

Automated Control System

- Weather Station & Rail Sensors Determine How Much Heat to Apply Autonomously
 - “Man-Out-of-the-Loop”
- Energy Savings Maximized – Heat When Needed
- Automated Energy Savings beyond Flat Heater Energy Savings
 - Up to 83% Additional Savings with Weather Station and Rail Sensors Against Dispatch Control
 - Up to 92% Additional Savings with Weather Station and Rail Sensors Against Manual Control
- Avoids Track Fires by Keeping Power Levels Where Needed
- Allows for Remote and Local Override – Can Be Viewed Any Time
- Can be accessed from Computer, Tablet or Enclosure

Single or Dual Heating Elements, Up To 300 W/ft X2 = 600W/ft Max

- Dual Elements use Patented Pulse Width Modulation(PWM) Algorithm for shared heat
- Second Element Acts as a Redundant Heater – Should One Fail Heat Remains

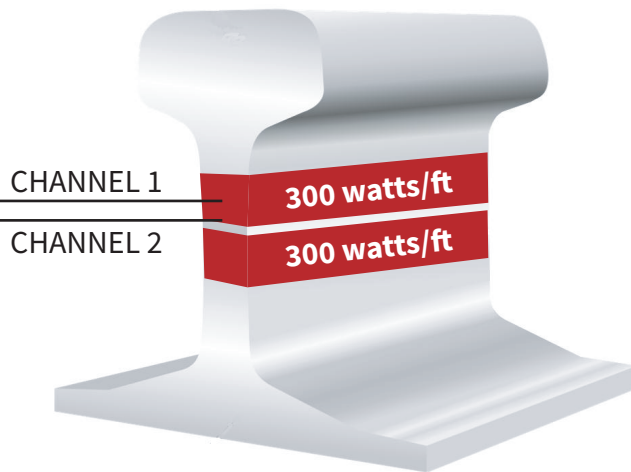
Modulated Power – Extreme Heat (600 W/ft) for Extreme Conditions

- Blizzard Mode: Steady Wind in Excess of 25 mph
- Boost Mode: Heavy Snow and/or Extreme Cold & Snow
- Rush Hour Mode: Snow & Rush Hour – Tight Headway
- Following Snow Detection Mode: Snow Detected in Track from Departing Train

Remote Diagnostics and Notification on Failed Heating Element & Sensors – See Call Center



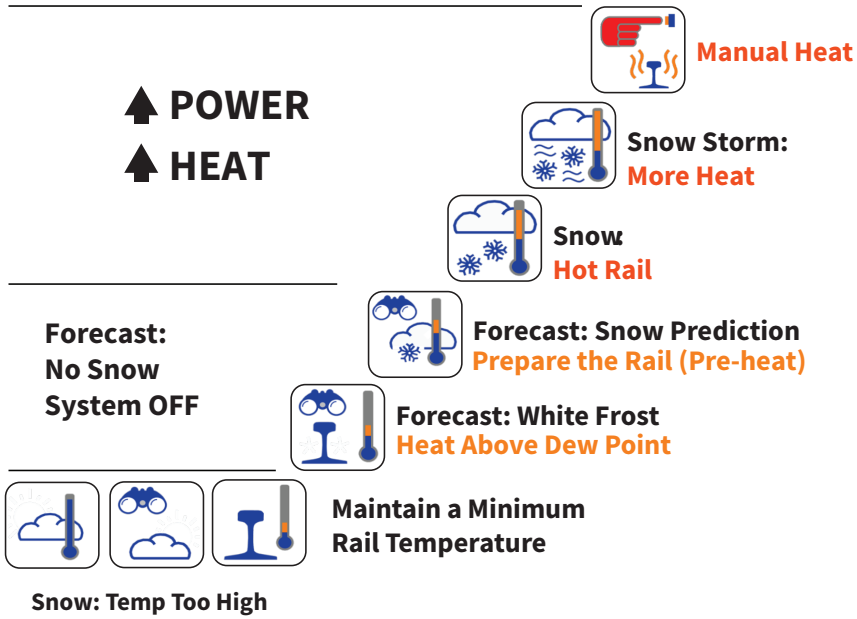
Dual Element Power Modulation with Redundancy



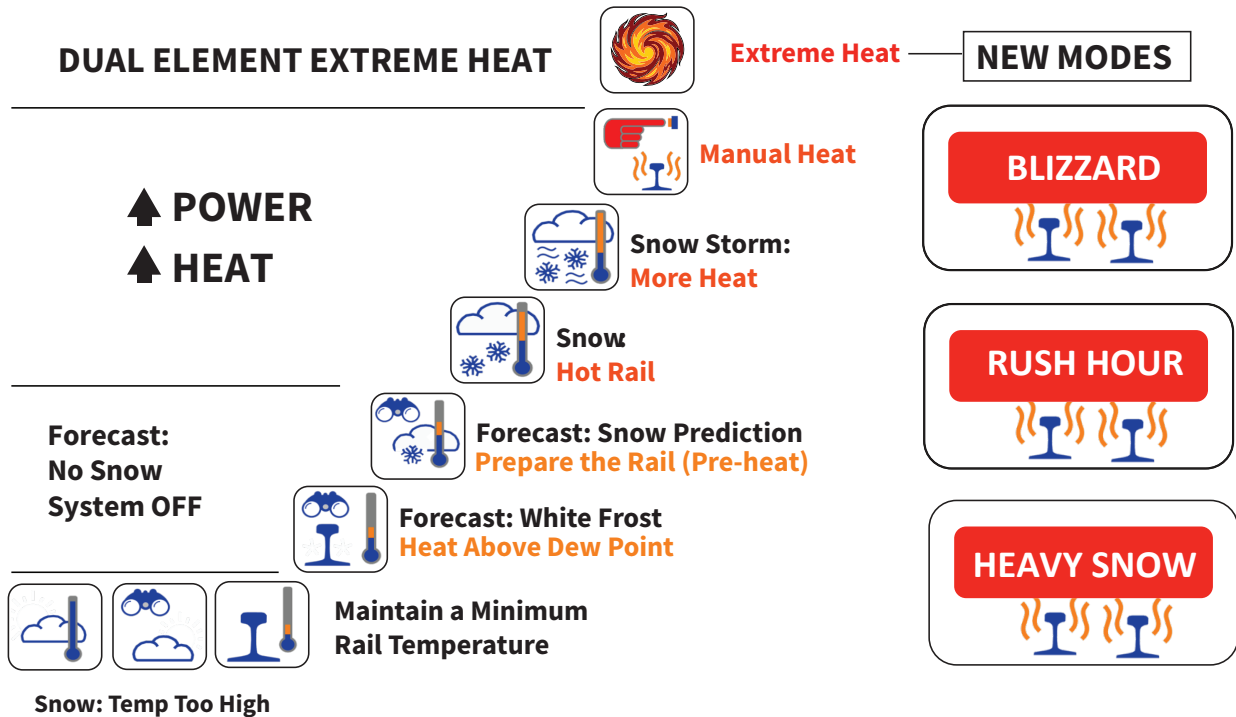
- Pulse Width Modulation (PWM) (Patented) Regulates The Duty Cycle of the Heaters to Attain a Specific Wattage
- A Single Element may not Provide Enough Power for Extreme Conditions – Dual Elements Provide Extreme Power – up to 600 w/ft
- Regulate the Duty Cycle According to Need Based on Rail Sensors, Prediction and the Weather Station – maximize energy savings
- Weather Station, Rail Sensors & Weather Forecast Provide Optimal Automated System – “Man-Out-of-the-Loop” capability
- Blue Point and PWM Provides for:
 - Extreme Heat When Needed
 - Nominal Energy Savings
 - A Redundant Heating Path
- Patent has been granted in US & Canada - PWM for Switch Heating

Extreme Heat When Needed, Nominally Energy Efficient and Redundant Elements

Fully Automated BluePoint SCADA System - Single Element



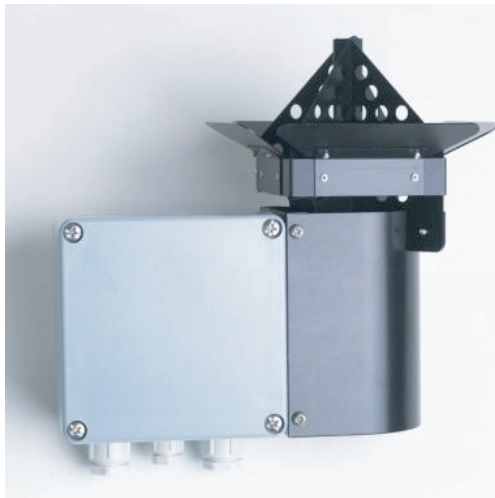
Fully Automated-Modulated BluePoint SCADA System - Dual Element Additional Modes



Blue Point Weather Station and Sensors

- Heat only when necessary
- Save up to 92% energy, compared to manual systems
- Save up to 83% energy, compared to dispatch controlled systems
- Maintenance free weather station
 - Wind speed
 - Air temperature
 - Snow & precipitation
- Hot & Cold Rail Temperature Sensors
- Blowing & Following Snow Detection

Weather Station



Snow & Precipitation Detector



Ambient Temperature



Hot & Cold Rail Temp



Wind Detection

Data Center –Call Center

Data Center

- Local SCADA at Enclosure and Remote SCADA over NIBE Secure Cloud
- Server HW, SW Licensing and Comm Provided & Maintained
- Secure Access Over Cloud
 - Private Cell Port
 - External Comm not Needed for Local Operation - “Autonomous”
 - > Needed to Collect Data and Remote Diagnostics
- Authorized Users
- Blue Point Access via 256bit Encrypted Web Browser or Local Panel

Call Center

- Blue Point Monitored 24X7
- Customer is notified of a failure or anomaly
 - Type of contact is determined by severity (phone call or email)
 - NIBE Element Rail Team provides remote diagnostics before contact

Benefits of NIBE Data Center & Call Center

Blue Point Feature	Customer Hosted Blue Point	Cloud Hosted Blue Point
Blue Point SCADA Software - Online & Local	✓	✓
Online Configurable - Setting & Thresholds *	✓	✓
Data Log - Database Capture - Requires SQL	✓	✓
Call Center Alerts & System Alarms	Customer Provides	✓
Automated SW Updates Server SCADA & PLC	Service Contract & Site Visit	✓
Online Diagnostics & Maintenance	Not Available	✓
Weather Forecasting	Not Available	✓
Database - Excel Downloads - E-mail	Not Available	✓
Weekly Usage Data (optional)	Not Available	✓
Server & Communication HW Supplied	Customer Provides	✓
Server Licenes OS/ SQL / Web	Customer Provides	✓
User Access: RDP/HTML5 - web server	Customer Provides	✓
Backup & Recovery Services	Customer Provides	✓
Offsite Configuration & Support	Requires onsite contract	✓

* We recommend that the NIBE Rail Team Make Modifications

Monel 400 heating elements

Flat Heater Thermal Conductivity & Heat Transfer

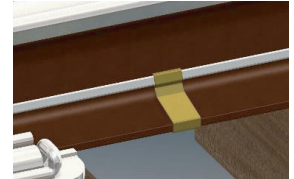
- Flat Heater ~ 40% contact with rail vs round tubular 15% contact with rail
- Monel 400 has heat transfer coefficient 2X next best alloy (Stainless Steel)

Proven Reliability & Long Life Time

- Monel 400 sheath - impervious to salt & chemicals – 10 year warranty
- Monel heaters are never coiled – eliminates heat loss due to gaps
- Internal coiled element -> expansion & contraction
- 1 Million+ successful installations

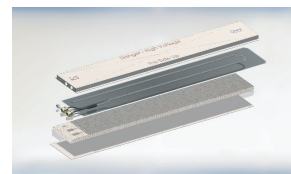


Stainless Steel Knock On Clips

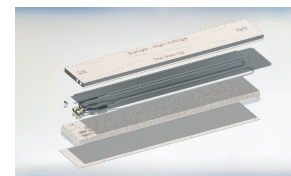


PAN Heaters

- Utilize Monel 400 Sheathed Elements in Pan Enclosure
- Single & Dual Element Design
- Pan Slides Under Switch Rods Easily
- Stainless Steel Pan with Cross Breaks
- Varied Lengths 2ft to 12 ft with Articulated Option
- Varied Wattages 100 w/ft to 300 w/ft – Single and Double Element



Single Element Pan



Dual Element Pan

North American Blue Points

40 Year Evolution Over 600 Units Deployed Worldwide



Customer	Location	# of Blue Points & Application	Power	Installation
Amtrak – Reedville	Reedville, MA	1 - Blue Point + Dual Heat	Dual 250w/ft – 480V @60hz	2017
Amtrak Swift	Kearny, NJ	3 - Blue Point + Dual Heat	Dual 250w/ft – 480V @25hz	2018
Maryland MTA	Baltimore, MD	1 - Blue Point + Dual Heat	Dual 200w/ft – 750VDC	2018
Amtrak Orms	Providence, RI	3 - Blue Point + Dual Heat	Dual 250w/ft – 480V @60hz	2019
MBTA	Newton, MA	3 - Blue Point + Single Heat	Single 250w/ft – 625VDC	2019
PRT	Pittsburgh, PA	4 - Blue Wire - 12,800'	4 Blue Wire - 750VDC	2019-2021
Amtrak Rensselaer	Albany, NY	6 - Blue Point + Dual Heat	Dual 250w/ft – 480V @60hz	2020
Amtrak Paul	Baltimore, MD	3 - Blue Point + Dual Heat	Dual 250w/ft – 480V @25hz	2022
Amtrak Erie	Secaucus, NJ	2 - Blue Point + Dual Heat	Dual 250w/ft – 480V @25hz	2023
Amtrak Adams	North Brunswick, NJ	2 - Blue Point + Dual Heat	Dual 250w/ft – 480V @25hz	2023
Amtrak Delco	New Brunswick, NJ	2 - Blue Point + Dual Heat	Dual 250w/ft – 480V @25hz	2023
NYCT	Brooklyn, NY	1 - Blue Point + Dual Heat	Dual 250w/ft – 625VDC	2023
Waterloo Light Rail	Waterloo, Canada	1 – Blue Wire – 4,800ft	1 Blue Wire – 750VDC	2023
Amtrak Biddle	Baltimore, NJ USA	3 - Blue Point + Dual Heat	Dual 250w/ft – 480V @25hz	2024
Amtrak Allied	Secaucus, NJ	2 - Blue Point + Dual Heat	Dual 250w/ft – 480V @25hz	2024
Amtrak 21st St.	Chicago, IL	2 - Blue Point + Dual Heat	Dual 250w/ft – 480V @60hz	2024
GCRTA – Light Rail	Cleveland, OH	1 – Blue Wire – 4,000ft	1 Blue Wire – 750VDC	2024
Amtrak Spring	Springfield, MA	1 – Blue Point + Dual Heat	Dual 250w/ft – 480v 60hz	2024
Amtrak Fitter	Clinton, CT	3 – Blue Point + Dual Heat	Dual 250w/ft – 480v 60hz	2025
Amtrak Grundy	Bristol, PA	3 – Blue Point + Dual Heat	Dual 250w/ft – 480v 25hz	2025
Amtrak Bergen	Secaucus, NJ	2 – Blue Point + Dual Heat	Dual 250w/ft – 480v 25hz	2025
Amtrak Legget	Bronx, NY	2 – Blue Point + Dual Heat	Dual 250w/ft – 480v 60hz	2025
Amtrak Lumber	Chicago, IL	2 – Blue Point + Dual Heat	Dual 250w/ft – 480v 60hz	2026



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