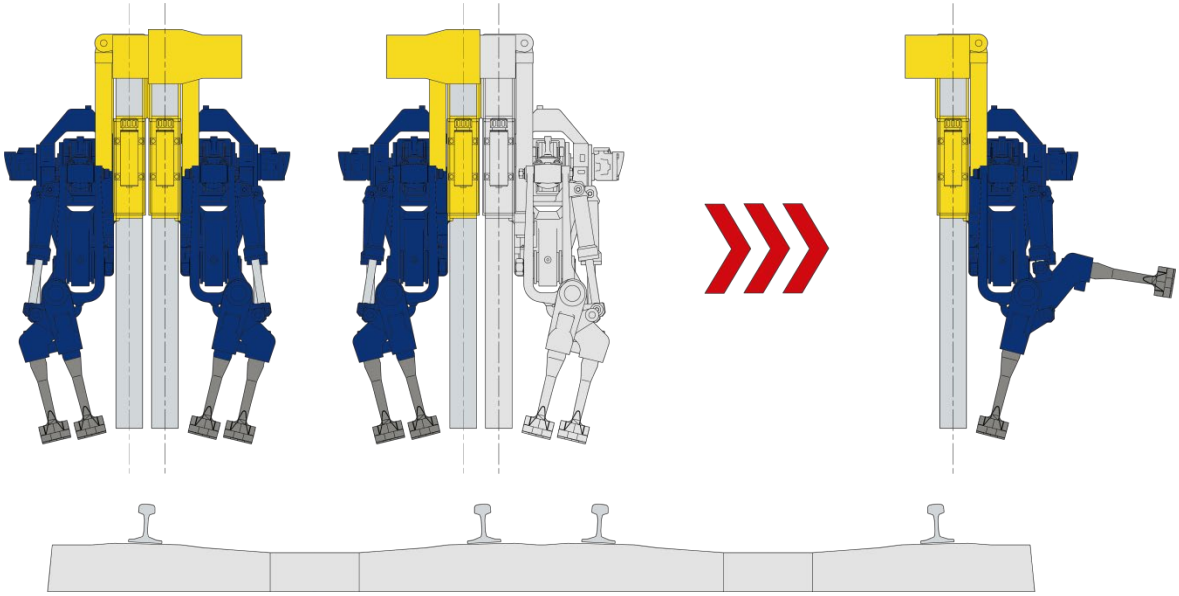
These tamping units combine the advantages of the tilting tamping tools as necessary for turnout tamping with those of the tool pairs used on tracks.

The tamping units of the machine consist of 4 individually lowerable tamping unit halves. The tamping unit halves itself are equipped with 4 tiltable tamping tools each.



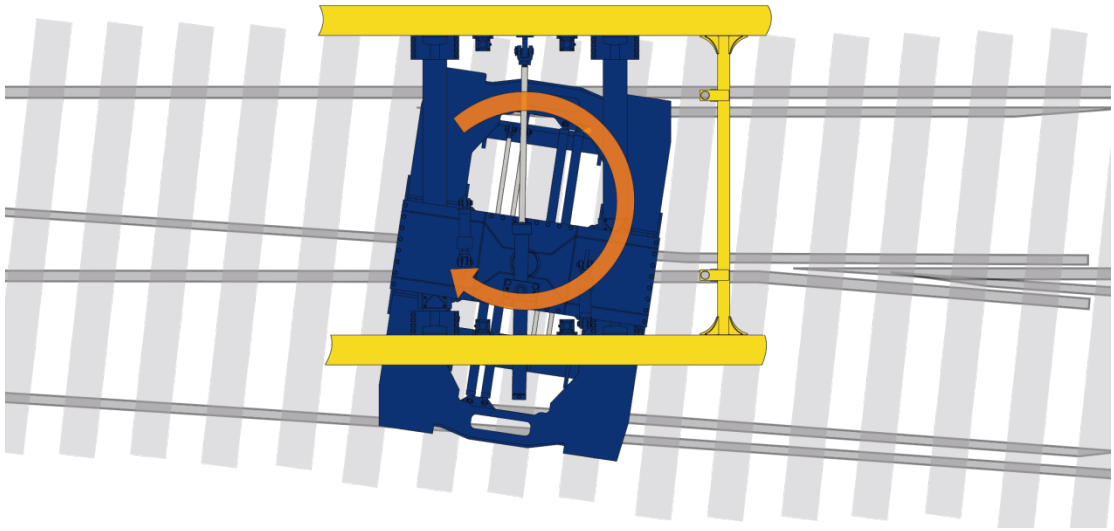

Tamping unit principle Scheme

By moving or pivoting of the tamping unit halves is it possible to tamp the diverging line of the turnout in one go.



Lateral movement of the tamping units Scheme

The lateral guiding columns carrying the tamping units are fixed to the subframe by slewable, telescopic mountings. Thus it is possible to turn all tamping unit parts ± 7° in either direction to tamp slanting sleepers.



Turning device in the turnout Scheme

The tamping units carry a total of 16 tamping tools placed in pairs outside and inside of each rail on either side of the sleeper. The opposing pairs always penetrate into the ballast simultaneously.

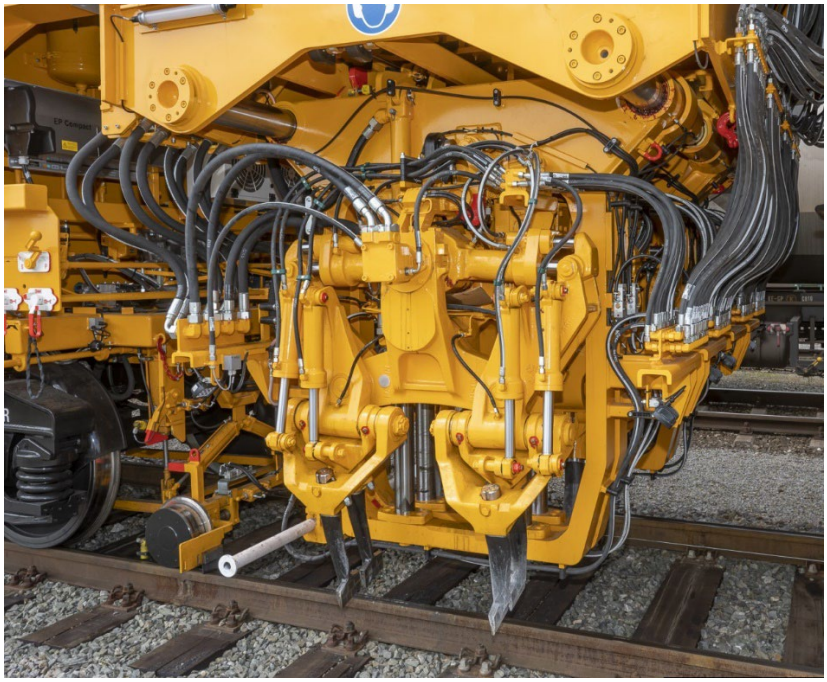
Two swing levers per unit carry a joint on their lower end. This joint allows the pairwise or individual tilting of each tamping tool parallel to the sleeper. In this manner the tools may be set up to an angle of 15° inwards and 85° outwards from their normal vertical position.

In case of obstacles preventing the penetration of the twin tools one tool is tilted off, to leave but one to penetrate in the narrow space. If necessary, both tamping tools may be tilted also.

In practice this means that due to these versatile, optionally and individually adjustable 16 tamping tines, the tamping work can be adapted optimally to the prevailing conditions.
Thus it is possible, on the one hand, to tamp turnouts and crossings practically in their entire area and that also in parts which normally cannot be tamped (in the vicinity of frogs, guard rails, check rails etc.).
On the other hand, these 16 independent of one another side tilting tamping tines have in basic position the same position as on plain line tamping machines, i.e. tamping is done with four pairs of tines per rail.

The tilting of the tamping tools is controlled from the operator's seat, mediating hydraulic cylinders.

The working process is controlled from the operator.
The work sequence is controlled either semi-automatically or manually during track work.



Tamping unit Example

## 6.1 Tamping system

PRESSURE VIBRATION TAMPING according to the
NON-SYNCHRONOUS CONSTANT PRESSURE TAMPING PRINCIPLE

optimum tamping frequency of 35 Hz

directional, linear oscillation

The squeezing action of the tamping tools is carried out with directional, linear oscillation and the optimum tamping frequency of 35 Hz. This oscillation frequency produces the best consolidation values and the greatest durability of the track geometry.

ROTATION SPEED MODULATION FOR WEAR OPTIMIZATION

To minimise the wear on the tamping tines both in idle mode and while the tines are lowered, the tamping units are fitted with a rotation speed modulation.

When the tamping units are lowered, the speed is increased to approx. 45 Hz. During the squeeze movement of the tamping tines, the speed is reduced and the 35 Hz technology is applied.

After the tamping units have been raised, the speed is further reduced up to a frequency of 28 Hz. It remains at this frequency until the units are lowered again.

As a result,

- the mean speed and consequently the strain on the tamping units is decreased,
- the service life is increased,
- and the noise emitted in idle mode is reduced.

VIBRATION

The vibratory movement of the tamping tines is produced by a vibration shaft (eccentric shaft) mounted centrally in each tamping unit. A hydraulic motor provides the power.

Piston rods pivoted on the shaft transmit the eccentric movement to the swing arms which in turn cause the vibratory movement of the tamping tines. The piston rods are designed as hydraulic cylinders.

FREQUENCY SYNCHRONISATION

An automatic frequency synchronisation is provided to ensure a synchronous vibration direction of the tamping tines in each pair of tamping units. The positions of the eccentric shafts of each pair of tamping units are monitored by sensors and automatically corrected if necessary.

CLOSING AND OPENING OF THE TAMPING TINES

The squeezing movement and the opening of the tine pairs is achieved by the cylinder pistons. All cylinders of one unit are pressurised by the same circuit for the squeeze movement of the tamping tines. This ensures that each tine exerts the same pressure, achieving the non-synchronous effect.

The squeeze pressure may be varied to adapt to the prevailing ballast conditions.

For double sleepers, the opening width of the tamping tines is enlarged by changing the stroke limitation.

## 6.2 Lifting and lowering the tamping units (parts)

The lifting and lowering of the tamping unit sections are lifted and lowered by means of hydraulic cylinders which are controlled proportionally. The tamping depth is steplessly adjustable.

## 6.3 Tamping tines with hardened metal plates

The tamping tools are drop forged of special steel.

The ends of the tamping tool shafts are supported in the swing arms and fixed with screws. This type of fastening allows the tamping tools to be removed and inserted very easily.

The tool blades have a spade-like straight edge. The spade-like edge permits easy penetration of the ballast.

The tines are armoured in the exposed areas by brazed, hardened metal plates (penetration edge, front of tine plate, conically-shape rear side of tine, side surfaces with brazed, hardened metal sections).

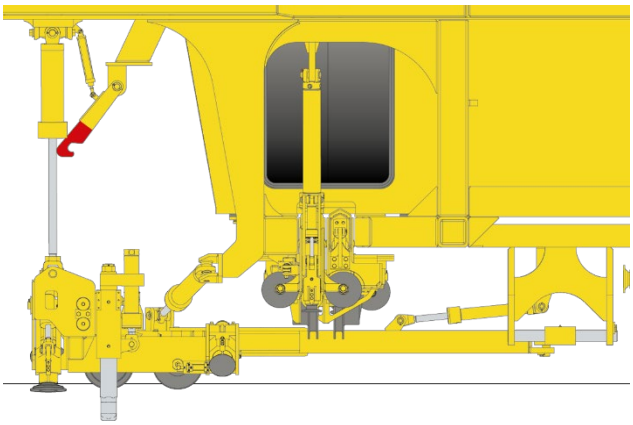
Example

## 6.4 Lubrication

Grease lubrication for eccentric shaft.

Automatic, central grease lubrication for all other lubrication points of the tamping units. The lubrication is activated as soon as the mode "working operation" is selected and the vibration shafts of the tamping units are running.

# 7 LIFTING AND LINING UNIT



Lifting and lining unit Example

The machine is equipped with combined lifting and lining units. The units are located directly in front of the tamping units (between the bogies).

This unit may be displaced along the rail direction for ± 200 mm and is composed of a separate frame holding a roller lifting clamp (one lifting roller one each side of the rail), one outside lifting roller, one lifting hook and two inner flanged lining rollers per rail. The lifting hooks may optionally apply under the rail head or under the rail base.

| | |
|---|---|
| | Lifting is carried out by the machine centrally over each rail without any support on the ballast bed. |

The roller lifting clamp and the lifting roller mainly are brought into operation during track tamping but also for turnout tamping operation as far as applicable.

The lifting hooks are brought into operation by lowering the tamping units. They are brought close to the rail automatically during every tamping operation.

The lifting is carried out by two hydraulic cylinders.

The lifting process of the track which is hold from the lifting hook or the lifting rollers is carried out by hydraulic cylinders during the lifting process.
For the lining process, the frame of the lifting and lining unit is articulated to the machine frame via a crosswise mounted hydraulic cylinder on each side.

During the lifting process the lining cylinders move tool carriers in the required direction. This distribution of the lining force exerts a minimum of stress in rail fastenings and moves the rail into the correct position without impact.
At the beginning of work, the combined lifting and lining unit is lowered onto the track, where it remains during the entire process. While the machine advances the lining rollers roll along the rails.

As the lifting and lining unit is movable in all directions and the lining cylinders are de-pressurized, the unit adapts to curves without exerting any force to the rails during forward drive.

The lifting and lining operation is started automatically by lowering the tamping units. Lifting lasts until the levelling equipment interrupts the control circuit of the automatic lifting action. The track is held in a raised position until completion of the tamping operation.

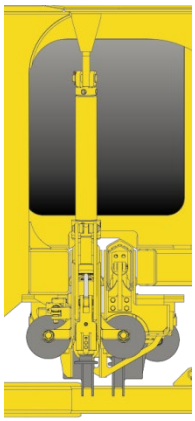
| | |
|---|---|
| | The operator usually doesn't need to control these processes, he only has a controlling function. |

Lifting hook in operation

Examples

Roller lifting clamp in operation

# 8 SYNCHRONOUS 3RD-RAIL LIFTING UNIT



3rd-rail lifting unit Example

This device serves to execute an automatic additional synchronous lift for turnouts. Specially needed for turnouts with heavy concrete sleepers in the area of the long sleepers.

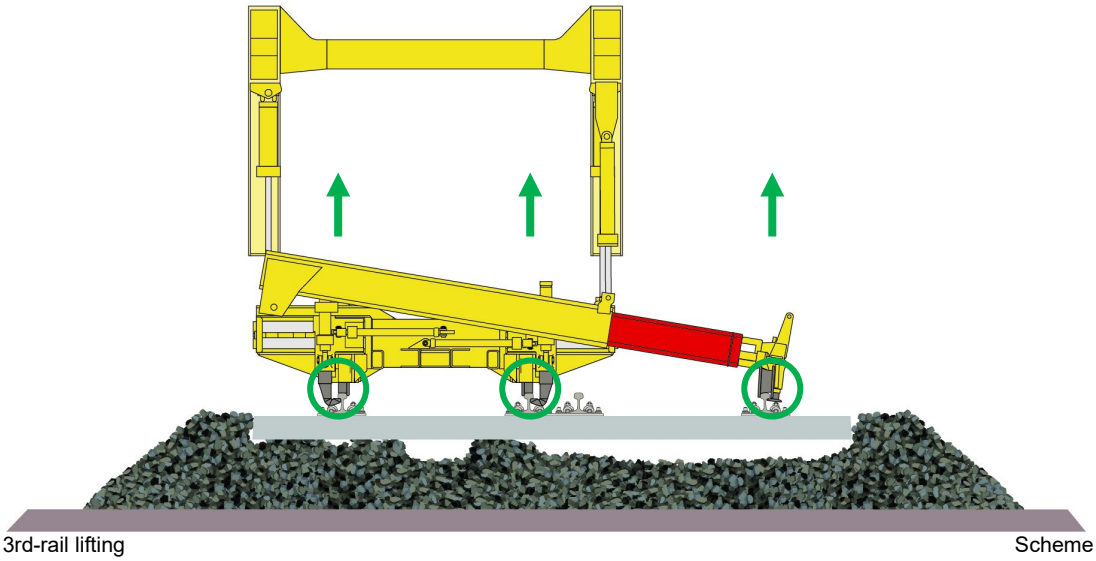
| | |
|---|---|
|  | Lifting is carried out without any support on the ballast bed. |

This is necessary because rail fastenings get overstressed again and again during the lifting process in the area of long sleepers in turnouts. Thanks to the operating synchronous 3rd-rail lifting unit a gentle treatment during the lifting process and therefore a long-lasting track geometry can be achieved.

Depending on the direction of work of the tamping machine, the lifting device may be used on the left or right side of the machine next to the combined lifting and lining unit.

Basically the 3-point switch lifting device consists of three elements:

- two telescopic arms with lifting cylinder
- rail-mounted supplementary roller clamp which clamps the rail from the outside under the rail head and two lining rollers for guiding the rail with pivoted rod and displacement cylinder for automatic adaption of the lifting unit to the diverted rail during forward travel
- control units



3rd-rail lifting Scheme

The unit is brought into operation from the operator's seat in the work cabin (cabin 2). The lifting process is controlled from the levelling system.

3rd-rail lifting unit Example

## 8.1 Slewing limitation for the synchronous 3rd-rail lifting unit.

Please refer to Pt. 4.1 *(Slewing limitation for the outer tamping units and the 3rd-rail lifting unit)*

# 9 LEVELLING UNIT

for longitudinal level and cross level

The machine is equipped with the

**parallel levelling system**

The lifting speed is proportional to the lifting value. Lifting commences at high speed and slows down up to the cut-off point which achieves an excellent quality of work.

## 9.1 Longitudinal level

The track is scanned by measuring wheels at three points per rail:

- in front of the front bogie of the main machine (bogie 1)
- in the tamping area
- behind the rear bogie of the main machine (bogie 2)

Some of the measuring wheels are also used for the lining measuring system. For transfer travel they are lifted up and secured to the machine frame.

A steel chord is spanned over each rail, from the rear reference point to the front one, which forms the reference line for longitudinal levelling.

The scanning system positioned in the tamping area carries a transducer on each side which measures the height of the steel chord.

The levelling system is triggered when the tamping units are lowered. The measuring device over the tamped area determines the voltage necessary for lifting which is amplified and acts on a servo system.

The levelling and lifting unit remains switched on during the entire tamping process, so the longitudinal level of the track is automatically checked the whole time. The levelling process is switched off again when the tamping units are raised.

## 9.2 Cross level

Cross level is also controlled by the two steel chords.
The front trolley (front reference point) carries an electronic precision pendulum which automatically regulates the cross level of the two chords so that the cross level is always set to the desired value.

Another electronic precision pendulum is used to check the cross level of the sleeper being tamped. A large display instrument and a digital pre-setting for the target superelevation enable an extremely exact reading.

A digital display in conjunction with a precision pendulum is used to check the cross level of the corrected track.

## 9.3 Working method

The Plasser & Theurer proportional parallel levelling system allows different methods of work:

### 9.3.1 Compensation method

When working on tracks using the compensation method, existing errors in longitudinal level are reduced.

Cross level faults are completely corrected.

#### 9.3.1.1 Method of work when the track geometry is known

The system correction values required in track radii transitions are sent to the levelling system manually or automatically by the SmartALC automatic guiding computer.

The total lift of the track is made up of:
- the lift resulting from the ratio of reduction and
- the pre-selected basic lift.

The basic lift is pre-selected electronically by zero-point adjustment of the respective reference chord.

#### 9.3.1.2 Method of work when the track geometry is not known

Using the measuring system installed on the tamping machine, a measuring run is performed first and the longitudinal level and cross level (together with the versines) are recorded on the SmartALC automatic guiding computer. With the help of special software, an electronic off-set of the measured actual track geometry is performed and a new geometry is obtained with the appropriate correction values. During work, the correction values are passed automatically to the levelling system (see also description of the SmartALC automatic guiding computer).

### 9.3.2 Precision method

To produce the desired target geometry.

The lifting values of the reference rail are established before start of work (independent of the tamping machine). During work the corresponding left or right hand reference point is adjusted electronically by zero-point adjustment according to the marked values, while the other is automatically raised to the correct cross level by the automatic adjustment. This method achieves an absolutely correct longitudinal level.

Three different methods of input are available:

a) The values are written down on every 5th to 10th sleeper and entered manually into the levelling system.
b) The values are entered into the guiding computer before start of work and then automatically fed into the levelling system during work.
c) The values are available on data carriers (USB stick) and are entered into the SmartALC automatic guiding computer before start of work and then fed into the levelling system automatically during work.

# 10 LINING MEASURING SYSTEM

The machine is equipped with the

one-chord 3-point lining measuring system

The lining speed is proportional to the lining value. Lining commences at high speed and slows down up to the cut-off point which achieves an excellent quality of work.

The lining process is triggered when the tamping units are lowered and the track is held in the desired position until the tamping process is completed. When the tamping units are raised, the lining cylinders are switched back to pressureless state. During forward travel no forces are transmitted to the track.

A chord is spanned in the middle of the track from the front to the rear reference point. The versine is measured electronically. The linear transducer is connected via processing electronics to a servo mechanism which controls the lining process automatically. The lining process can also be controlled manually.

The measurement is displayed on an instrument in front of the machine operator. The hand of this instrument indicates the deviations of the track from the target value established by the one-chord measuring system, then the movement of the track during the lining process and finally the track position after lining which is equal to the target position when the hand points to zero.

In straight track the versine must have the value 0. In the case of a deviation, the lining process is triggered automatically until the value 0 is reached. In track curves the target value of the versine is either set by the machine operator or calculated and entered automatically by the SmartALC automatic guiding computer.

## 10.1 Working methods

The Plasser & Theurer proportional one-chord 3-point lining measuring system allows the following methods of work:

### 10.1.1 Compensation method

Existing lining faults are reduced automatically.

#### 10.1.1.1 Method of work when the track geometry is known

The system correction values and the target versines required in track radii transitions are sent to the lining system manually or automatically by the SmartALC automatic guiding computer.

#### 10.1.1.2 Method of work when the track geometry is not known

Using the measuring system installed on the tamping machine, a measuring run is first performed and the versines (together with the longitudinal level and cross level) are recorded on the SmartALC automatic guiding computer. With the help of special software, an electronic off-set of the measured actual track geometry is performed and a new geometry is obtained with the appropriate correction values. During work, the correction values are passed automatically to the lining system (see also description of the SmartALC automatic guiding computer).

### 10.1.2 Precision method

To produce the desired target geometry.

The values of the reference rail are established before start of work (independent of the tamping machine) and then entered into the lining measuring system by electric zero-point adjustment.

Three different methods of input are available:

a) Values are written down on every 5th to 10th sleeper and entered manually into the lining measuring system.
b) The values are entered into the guiding computer before start of work and then automatically fed into the lining measuring system during work.
c) The values are available on data carriers (USB stick) and are entered into the SmartALC automatic guiding computer before start of work and then fed into the lining measuring system automatically during work.

# 11 MEASURING TROLLEYS

Measuring is performed with the help of measuring trolleys which are pressed onto the respective reference rail by a central compressed air system.

The measuring trolleys are equipped with large running wheels. For transfer travel they are lifted up and secured to the machine frame.

## 11.1 Central lowering assistance for measuring trolleys

With the help of the central lowering assistance, the operator can unlock and lower the measuring trolleys onto the rails from the cabin at start of work. This is performed using colour cameras, a monitor and manual control of the respective lowering cylinders and pressure cylinders. This ensures a high level of operating safety.

## 11.2 Limit switch for measuring trolleys

For preventing damage of the measuring trolleys during work, measuring runs and/or forward drive each wheel is equipped with a limit switch. Therefore, an optical signal will be displayed in case of derailing.

# 12 SMARTALC – THE SMART AUTOMATIC GUIDING COMPUTER

The SmartALC consists of an industrial computer with touch screen, flash disk, 21.5" full HD colour display, USB port at front, stainless steel keyboard and specially developed software. It performs the complete guidance of the tamping machine's levelling and lining system.

Fitted with a day/night switchover, the SmartALC can be operated easily both during day and night.


Main screen of the SmartALC Example

The SmartALC displays data horizontally from left to right as standard setting. However, data can also be display vertically.

An optimised user interface is available for the new 21.5" multi-touch display. It includes gesture control enabling, for instance, turning pages or scrolling through measurements and geometry representations using gestures.

Alternatively, it is possible to switch over to the Windows user interface.

The SmartALC has two main functions:

- to direct the tamping machine when target geometry data is known and
- to measure the actual track position (longitudinal level, superelevation and alignment) with subsequent electronic compensation when the target geometry is unknown.

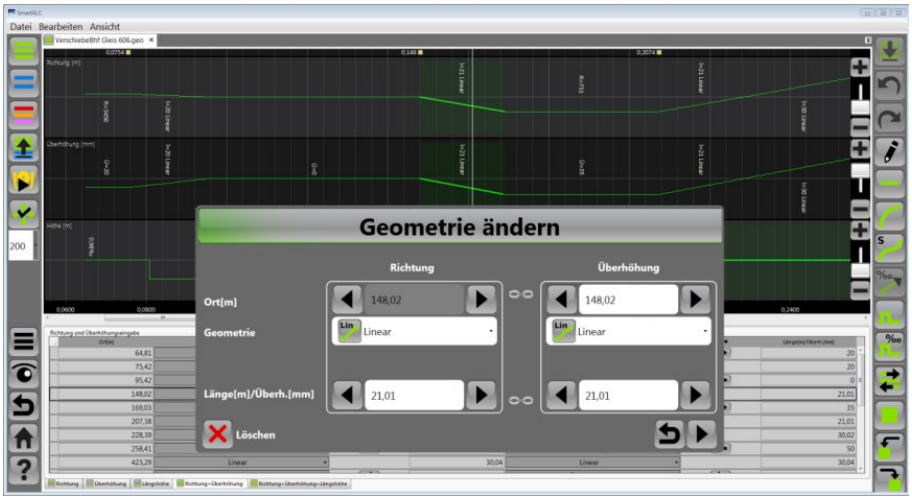
## 12.1 Operating the SmartALC with known target geometry

To direct the machine, the following target data is required:

- kilometre position of the main points of the curve (start [UA] and end [UE] of transition, etc.),
- radii and direction of curves,
- track superelevation and its direction,
- details of changes in gradient (length of tangent [ta], radius of vertical curve [Ra]) and
- displacement values and height correction values (when working according to the precision method).

The target geometry data (start [UA] and end [UE] of transition, superelevation, radius, etc.) is either entered manually in advance (during intervals between trains, work k, etc.) or read in from a USB device.

Geometry data can be entered in tabular form or graphically using optimised dialogues for the operation via touch screens.




Entering geometry data manually via touch screen Example

When working according to the precision method, the correction values for alignment and for longitudinal level are also fed into the SmartALC (e.g. EM-SAT data collected during surveying, manual measurement ahead of the machine and entering values into the computer from a list).

During the processing of these correction values the computer automatically interpolates between the adjacent input points dependent upon the path travelled.

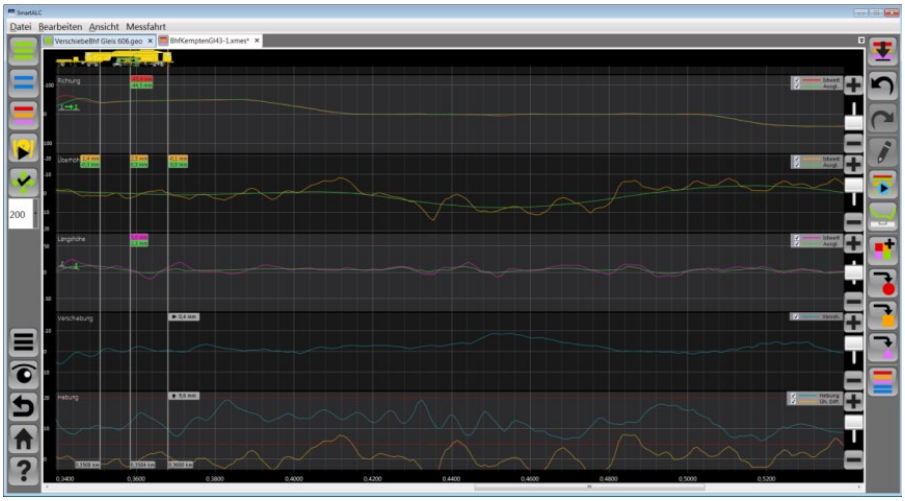
## 12.2 Operating the SmartALC when the target geometry is unknown

During a measuring run using the tamping machine and subsequent geometry compensation of the actual recorded track geometry (longitudinal level, superelevation and alignment) an optimised versine progression including correction values (displacement and lifting values) is obtained.

Above the graphic representation of the measuring values, the machine is displayed to show the current position of the chord more clearly. Measuring values are shown at the respective machine positions.

The electronic compensation provides the following options:

- Automatic calculation of a versine compensation line and a longitudinal level compensation line after the completed measuring run. The operator can influence the degree of compensation.
- Advanced users can opt to process the superelevation using the geometry. For this purpose, the program calculates the superelevation geometry automatically based on the measured values. Subsequently, the superelevation geometry can be processed by the user.
- Automatic calculation of the displacement values and the lifting correction values (allowing for long wave faults)
- Graphical representation of the measuring run and the results (versine, longitudinal level and superelevation)
- Graphical representation of the lifting correction values with interactive processing by the operator (taking account of high points - defining lifting values at high points or input of lifting value limitations at points of constraint and start/end ramps, etc.)
- Constraints and fixed points can be marked and taken into account. Optionally, tolerances for displacement and lifting values can be defined here too.
- Definition of the maximum permissible displacement and lifting values for the versine and longitudinal level compensation.

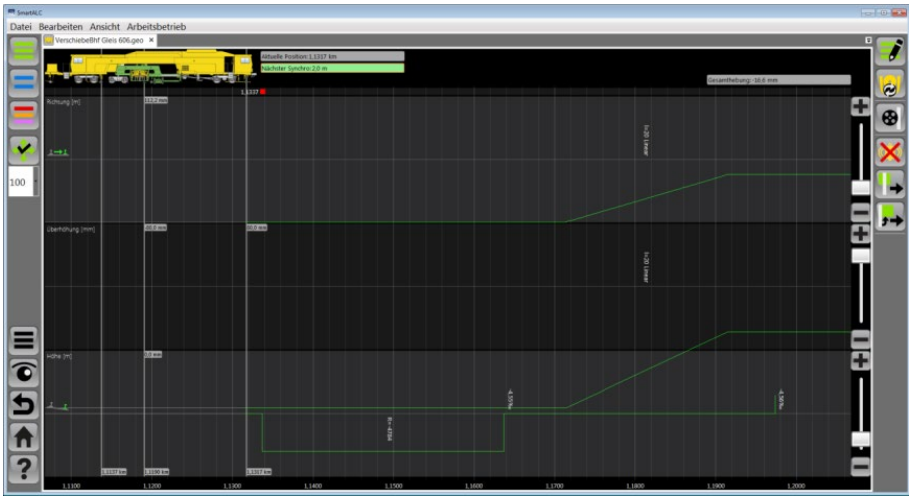



Display during measurement Example

## 12.3 Working operation

During working operation, the tamping machine is also shown above the graphic representation.
The current values are displayed at the cursor lines at their respective machine position.

At the push of a button, the operator can switch between zoom (100 m or 200 m), showing the machine, and overview, showing a longer section of the track work site.




Display during working operation Example

# 13 DRP – ELECTRONIC RECORDING, EVALUATION AND DISPLAY SYSTEM

The DRP electronic data recording processor serves to record, evaluate and display the track geometry after track maintenance work.
This includes the measurement and digital real-time evaluation of the measured values collected.

| | |
|---|---|
| ℹ | The parameters are recorded during work. |

Basically the hardware consists of measuring equipment, a 15" touch panel PC with flash disc and an ink-jet printer.

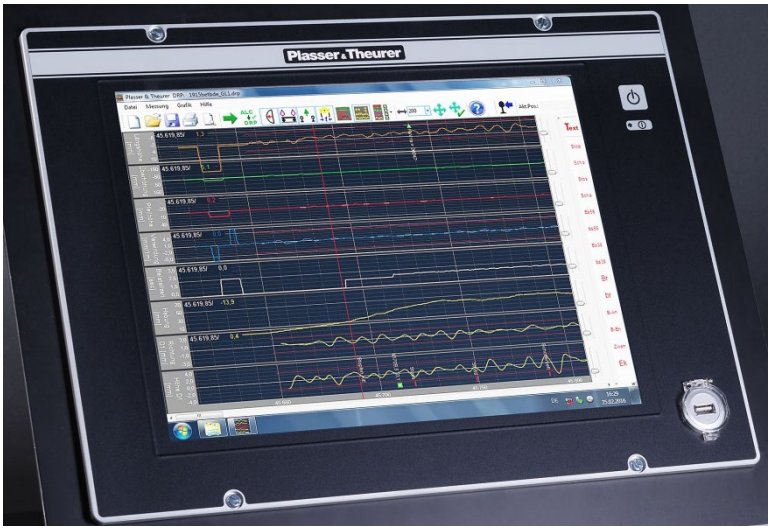
The measuring equipment for the various parameters supplies analogue signals. These are acquired by the DRP system at regular intervals (e.g. every 25 cm) and displayed on the monitor. These can also be printed out on the printer, if required.

| | |
|---|---|
| ℹ | As stipulated by standard EN 13848, levelling and alignment faults are restricted to the wavelength range D1 (3-25 m) separate for each rail. |

Up to 5 speed categories can be defined in the DRP. This means that for each speed category separate limit values can be laid down for cross level, longitudinal level, versine of the reference rail and twist.

| | |
|---|---|
| ℹ | Limit values as per EN 13231 or as required by the customer. |

The PC is fitted with a USB port and a switchover for operation using the ALC keyboard.




DRP Example

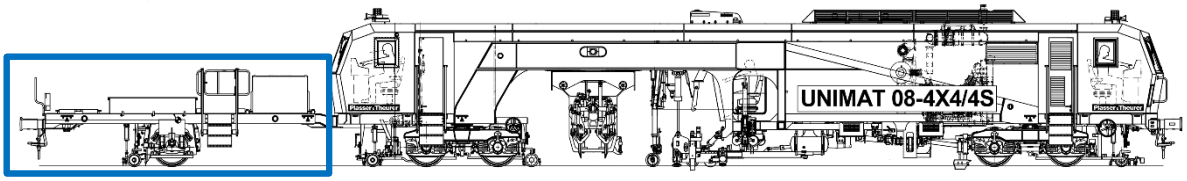
The following parameters can be recorded in real time:

- versine left
- versine right
- alignment left as per D1
- alignment right as per D1
- longitudinal level left
- longitudinal level right
- height left as per D1
- height right as per D1
- superelevation
- twist (calculated)
- track gauge
- lifting value
- squeeze time

Self-check for versine, cross level, longitudinal level, gauge and squeeze time before start of work.

Reports allow evaluations when threshold values are overstepped and supply information on the state of quality of the track.
The standard deviations can be calculated in 200 m sections for the parameters alignment of the reference rail, longitudinal level and twist.

# 14 INTEGRATED PLASSER MATERIALTRAILER




Sturdy welded construction of rolled steel profiles and steel sheets assembled according to the most up-to-date welding techniques and manufacturing methods.

The Plasser MaterialTrailer is equipped with:

- a loading platform
- a fuel tank with 3 000 l
- a measuring trolley for the recording system

The material trailer is accessible by side ladders with hand rails.

Integrated Plasser MaterialTrailer Example

# 15 FURTHER EQUIPMENT

## 15.1 ATC- Installation

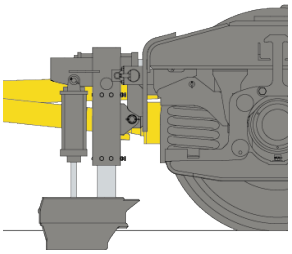
The ATC-system will be provided and installed by Plasser & Theurer.

## 15.2 Preparation for gauge conversion 1 435 mm to 1 668 mm

Machine is prepared for gauge conversion kit from 1 435mm to 1 668 mm

## 15.3 Ballast deflectors

(for track work)



Ballast deflector Example


Ballast deflector Example

For removing the ballast in the area of the rail heads and the lining chord to guarantee a faultless function of the lifting unit and the lining measuring system, even in situations where there are large quantities of ballast.

One ballast deflector per rail is installed on the front bogie (bogie 1).

## 15.4 Non- polluting Hydraulic Oil with By-Pass filter unit


The hydraulic oil in standard use will be replaced by the biodegradable hydraulic oil PANOLIN HLP SYNTH E which in the event of leakages in water and/or soil is degraded virtually without residue.

# 16 SAFETY EQUIPMENT

## 16.1 Data recording device including SIFA feature - “DEUTA REDBOX”

| | |
|---|---|
| | Recording device in accordance with EN 14033-1:2017. |

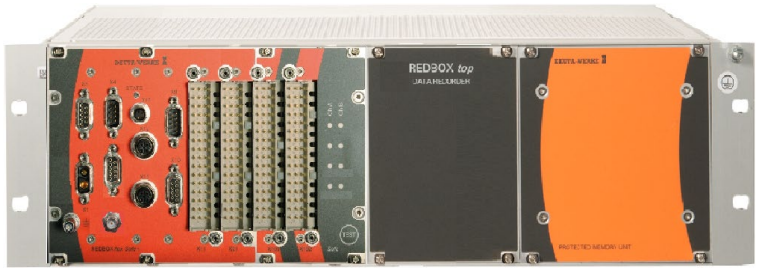
DEUTA-WERKE
Technology under Control

DEUTA REDBOX is a data recording device with integrated SIFA feature. It records safety-related data in accordance with EN 14033-1:2017 and saves them in a crash protected memory. REDBOX is a safety module that blends into the train protection environment of PZB, LZB or ETCS.

The REDBOX consists of the following main components:

- DEUTA REDBOXflex S*afe*+ (SIFA feature with internal memory)
- Data logger
- Flash memory (crash protected memory)

REDBOX is installed as a compact system in a 19’’ rack.




DEUTA REDBOX Design example

Among others, it includes the following safety features:

- SIFA - Driver's safety device
- Standstill detection
- Roll-back protection
- Monitoring of the maximum speed
- Monitoring the limiting speed
- Speed signals

### 16.1.1 Integrated SIFA feature

The integrated SIFA feature monitors the alertness of the machine driver. Each driver's seat is fitted with an operating pedal. The control desk is fitted with a buzzer, pilot lamp indicator and acknowledge switch.

The SIFA feature operates according to the closed circuit current principle, i.e. in the event of a power failure, cable break, etc. the machine immediately starts braking.

### 16.1.2 DEUTA pick-up sensors

The pick-up sensors determine the driving speed and the rotational direction of two independent axles.
This ensures the redundant supply of relevant information to the safety features and allows them to work independently of the machine control.

### 16.1.3 Integrated tachograph feature

REDBOX includes tachograph features. It records travelling speeds, the distance travelled, etc.

## 16.2 Warning installation system Zöllner

Air pressure warning device ZÖLLNER, mounted on the roof of the end cabins.

## 16.3 Preparation for ETCS

Preparation*) for later installation of ETCS train control system level 2.

*) Installation space electrically and mechanically kept empty, empty tubes from balises to the built-in wardrobe (only prepared) are laid.

## 16.4 Train radio MESA 26

The train radio system allows radio traffic to fixed stations and to other railway vehicles, which are equipped with a train radio system.

| | |
|---|---|
|  | The train radio system is provided and integrated into the machine by Plasser & Theurer. |

| | |
|---|---|
|  | The SIM card for the GSMR part is to be requested by the purchaser at the responsible railway administration. |

# 17 TOOLS AND ACCESSORIES

An extensive set of tools and accessories will be supplied together with the machine.

# 18 SCANDINAVIAN PACKAGE

Includes:

- Increased isolation of cabin floors and specially sealed cable lead through
- Axle-bearings for Hot-Spot detection
- Pre-Heating for engine and hydraulic
- External socket for shore power 3x230 V + 1x230 V for battery charger
- Warm air heating units of the cabins with increased power
- Additional filtering unit for the HY-oil, electrically powered 24 V
- Drainage holes for outside mounted switch boxes
- Speed regulation Vmax = 80km/h

# 19 LEGAL INFORMATION

Illustrations and descriptions may contain optional equipment.

We reserve the right to make alterations
in line with the further technical development!

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