

# Energy Metering Technology for Modern Railways - Vehicles also Infrastructure

**POLL, s.r.o.** member of SKODA GROUP

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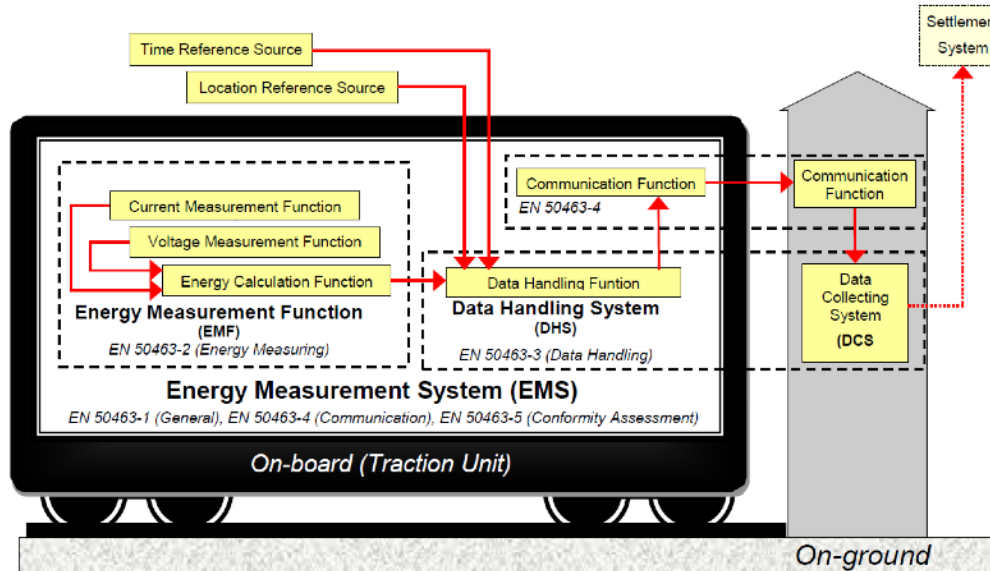


# On-Board Energy Measurement System

- Certification directives and standards: EN 50463:2017, Certification 1302/2014(TSI RST LOC&PAS), Measuring Instruments Directive 2014/32/EU, EN 50470-1, EN 50470-3, IEC 62052-11, IEC 62053-22, IEC 62053-24
- Device is compatible with measuring transformers/converters from Knick, Ritz, LEM, Pfiffner
- Measurement of active and reactive energy, consumed and recuperated energy in all traction power systems (25kV/50Hz, 15kV/16 $\frac{2}{3}$ Hz, 3kVDC, 1,5kVDC, 750VDC, 600VDC)
- Real time monitoring of power, voltage and current
- Saving and transfer of min./max. power, voltage and current values in set periods of time, 15 minutes and daily power consumption reports
- Up to 72 days data logger
- NTP or GPS time synchronisation
- GPS localisation – logging and transfer of location reports
- Data connection via GSM/GSM-R in ABL/XML/UTILTS data format
- ERESS compatibility FTP/SFTP, HTTP data formats for full DCS
- Remote monitoring/management/diagnosis via server (DCS)

# On-Board Energy Measurement System

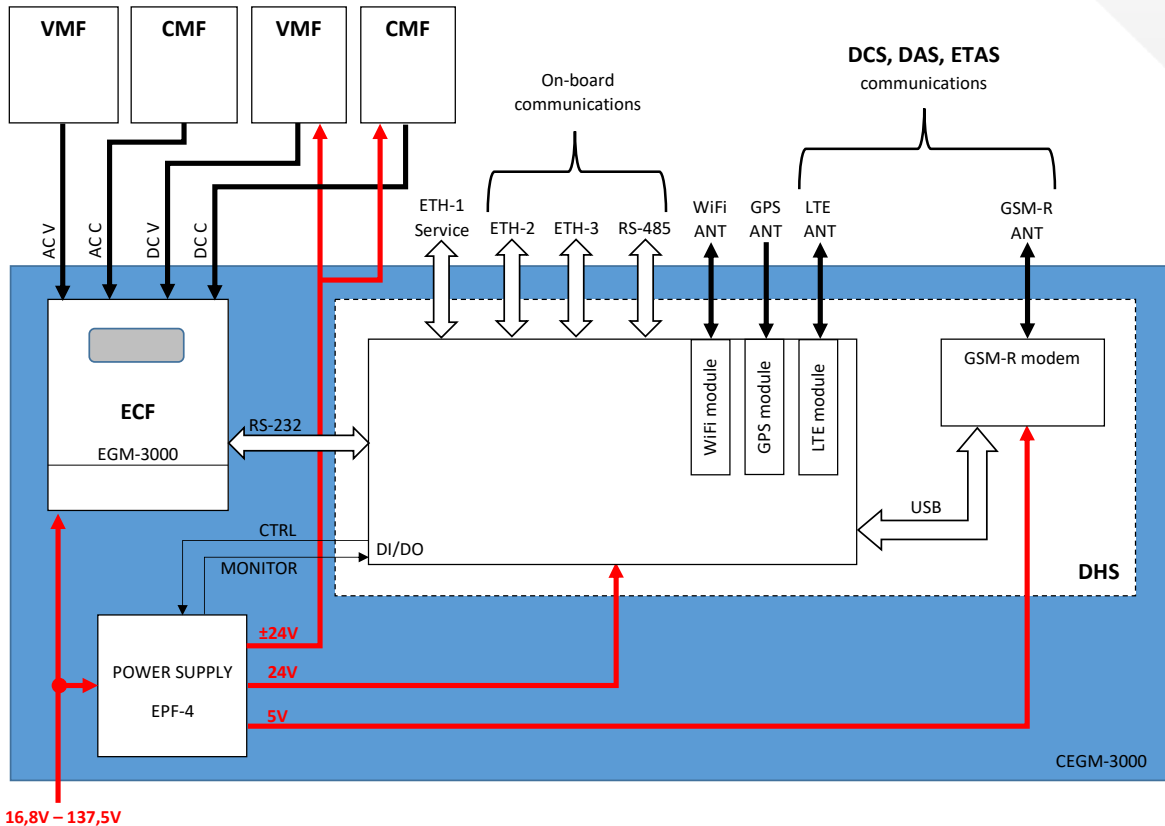
System Architecture in Accordance with EN 50463:2017



- Current Measurement Function (CMF)
- Voltage Measurement Function (VMF)
- Energy Calculation Function (ECF) ... POLL EGM-3000
- Data Handling System (DHS) ... POLL CEGM-3000
- Communication Function ... POLL CEGM-3000
- Data Collecting System (DCS) ... POLL DCS
- BILLING + ETAS ... POLL Systems
- DAS ... POLL supports data transfer from DHS

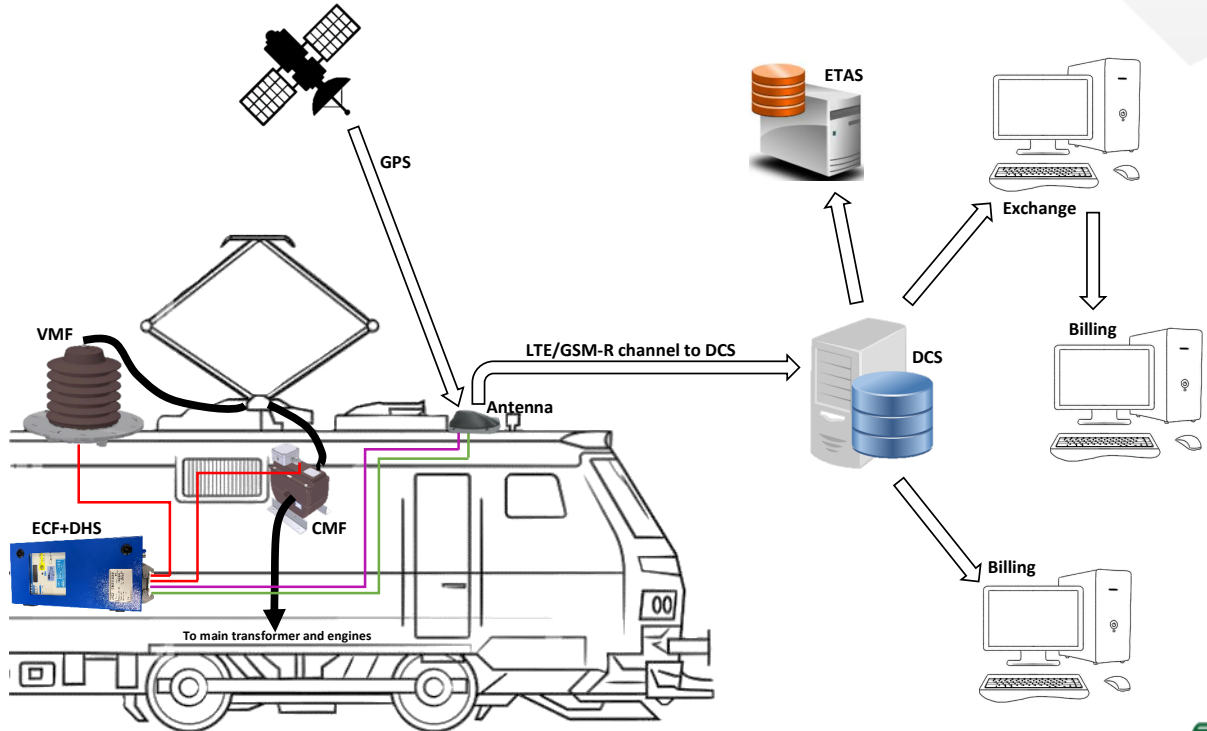
# Dual Energy Measurement System

System Architecture in Accordance with EN 50463:2017



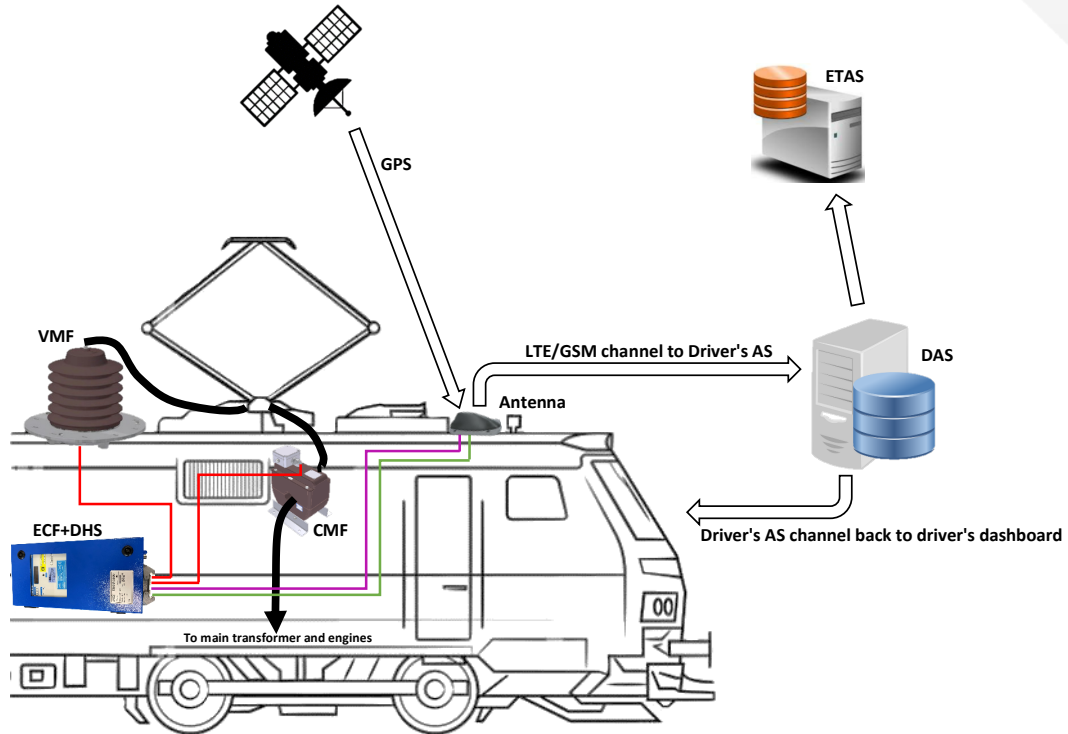
# Dual Energy Measurement System

System Architecture in Accordance with EN 50463:2017



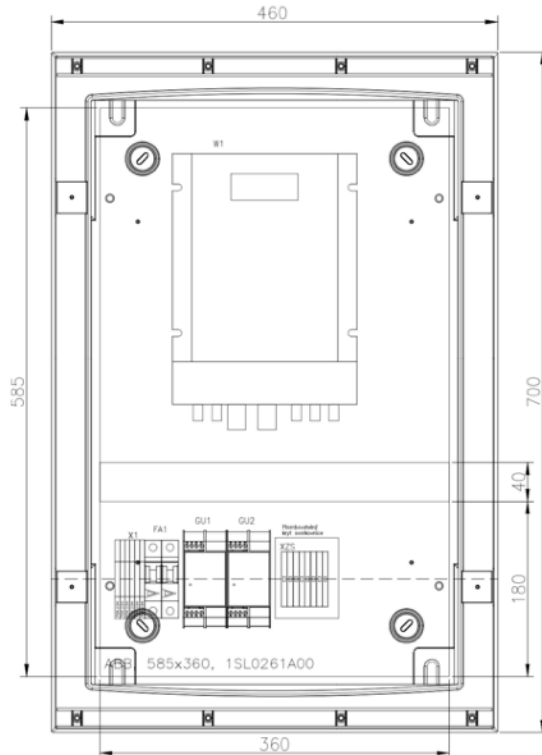
# Dual Energy Measurement System

System Architecture in Accordance with EN 50463:2017



# Stationary Energy Measurement System

System Architecture in Accordance with EN 50463:2017



# Energy Meter CEGM-3000



## ECF Meter Features:

- Broadband power supply 16,8V to 137,5V DC
- Power supply failure class S2
- Temperature class OT4 (-40°C to +70°C)
- Storage temperature (-40 °C to + 85 °C)
- Degree of protection IP54
- Compact design 280mm x 165mm x 46mm
- Simple sealing of measuring inputs
- Isolated measuring inputs 2000V AC / 50Hz / 1 minute
- VFD display
- Accuracy class 0,5R according to EN 50463 / C according to EN 50470 / 0,5S according to IEC 62053-22 and IEC 62053-24
- Rated voltage range AC voltage 40V to 250V
- Nominal AC current range 40mA to 5A
- Rated current DC range 20mA to 100mA
- Rated current DC range 20mA to 2A
- Record period 1 minute to 60 minutes
- A record memory of at least 72 days
- Snapshot records after 1 second to 60 seconds
- Memory snapshot records 60 minutes

## Associated DHS Features:

- Built-in GPS module
- GSM / GSM-R / UMTS / LTE with two SIM switching
- 2x 100BASE-T Ethernet
- RS-485
- RS-232
- WiFi Access point for wireless supervision / management
- Saving and sending of measured data by OBIS protocol
- Transmitted data formats ABL, XML, HTML, UTILTS

## Standards and Directives:

- Commission Regulation EU no. 1302/2014 (TSI RST LOC&PAS)
- Measuring Instrument Directive 2014/32/EU
- ČSN EN 50463:2018
- ČSN EN 50155:2018
- ČSN EN 45545-2+A1:2016
- ČSN EN 50125:2015
- ČSN EN 50121-3-2:2019
- ČSN EN 50124-1:2018
- ČSN EN 61373:2018
- ČSN EN 60529:2014
- ČSN EN 50470-1:2007
- ČSN EN 50470-3:2007
- ČSN EN 62052-11:2018
- ČSN EN 62053-22:2018
- ČSN EN 62053-24:2018



# Pictures of EGM-3000 (ECF)



# Pictures of CEGM-3000



# Dual Energy Measurement System CEGM-3000

## Key Features

- Fulfilment of all standards and directives (Commission Regulation EU č. 1302/2014 (TSI RST LOC&PAS), Measuring Instruments Directive 2014/32/EU, EN 50463:2017, Metrological standards etc.
- Broadband power supply 16.8V to 137.5V DC
- Power supply failure class S2
- Temperature class TX (-40°C to +70°C)
- Storage temperature (-40 ° C to + 85 ° C)
- Isolated measuring inputs 2000V AC / 1 minute
- VFD display
- Accuracy class 0.5R according to EN 50463/C acc. to EN 50470/0.5S acc. to IEC 62053-22 and IEC 62053-24
- Measurement of active and reactive, consumed and regenerated energy in all traction power systems (25kV/50Hz, 15kV/16 $\frac{2}{3}$ Hz, 3kV/1.5kV/750V/600V DC)

# Dual Energy Measurement System CEGM-3000

## Key Features

- Range of AC nominal voltages 40V to 250V
- Range of AC nominal currents 40mA to 5A
- Range of DC nominal currents on voltage input 20mA to 100mA
- Range of DC nominal currents 20mA to 2A
- Record period 1 minute to 60 minutes
- A record memory of at least 72 days
- Snapshot records after 1 second to 60 seconds
- Memory snapshot records 60 minutes
- Built-in GPS module
- ERESS compatibility FTP/SFTP, HTTP data formats for DCS

# Dual Energy Measurement System CEGM-3000

## Key Features

- Smart Sealing System – avoidance of misapplication
- IP54 covering and easy sealing of connected cables, even in setup without switch board
- Possibility of installation in a distribution box for easier and faster installation / replacement on a locomotive
- Dimensions of CEGM-3000 ... 400mm x 200mm x 125mm
- Dimensions of EGM-3000 ... 258mm x 165mm x 49mm
- Significantly easier production process with better reliability

# CEGM-3000 Communication Interface

## Energy Measurement System Offers These Communication Interfaces:

- RS-485, RS-232 – Serial communication bus with possibility of external GPS module connection
- 2x 100Base-T Ethernet – internal train Ethernet network connection, Ethernet for service access
- GPS – connector for external GPS antenna
- GSM – connector for external GSM/GSM-R/UMTS/LTE antenna
- WiFi – WiFi antenna connector
- WiFi Access point for wireless supervision / management
- Transmitted data formats ABL, XML, HTML, UTILTS

# Outputs from DCS of CEGM-3000

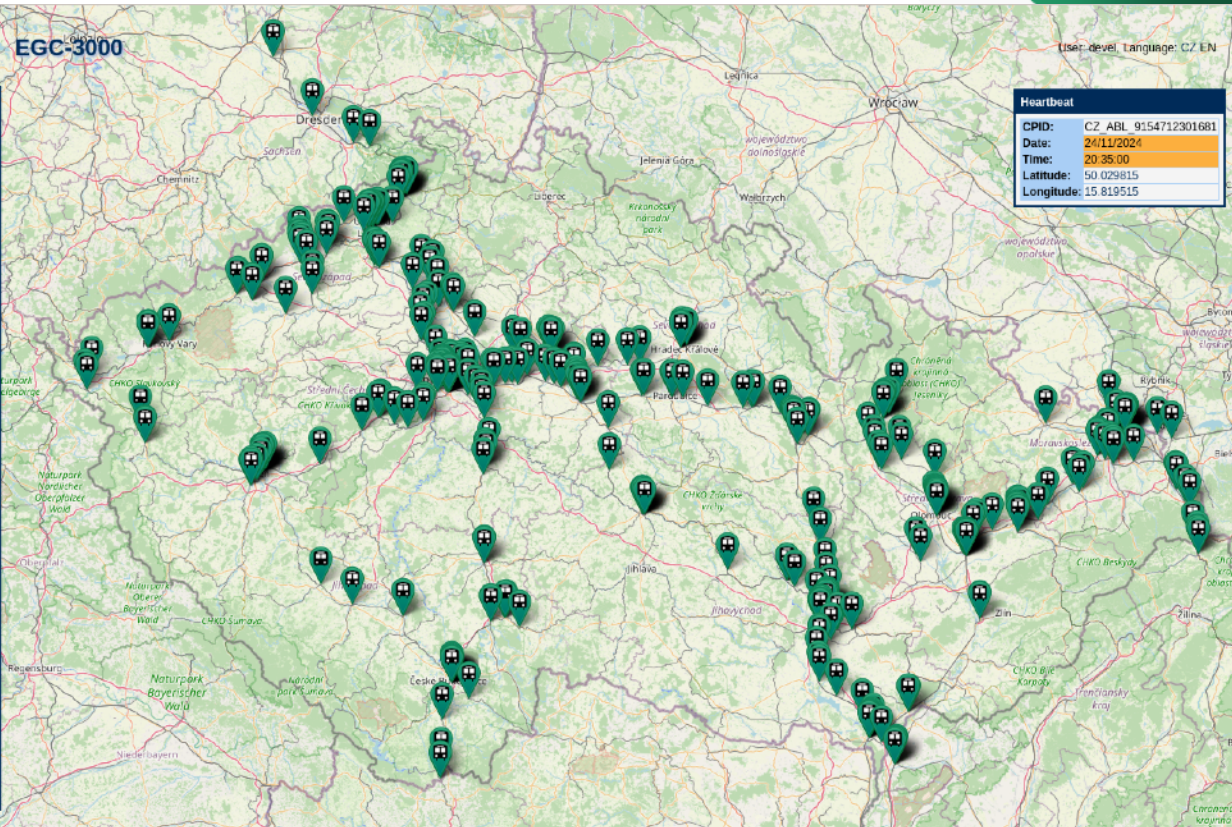


EGC-3000

User level: Language: CZ/EN

Heartbeat	
CPID:	C2 ABL 9154712301681
Date:	24/11/2024
Time:	20:35:00
Latitude:	50.029815
Longitude:	15.819515

Status
Data Collecting System
DCS Report
Server Report
Resources
EMS sheet
Overview
Heartbeat
Reading
CEBD
Event
Report
Statistics
Daily table
Daily chart
Daily group
Export
Hybrid model
Records
Uploaded
Browse
Watchdog
Data quality
Log
System
Input auto
Output auto
Output request
Map
Heartbeat
Setup
Users



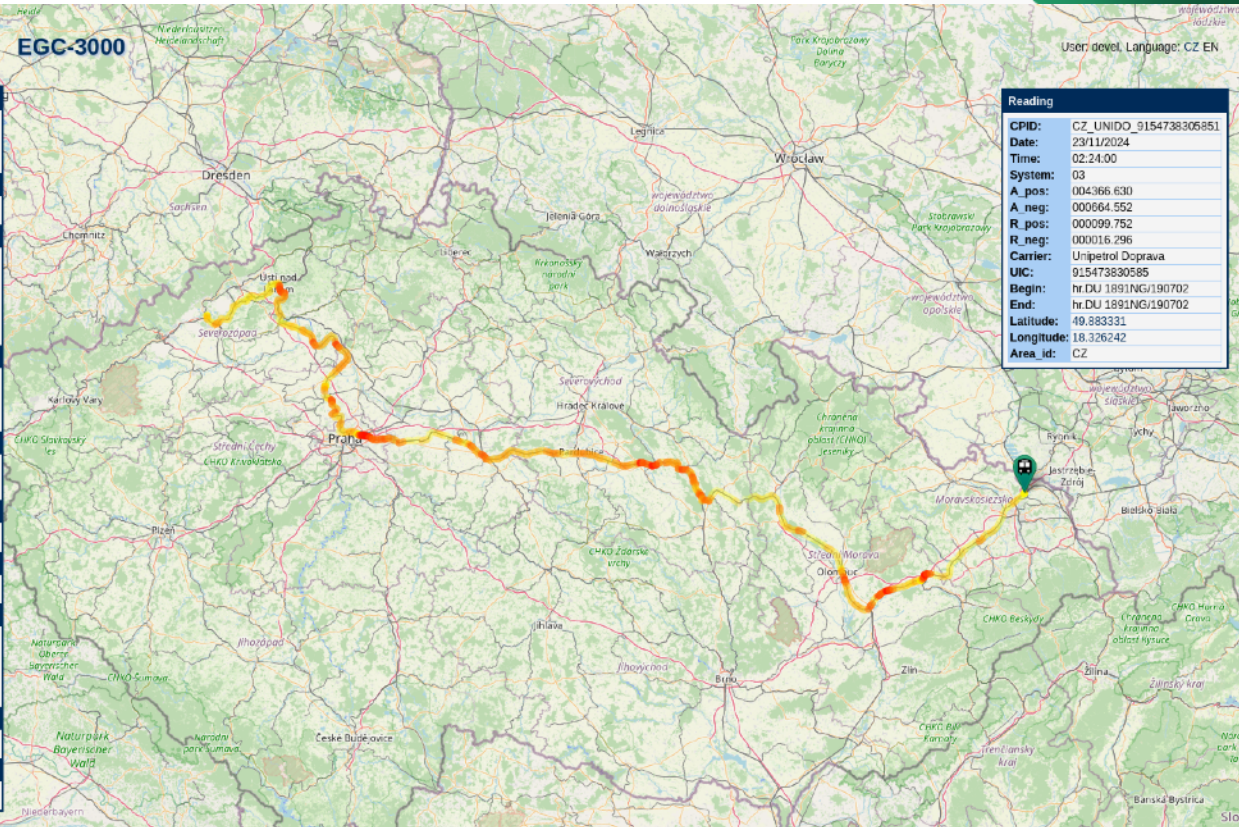
# Outputs from DCS of CEGM-3000



EGC-3000

User: devel. Language: CZ EN

<b>Status</b>
Data Collecting System
DCS Report
Server Report
<b>Resources</b>
EMS sheet
<b>Overview</b>
Heartbeat
Reading
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<b>Statistics</b>
Daily table
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Data quality
<b>Log</b>
System
Input auto
Output auto
Output request
<b>Map</b>
Heartbeat
<b>Setup</b>
Users



<b>Reading</b>
CPID: CZ_UNIDO_91547383065851
Date: 23/11/2024
Time: 02:24:00
System: 03
A_pos: 004366.630
A_neg: 000664.552
R_pos: 000099.752
R_neg: 000016.296
Carrier: Unipetrol Doprava
UIC: 9154738306585
Begin: hr:DU 1891NGJ190702
End: hr:DU 1891NGJ190702
Latitude: 49.883331
Longitude: 18.326242
Area_id: CZ





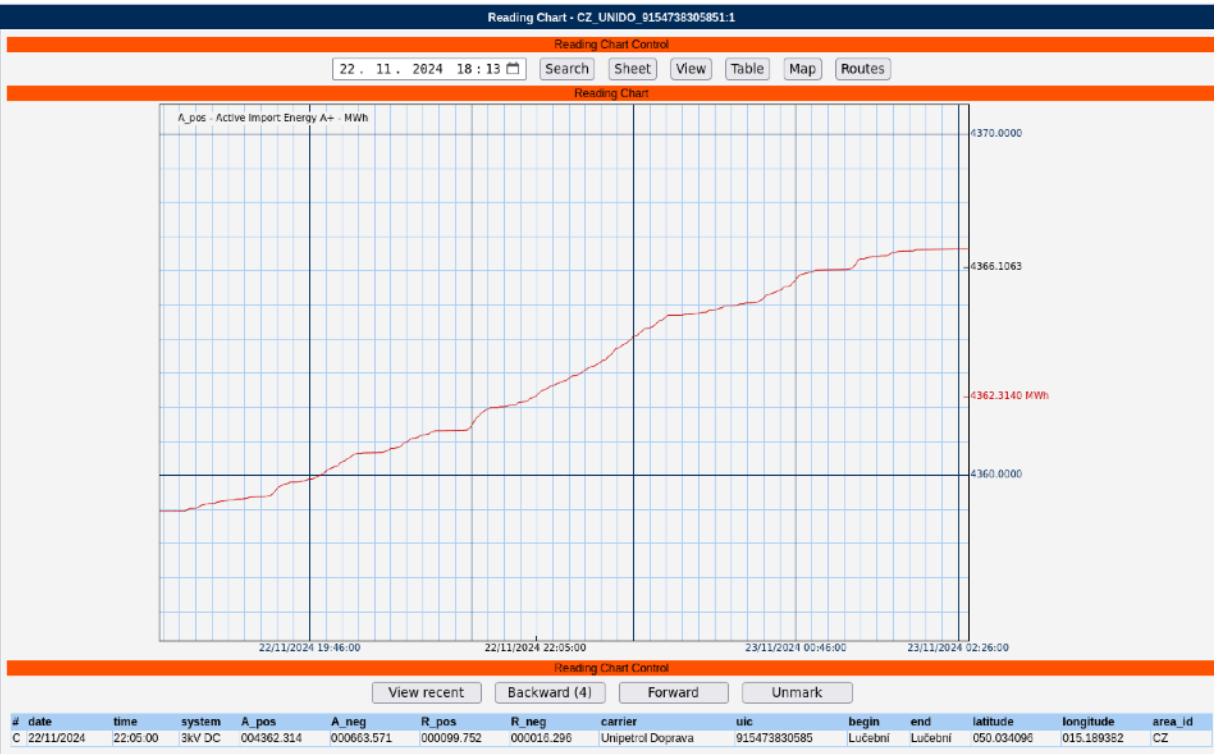
# Outputs from DCS of CEGM-3000



EGC-3000

User: devol, Language: CZ EN

Status
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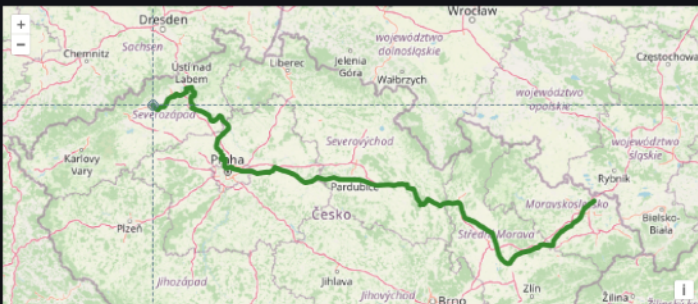


# Analytical Outputs from DCS of CEGM-3000

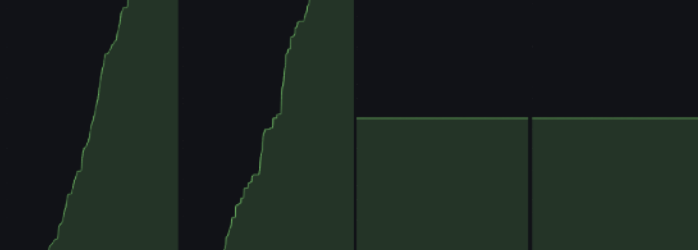
CPID CZ\_UNIDO\_9154738305851

2024-11-22 15:58:51 to 2024-11-23 06:41:52 Refresh

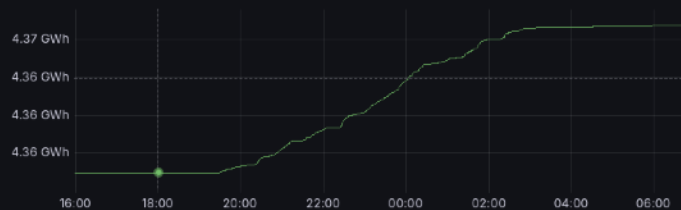
Tracks



A\_pos 7.80 MWh  
A\_neg 1.81 MWh  
R\_pos 0 MWh  
R\_neg 0 MWh



Active positive



Speed



Voltage



Current



# References

- **Správa železnic** - is the owner and provider of national and regional railway infrastructure owned by the state [www.spravazeleznice.cz](http://www.spravazeleznice.cz). **POLL** has delivered **549 pieces** of EMS type CEGM-3000 and another **150 pieces** is actually delivering. Together 699 pieces.
- **ŽSSK Cargo - POLL** is actually delivering of customised **182 pieces** of EMS type CEGM-3000.
- **Správa železnic - POLL** is newly providing customized **DCS (Data Collecting System)**.
- **STADLER Polska – ADY FLIRT EMU IR Project. 19 pieces** of **EGM-3000** for Azerbaijan Railways
- **RELOC SA Romania - POLL** is actually delivering of customised **19 pieces** of EMS type CEGM-3000.
- **Knick Elektronische Messgeräte GmbH & Co. KG** [www.knick.de](http://www.knick.de). **POLL** has delivered **2 test samples** of EMS type CEGM-3000.

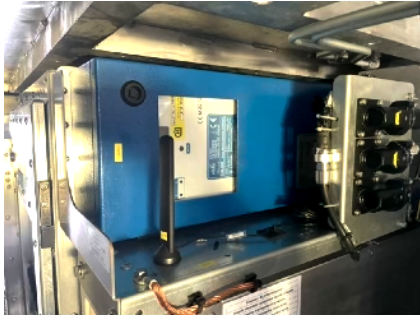
# References – EMUs and Loco Engines

- **ALSTOM Ferroviaria - Pendolino (České dráhy a.s. - Czech railways - <https://www.cd.cz/en/default.htm>)**
- **CRRC Sirius EMU 665 for Leo Express - <https://www.leoexpress.com/cs/o-nas/media/sirius-by-mohl-jezdit-v-nemecku>**
- **PESA – RegioJET - <https://regiojet.com>**
- **SIEMENS VECTRON (ČD Cargo)**
- **Bombardier TRAXX (ČD Cargo)**
- **SKODA Loco Engines – almost complete portfolio used in Czech rep., Germany, Poland, Slovakia, Hungary railway**
- **SKODA EMUs – 13Ev, 14Ev2, 15Ev, 18Ev, 19Ev, 20Ev, 21Ev**
- **STADLER ADY FLIRT EMU IR, Azerbaijan Railways**
- **LE 5100 kW locomotives, RELOC SA Romania**

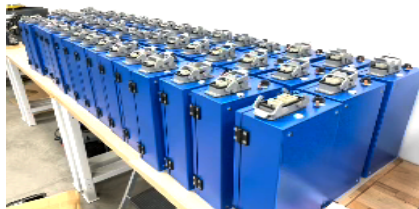
Application of CEGM-3000,  
EMU ČD 680 ALSTOM PENDOLINO,  
SKODA ZSSK 14Ev2



# Application of CEGM-3000, SIEMENS VECTRON



# Production of CEGM-3000



# Production of CEGM-3000





# Production of CEGM-3000



**Thank you for your attention**

