3M stands for Minnesota Mining & Manufacturing

From its beginnings as a mining company (= Mining), and later including further processing (= Manufacturing), 3M has now developed into a diversified technology company with worldwide operations.

Founded: in Two Harbors, USA in 1902

Headquarters today: St. Paul, Minnesota, USA
We bring solutions to markets through our business groups

2017 Results

$31.7B Revenue

- Health Care: $5.8B
- Safety & Graphics: $6.1B
- Industrial: $10.9B
- Electronics & Energy: $5.2B
- Consumer: $4.6B
Legacies’ History

OLDHAM
- 1968: Foundation of Oldham by Joseph Oldham
- 1954: First Oldham Flameproof Gas Detector
- 1958: Oldham’s First CO and Toxic Gas Detectors
- 1968: MX 11 launch – 1st portable linked to Minidel
- 2006: Acquisition by Industrial Scientific
- 2010: Launch of GM 25

SIMRAD
- 1963: ICARE foundation
- 1980: ICARE foundation
- 2007: Acquisition of Water Management Engineering A/S (WME)

ICARE
- 1954: Foundation of A.F. Ramay Ltd by Albert Ramay
- 1958: 1st automatic analyser for French submarines
- 1961: Creation of ICARE
- 1970: Creation of ICARE
- 2011: Launch of V9250

GMI
- 1967: Foundation of G. M. Moroney Ltd by Albert Moroney
- 1979: First Gasometer products sold to Batcher Gas
- 2004: Integration to SIMRAD Optronics
- 2011: Launch of V9250

DETCON
- 1983: Creation of DETCON
- 1995: First entered the commercial market with its IG20 Solid State Sensor
- 2006: "Environmentally bulletproof" Model 706 gas detector launch

2015: IST acquired by Scott Safety, Tyco Group

March 2016: Launch of the brand: Tyco Gas & Flame Detection

September 2016: Fusion Tyco & JCI

October 2017: Acquisition by 3M – Personal Safety Division

2019: Merge between Oldham & Simtronics
H₂S - Hydrogen Sulfide

Found in any location where decaying matter is present

5 ppm: Threshold limit value in Norway (TLV). Smells of decayed eggs.

>100 ppm: Loosing sense of smell.

> 500 ppm: Respiratory problems and collapse.

>1000 ppm: Unconsciousness and death without warning. → Knock-down gas

Ignites at 290 ºC.

Heavier than air → Accumulates in low areas

Corrosive.

Environment: Very poisonous for organisms living in water.

Possibly the second-most deadly gas after carbon monoxide encountered in the industrial environment.
Detection methods
H₂S detector technologies

Electrochemical

- Low cost
- Limitations high temperatures and dry climate
- High humidity
- Cross-sensitive other gases
- Need regular calibration
- Consumables

Metal Oxide Semiconductor (MOS)

- Reasonable cost
- Cross-sensitive other gases
- Need regular calibration
- Consumables
Other traditional approaches

✓ Very low cost
❌ Non adjustable alarm levels
❌ Cross sensitive
❌ Consumables (food + chickens)

Chickens – not recommended
Readings on Point and Open Path Detectors

Point Detector: 10 ppm

Open Path Detector: 10 ppm x 5 m = 50 ppm*m

The ppm*m is the measured value and the path length is not used in the output value of H₂S.

→ Same cloud size will give same measurement irrespective of path length
→ If cloud size is known concentration can be calculated
→ More often used as a “safe fence” and ppm not so important.
LOS measurement ambiguity

Reading:
2 ppm x 50 m = 100 ppm.m

Average ppm = 2 ppm
LOS measurement ambiguity

Reading:
2 ppm x 50 m = 100 ppm.m
Average ppm = 2 ppm

Measuring path = 50 m

Reading:
100 ppm x 1 m = 100 ppm.m
Average ppm = 2 ppm
False impression of situation
Laser diode
Detection principle
Scans a range of the optical spectrum, both amplitude and shape of the different gases.

Atmospheric CO$_2$ is used as reference gas.

The laser is locked to the CO2 reference absorption line (independent of concentration).

The laser scans at 8 kHz across the CO$_2$ reference and the H$_2$S absorption line.

Advanced algorithms are used to determine the gas concentration.

An internal CO reference is checked to verify correct CO2 peak.

**Laser used: Class 1, Eye safe**
Detection scan – detecting H₂S

Normal operation

H₂S in measurement path

Known offset

Target gas line
Detection scan – checking response with \( \text{CO}_2 \)

Normal operation

\( \text{CO}_2 \) in measurement path
GD1 Open Path H$_2$S Detector
Laser based
# Accessories and spare parts

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GD1-X00-TR01</td>
<td></td>
<td>Alignment Kit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laser alignment tools, Alignment Interface Unit and carry case.</td>
</tr>
<tr>
<td>GD1-X00-TR05</td>
<td></td>
<td>Gas Test Cell Kit – long version</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Airtight chamber for function and calibration tests. The chamber has a length of 54 cm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spare part</th>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunshade front</td>
<td>599-816662</td>
<td></td>
</tr>
<tr>
<td>Junction box</td>
<td>599-816526</td>
<td>(temperature range -40 to +65°C)</td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td>GD1-X00-TR01</td>
<td>Mounting plate</td>
</tr>
<tr>
<td>499-816755</td>
<td>Adjustment bracket</td>
</tr>
<tr>
<td>499-816649</td>
<td>Alignment laser unit</td>
</tr>
<tr>
<td>499-816845</td>
<td>Wireless router</td>
</tr>
<tr>
<td>419-906123</td>
<td>Laser glasses</td>
</tr>
<tr>
<td>814-816855</td>
<td>Spare screws and nuts for the GD1.</td>
</tr>
<tr>
<td>700-816859</td>
<td>All typical tools needed for alignment and service of the GD1.</td>
</tr>
</tbody>
</table>
Take Aways

➤ Laser technology
  • No cross sensitivity with other gases
  • Fast response
  • No consumable
  • High sensitivity (detects low concentration for early detection)
  • Lifetime > 10 years

➤ CO₂ verification and internal reference
  • Lifetime > 10 years

➤ SIL2 by design

➤ Built for harsh environment
  • Desert, offshore, arctic
  • Unaffected by changing weather conditions
  • Well proven measurement technique (since 2006)
THANK YOU
Now proudly part of 3M.