Sistema di controllo dalla marcia del treno

SCMT train protection – Italy

2008_GB

DEUTA-WERKE
The Transport Vision Company
Train protection in Italy

The project:
Train protection in Italy

Trenitalia has been innovating the signalling system of the core network on Italian routes since 2002. In 2008, the train protection system SCMT (Sistema di controllo della marcia del treno) will be launched on a route network of roughly 11,000 km.

9,200 trains transport an average of approx. 1.4 million passengers and 220,000 tons of goods each day.

The task:
Maximum functional safety with the highest possible availability

DEUTA is involved in this project with the DF 16 pulse generator and the SIL 2 ESG 14 indicator device. Roughly 4,000 trains have been retrofitted up to now. As few pulse generator variants as possible should be deployed for all of the different locomotive types. This was a challenge for the Deuta constructing engineers. The high SIL 2 safety requirements were linked to the indicator in the driver’s console to achieve SIL 4 in the train protection system.

The individual development stages were defined here in close co-ordination with the customer.

Creativity in the construction reduces diversity

To measure the vehicle speed, the DF 16 pulse generator was adapted to the specific requirements of SCMT. Concretely, the electronics and the housing construction were changed. Because of the constructive adaptation, it was possible to reduce the variant diversity for the entire fleet to 2 basic constructions.

All vehicle types were optionally equipped with a two-channel or four-channel design.

The DF 16 generates output frequencies that are proportional to the speed. The vehicle electronics evaluates the frequencies. The channels guarantee redundancy and make it possible to determine the driving direction. The four-channel pulse generator permits the simultaneous operation of SCMT and DIS – the equally safety-related Driver Information System.

More safety through integrated monitoring

To visualise the speed in the driver’s console, DEUTA chose the ESG 14 electric stepper motor indicator. A special feature of the ESG 14 is its integrated monitoring system which always informs the user about the functionality of the device. A control element specifically for the SCMT application was integrated beneath the speed indicator. This element monitors the functionality of the indicator and checks whether information about the speed is available. If there is no error, the SCU (speed computing unit) supplies the control element with current so that the indicator is dark. The train driver recognises an error, or misinformation, by the red-white signal.

“The indicator in the driver’s console satisfies the SIL 2 safety standard and thus contributes towards achieving SIL 4 in the train protection system. – We would be pleased to make suggestions for project-specific solutions.”

Richard Durand, DEUTA
**DF 16 – The optoelectronic pulse generator**

- Compact structure and primarily maintenance free
- Specifically designed for rough use on railway vehicles
- Pulse part with optoelectronic fork light barriers
- With up to four electronic pulse generator channels – different mutual phase relationships are possible
- Two-track system can realise two different resolutions
- Galvanically isolated channels
- Switch box or hinged cable
- The output frequency rises in proportion to the speed
- Pulse evaluation and level monitoring occur in the vehicle electronics
- The phase offset enables the recognition of the driving direction

**ESG 14 – The Electric Indicator**

- Analogue display of diverse types of measuring sizes
- For input change, tracks the pointer without noticeable, disrupting stages
- Its adjustment speed corresponds to that of a conventional indicator device
- Pointers and scales are created according to the latest ergonomic findings
- The point position is continuously monitored by an autarkic system

**ESG 14 cy**

- Panel cutout: ø 138⁺¹ x 138⁺¹ mm
- Installation depth: approx. 140 mm incl. plug
- Weight: approx. 1 kg
- Mounting: Tensioning elements at the housing
- Installation position: 0 – 90 – 180°
- Protection category front face: IP 54
- Protection category plug: IP 41
- Connection: 2 x D-Sub 15-pole
- Lighting: Internal with LED
- Operating voltage: 24V DC ±30 %
- Control: RS 485 protocol
- Feedback: RS 485 protocol
- Error message: LCD
- Pointer deflection: max. 320°
- Accuracy class: 0.6 %
- Adjustment speed: 60°/± second
- Temperature range: -25°C to+70°C
- Test voltage: 1,000V, 50 Hz, 1 min
- Vibration testing: in accordance with EN 61373
- Device definition: EN 50155, EN 50121-3-2
- Housing: Aluminium, black lacquer
- Additional indicator: 2 signal lamps, 1 error detector

**DF 16**

- Working principle: 1 to 4 channel pulse generator
- Pulses per revolution per channel (1 to 128): upon request
- Current consumption per channel: max. 50 mA
- Load current: max. 100 mA
- Phase shift: K1 - K2 - K3 - K4
- Pulse duty factor: 0.5 to ± 0.2
- U high: 10V DC to 30V DC
- U low: < 2V for monitoring purposes
- Operating temperature: -40 to+70°C
- Rotational speed range: 0 to 2,000 min⁻¹
- Insulation channel/housing: 1,500V, 50 Hz, 1 min
- Protection category housing: IP66
- Protection category drive side: IP54
- Weight without plug and drive: approx. 2.3 kg
- Vibration testing: in accordance with EN 61373
- Device definition: EN 50155, EN 50121-3-2
- Drive/ Drive version: a: Cross-slotted
  - ac: Drive fork
  - ad: Driving tongue
  - af: Driving disc