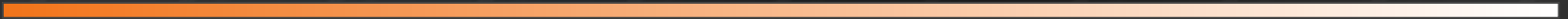


Is Your Scale Optimized?

*Precision and Peace of Mind
with **Digital and IoT Solutions***

Eric McDonald
Cech Scales
www.cech.com





Thanks for the invite!

Cech has served all industries in Michigan since Tony Cech started in 1936, in Saginaw.

Bolstered by Hilde McDonald from 1980s to 2020s (Saginaw, Wixom offices)

Top left, circa 1930s
Bottom, 2020s

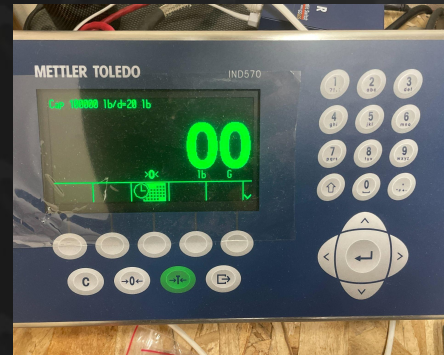
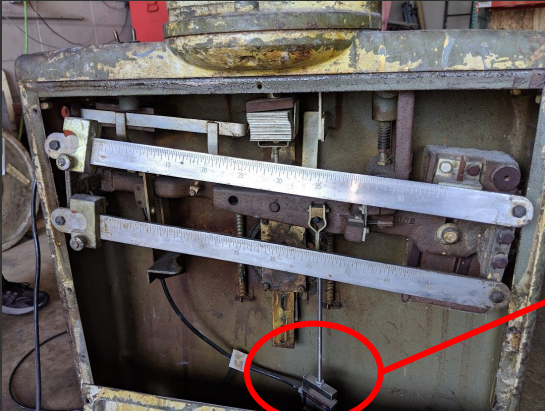
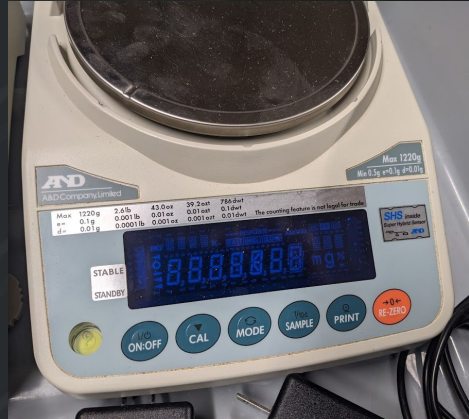
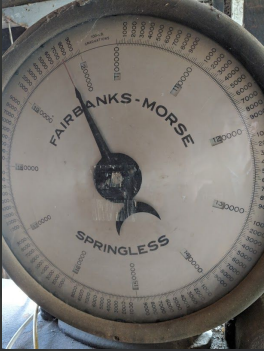




We / Michigan have a significant industries, we're 'down to Earth' and essential.

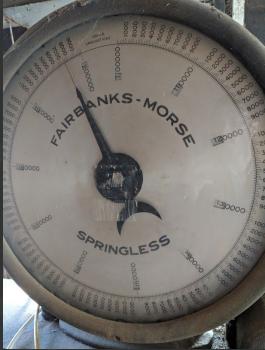


Actually What's Digital?

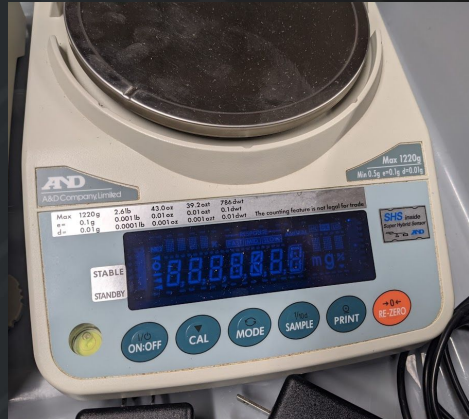


Digital >> the Load Cell, not the Display

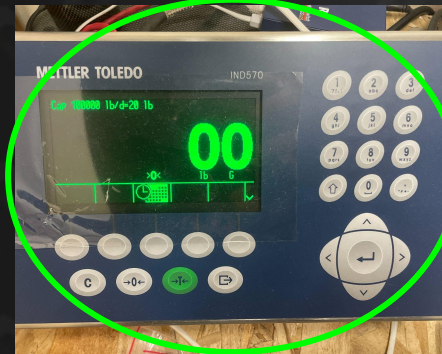
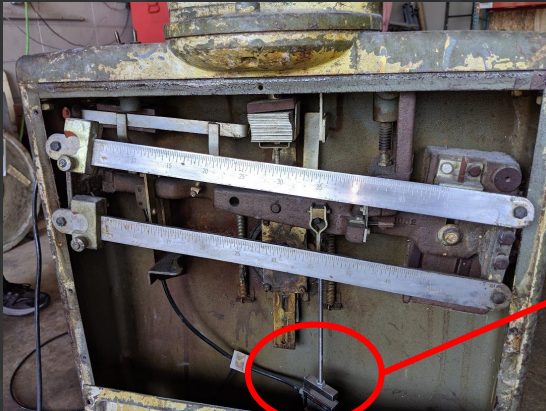
Mechanical converted to analog cell



Analog cell



Full mechanical



← Digital

Have to see the 'guts' to know

Is this You [yet]?

You are growing the aggregate business, opening new sites, and America needs your stuff.

You have amazing People and own some if not all of your equipment.

Operations have great process control and downtime is minimal and manageable.

You're an A+ producer.



So what's the problem?

Unaccounted Material is Lost Money
Risk of Reputation

*“You don't know how much you're losing 'til you get a truck scale”
- Actual MAA Folks*

*“Your Scale is your cash register”
- Cech Scales*

But 1st:

Let's prove it

Payloader scale: AKA onboard scales,

Typically have an accuracy range of $\pm 0.5\%$ to $\pm 3\%^*$ of the total load weight..

Concrete Sand ~\$11 / ton
2NS Sand ~\$25 / ton
Beach Sand ~\$35 / ton

\$11 to 35 / ton,
or \$0.005 to 0.02 / lb

~120k lb = 60 ton NET gravel train
60 ton x \$25 a ton = ~\$1.5k
\$1.5k x 1% = \$15 a load
10 trucks = \$150 a day
\$120k scale / \$150 = 800 days

Scale paid off in ~2yr of 'variations'

*Scales are legally rated at 0.01% (1 in 10,000), or 100+ times better

So you got a scale!

Disclosure: **We work with ALL scales**

Just like to show you the whole picture of what's out there

*Digital premium ~10%

*And pit scale is
~\$120k installed

A 10% premium, *at first*

Avg +/-100 lb* @ 120k lb

Avg \$0.012 a lb x 100 lb = \$1.25 a load

10 trucks = \$12 a day

\$12k / \$12 = 1k days ~3 yr

And scale last ~20+ yrs;

Analog costs ~\$70k+ MORE in misses

*Based on similar, real-world testing data

But not all Scales are the same..

So:

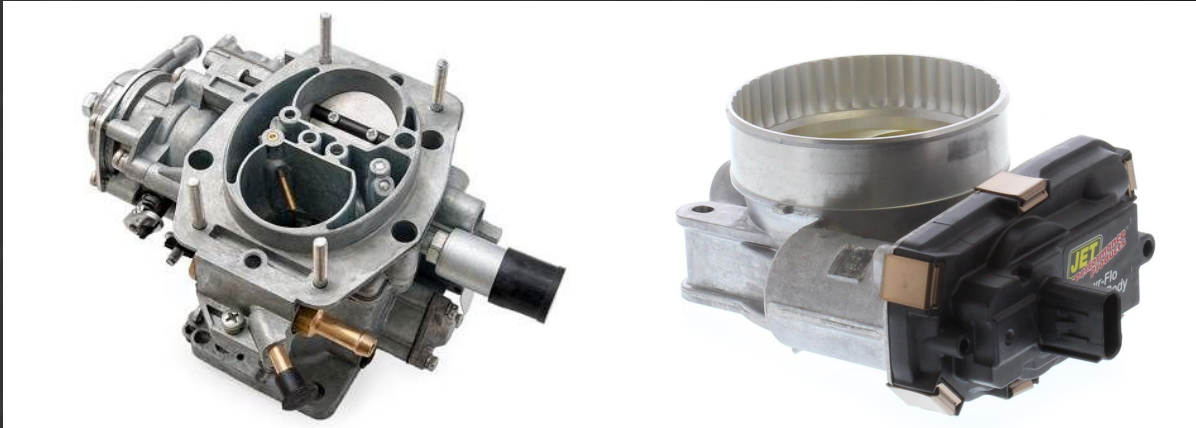
Cars or Guns?

Why not both!



Gearheads - Let's talk cars

More of an Operator's analogy
(think: fleet uptime, efficiency)



Analog vs Digital.. *in a nutshell:*

Anything goes on the weekend.. but *how would you power the fleet?*

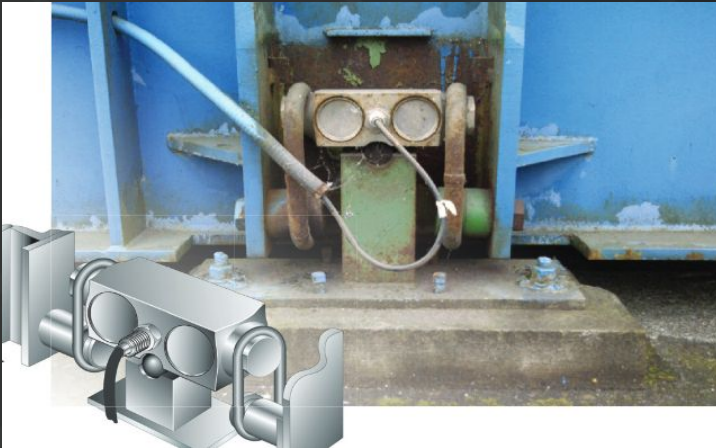
Analog (Carburetor)



Analog was a mainstay; in the late 1960s..

Think:

- *Not modular (load cell, cable)
- *Complex remove/replace
- *Each one different (initial)
- *More errors (running)
- *Tedious calibration (whack a 'pot')
- *No diagnostics (ex, rodent or LC?)



Hybrid (Throttle Body)



Was a good way to 'keep the Analog alive';
still obsolete

Still:

- *Not modular (load cell, cable)
- *Complex remove/replace
- *Each one different (initial)

Now:

- *Less errors (running)
- *Easier calibration
- *Maybe diagnostics (think OBD-I)



Digital (Full Injection)



Welcome to the future (since the 90s anyway!)

Now:

- *Modular (load cell, cable)
- *Easy jack up & swap out
- *All tuned to 'zero' from the factory
- *Almost NO errors (running)
- *Easiest calibration
- *Full diagnostics (think OBD-II)

Fleet Summary



	Analog (Carburetor)	Hybrid (Throttle body)	Fully digital (Full injection)
Cost	Looks 'cheap and easy'	~5% initial premium	~8-10% initial premium
Accuracy	Prone to drift and errors; WILL weigh <u>wrong</u>	Some error corrections, but lingering analog weaknesses; MAY weigh <u>wrong</u>	Peak accuracy, efficiency with error correction; CANNOT weigh <u>wrong</u>
Reliability	External junction boxes with sensitive signals; many failure points	Still junction boxes, signal only ½ digital; similar failure points	No external junction boxes, 100% encoded, way less failure points
Maintenance	Tedious to adjust and replace parts	Easier to calibrate, not all parts are modular	All parts modular and tuned zero error from the factory
Diagnostics	Reactive troubleshooting - issues only show up after it's too late	Limited features, with legacy troubleshooting headaches	Full diagnostics - catch trends before failures Max performance and uptime with monitoring

Sharpshooters - Let's talk guns

More of an Manager's analogy
(think: *pinpoint*, take it to the bank)



Analog vs Digital.. *in a nutshell:*

You can hit the target.. but *what's the cost of deviation* (even small)?

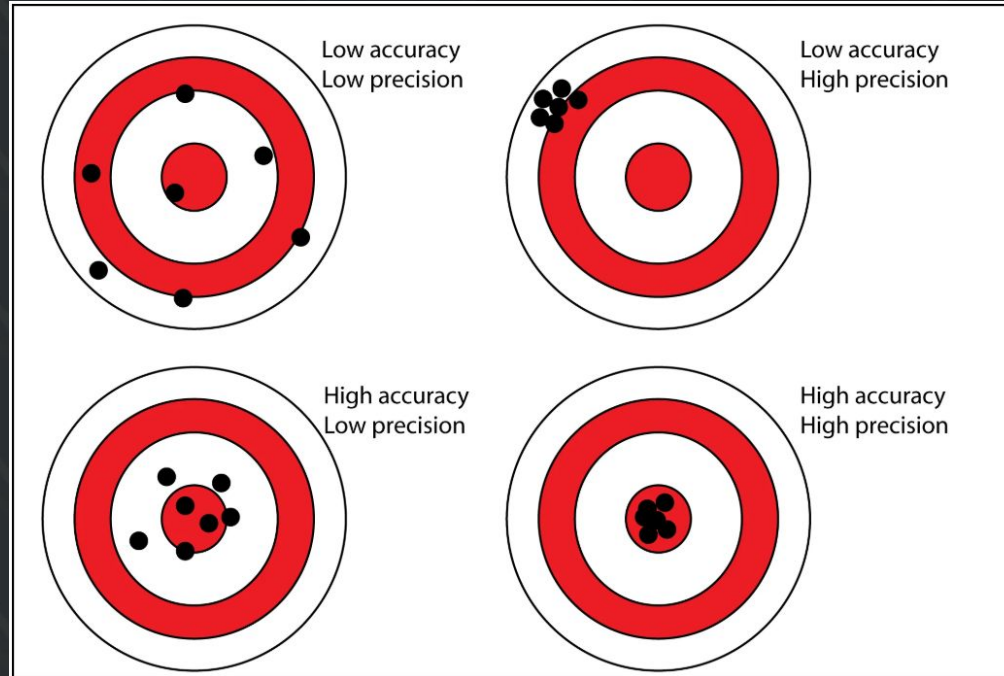
One Sec – What's Accuracy vs Precision?



Loose pattern



Tighter pattern



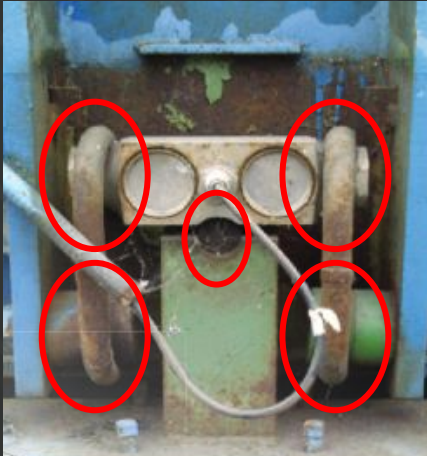
*Tight pattern,
Not calibrated*



*Tightest pattern,
Calibrated*

But How?

Inherent Geometry!

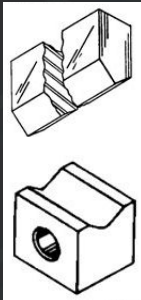


Left, remember our analog scale? It's all 'hanging in the balance'. Literally, misalignment, friction, etc. all hide that pinpoint accuracy and precision.

Right top, modern digital column cell, supports a free-floating scale (no horizontal loads).

Right bottom, see those locator pins? That's how you hit the bullseye every time.

*Throwback:
Remember the
knife- edges in
Mechanical
scales?*



Don't forget to ask me about checking!

But How?

Full disclosure, they all start analog, but most stop there.

What if you added DSP
error-correction, full encoding?
BAM - you got **digital**!

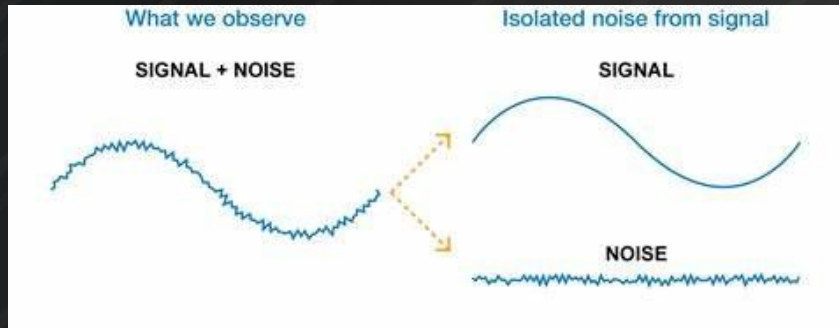
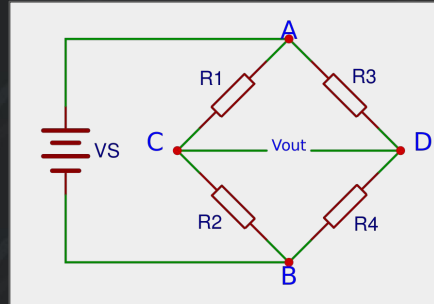
Been around for decades

Top left, scales start with analog sensors;

Top right, cutaway view of Digital cell;

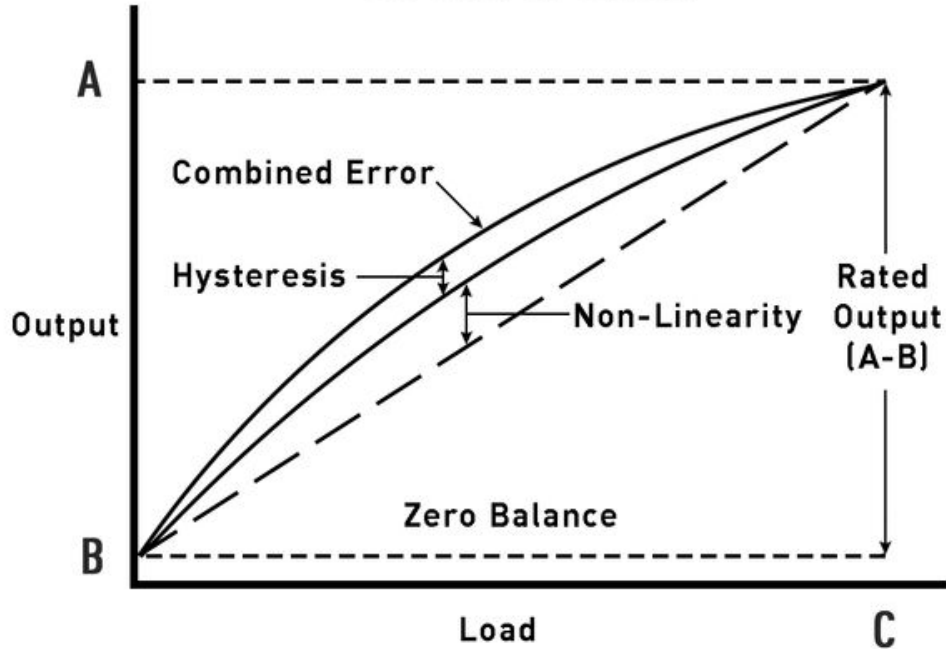
Bottom, the best are DSP 'all the way' to scale display

Inherent Signals!



Bullseye Summary

Typical Calibration Curve
for Load vs. Output



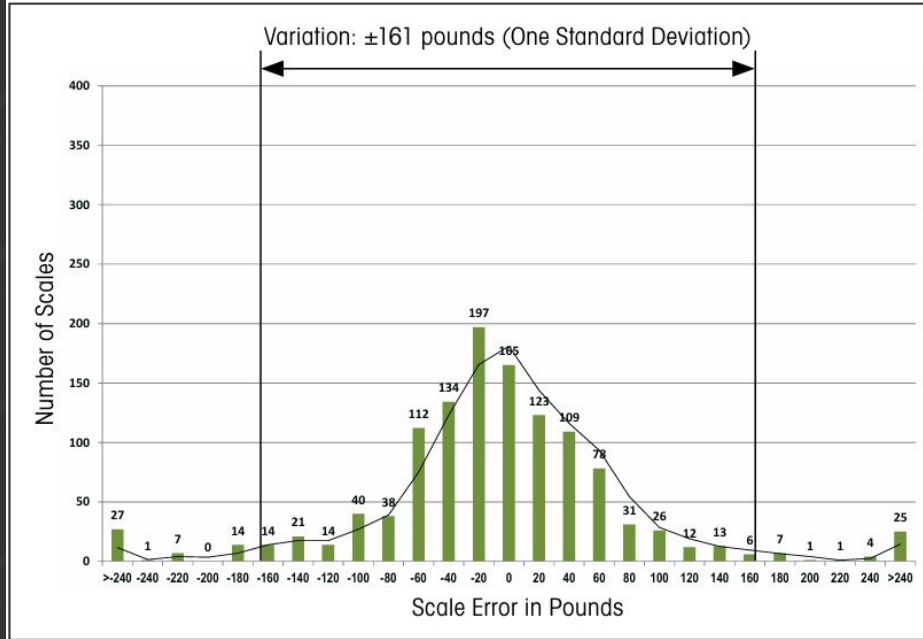
Does it look like a ballistics curve??

So many things can cause weighing signal errors:

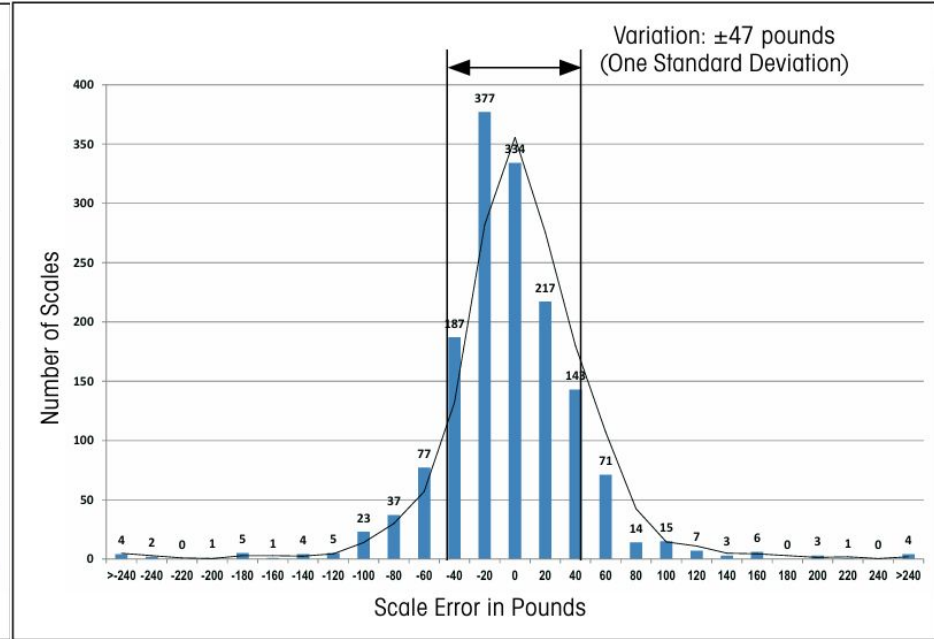
- *Friction / side loads
- *Electrical interference (corrosion, radio waves, limited lightning grounds)
- *Time and material responses
- *Manufacturing variances
- *Temperature
- *And calibration

Some basically **non-existent** with Digital, and the rest **filtered out** with *SCIENCE*

Hit the Mark - Math Terms



Analog



Digital

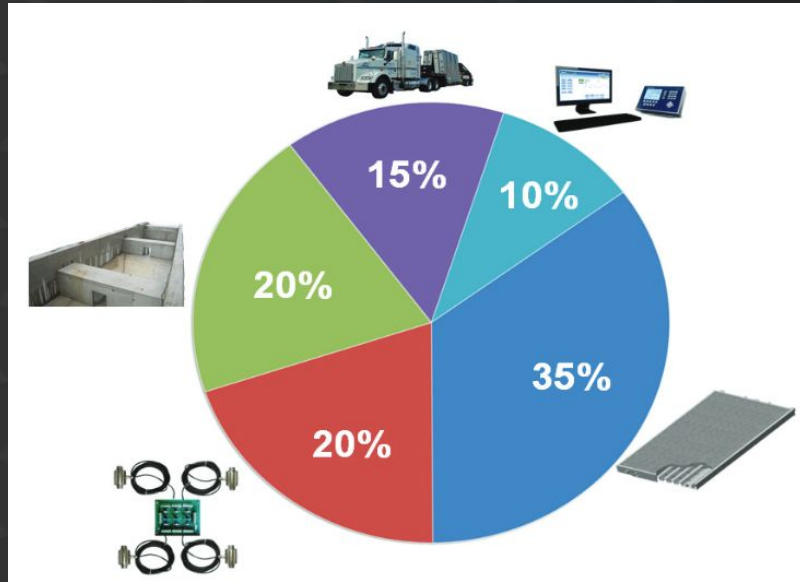
The longer lower tail in analog is intuitive, many errors bias the low side; misalignment, friction, interference. Think: **there's more error space than bullseye space.**

So can I 'add' Digital?

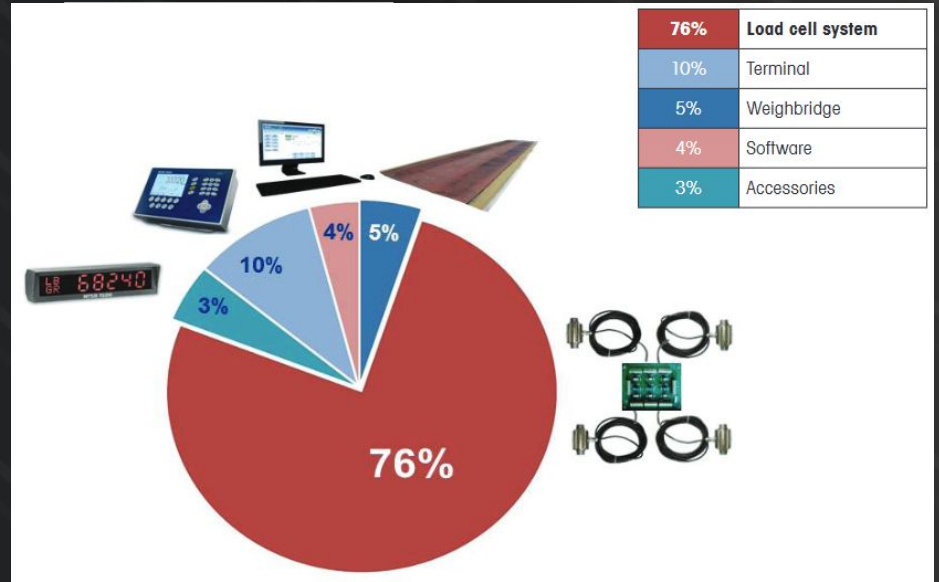
Of course!



Yes it 'Maths'



Initial costs



Running costs

Buying (and installing) another version of your load cells could save ½ or more of your running costs!

Kits are Available



A POWERCELL® PDX® load cell connected to an iND780 terminal during a lightning test

Give a new lease on life to your **existing scale**, whole new warranty too.
Did I mention they're **lightning** protected? (That's a real test, top right)

Digital Summary

Actually still great uses of analog;

Hazardous (low voltage), simpler, and more protected areas

Which type of load cell should be used?

Analog Load Cells

Suitable for simple, cost-effective applications with

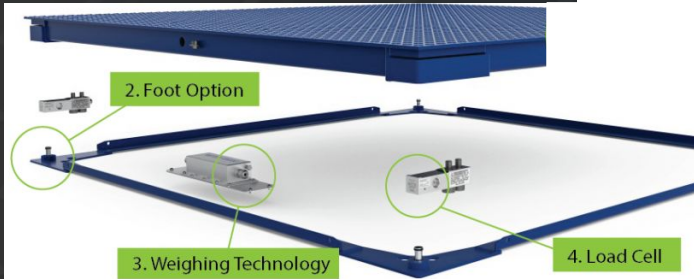
Digital Load Cells

Ideal for high-precision, complex applications with high resolution.



All else better off with Digital

They even have digital floor scales now for 2x the precision!

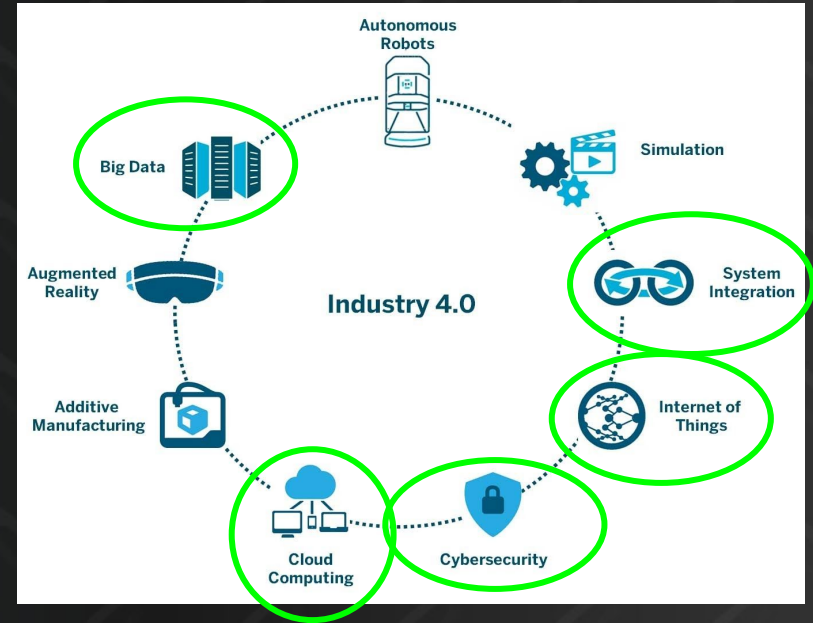
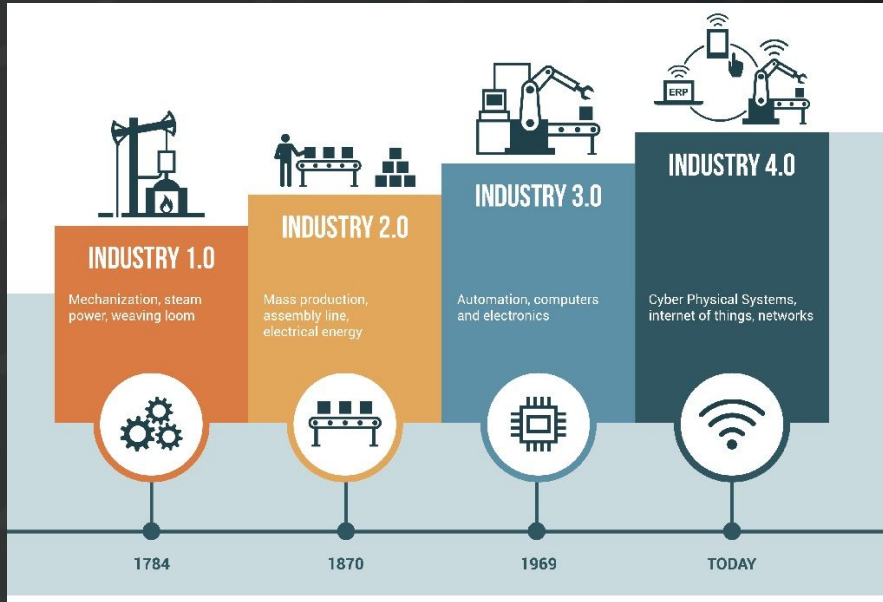


We're done, right?

But wait, there's more 'better'!

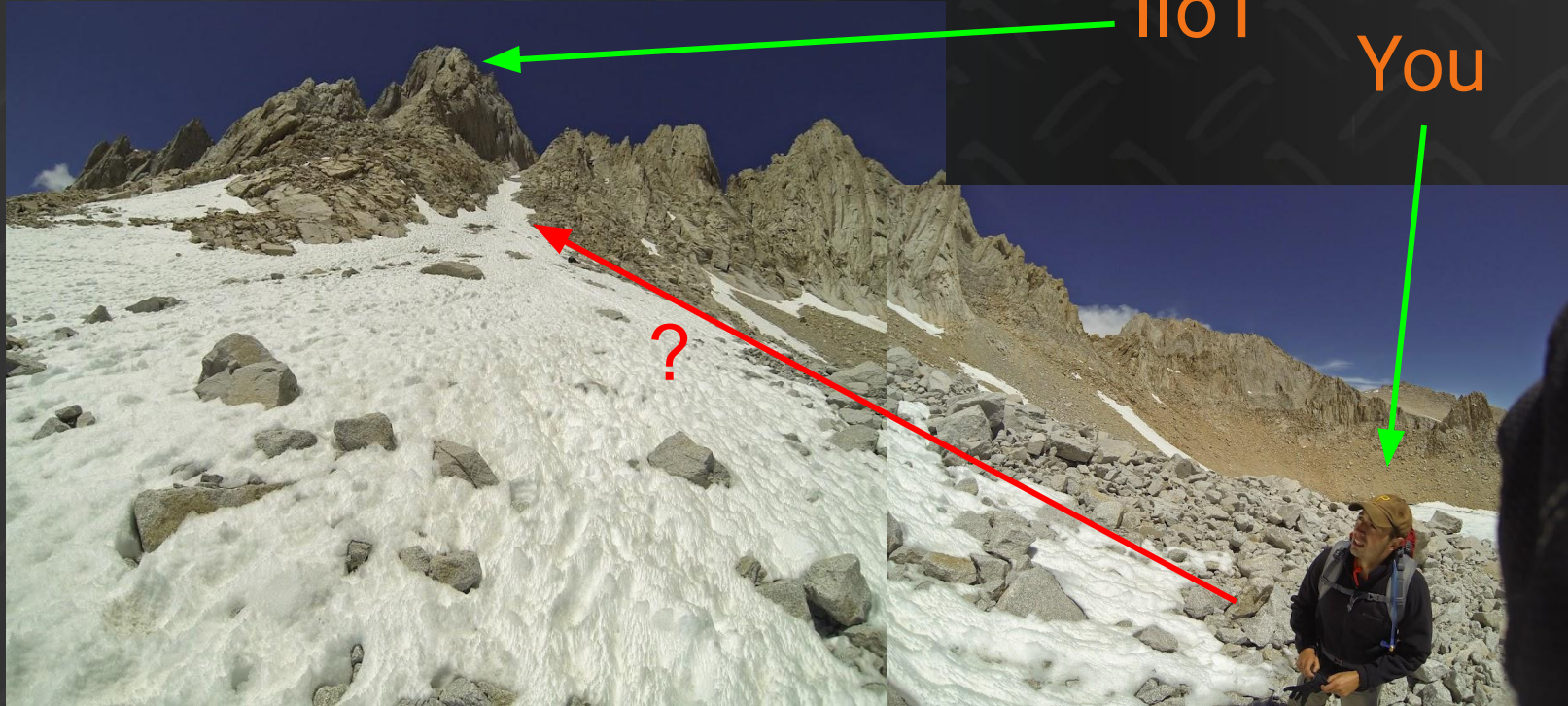


IIoT = Industrial Internet of Things



'Steep' challenge?

Mt. Whitney, CA; highest in the 48 States, done in ~20hrs June 2014















I led a 9-person permitted 'expedition'

Our **Analog baseline**
(not a bad thing) >>

Here's our **'avg'** Digital
premium >>

And just a **'tad'** more >>

	Cost	Risk	ROI
Analog Scales  ?	90% 	100% 	0% 
Digital Scales  The upgrade cost better be worth it!	98% 	30% (Manual Monitoring) 	100% (Cheaper, Shorter Maintenance, More Uptime) 
Digital Scales + IoT Monitoring  I can PROVE it's right, boss!	100% 	2% 	300% (Compounding) 

For Scales!

<< **YOUR** risk reduction

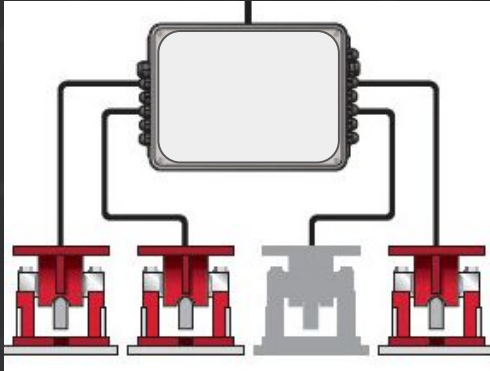
<< Makes you essentially **risk-free**;

"How do you evaluate the risk of not doing something?"

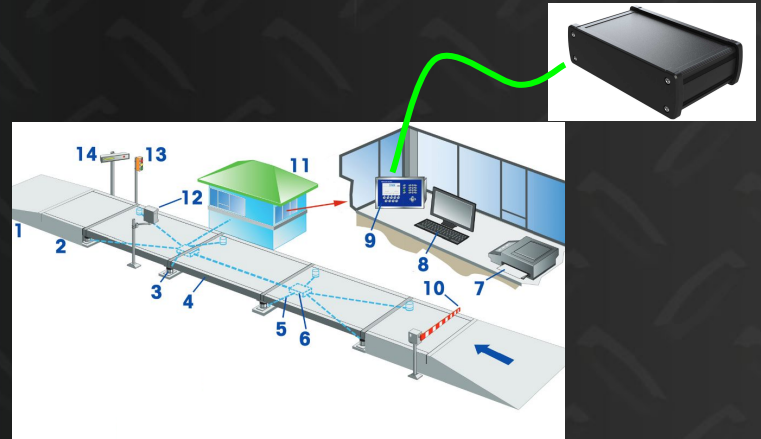
-Zero Dark Thirty

But not all systems are equal

Remember our cars and guns?!



Vs



Pros	Cons
Looks 'cheap and easy'...	Like our throttle body , same old analog cells (reactive)
Maybe support a camera	Opens a security hole in your network
	Manual settings

Pros	Cons
Plug and play, no computer	
Has own cellular connection	May not support a camera
Auto-learn with AI	

“To the Future, Boys”

Example system,
Manager view

Truck 01 (Lans)

Connected since Tue, Jan 28, 2025, 10:56:13 AM

Operator Stats | **Manager Report** | Nerd Board | Data Explorer | Events | Thresholds | Custodian | Data Rates | Properties | Service Settings

Manager Report

Download CSV

Email as PDF

0 70 100

Device Health

37 minutes ago

Health Problems

Times Zeroed Last 7 Days: too low -> 0

Zero Counts: too high -> 326885

Does your system:

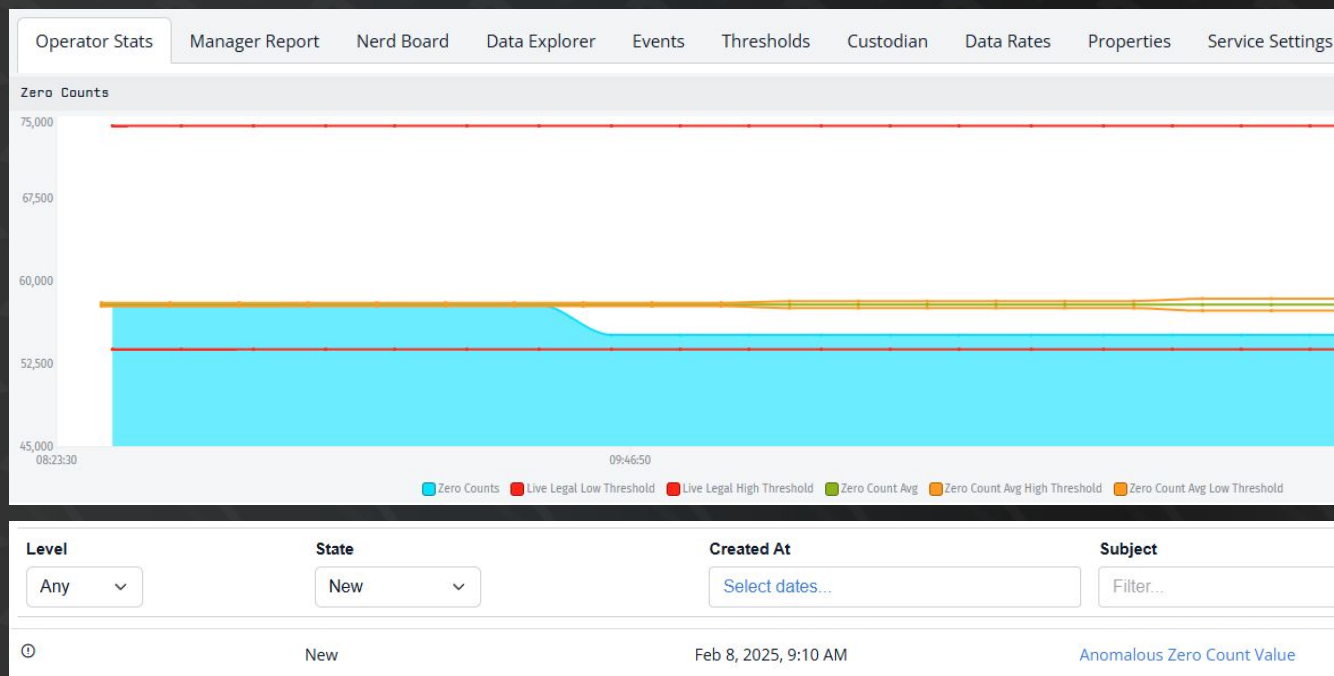
Give you a headache?

/or/

*Help you sleep peacefully
at night?*

“To the Future, Boys”

Same example,
Operator view




And does it:

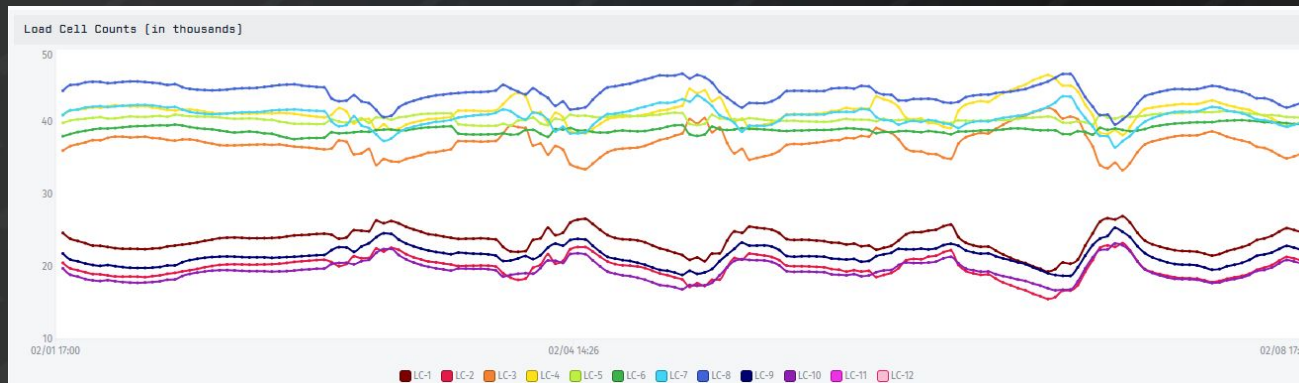
**Auto-learn?*

*.. to calculate the math
on your scale and
conditions?*

“To the Future, Boys”

Same example,
Nerd view

Attribute	Override Defaults	Include In Health	 Low Enabled	High Enabled	Threshold Low	Threshold High
WARNING						
Power Error	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="text" value="100"/>	<input type="text"/>
Tare	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
Times Zeroed Last 7 Days	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="text" value="7"/>	<input type="text"/>
Zero Counts	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="text" value="326340"/>	<input type="text" value="326714"/>
Zero Counts Legal	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="text" value="299126"/>	<input type="text" value="353526"/>



Yes also:

- ***Really** Predictive?
- *Customizable?


.. And integrates into your existing SCADA / Dashboards?

Show me the \$\$ - #1

What if I told you...
That errors are extreme
when unnoticed?



Alerting Configuration for Gate 1 - 02 (BC)

Attribute	Override Defaults	Include In Health	 Low Enabled	High Enabled	Threshold Low	Threshold High
CRITICAL						
Overload	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text" value="58"/>
ERROR						
Gross Error	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="text" value="-120"/>	<input type="text" value="500"/>
Gross Errors In Last 7 Days	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text" value="327"/>
Load Cell Error	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text" value="0"/>

As of 1st week of Feb, 2025

Show me the \$\$ - #2

Gate 2 - 02

Connected since Mon, Oct 28, 2024, 9:00:00 AM

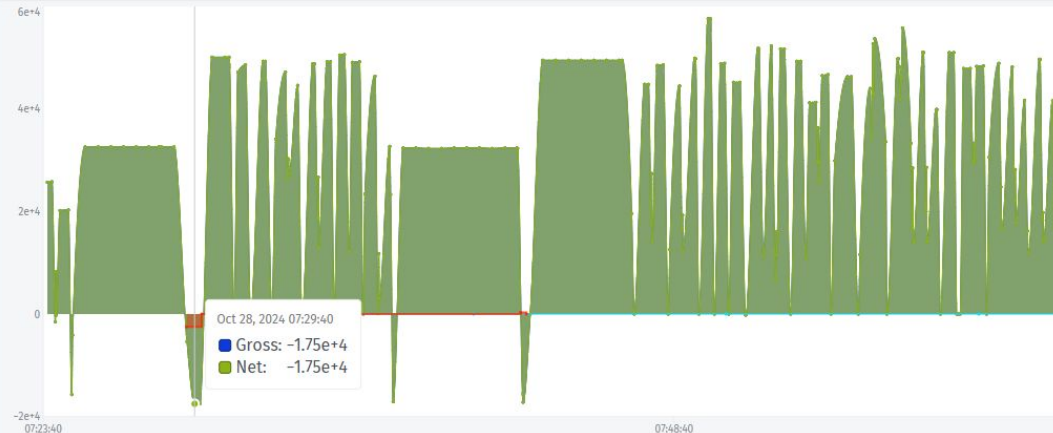
Scale Stats Health Stats Data Explorer Events Alerting Properties Service Settings

Burst Gross Readings

Update Dashboard

Download CSV

Gross Weight



■ Gross ■ Net ■ Tare ■ Gross Error ■ Transactions □ Velocity (mph)

What if I told you...
That errors are extreme
when unnoticed?



A real weight over time chart:

*Can you **pinpoint** when a weight went bad?

*And for how long?

.. Did I mention helps save your a\$\$?

IoT Summary

Critical alerts

Maintenance insights

Predictive diagnostics

Remote monitoring

>> A check-engine light for your scale

>> Address wear points before they break

>> Reduce costly downtime and emergencies

>> Track / audit scale from anywhere

Total operational confidence;

No surprises.

No disruptions.

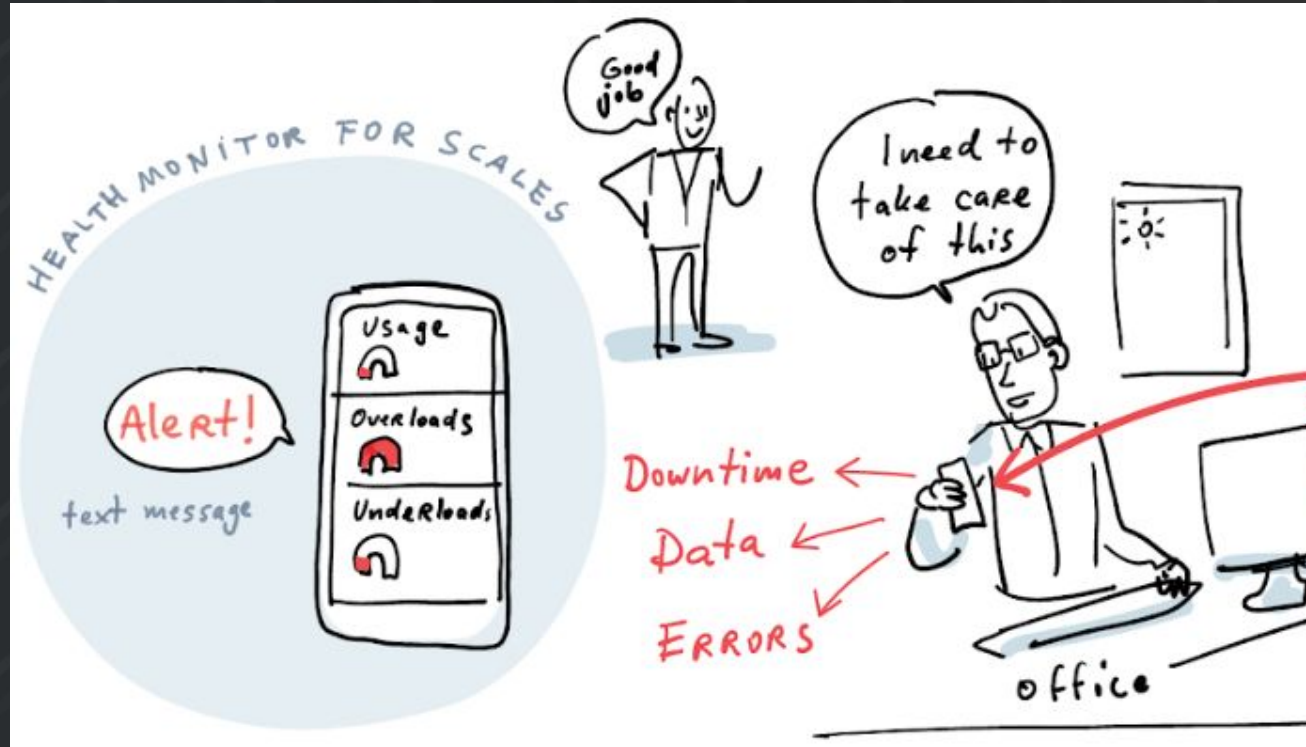
Just assurance.



*Don't forget to ask me
about case studies!*

Congrats!

We did it!



Backup slides



Architecture - slide 1 of 2; the old way

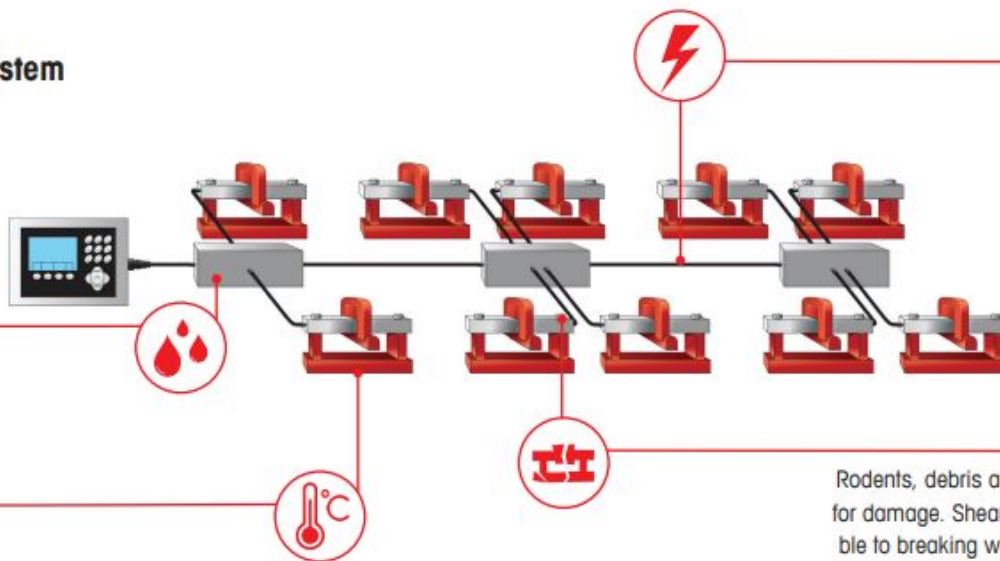
Traditional Analog Load Cell System

Water

Liquids that get inside junction boxes may corrode the hardware from the inside.

Temperature Fluctuation

Varying climates may affect the accuracy of analog load cells.



Lightning

A single lightning strike can damage an entire string of load cells.

Physical Damage

Rodents, debris and overloading cause additional potential for damage. Shear beam load cells are also most susceptible to breaking when overloaded. With cables that are permanently connected to the load cell, if a cable is damaged the entire cell must be replaced.

Architecture - slide 2 of 2; the new way

Active Compensation

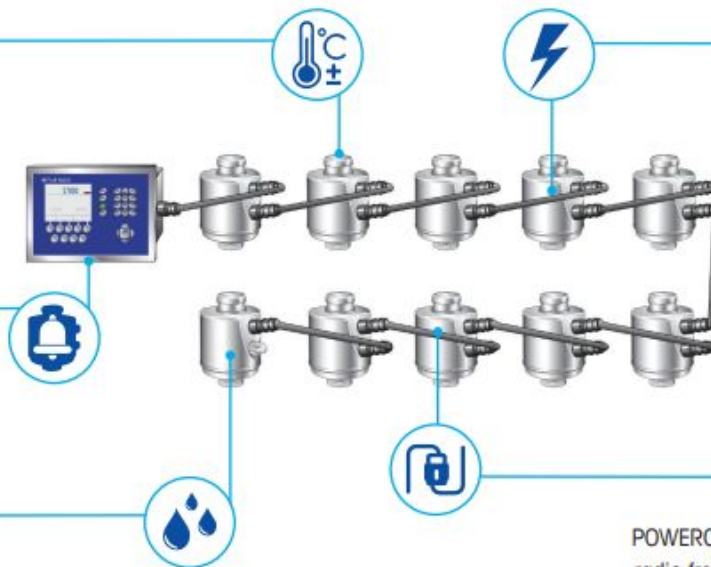
Built in to every POWERCELL load cell, counteracting negative environmental influences such as temperature, linearity, hysteresis & creep.

Improved Diagnostics & Fraud Prevention

Breach-detection technology alerts the scale operator at the first sign of physical damage or tampering.

No Junction Box

METTLER TOLEDO believes that removing the junction box from the load cell system eliminates many potential problems. Additionally, the entire system is tested to IP68 and IP69K submersion ratings.



Lightning Protection

Tested by an independent laboratory and rated for 80K amperes, the POWERCELL® PDX® protects nearly 3 times the average lightning strike.

Stronger Cables

Stainless steel braided sheathing comes standard with all POWERCELL load cells and protects against rodents, moisture, and radio frequency. Additionally, our quick-disconnect cables allow for only the cable to be replaced in case of damage, a much less expensive and easier fix than replacing an entire load cell.



Bumpers - needed or not?



.. Spoiler alert, self-checking has been around a while. Look what it does to the load cell and also breaks away from the foundation.

One of the most costly repairs

*Beyond difficulty in servicing,
breaks away from foundation.*

Alternate slides



Fleet Summary



Analog Load Cells (Carburetor)

- Cheap and simple at first glance
- Prone to drift and errors over time
- External junction boxes create failure points
- Reactive maintenance - issues only show up when it's too late

Hybrid Systems (Throttle Body Injection)

- Some error corrections, but lingering analog weaknesses
- A step up in reliability, but still relies on older tech
- Limited performance gains, with legacy troubleshooting headaches

Fully Digital (Full Fuel Injection)

- Peak accuracy, efficiency, and uptime
- Fewer failure points, no external junction boxes
- Built-in diagnostics—catch issues before they become failures
- Optimized performance with real-time monitoring

Congrats!

We did it!