



Electro Standards Laboratories
ADVANCED SYSTEMS DESIGN & SERVICES



Application Note

Load Cell Calibration

How to Make your own Plug-and-Play Load Cell System and eliminate costly user errors.

The Problem:

Typically, this is the problem you face: A variety of load cells are needed to calibrate your system or to conduct a range of force measurements for a testing application. The load cell connected to the instrument needs to be changed before the process continues. When the new load cell is connected to the instrument, the appropriate calibration factors need to be installed in the instrument. Manual data entry or selecting from a database of stored calibration parameters introduces the possibility of user error. Loading the wrong parameters for a load cell, or corrupting the existing calibration data can lead to erroneous results and costly re-calibration expenses. It would be much more efficient if the instrument could automatically identify the load cell that is being attached to it and self-install the proper calibration data.

Evaluate: Why Not TEDS?

You've heard of the Transducer Electronic Data Sheet, referred to as TEDS technology, where data can be stored inside of a memory chip that is installed inside of a TEDS-compliant load cell. You've investigated the TEDS standard but it seems complicated. And it is.

- The TEDS standard specifies a huge number of detailed electronic data templates with some degree of standardization, but simplicity has been traded for flexibility.
- Even when using the data templates, it is not guaranteed that different vendors of TEDS-compliant systems will interpret what data goes into the electronic templates in the same way.
- More importantly, a particular vendor's TEDS unit may not support the calibration data needed for your application.
- You must also be sure that you have a way to write the TEDS data into the TEDS-compatible load cell, either through a TEDS-compatible instrument that has both TEDS-write and TEDS-read capabilities, or through the use of some other, likely computer-based, TEDS data writing system.

For precision applications, such as calibration systems, it should also be noted that the load cell calibration data stored in the load cell is the same no matter what instrument is connected to the load cell. Additional compensation for the instrument itself is not included. Matched load cell — multi-instrument systems, where a field service calibration group might be attaching different load cells to different instruments, can present a problem.

The Solution: It doesn't need to be this complicated!

TEDS implementation with ESL TEDS-Tag® Auto ID System!

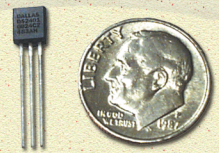
The **ESL TEDS-Tag® Auto ID System** retains the self-identification feature of the TEDS standard, but is simple to implement on any load cell; and when connected to the **ESL Model 4215 Smart Indicator** or **ESL Model 4325B CellMite® Intelligent Digital Signal Conditioner**, becomes transparent to the user. Multi load cell – multi instrument matched pair calibrations are also supported, a critical advantage in field calibration services.

- 1) With the TEDS-Tag® system, a small, inexpensive electronic identification chip is placed in the cable extending from the load cell or is mounted within the load cell housing. This chip contains the unique electronic serial number that can be read by the ESL Model 4215 or CellMite® to identify the load cell.
- 2) The load cell is then connected to the unit and a standard calibration procedure is performed. The instrument automatically stores the calibration data inside the unit itself along with the unique load cell identification number from the microchip.
- 3) Whenever that load cell is reconnected to the instrument, it automatically recognizes the load cell and self-installs the appropriate calibration data. True plug-and-play operation is achieved.

With this system, the calibration data can automatically include compensation for the particular instrument so that high precision matched systems are realized. If the load cell is moved to another instrument, that instrument recalls the calibration data that it has stored internally for that load cell. The ESL instruments can store multiple load cell calibration entries. In this way, multiple load cells can form a matched calibration set with multiple instruments.

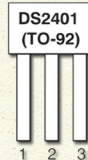
How to make you own TEDS-Tag® Plug-and-Play Load Cell

- 1) The electronic identification chip is from Dallas Semiconductor, PN DS2401. The chip is inexpensive, small and easy to fit into a cable hood or load cell housing.
- 2) Both the ESL Model 4215 and CellMite® are connected to load cells via a DB9 connector with identical pin outs. The electronic identification chip does not interfere with the load cell signals. Pin 3 of the DS2401 is not used and can be cut off if desired. Connecting pins 1 and 2 from the DS2401 to pins 8 and 7, respectively, of the ESL DB9 connector will enable plug-and-play operation.
- 3) It may be convenient to locate the DS2401 in the hood of the cable in off-the-shelf load cells. The load cell comes with a cable that protrudes from the load cell housing. At the end of the cable, strip back the insulation from the individual wires and solder the wires into the DB9 connector per the pin-out table. The DS2401 is soldered across DB9 pins 7 and 8, and fits within the connector's hood.

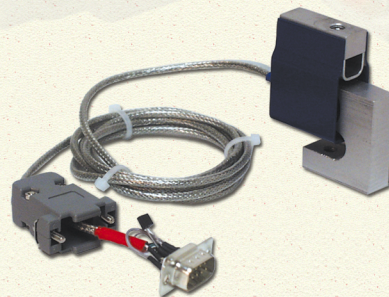


Pin	Signal
1	Excite +
2	Sense-HI
3	Output-HI
4	Output-LO
5	Sense-LO
6	Excite-LO
7	Auto ID-A
8	Auto ID-B
9	Chassis GND

Pin	Signal
1	GND
2	Data
3	No Connect



Interconnection of the DS2401 tag identification chip with the DB9 Sensor connector on the rear of the ESL instruments.



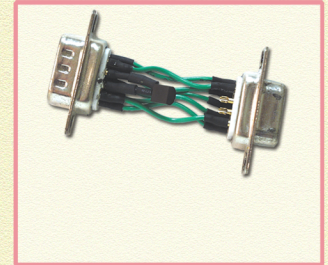
Standard S type load cell shown with a DS2401 electronic tag chip mounted in the hood of the cable.

Can't access the load cell or the cable? Then, make an in-line TEDS-Tag® ID System

Figure illustrates how a straight through in-line cable adapter incorporates the **DS2401 electronic chip**. The protective hood has been removed for clarity. The cable adapter is placed in series with the load cell cable before it is plugged into the **ESL Model 4215 or CellMite®**.

Use this technique in applications requiring different calibrations on the same load cell. With a single load cell and instrument, the user changes the calibration data to be auto-selected by simply changing the in-line cable adapter.

Since each cable adapter has a different tag identification chip, the ESL Model 4215 or CellMite® associates a different calibration data set with each in-line adapter. This can be useful, for example, if a precision 6-point linearization of the load cell is required in two different operating ranges of the same load cell.



Plug-and-Play Operation with the Perfect Calibration System!

Now that the load cell has been converted to a TEDS-Tag® load cell, it can be connected to the ESL Model 4215 or CellMite®. The very first time it is connected, a standard calibration procedure is performed to initialize the cell's calibration data in the instrument. The ESL instruments support a wide variety of industry standard calibrations including mV/V, shunt, 2-point, or multi-point calibration. The instruments automatically detect the presence of the **TEDS-Tag® load cell** and match it with its calibration data. From this point forward, the system is completely plug-and-play.

Typical startup is now:

- 1) Plug load cell into the **ESL Model 4215 or CellMite®**.
- 2) Turn on the power.
- 3) You're done.

After the load cells have been initially calibrated on the Model 4215 or CellMite®, change cells by simply plugging the new cell into the Model 4215 or CellMite® and turning the power on. **That's it!**



Model 4215 Smart Indicator



Model 4325B CellMite®
Intelligent Digital Signal Conditioner