SWB605 PowerMount™

# Comparing PowerMount™ with Analog Weigh Modules

**METTLER TOLEDO's new PowerMount™ weigh modules continuously monitor load cell performance, discovering variances before they impact productivity. This allows manufacturers to stay in control of processes and avoid mistakes before they cost money.**

Without the kind of continuous monitoring offered by POWERCELL®, errors such as load cell overload, poor communication between modules, out-of-symmetry errors, and out-of-range temperatures can go unnoticed for long periods. When they do, out-of-specification batches and poor quality product are the result. Significant costs and damage to company reputation can occur.

PowerMount™ POWERCELL®- equipped load cells with on-board microprocessors not only alert operators to performance degradation — they also adjust the weighing signal to compensate for environmental changes. This allows PowerMount™ weigh modules to provide accurate weighing regardless of the effects of temperature, linearity, hysteresis, and creep. In the unlikely event of load cell failure, PowerMount's design also makes individual load cells easy to replace.

Global approvals are standard on PowerMount™ load cells, including OIML, C3, NTEP 5K , OIML C6, and NTEP 10K .

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# 1 Types of Weigh Module

A weigh module is a weighing device that attaches to the supports of a tank, platform, conveyor, hopper, vessel or any structure used as a scale.

Today there are two types of weigh module systems being offered: Systems equipped with analog load cells and systems with digital POWERCELL® load cells. POWERCELL® load cells incorporate the A/D conversion electronics and provide digital CAN bus output.

Measurement errors caused by temperature, creep, non-linearity, hysteresis, etc. are compensated digitally in POWERCELL® and allow for better accuracy and tighter tolerances.

Understanding the differences in their features and operation can help you choose a system that will be accurate and reliable, providing the most value for your investment.

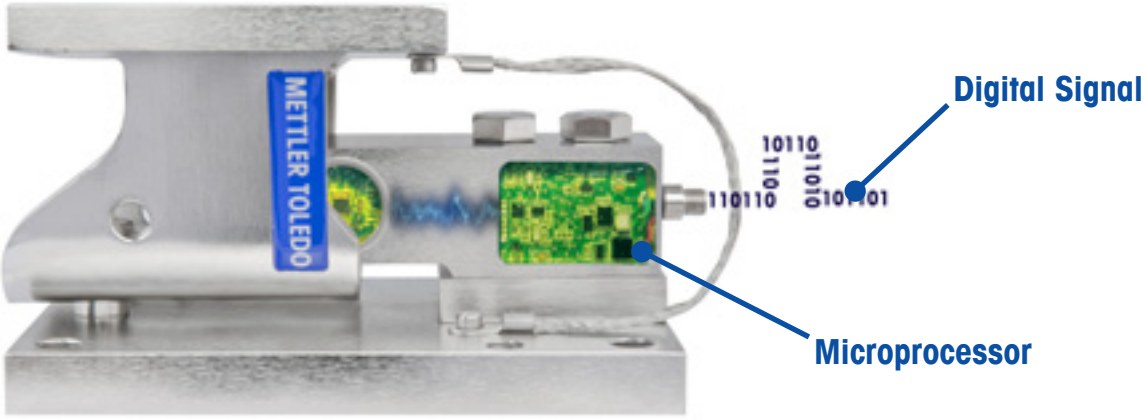


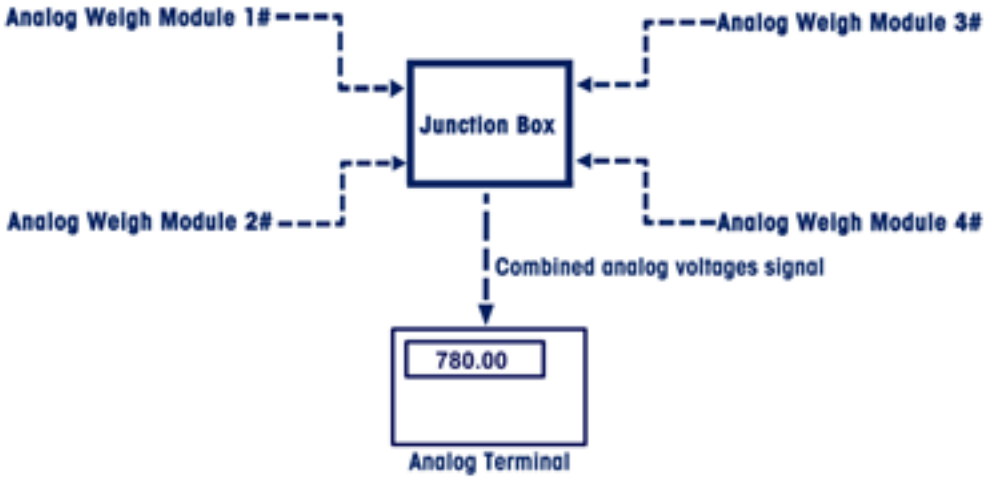

Figure 1 – View into a Weigh Module with POWERCELL®

## Analog System Architecture

An analog weigh module system usually requires the following devices:

- Weigh modules with analog load cells and their cables
- Junction box
- Home-run cable to the Terminal

In an analog system the cables and junction boxes have a significant impact on the very low level signals and the system must be calibrated as a whole. Any change or replacement of parts requires a full recalibration of the system. In addition, system performance is impacted because the small analog signal is susceptible to RFI/EMI and degradation due to moisture.

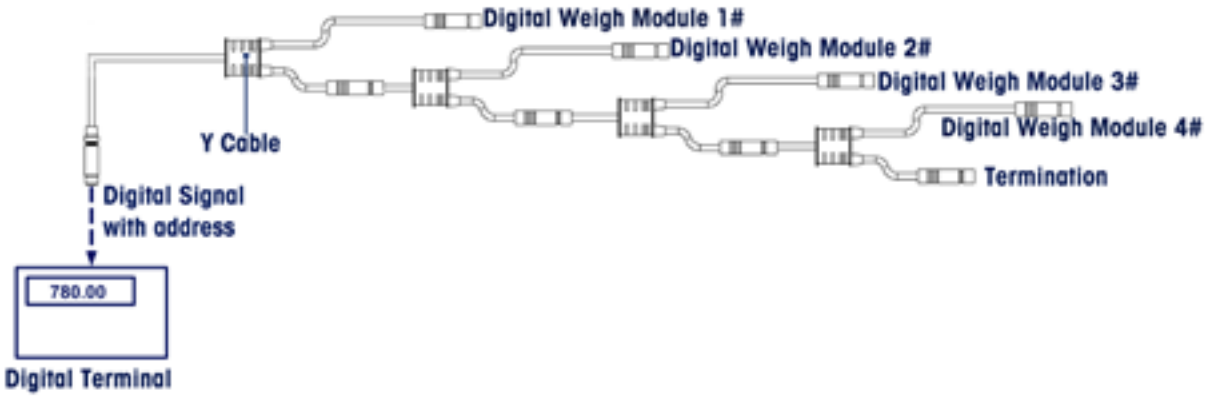


### POWERCELL® System Architecture

In contrast, a POWERCELL® weigh module system consists of the following:

- Weigh modules with POWERCELL® load cells
- Separate cables attached via connectors
- Termination resistor for last load cell on network

Obviously such a system has no junction box, thus one significant component less influencing the system performance and reliability. Not so obvious is the fact that the weighing information is provided digitally and hence the cables do not influence the system performance at all. That allows changes or replacement of cables at any time without impacting performance.




# 2 Performance Differences

### Signal Content

Analog systems only provide the combined signal of all load cells. Thus it's impossible to monitor individual load cells from a central unit like the terminal. Load cell failures very often go undetected in such a system with consequences that can be very significant. The POWERCELL® network handles the weight information from each load cell separately. Thus the terminal can monitor every load cell individually and can make judgments on load cell and system condition.

### Signal Strength

Analog signal strength is very low. Each incremental step on the terminal display relies upon detecting a signal change from the load cells of approximately 5 millionth of a volt (5µV). It's easy to understand that such low signals can be disturbed easily by mobile phones, proximity to large electric motors, moisture, etc.

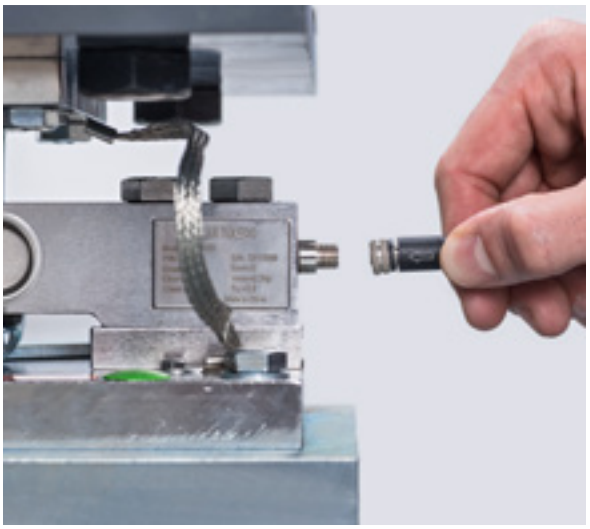
POWERCELL® uses CAN Bus for data transmission. It is a very robust +/- 5V digital signal commonly used in the car industry.

### Data Sample Rate

In an analog system the speed is determined by the terminal only. Additionally with POWERCELL® the CAN Bus update rate could become a limiting factor. For most POWERCELL® systems the update rate is 40Hz which means that the terminal remains the limiting factor.

## Cable influence

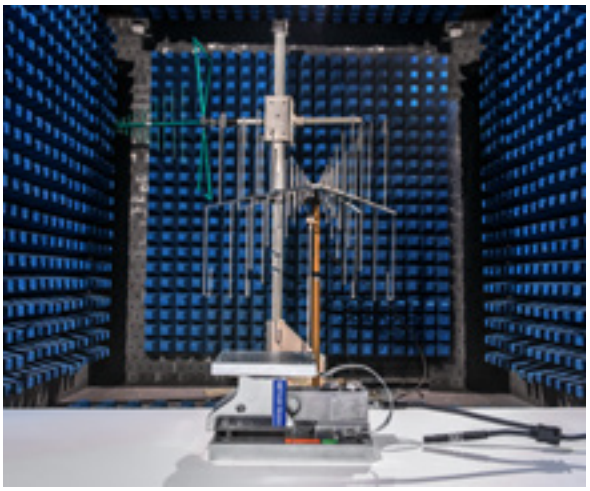
As stated before, analog cables have a significant impact on system performance. Cable length, cross-sectional area, quality, shielding, 4 versus 6-wire, etc. all influence performance. Sometimes simply to bend the cable differently can have a significant impact. That leads to the inconvenient fact that any analog system must be calibrated as a system. Any change needs recalibration which can be a huge effort especially for larger tank scales.



The POWERCELL® system performance is totally independent of the cables, thus cables can be changed at will without influencing the calibration. Cable defects can be fixed in minutes.

## EMI Immunity

EMI Immunity is a measure of a system's ability to withstand influence on its performance by external electromagnetic fields such as those caused by mobile phones, high current lines, etc. Analog systems with their low signal strength are very sensitive to installation methods and conditions. A guaranteed EMI immunity would require full system testing, which is impractical to do.



In contrast, POWERCELL® load cells can guarantee modern 10V/m field strength system immunity as all components are controlled and the digital signal is much more robust.

## Accuracy

A key difference between analog and POWERCELL® load cells is the method by which the errors inherent to any load cell are compensated. This table summarizes the major sources of error and indicates which can be compensated readily in production for analog and POWERCELL® load cells.

Comparison of production compensations possible with analog and POWERCELL® load cells

| Parameter | Analog Load Cell | POWERCELL® Load Cell |
|---|---|---|
| Zero temp. effect | yes | yes |
| Span temp. effect | yes | yes |
| Linearity | no | yes |
| Hysteresis | no | yes |
| Creep | no | yes |
| Zero Return (after 30 min) | no | yes |
| Creep TC | no | yes |
| Temp. effects on A/D | no | yes |

Analog load cells use passive components to compensate temperature effects and to adjust calibration. Passive components are available in a limited range of values thus limiting the precision with which any compensation can be made. .Practically speaking this leads to a wide variation in tolerances which causes analog load cells to vary and to be non-interchangeable.

POWERCELL® on the other hand uses the in-built microprocessor and sophisticated sensors and algorithms to compensate performance errors. All of the major sources of error are compensated automatically. Two practical consequences are worth mentioning. First of all higher accuracy is possible even up to the unique OIML class C 10000e performance level which is 3 times higher than standard. Secondly POWERCELL® load cell outputs are matched much more tightly making them 100% interchangeable in the field. A very important fact when it comes to changing defective load cells without the need to recalibrate the system.

# 3 Calibration Differences

## CalFree™ vs. CalFree™ Plus

CalFree™ weightless calibration of larger systems, where calibration with test weights or other means would be impractical, is state of the art. Basically the factory calibration of the load cells is manually transferred to the final system. Analog load cell systems with the uncertain impact of cables, junction boxes and cross talk between cells reduce the transfer accuracy. Additionally the accuracy of the calibration relies on calculations by the technician and means to double check a CalFree™ calibration are limited. In the worst case a completely inappropriate calibration goes unnoticed.

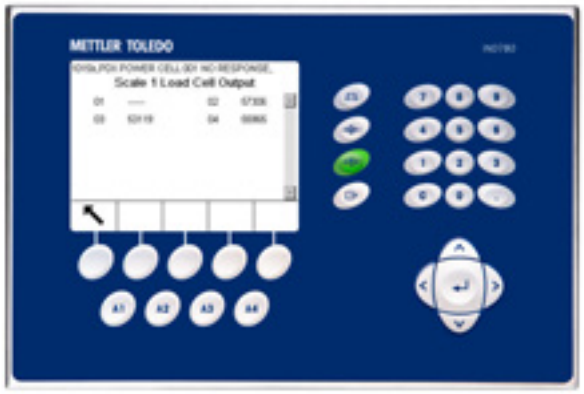
POWERCELL® CalFree™ Plus eliminates many potential sources of failure. Cables have no impact, junction boxes and cross talk effects do not exist and calculations by the technician are not required. Thus the reliability of the calibration with POWERCELL® using CalFree™ Plus is significantly better.

# 4 Diagnostics and Maintenance Differences

What happens when a signal from an analog weigh module is incorrect due to degradation or other reasons? If the error is significant, the scale operator may notice and investigate the cause. However, this would require an experienced operator and be likely only if a weigh module was completely "dead". Otherwise, the scale operator has no way of knowing if the scale is inaccurate. Consequences can be severe, depending on the importance of the equipment to the quality of the final product.

In a PowerMount™ weigh module system, each load cell is equipped with sensors that monitor the performance of each cell. Should a problem be imminent, a message is generated at the scale terminal noting the specific cell affected and the issue it is experiencing.

The scale can continue to operate normally until the load cell can be replaced at a scheduled time. Monitoring the integrity of each load cell eliminates "hidden" problems that eventually can cause unexpected scale failures.




# 5 Conclusions

A PowerMount™ weigh module system helps to avoid hidden failures which can lead to significant consequences in the end product quality and associated costs. It allows repairs to be made before a failure actually occurs. It also supports quick recovery as the need of recalibration after service is eliminated. This table summarizes the benefits.

| POWERCELL® Features | Benefits |
|---|---|
| Predictive Maintenance | Avoid undetected failures which could create lots of follow up costs.<br>Carry out repairs before final scale failure. |
| Digital signal and cables with connectors | Cables can be replaced easily w/o the need to recalibrate |
| microprocessor compensation | Superior Accuracy up to OIML class C 10000e.<br>Tight tolerances make load cells interchangeable and eliminates the need for recalibration after load cell replacement |
| Strong Digital Signal | EMI immunity to 10V/m guaranteed |
| CalFree™ Plus | Accurate transfer of load cell factory calibration to the system. |

**www.mt.com/ind-powermount**

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