Installation Instruction

English

Lightning protection

for vehicle scales with RTN load cells

HBM

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1 General information

Electromechanical road vehicle scales are used to weigh trucks and similar vehicles.

The steel or concrete platforms for these vehicle scales are usually installed in the open air. This means that the high-precision electrical and electronic components of the scale are frequently exposed to the possibility of lightning strikes.

Using RTN load cells, a grounding concept adapted to the on-site conditions, and expert protection of the evaluation electronics, can drastically reduce the risk of lightning damage.

1.1 Lightning protection for weighing systems

Complicated processes in the atmosphere result in huge electrical charges within thunderclouds, which generate a field between the clouds and the ground. There are approx. 2000 storms at any time around the world. When these fields are discharged (lightning), very high currents flow, producing strong electric fields throughout the surrounding areas. Approx. 100 lightning flashes (around 15% of all lightning flashes) reach the ground every second.

The electric fields of lightning that occur up to a distance of about 300 m, and therefore occur indirectly, can also affect the functionality of systems with electronic components - including modern weighing systems - and can actually lead to such systems failing. Direct lightning strikes to unprotected systems usually lead to total destruction due to the energy contained within the light-

ning. Some typical lightning current parameters are given below:

Parameters	Current peak value	Gradient	Charge	Specific energy
Typical values	2 - 200 kA	2 - 200 kA/µs	150 - 300 As	2.5 - 10 MJ/Ω

1.2 Lightning damage to weighing systems

Modern weighing systems generally consist of load cells based on strain gages and electronic evaluating devices. Most lightning damage to such systems is not due to a direct lightning strike but the effects produced by distant strikes. Either a partial current from the lightning finds its way to the weighing system or an overvoltage is induced in the system due to the high lighting currents. These mechanisms can destroy the strain gages and balancing resistors in the load cells, as well as the evaluating electronics.

1.3 Principles of lightning protection

There is a difference between external and internal lightning protection. A vehicle scale set up in the open air can be protected from direct lightning strikes by an arrester device. This is external lightning protection. However, a strike into the arrester generates a strong electrical field which can, in some cases, destroy the weighing system. Electronic devices cannot be protected without additional lightning protection.

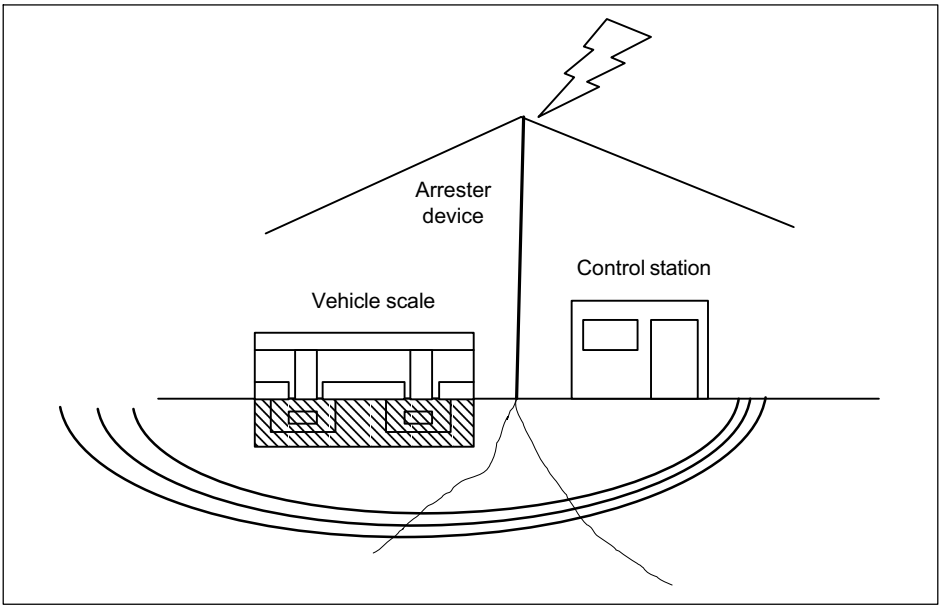
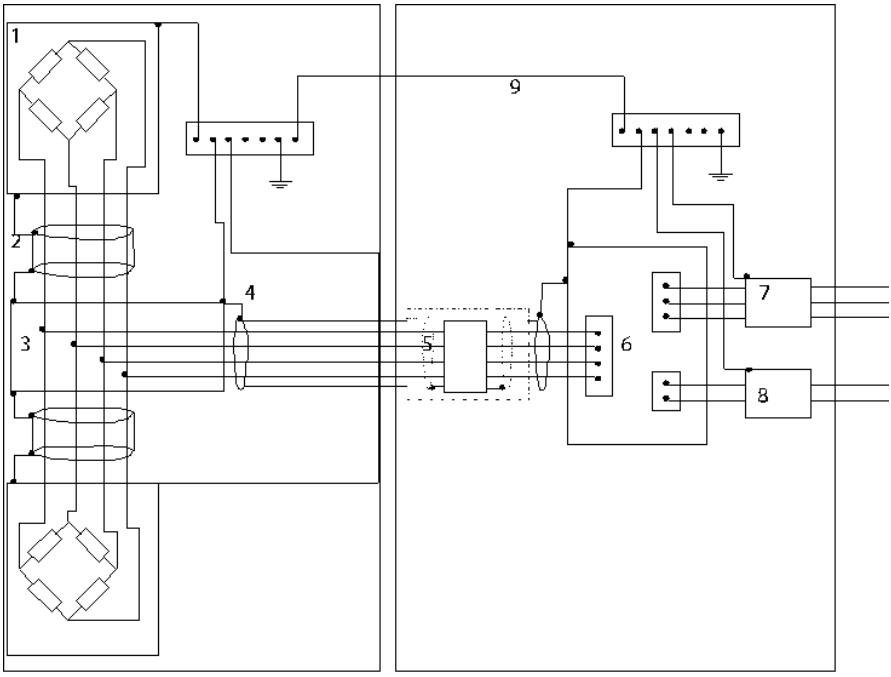


Fig. 1.1 Principle of external lightning protection

In contrast, the internal lightning protection enables a degree of protection of well over 90% to be achieved. This high level of lightning protection can only be achieved when the system, consisting of scale and control station, and including all connection lines to this system, is protected. Internal lightning protection measures include *potential equalization between individual components and comprehensive shield connection*.



1 RTN load cell (analog); **2** Shielded load cell cable; **3** Junction box/connecting box VKK(R); **4** Shielded cable to control station; **5** Surge voltage protector for weighing indicator in metal enclosure (e.g. Dehn ALGA5 aluminum enclosure, with BXT BAS basic element, BXT ML4 BE 60 (920 242) protective equipment and BXT ML2 BD S 12 (920 242) protective equipment); **6** Weighing indicator (e.g. WE2111); **7** Surge voltage protector for data lines; **8** Surge voltage protection for voltage supply; **9** Potential equalization line (in addition to the installed shielding, a potential equalization conductor (min. 16 mm^2 Cu) must be run between the weighing installation and the electronics)

Fig. 1.2 Principle of internal lightning protection, using a vehicle scale installation with potential equalization and weighing indicator protection against overvoltages as an example.

1.4 Lightning protection on a vehicle scale with HBM components

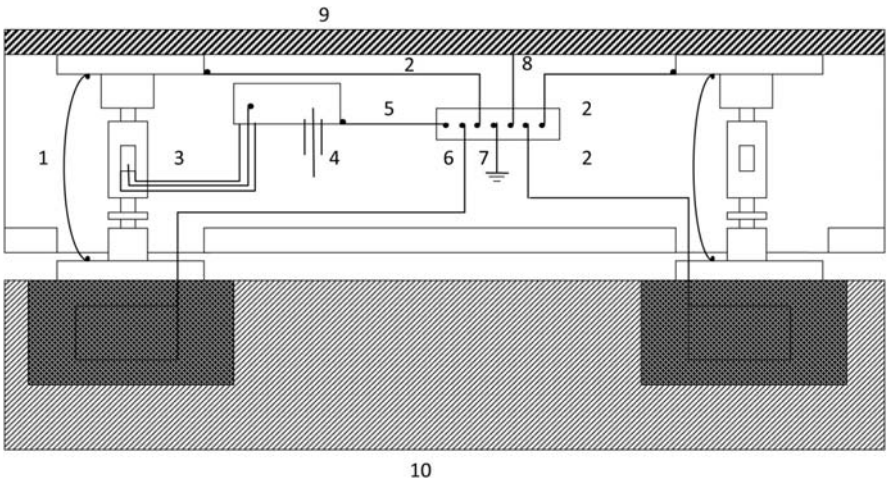
HBM products make an effective contribution to lightning protection in this regard with the HBM shielding design for signal leads.

The destructive effects of a different potential between scale and control station are avoided by the cable shield being properly connected on both sides to the load cell and the electronics. In addition to the installed shielding, a potential equalization conductor (min. 16 mm^2 Cu) must be run between the weighing installation and the electronics. Compensating currents flow across the cable shield without destroying the load cell and the electronics. The measure also offers excellent EMC protection. HBM load cells with the CE mark have extensive contact between the cable shield and the enclosure.

Good, star-shaped potential equalization within the scale, created with suitable ground cables, is also important for lightning protection. Potential equalization ensures that different potentials within the scale are minimized, if there is a lightning strike. This avoids high compensating currents flowing through the metrological components. The ground cable cross-sections should have at least the following values:

- Cu = 16 mm²
- Al = 25 mm²
- Fe = 50 mm²

Shorter lengths are more important than large cross-sections for the effectiveness of the potential equalization. The use of foundation reinforcement for grounding is an inexpensive and effective method and can, in some cases, save on further grounding measures. This grounding also has outstanding protection against corrosion.



1 Ground cable to connect top and bottom of the load cell; **2** Ground cable to star-shaped potential equalization; **3** Shielded load cell cable with shield contact on both sides; **4** Shielded cable to weighing indicator with shield contact on both sides; **5** Ground cable to distributor box; **6** Ground cable to foundation reinforcement; **7** Ground cable to local ground; **8** Ground cable to weighing machine platform (in the case of concrete platforms, to platform reinforcement); **9** Weighing machine platform with (reinforcement); **10** Foundation with reinforcement

Fig. 1.3 Lightning protection for a vehicle scale

Information

Depending on the actual on-site situation (weighing machine platform and control station really far away from one another, unexpectedly high ground potential over the longer term, specific underground conditions, etc.), a different protection concept may be required. Please contact a specialist company, to work out an effective protection concept for your particular on-site situation.

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