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The Application of Digital Sensors in Electronic Car Scales

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Abstract

This article introduces the working principle of digital weighing sensors, analyzes the characteristics of digital weighing sensors, including convenience and speed, strong anti-interference ability, good lightning protection performance, and high working reliability. After installation, on-site debugging and application, it was found that the equipment met the weighing and measuring requirements, worked stably, measured accurately, and greatly improved the high-tech quality of electronic truck scales.

Keywords

Mathematical Sensors; High Accuracy; Surge Protection.

1. Preface

At present, analog weighing sensors are mostly used on electronic truck scales, which are easily affected by various external factors during operation, resulting in unstable measurement data. Once problems occur, a large amount of time is required for maintenance, seriously affecting work efficiency. In addition, after replacing the sensor, it is necessary to contact the metrology department for re calibration before use, which causes significant waste of manpower, material resources, and financial resources. The digital weighing sensor has the characteristics of stable operation, high reliability, and significant anti cheating effect.

2. The Working Principle and Performance Parameters of a Digital Weighing Sensor

The digital weighing sensor system is developed from the traditional resistance strain gauge, which integrates advanced microelectronics and microcomputer technology, promoting the continuous improvement of weighing work efficiency.

Digital weighing sensors are mainly composed of analog sensors and digital conversion modules in a certain structural form, which can meet the requirements of various weighing methods. Among them, the digital module is essentially an electronic circuit with very high integration. In order to achieve rapid weighing, the amplifier, A/D are integrated using SMT mounting technology.

The corresponding accessories such as converters and microprocessors are connected in a certain way to achieve the purpose of weighing.

2.1 Working Principle

1) In the actual weighing process, the weight information measured by the sensor is transmitted in the form of millivolt signals, which are further transmitted to the front-end position of the amplifier after being processed by the strain gauge. In order to ensure the quality of signal transmission and minimize errors and electromagnetic signal interference during the transmission process, it is necessary to effectively control the length of the transmission wire within the range of 8mm.

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2) After further processing in an ultra-low noise precision instrument, the analog signal is amplified and transmitted to an A/D converter through an amplifier. The built-in A/D converter uses the highest precision 24 bit converter currently available, with a resolution of up to 0.6X10-9 during operation. It can accurately identify all transmitted signals, thereby limiting signal loss to a reasonable range, ensuring high-quality signal conversion.

3) The signal processed by the A/D converter is further transmitted to the core processor CPU, which can comprehensively calculate and correct various errors caused by environmental factors, ensuring that the measurement data can objectively and truly reflect the actual situation.

4) The data processed by the core processor CPU is output through the RS485 interface, which has excellent performance and can transmit up to 1.2km, especially in harsh electromagnetic interference environments, ensuring high-quality signal transmission.

2.2 Main Performance Parameters

Table 1. Main Performance Parameters of Digital Weighing Sensors

Performance	parameters	Performance	parameters
Data refresh rate/(times. S^{-1})	10-200	temperature range/℃	-40-80
Data transfer rate/bps	9600-38400	zero point input	< ± 0.1% F.S
Digital module A/D code	10 million	safety overload	150% F.S
Sensor maximum output/code	60000	Sealing level	IP68
Module Zero Temperature coefficient	<±0.002% F.S/10 ℃	Recommended output voltage/V	9-12
Module sensitivity Temperature coefficient	<±0.002% F.S/10℃	Recommended output voltage/V	25
Sensor creep (30min)	<±0.002% F. S	recommended output voltage/V	1200
sensor Temperature coefficient	<±0.001% F.S/10℃	Accuracy level	C3

3. Characteristics of 2 Digital Weighing Sensors

(1) Long transmission distance, fast communication speed, and significant anti cheating effect. Compared to analog sensors, digital sensors use digital signals for transmission, and the electrical frequency during the transmission process is very high, usually more than a hundred times that of the former. This greatly improves its anti-interference ability and transmission speed, and can meet the transmission needs in harsh environments. At the same time, corresponding confidentiality protocols are also built-in, which can detect and take effective control measures in a timely manner in case of remote control cheating during the transmission process, ensuring the safe transmission of data.

(2) Strong anti-interference ability, high reliability, and good lightning protection performance. Digital weighing sensors have a wide range of adaptability, with a protection level of up to IP68. They can still operate normally in harsh environments, minimizing the adverse effects caused by various external disturbances, and ensuring stable signal transmission.

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(3) Exemption from calibration. The digital weighing sensor has been calibrated using a standard force measuring machine in production, and its output corresponds to the standard value. Since it has basically no loss during transmission, the read value is the actual measured value, which can eliminate the calibration process.

(4) The angle difference adjustment is convenient and easy for the scale body composed of digital weighing sensors. As long as the load is applied to each corner once, the angle difference coefficient of each point can be calculated, and the angle difference adjustment can be automatically carried out, eliminating the trouble of repeatedly loading weights. The angle difference adjustment can be completed through one load, improving efficiency.

Application effect of 3 digital weighing sensors

The digital weighing sensor mainly replaces the analog sensor of each truck scale with a D2002E digital sensor, connects the on-site digital sensor with a dedicated stainless steel double shielded cable, and is equipped with a complete set of digital weighing displays. After installation, accurate measurement verification was carried out through on-site debugging, meeting the weighing and measuring requirements. Currently, this system has been working stably and measuring accurately. It is not difficult to find that the digital weighing sensor group scale has the advantages of convenience and speed, strong anti-interference ability, good lightning protection performance, and high working reliability.

4. Problems with Digital Weighing Sensors

Although the intelligence level of digital weighing sensors has greatly improved and they have self diagnostic functions, making it easy to find faults, if a digital weighing sensor or digital weighing display malfunctions, it is necessary to standardize the communication protocol due to the different communication protocols of different manufacturers, in order to achieve the interchangeable use of digital weighing sensors and digital weighing displays from different manufacturers.

5. Conclusion

Digital weighing sensors have excellent performance and can provide communication and fault diagnosis capabilities with each digital sensor for the weighing system. The use of advanced digital intelligent weighing sensors and digital weighing display instruments on electronic car scales results in better overall performance, stronger environmental adaptability, and higher degree of weighing intelligence. This can greatly improve the high-tech quality of electronic car scales and enable them to embark on the path of digitization.

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