LI-ION TAMER® SENSOR (MOS) FREQUENTLY ASKED QUESTIONS

Q1. What are the stages of Lithium-ion Battery Failure?

A.

- Stage 1: Abuse factor - Thermal, electrical, or mechanical abuse.
- Stage 2: Initial Cell Venting (Off-Gassing) - Battery electrolyte liquid converts to vapour and vents to the outside.
- Stage 3: Smoke/ fire generation - Single failing cell can quickly overheat the surrounding cells, causing them to go into thermal runaway.

Q2. What gases does the Li-ion Tamer Sensor MOS detect?

A.

- The Li-ion Tamer Sensor MOS is a device that detects hydrogen and carbon monoxide gases, which are generated during thermal runaway of lithium-ion batteries. The detection of these gases allows proper management of flammable gas accumulation to avoid explosive conditions.
- It is also capable of detecting the initial venting of battery electrolyte solvent vapours (off-gassing phase) that occurs early in the failure mode of lithium-ion batteries. The early detection of such events allows proper mitigation steps to be taken to avoid a catastrophic thermal runaway failure.

Q3. Does Li-ion Tamer Sensor MOS detect different Lithium-ion Chemistries?

A.

- Chemistry is often referring to anode and cathode chemistry, such as LFP (Lithium Ferro Phosphate or Lithium Iron Phosphate) or NMC (Nickel Manganese Cobalt).
- Li-ion Tamer Sensor MOS can detect the initial venting of different battery chemistries; it does this by detecting the presence of battery electrolyte solvent vapours which are common to all battery chemistries. It is agnostic towards the types of anode and cathode chemistries used.
- It also detects hydrogen and carbon monoxide gases, which are common gases generated during lithium-ion battery thermal runaway.

Q4. How do you stop thermal runaway?

A. Off-gas events are the earliest indicator of thermal runaway, and once detected provides sufficient time to initiate containment measures, such as automatically isolating electrical systems, and ventilation activation to remove flammable gas accumulation.



Q5. How many minutes of early warning does Li-ion Tamer Sensor MOS provide?

A.

- Li-ion Tamer Sensor MOS typically provides between 2 and 30 minutes warning of a thermal runaway event. The severity of the abuse factor greatly effects the amount of time between the cell venting and thermal runaway.
- When using the UL 9540A recommended failure method, Li-ion Tamer consistently delivers early warning with many different types of cell manufacturers, chemistries, and form factors.

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Q6. What is the physical arrangement of the Li-ion Tamer Sensor MOS?

A. The Li-ion Tamer Sensor MOS consists of two primary components:

1. Off-gas Sensor: detects hydrogen and carbon monoxide gases generated during thermal runaway, and the battery electrolyte solvent vapours generated during the initial venting of lithium-ion batteries.
2. Interface Module: connects to the Off-gas Sensor for status monitoring and provides 3 relay outputs (Alarm, Fault), Modbus 485 and CANbus outputs.

Q7. What is the specification of the network cable that connects the Interface Module to the Off-gas Sensor?

A.

- Must be Cat 5e or Cat 6a, straight through, shielded (at least S/UTP), 24 – 26 AWG cable.
- Connector plugged into the sensor should be unshielded and connector plugged into the interface module should be shielded for ideal ESD protection.

Q8. Does Li-ion Tamer Sensor MOS meet ESS Codes and Standards?

A.

The off-gas sensor meets the following certifications and regulatory requirements:

- UL 2075 and ULC 588 Recognized for Hydrogen (H_2) detection
- UL 2075 and ULC 588 Recognized for Carbon Monoxide (CO) detection *
- UL 2075 and ULC 588 Recognized for Battery Electrolyte Solvent Vapour detection
  Includes Diethyl Carbonate (DEC), Dimethyl Carbonate (DMC), and Ethyl Methyl Carbonate (EMC)
- FM 6540 Approved for Battery Electrolyte Solvent Vapours (ex. DEC, DMC, EMC) **
- ETL listed to UL 61010 and CSA 22.2 NO. 61010 for product safety
- EN 61326 for EU Directive (2014/30/EU)
- RoHS 3 EU 2015/863
- CE, UKCA, FCC
- CSFM (according to UL 2075 for H_2)

** Available on selected models.*
*** Model (LT-SEN-M) only.*

The interface module meets the following certifications and regulatory requirements:

- Certification of fire alarm system module UL864 10th
- ULC S527
- FM 6540
- Safety UL61010-1
- RoHS EN50581-2002
- EMI EN55011-2010
- EMC EN61326-1-2021

The Li-ion Tamer Sensor MOS is to be installed in lithium-ion battery systems according to the following codes and regulations:

- Any national or international standards or fire codes that require detection of flammable gases (H_2) at or below 10% of the LFL (ex. NFPA 855/ NFPA 69).
- Any national or international standards or fire codes that require detection of battery electrolyte solvent vapour for early intervention detection (ex. NFPA 75, NFPA 76, FM 5-33).
- Local codes and standards.

Q9. How do you know if the Li-ion Tamer Sensor MOS Off-gas Sensor is functioning properly?

A. The output of the Li-ion Tamer Sensor MOS Off-gas Sensor is fail-safe and has self-diagnostic capability.

Q10. Can the Li-ion Tamer Sensor MOS be tested with a test-gas to activate the Off-gas Sensor?

A. Yes, the off-gas sensors should be bump tested once or twice a year based on the gas that the Li-ion Tamer Sensor MOS is designed and installed to detect, as explained below:

- **Bump test every 6 months**: if it is designed and installed to detect Battery Electrolyte Solvent Vapours (DEC, EMC, DEC)
- **Bump test every 12 months**: if it is designed and installed to detect Hydrogen and Carbon Monoxide gases.
- Bump tests should only be performed by appropriately trained and qualified personnel.

Q11. How can you be sure Li-ion Tamer Sensor MOS works in my systems' airflow?

A.

- Li-ion Tamer Sensor MOS has been extensively tested in many different battery environments, under varied ventilation conditions. During the applications engineering process, the ESS air flow patterns are considered to ensure the system operates within its performance envelope.
- If you have a specific battery configuration that requires off-gas detection; individual assessment or testing can be conducted. Additionally, if UL9540A testing is going to be performed, Li-ion Tamer Sensor MOS hardware can be implemented for evaluating product functionality.

THE FUTURE IS WHAT WE MAKE IT

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