



Point heating systems with system-related energy management

System **WHVI**[®]

Requirement

In winter, points both represent a high risk to smooth rail operation and an extreme cost factor. ESA Elektroschaltanlagen Grimma GmbH approached these factors and developed an efficient and energy-saving point heating control system with state-of-the-art sensor and switchgear technologies.

Despite the requirement for all persons responsible for the system to generate little energy costs, it is key that the functionality of the points is always ensured, especially in the high-speed sector but also in regional transport.

In the opinion of ESA Grimma, many different factors are required for an efficient point heating system, which is efficient and particularly effective under any weather condition.

On the one hand, it is absolutely necessary to reduce the actually required energy amount and, on the other hand, to reduce the peak load (power input) of the heating system as per DIN EN ISO 50001.

Our solution

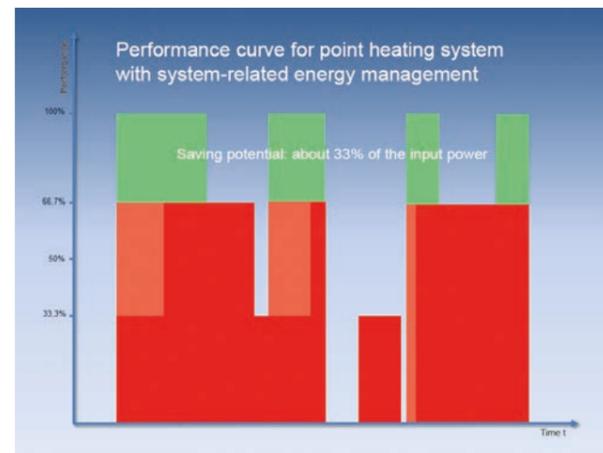
The point heating control system developed by ESA Elektroschaltanlagen Grimma GmbH combines the integration of weather forecasts with an optical precipitation sensor and a system-relevant energy management system. It ensures fully operational points with optimum use of energy, even under extreme weather conditions.

Your advantages

- Reduction of the system's input power by about 33%
- Safe function with optimum use of energy
- Pre-heating of the point according to forecast precipitation
- Optimum control regime for different types and amounts of precipitation
- Power heating in case of severe weather warning, for example, in case of snowstorms

Saving potential

- Reduction of the system's input power by about 33%
- Energy saving
- Mild winters => about 45% saving potential
- Cold winters => about 20% saving potential



Operation

In order to reduce the system's power input, the points of the point heating system distribution are divided into three groups, which are equal in terms of capacity, and heated as per the following fixed cycles.

Cycle	Group 1	Group 2	Group 3
1	Heated (Red)	Heated (Red)	Cooled (Blue)
2	Cooled (Blue)	Heated (Red)	Heated (Red)
3	Heated (Red)	Cooled (Blue)	Heated (Red)

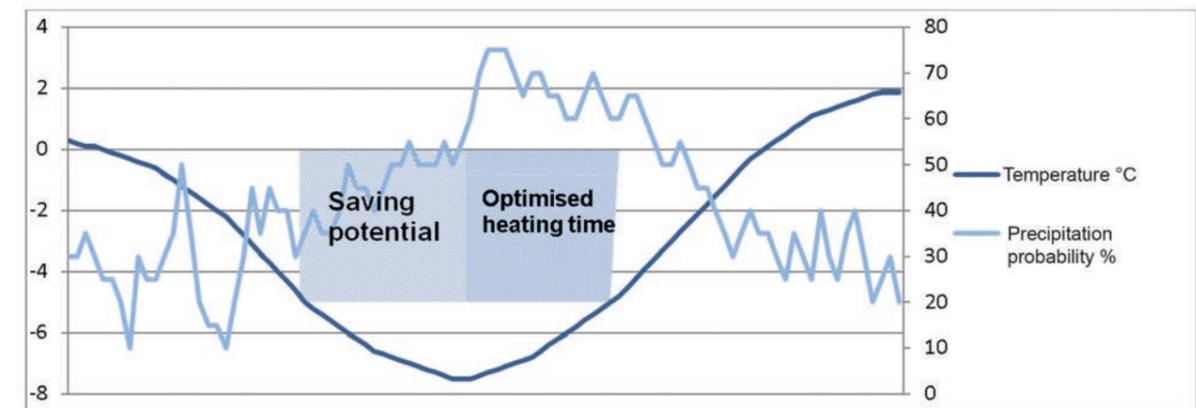
Red	Point heated
Blue	Point cooled

The control system assesses the forecast and locally measured weather data at regular intervals. Afterwards, the control system calculates the optimum energy input according to a predefined algorithm as well as the optimum target rail temperature for these values.

Interruption of low-temperature heating

For this functionality, a weather service is requesting forecast values for the precipitation probability and type. If the precipitation probability is below 60% in the next 30 minutes in case of low temperatures, low-temperature heating will be interrupted. If the precipitation probability is higher than 60%, it is differentiated whether the expected precipitation will be snow or rain and the low-temperature heating is activated as pre-heating

function. In case of rain, pre-heating is activated for a precipitation probability of 80%, whereas the heating is already activated at a precipitation probability of 60% if snow is forecast. In the pre-heating mode, the rail temperature is constantly kept at 0 °C until the precipitation actually starts.



Optimization of the target rail temperature value

The optimization of the target rail temperature is another saving potential. In case of rain, for example, this temperature does not have to be as high as that for snow. This value also depends on the actual precipitation amount.

In cooperation with Fraunhofer Institute, ESA Grimma has developed an optical precipitation sensor by means of which the type and quantity of precipitation can be determined. The annular design records the precipitation passing through and is capable of measuring the particle size. Particles of a size from 0.2 to 8mm moving at a speed from 0.2 up to 20m/s can be detected.



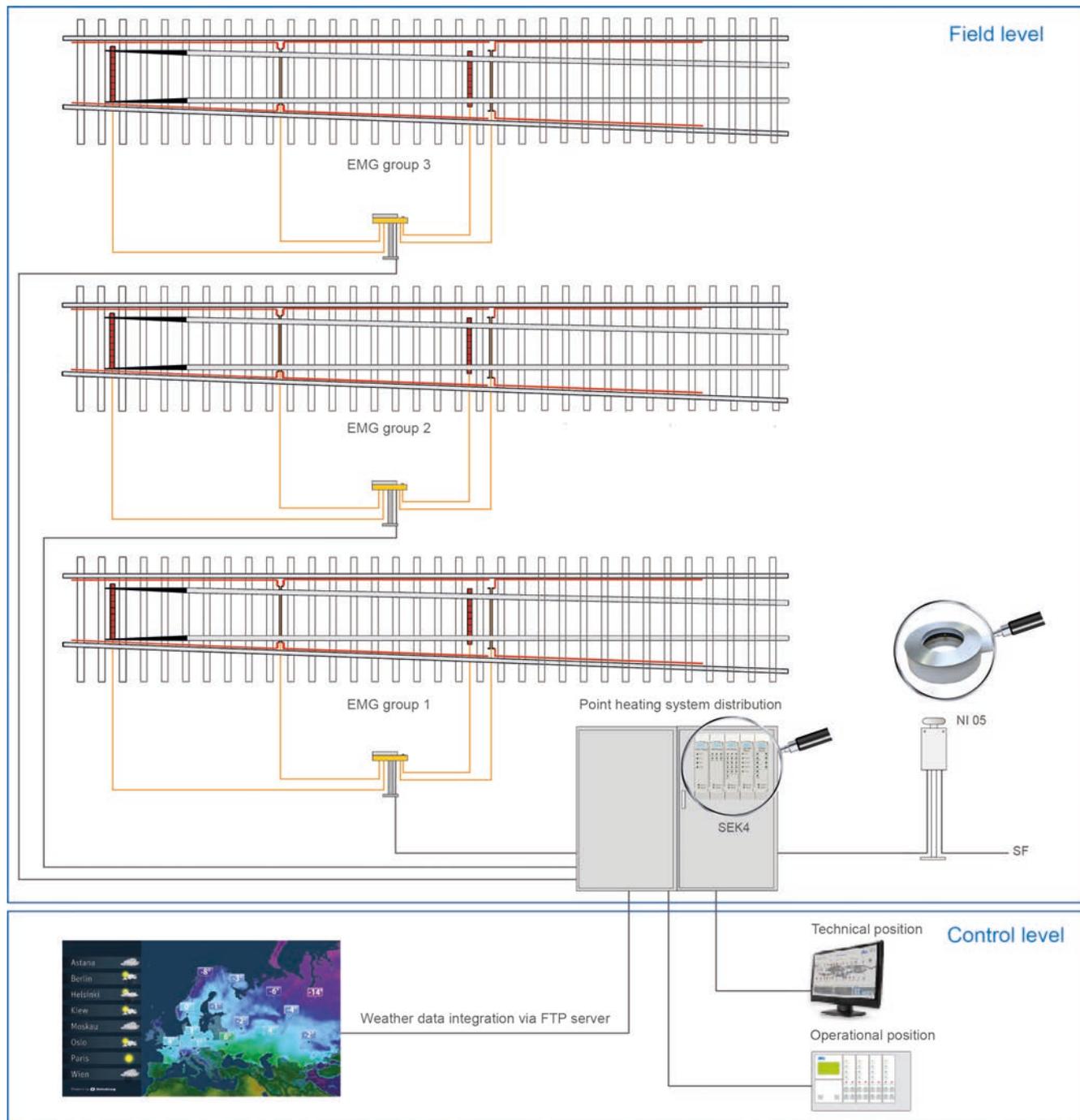
Data recorded by the sensor is taken into account in the control regime so that the target rail temperature dynamically adapts to local precipitation events. If the precipitation sensor detects drizzle or rain, the rail will be heated to only 1 °C in order to prevent rain from freezing on too cold slide chairs or tongue rails. Compared to the current standard value of 6 °C, significant savings can be achieved.

In case of snow, a respective target rail temperature can be selected depending on the precipitation amount according to a preset classification.

After precipitation has stopped, it is optionally possible to heat the rail to 6 °C once within about 30 minutes so that there is no more moisture. This dry heating of the rail ensures that no residual moisture is freezing on the rail if the temperature drops as well as if there is no precipitation and the heating is thus not switched on.

Snow quantity per hour	Constant control of target rail temperature	Two-point control of target rail temperature
1 cm	2 °C	0 to 3 °C
2 cm	3 °C	0 to 4 °C
3 cm	4 °C	1 to 5 °C
4 cm	5 °C	2 to 6 °C
5 cm	6 °C	3 to 7 °C

Target rail temperature values are dynamically raised by 1K each depending on the air temperature from -1 °C.



System stability

In general, the system is secured against data transfer failures. If the process chain fails, the local weather data gathering system will control the system as usual.

In addition, this weather data gathering system sends a fault message to the control level pointing out that the weather-forecast based control system failed.

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ESA Elektroschaltanlagen Grimma GmbH reserves the right to make changes due to technical progress.

Image sources: ESA Elektroschaltanlagen Grimma GmbH

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