Railway special

EPHY MESSAGE 09/14

EDITORIAL

What will Industry 4.0 mean in future for us in Germany and EPHY-MESS

The 4th industrial revolution was the hot topic in Berlin at the Ambassadors Conference at the end of August. Having passed through the invention of the steam engine (1st industrial revolution), electric power and mass production (2nd industrial revolution) and microelectronics and resultant automation (3rd industrial revolution), the 4th, involving the digitalization of industry, is now upon us. One thing is for certain: Germany needs to lead the way in this fourth wave, Industry 4.0, if we want to maintain the leading global financial position that we fought so hard to gain in 3.0. If the German economy could tackle the challenges of production digitalization, it would give us a major boost in terms of growth and stop us sliding into recession in 2015/16. The highly innovative industrial software sectors are paving the way for communication between production and production systems, thereby increasing our international competitiveness in terms of improved efficiency, sustainability and flexibility, which in turn means a far quicker time to market for newly developed products.

The digital planning of production facilities, e.g. in the automotive industry or mechanical engineering, is resulting in the merging of the virtual and real worlds via robotics. This means that robots are capable of communicating entirely among themselves on digital enterprise platforms, working together without human intervention to build the car of the future or electrical propulsion engines.

There are obviously many fantastic potentials and opportunities for the German economy here. The only question remains that of the security and reliability of the communication itself within such complex production networks. This issue, among others, will impose higher requirements on operational management, though the possible benefits should be motivation enough to tackle the challenge. Like it was before at the start of the 1980s, it's time to roll up our sleeves and get on with increasing the national product.

Sincerely yours

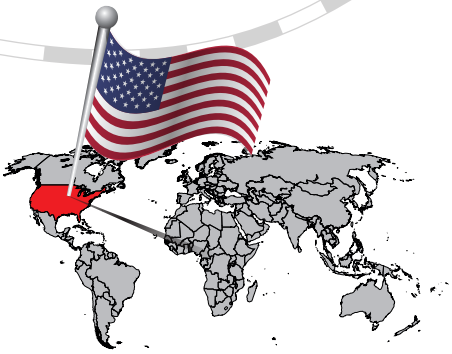
Andreas Becker
Corporate management

EPHY-Mess makes it possible

From the USA to India by railway.

EPHY-MESS is a global partner serving the railway industry. This special edition of EPHY-MESSAGE presents the trains and railway companies operating between the USA and India, sketching out the routes. And what's more: we can also tell you the trains in which the Wiesbaden components are used. The international railway journey with EPHY-MESS begins in Sacramento, the capital city of the state of California, and ends in India. The stops in between are England, Germany, Austria, Russia and China.

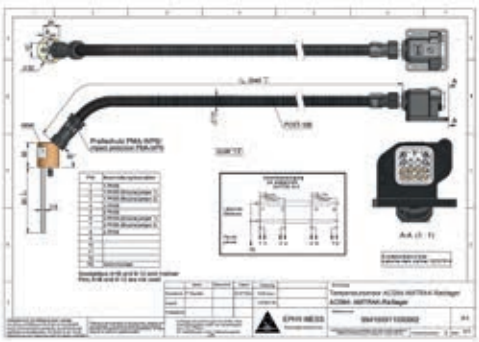
Railway technology for the USA



In October 2010, the American railway company Amtrak concluded a contract with Siemens for the delivery of 70 ACS-64 electrical locomotives. The new Amtrak Cities Sprinter trains are intended to replace their predecessors, the AEM-7 and HHP-81, which run on the electrified routes in the USA, along the Northeast Corridor between Boston and Washington and the Keystone Corridor between Philadelphia and Harrisburg.

The development of this first complete locomotive for the North American market by Siemens was largely carried out in Germany. The Siemens railway manufacturing plant in Sacramento completed the development order. As the project is partly financed by the Federal Railroad Administration (FRA), Siemens had to prove its compliance with „Buy American" regulations: alongside various small parts, only the main transformers, the first ten cars and the bogie frames came from Europe. The rest of the components were mainly manufactured in the USA. Many components were

assembled in California, including the final assembly of all 70 locomotives up to the routine test stage. The ACS-64 is based on the AC version of the Vectron locomotive, combining German technology with American standards and experience. The vehicle had to be „Americanized“ in order to fulfil some requirements in the USA that were quite different from those in Germany. The first locomotive was delivered in 2013 and put into planned operation at the beginning of 2014. Thermal monitoring of the wheelset mount on the Amtrak Cities Sprinter is carried out with two sensors equipped with PT100 in a stainless steel sleeve. The sensors comply with protection type IP69K and are therefore completely protected against contact, as well as being waterproof and protected against dust. The entire sensor system, including a 2940 mm supply line encased in a corrugated pipe, weighs 1.5 kg. The protection class test on the sensors is carried out in Wiesbaden on a protection class test bench in the plant itself.



Speed sensors on the way to London

The ties between the USA and Great Britain have always been close. And now there are further common grounds in railway terms: EPHY-MESS sensors. Individuals travelling via Eurostar from Brussels or Paris to London will stop at London St. Pancras, a Victorian architectural masterpiece. You can change here to the Thameslink route, a 225 km stretch between Bedford and Brighton. The Thameslink, similar to the S-Bahn in Germany, carries around 40 million passengers per year and the British government is set to renew and expand it as of 2015. Siemens presented the Desiro City series as the successor to Desiro UK as early as July 2009. In June 2013, Siemens received the order to deliver 1,140 cars for the Thameslink network in Southern England.

Siemens will also be taking long-term responsibility for the maintenance of the trains, building two new depots for this purpose. As of this year, the vehicles are being manufactured in the Siemens plant in Krefeld. The Desiro City Thameslink vehicles are to be run as eight- and twelve-car trains with both 750V direct current or 25kV alternating current.

The new trains on the Thameslink route are equipped with EM DWG04-Thameslink speed sensors, which can reliably calculate rotational direction and speed. EPHY-MESS develops and manufactures speed sensors on the basis of Hall elements that detect speed and direction of travel.

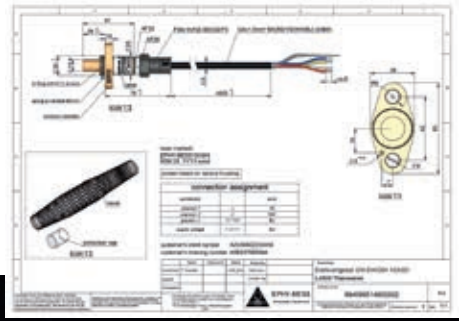
Of the 2,100 speed sensors required in total for this order, EPHY-MESS is supplying 1,800 sensors in the

fiercely competitive privatized English railway market. The technical benefits of this compact speed sensor gave it the edge:

- Vibration-resistant up to 200 m/s² and shock-resistant up to 200 g (exceeding the standard) in accordance with EN 61373 Category 3
- Protection type IP68 in accordance with (DIN EN 60529) and the British fire protection standard
- Quick assembly with flanges
- Designed with protection against reverse polarity, short-circuit-protected against supply voltage
- Maintenance and wear free
- Suitable for „zero-speed detection“
- Excellent long-term stability
- Non-magnetic housing (brass)

The speed sensors are designed to cope with temperatures of up to 125 °C.

The Desiro is a railway vehicle family designed by Siemens Transportation Systems (now: Rail Systems) for regional, inter-city and rapid-transit trains. The rail car concept allows for variable train configurations with diesel or electric drives in single or multiple units. The new Desiro City for rapid-transit, regional and inter-regional transportation in Great Britain reduces overall energy consumption and track wear by up to 50% by comparison with its predecessors. Desiro variants are also in use by Deutsche Bahn and many European countries, as well as in California.



With the ICx into the German railway of the future

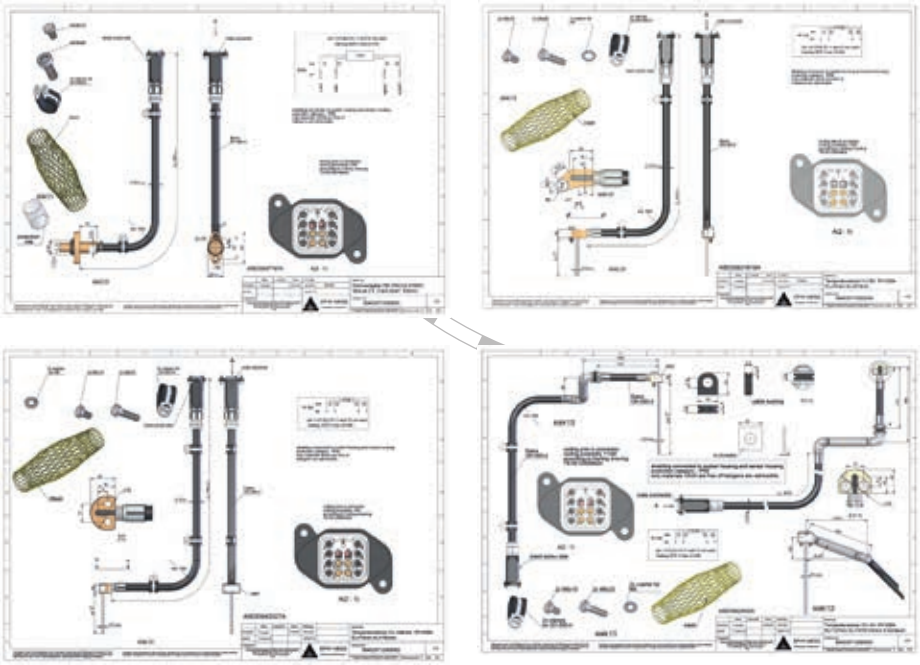
Travelling from England to Germany by railway has been a dream fulfilled for 21 years. With the first plans having been conceived as far back as 1753, a 50 km tunnel was built between Folkestone in the British county of Kent and Coquelles near Calais in France. The first trial run was carried out on 20 June 1993 and passengers were able to cross the English Channel from 14 November 1994 onwards. It became possible to travel from London to Cologne in only 4 hours 11 minutes.

Under the name ICx, Deutsche Bahn launched a project to manufacture up to 300 trains for long-distance travel. The Intercity/Eurocity trains were to be replaced as part of this project by around 2020, followed by the ICE 1 and ICE 2 vehicles. The ICx drive concept is based on the so-called Powercar concept, which allows for high flexibility. The drive system components – basically the transformer, traction inverter, traction cooling system and the four traction motors – are integrated under the floor in autonomous driven cars known as Powercars. Thanks to this design, the train can adapt in the best possible way to transport tasks in terms of acceleration, speed and passenger capacity. The 12-car version is intended to enter service as of December 2017 and the 7-car version as of December 2020.

Many products manufactured by EPHY-MESS are part of this project:

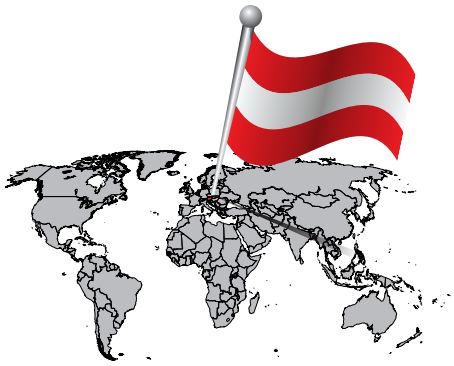
1. Speed sensors
2. Temperature sensors for the stator core: 1 PT100 with 4-wire circuitry for temperatures ranging between -40°C to +120°C at adjoining components and less than 200°C at the measuring point. The stator consists of the housing, stator core and incorporated stator winding and the sensor to monitor motor temperature.
3. Sensors for thermal monitoring of the ICx engine mount with similar data to the stator core sensors, but with different dimensions and connecting cable lengths.

All three temperature sensors are protection type IP68 and meet the following standards: DIN EN 60751, DIN EN 61373, DIN EN 45545-2.



From Cologne Cathedral to Stephansdom (St. Stephen‘s Cathedral) in Vienna

The train journey from Cologne to Vienna takes 8 hours and 13 minutes, almost twice as long as the journey from London to Cologne. This has nothing to do with the EPHY-MESS sensors! The „RailJet“ locomotive-hauled push-pull train is the flagship of the ÖBB. The Siemens ES 64 U2 locomotive is referred to by the ÖBB as „Taurus“. Intended for domestic and cross-border high-speed passenger transportation between Austria and Germany/Hungary, the train is derived from the EuroSprinter locomotive family. EPHY-MESS sensors monitor the temperature of the propulsion engines. The most important criteria when it came to choosing the manufacturer were mechanical stability and a high dynamic range. The EPHY-MESS sensors calculate the speed and direction of travel, as well as the temperature. An oil level gauge specially developed for the high-speed sector rounds off the measurement equipment in the locomotive bogies, used for quick checks on the oil level in the transmission. This oil level gauge has no protective cap or expensive bullet-proof glass, yet remains strong enough to prevent a direct stone impact from causing transmission oil leaks even at a speed of 230 km/h. The newest member of the Siemens Velaro platform series stayed with Rail Tec Arsenal (RTA) in Vienna for eight weeks. Here, in the longest climatic wind tunnel in the world, the train had to prove that it could function flawlessly at wind speeds of up to 300 km/h, temperatures ranging between -25 °C and +45 °C and in rain, snow and sleet. The new ICE3 series has to be technically perfect in order to be released to customers. Its predecessors are already driving in all weathers in Spain, China and Russia, complete with EPHY-MESS sensors.



Passengers making their way from Vienna to Moscow with ÖBB will find it takes somewhat longer than the journey to London – 30 hours and 17 minutes, to be exact. It takes 24 hours and 8 minutes from Berlin, including changing to broad-gauge vehicles.

„Sapsan“, the Russian peregrine falcon

The Velaro RUS is another member of the Velaro family. The Russian Velaro variant has been running between Moscow and St. Petersburg since December 2009. Siemens supplied the Russian state railway RZD with eight ten-car Velaro RUS trains and will be responsible for maintaining the trains for 30 years. RZD named the train fleet „Sapsan“ (peregrine falcon). The trains are specially adapted to Russian technical and climatic conditions and are capable of running in outside temperatures of down to -50 °C. In order to protect the traction components against freezing and snowdrifts while also ensuring sufficient cooling, the cooling air is fed through special air ducts from the roof to the almost entirely sealed base trays in winter mode. The bogie material has also been further developed and had to prove it would remain stable under extreme minus temperatures. Some of the Velaro RUS fleet were supplied as two-system trains and can therefore be used on both AC- and DC-powered routes.

Unlike the other Velaros, the Velaro RUS has ten cars instead of eight and is therefore 50 meters longer than, for example, the Velaro E used in Spain.

Bild: Siemens Mobility Division

Partner for Chinese high-speed trains

The „CRH3“ was developed by Siemens as Velaro CN (CN for China), based on the Velaro platform. While the first three electric multiple-unit trains were manufactured at the Siemens site in Krefeld-Uerdingen in Germany, the other units were made in China using Siemens components. As with the Spanish high-speed „Velaro“ train, very high requirements apply. The operating speed of the Chinese high-speed „CRH3“ trains is up to 350 km/h. The cars are wider in comparison to the other Velaro trains. They also needed to be adapted technically to high-speed transport in the People‘s Republic of China. The sensors housed under the floor are subjected to extremely high mechanical stress, particularly as the result of pressure differences when entering and exiting tunnels at high speed.

The manufacturers and operators of this „extreme means of transport“ have placed their trust in EPHYMESS technology. As in Spain already, temperature sensors are used on the motor, transmission and wheel bearings combined with corresponding wiring harnesses in the Chinese high-speed trains.

And if you‘re interested: if, for example, you leave Moscow at 21:35 on Tuesday, you will reach Peking by 14:04 on Monday of the following week. Travelling via Mongolia, the ticket costs approx. EUR 1010.

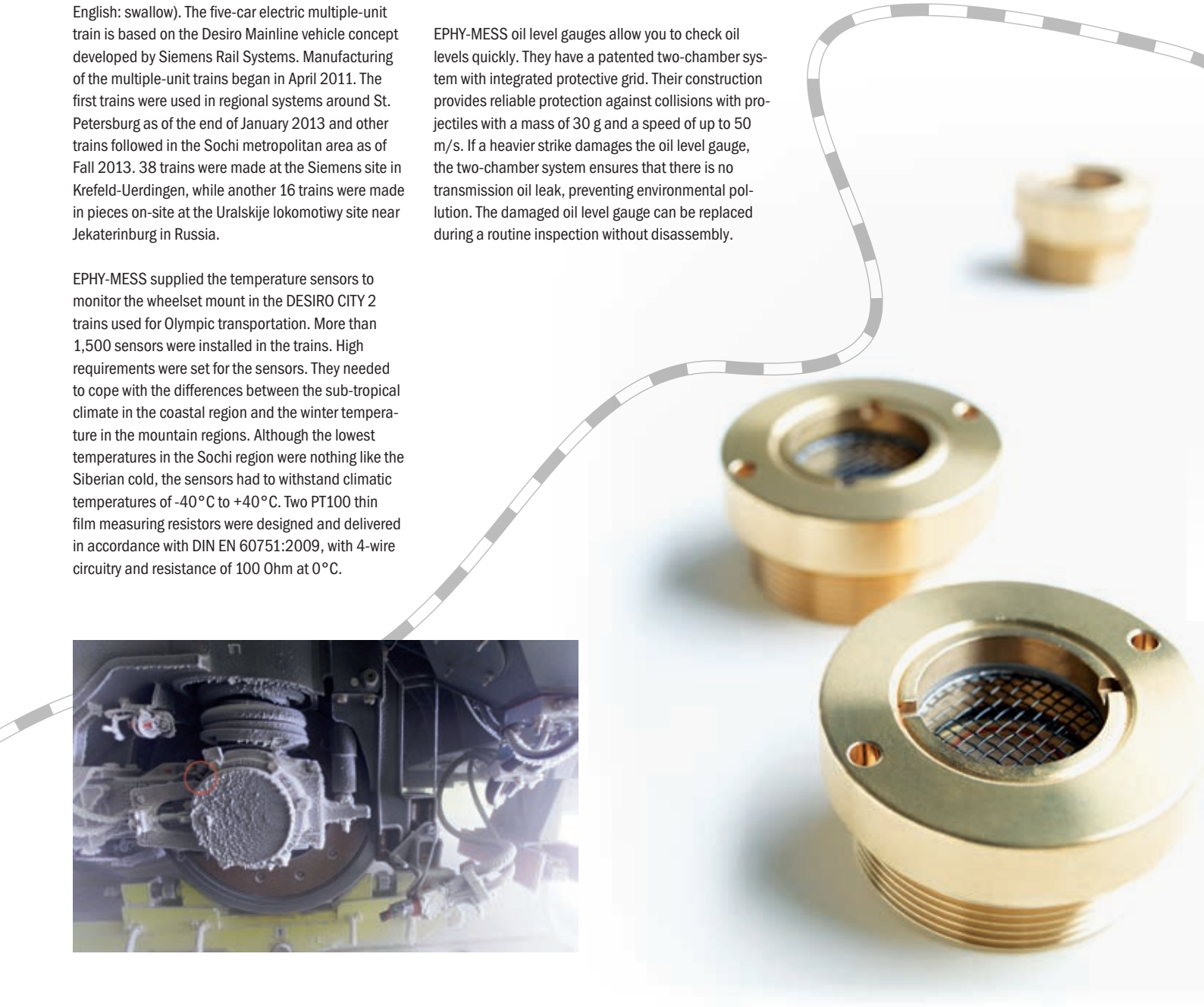
Olympic EPHY-MESS

The Winter Olympics in February 2014 in Russia: some of the competition sites in the mountain region around Krasnaja Poljana were about 50 kilometers away from the coastal region of the city of Sochi. Trains built in Germany transported the athletes and spectators between the coastal city on the Black Sea and the mountains. These cutting-edge vehicles belonging to the Russian state railway (RŽD) are part of the RŽD series ĐĐ1 „Lastotschka“ (Russian: ĐĐĐĐĐĐĐĐ; English: swallow). The five-car electric multiple-unit train is based on the Desiro Mainline vehicle concept developed by Siemens Rail Systems. Manufacturing of the multiple-unit trains began in April 2011. The first trains were used in regional systems around St. Petersburg as of the end of January 2013 and other trains followed in the Sochi metropolitan area as of Fall 2013. 38 trains were made at the Siemens site in Krefeld-Uerdingen, while another 16 trains were made in pieces on-site at the Uralskije lokomotiwy site near Jekaterinburg in Russia.

EPHY-MESS supplied the temperature sensors to monitor the wheelset mount in the DESIRO CITY 2 trains used for Olympic transportation. More than 1,500 sensors were installed in the trains. High requirements were set for the sensors. They needed to cope with the differences between the sub-tropical climate in the coastal region and the winter temperature in the mountain regions. Although the lowest temperatures in the Sochi region were nothing like the Siberian cold, the sensors had to withstand climatic temperatures of -40°C to +40°C. Two PT100 thin film measuring resistors were designed and delivered in accordance with DIN EN 60751:2009, with 4-wire circuitry and resistance of 100 Ohm at 0°C.

Alongside the temperature sensors, over 300 oil level gauges were built into the transmissions. Equipment located under the floor of railway vehicles is exposed to a high risk of stone impact. The oil level gauges used to check oil levels in traction transmissions are considered to be particularly sensitive components in this context. They need to be freely accessible and easy to clean, yet remain protected against stone impact.

EPHY-MESS oil level gauges allow you to check oil levels quickly. They have a patented two-chamber system with integrated protective grid. Their construction provides reliable protection against collisions with projectiles with a mass of 30 g and a speed of up to 50 m/s. If a heavier strike damages the oil level gauge, the two-chamber system ensures that there is no transmission oil leak, preventing environmental pollution. The damaged oil level gauge can be replaced during a routine inspection without disassembly.

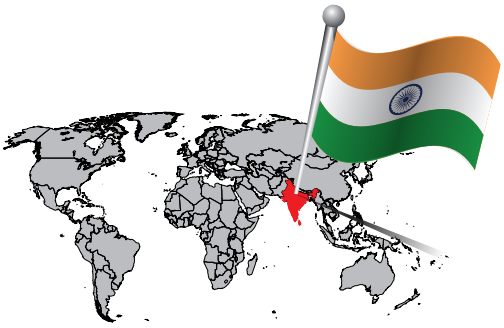


EPHY-MESS oil level gauge characteristics:

- Highly resistant against collision, thanks to two-chamber system with integrated protective grid
- System remains leak-proof, even if outer chamber is damaged
- Fast, environmentally-friendly maintenance without opening the oil container
- Customized designs available

Oil level gauges are available as standard in brass, aluminum or stainless steel housing with the following threads: M48x1.5, G1½“, G1¼“, G2“.

From Kathmandu to New Delhi

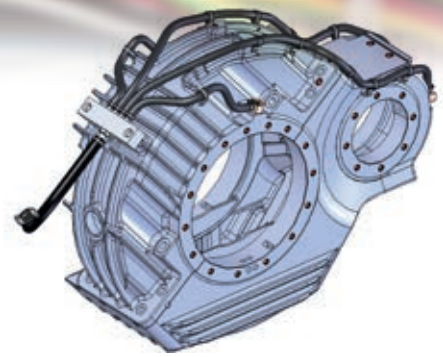


The distance as the crow flies from Peking to New Delhi is just short of 3,800 kilometers. Granted, there is no direct railway connection, but: the journey on the Tibetan railway from Peking to Lhasa is an amazing experience. From there, automobiles are required to travel to Kathmandu. From Nepal, you can then travel by railway to New Delhi. EMD GT46 Mac locomotives, made by Electro-Motive Diesel, Inc. in La Grange (Illinois/USA) are used in India. Part of the Caterpillar Group, the company is currently the second-largest manufacturer of locomotives in the world. The diesel-electric locomotives used most often in North America and across the world were made by EMD, and EPHY-MESS is on board too, with its tried-and-tested EM-DWG04 impulse sensor and corresponding temperature sensors.

We will now end our train journey today in India, as a visit to every country and railway company or train manufacturer where EPHY-MESS components are employed would need more space than the format of this newsletter would allow – indeed, it would fill a book! If you would like to find out more, please visit www.ephy-mess.de for details of our standard railway products or give us a call. We can offer solutions for all your technical requirements.

EPHY-MESS customized wiring harnesses

EPHY-MESS-Kabelbäume mit integrierter Mess-Sensorik sind aus der Bahnindustrie nicht mehr wegzudenken. Ob zum Beispiel in der nagelneuen ACS-64 Elektrolokomotive der amerikanischen Amtrak, ob im ICE oder im Velaro, in Lokomotiven des österreichischen RailJet, im spanischen Hochgeschwindigkeits-Triebzug AVE S-103 und auch im chinesischen CRH3 – die Kabelbäume aus Wiesbaden-Delkenheim sind weltweit in zahlreichen Hochgeschwindigkeitszügen im Einsatz. Mit ihrer Hilfe werden nicht nur die Temperaturen von Radsatzlagern, Motoren und Getrieben überwacht, sondern auch deren Drehzahl und Fahrtrichtung. Jeder EPHY-MESS Kabelbaum ist individuell auf die Kundenwünsche konfektioniert.



Wiring harness – installation sketch for Siemens industrial transmission

EPHY-MESS wiring harnesses with integrated measurement sensors are now an established aspect of the railway industry. Whether in the brand-new ACS-64 electric locomotive for Amtrak in the USA, in ICE or Velaro, in RailJet locomotives in Austria, the Spanish AVE S-103 high-speed multiple-unit trains or the Chinese CRH3 – the wiring harnesses from Wiesbaden-Delkenheim are at work all over the world in a wide range of high-speed trains. They not only monitor the temperature of wheelset mounts, motors and transmissions, but also their speed and direction of travel. Every EPHY-MESS wiring harness is customized to match customer requirements.

Temperatures are mainly measured by Pt100 measuring resistors with 2- or 4-wire circuitry. Pt1000 measuring resistors are also available. The sensors are well protected in a brass housing top with a stainless steel protective tube.

EPHY-MESS speed sensors with proven flange housing or the newly-developed flat housing can measure transmission or motor speed. The measurement principle is based on Hall sensors implemented in the electronics developed in-house at EPHY-MESS. And it's not just what's inside that counts. Reliable protection of sensitive components with suitable materials is also particularly important in the railway sector. Given rising requirements, the corrugated tube that was once used as standard for cable protection is often no longer enough these days. The standard protective tube has now been replaced by or supplemented with special rubber textile tubes. One particular highlight is the cable splitter made by EPHY-MESS. This divides the incoming wiring harness into its individual arms/branches. It can be made from milled brass or aluminum and can also be used to attach the wiring harness to the end device, e.g. transmission housing. You can therefore combine sensors to form a wiring harness, usually 2-4 sensors but more if required. Obviously, the wiring harnesses comply with all necessary requirements, such as DIN EN 60751, DIN EN 61373 and fire safety standards.

EPHY-MESS has been IRIS-certified (International Railway Industry Standard) since July 2009 and is optimally equipped to cope with the demands of the railway industry. Its wide range of products and ideal customer focus, combined with scrupulous quality checks on every component, ensure that EPHY-MESS maintains its market position and prevails over copycats from low-wage countries.

Zero-speed sensors

Speed sensors always display whatever they can even at zero speed. The top performers are the DWG04 with classic flange housing and straight cable outlet, the DWG05 with flange housing and side cable outlet and the flat DWG21.

All these sensors have the same brass housing and are also available in stainless steel upon request. They all have an 8-24V DC power supply (with protection against reverse polarity) and short-circuit-protected signal outputs. Special versions of the DWG04 and DWG05 sensors are available, e.g. push-pull signal outputs and electrically isolated power supplies for each channel.

Precise measurement of rotary motions

The most important characteristics of these speed sensors are the measurement range and auto-calibration. The measurement range reaches from 0.0125Hz to 25kHz. 0.0125Hz means that it takes 80 seconds until a single tooth of the sensor wheel passes the sensor. There is no real discernible movement of the object at this speed, but it is still registered. This slow repeated rhythm is no problem for the sensor: even lower frequencies have been measured with the speed sensors on the test bench. The signals are unique and stable, in the same way as when vehicles are stationary. Every time you „power on“, auto-calibration ensures that the optimum values are used for sensor wheel recognition. All it takes is for one tooth of the sensor wheel to pass the sensor.

Railway technology suppliers in developing and emerging countries have long since recognized these outstanding characteristics, but a quite different problem often applies there. Mechanical and electrical factors need to be taken into consideration when „retro-fitting“ old locomotives. These range from the different mechanical dimensions of the sensors to be replaced to the power supply. EPHY-MESS can also help with these issues and fulfil the customers‘ requirements.

Our tried-and-tested electronics are packaged in corresponding housing. Cables and plugs are adapted accordingly. The customer receives a product that complies with the latest specifications and that can be installed directly even in old locomotives without any mechanical or electrical modifications being required. Truly „Plug & Play“.

For all the most important technical details, see:

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