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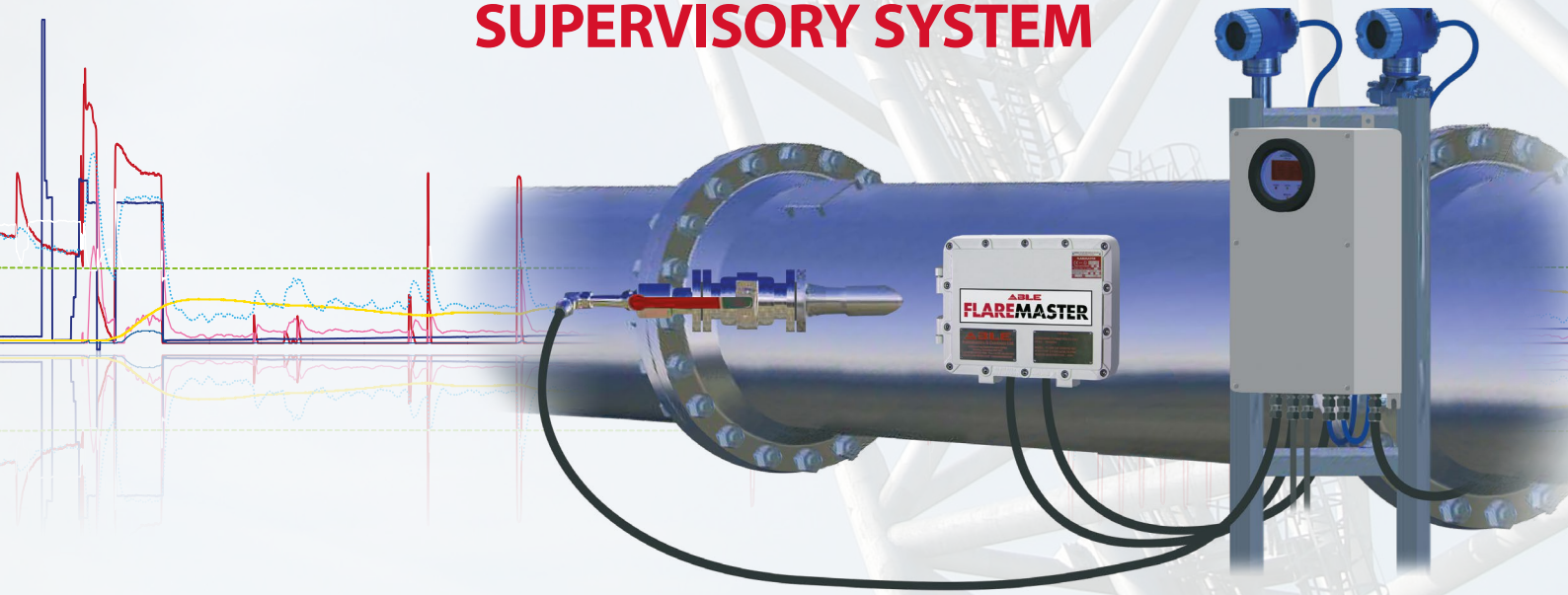
# FLAREMASTER™

## EXTENDED VELOCITY, DUAL REDUNDANCY SUPERVISORY SYSTEM



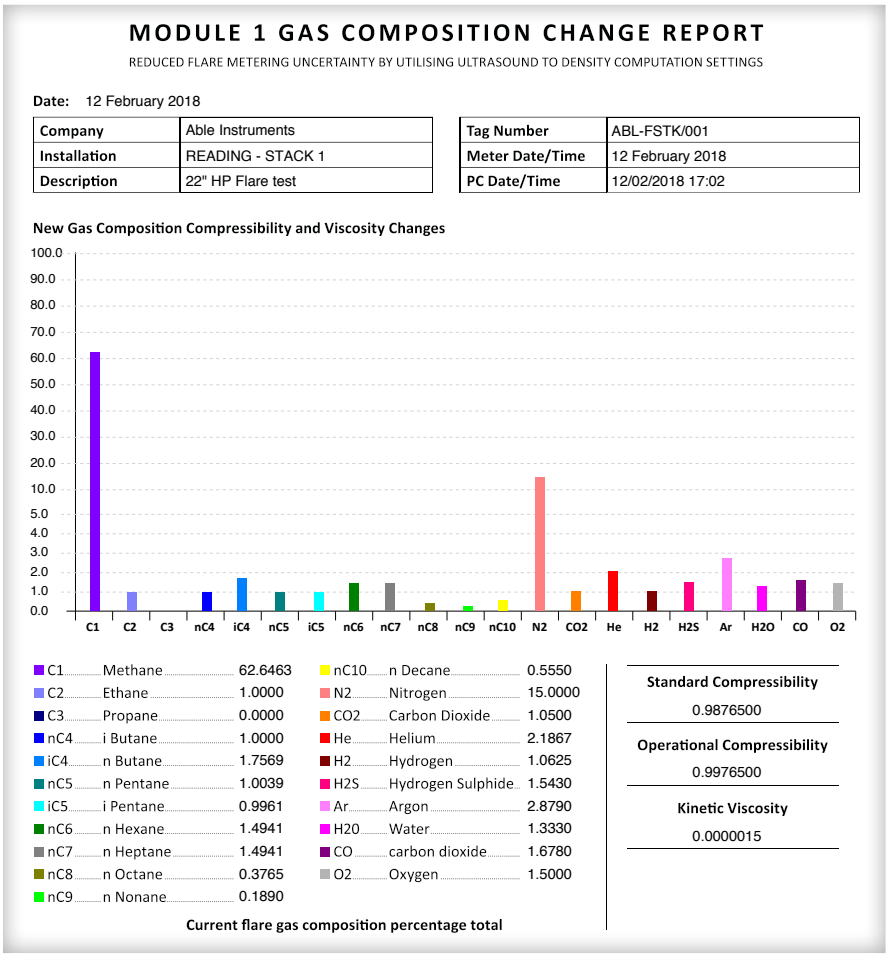
# FLAREMASTER™

## *Sustainable Flare Metering Under Process Extremes*

# Extended Velocity, Dual Redundancy Supervisory System

**FlareMaster constitutes a dual redundancy supervisory system which interfaces with the base ultrasonic flare gas meter, applying a high level of processing capacity and an enhanced layer of analytics to the data being generated. FlareMaster is able to data mine and harvest the myriad signals routinely produced by a flare meter that aren't normally visible or accessible to a standard, associated flow computer. FlareMaster is able to interpret and apply this data so as to ensure sustainability of measurement even during the most challenging process upsets and anomalies.**

FlareMaster is therefore designed to enhance the performance of ultrasonic flare gas flow meters, providing reliable and repeatable measurement under all process conditions regardless of extremes in velocity, diversity of gas densities and transducer contamination. FlareMaster will also increase the maximum measureable flow to velocities approaching 1000m/sec, higher than that achievable with any other flare meter technology.



MODULE 1 GAS COMPOSITION CHANGE REPORT

REDUCED FLARE METERING UNCERTAINTY BY UTILISING ULTRASOUND TO DENSITY COMPUTATION SETTINGS

Date: 12 February 2018

| | | | |
|---|---|---|---|
| Company | Able Instruments | Tag Number | ABL-FSTK/001 |
| Installation | READING - STACK 1 | Meter Date/Time | 12 February 2018 |
| Description | 22" HP Flare test | PC Date/Time | 12/02/2018 17:02 |

New Gas Composition Compressibility and Viscosity Changes



| | | | | | |
|---|---|---|---|---|---|
| C1 | Methane | 62.6463 | nC10 | n Decane | 0.5550 |
| C2 | Ethane | 1.0000 | N2 | Nitrogen | 15.0000 |
| C3 | Propane | 0.0000 | CO2 | Carbon Dioxide | 1.0500 |
| nC4 | i Butane | 1.0000 | He | Helium | 2.1867 |
| iC4 | n Butane | 1.7569 | H2 | Hydrogen | 1.0625 |
| nC5 | n Pentane | 1.0039 | H2S | Hydrogen Sulphide | 1.5430 |
| iC5 | i Pentane | 0.9961 | Ar | Argon | 2.8790 |
| nC6 | n Hexane | 1.4941 | H20 | Water | 1.3330 |
| nC7 | n Heptane | 1.4941 | CO | carbon dioxide | 1.6780 |
| nC8 | n Octane | 0.3765 | O2 | Oxygen | 1.5000 |
| nC9 | n Nonane | 0.1890 | | | |

Current flare gas composition percentage total

| | |
|---|---|
| Standard Compressibility | 0.9876500 |
| Operational Compressibility | 0.9976500 |
| Kinetic Viscosity | 0.0000015 |

## A Modular System

### Module I – Analytics & Gas Density Composition

Module I equips the flare meter with a full data acquisition and analytics package driven by a Rockwell Automation Allen Bradley Controller, providing full gas density inputs to the meter in order to negate the effects of density distorting gas compositions. Measurement uncertainty is typically reduced from +/- 5% to +/- 1% preventing over-reporting of Green House Gas (GHG) emissions and reduction of associated financial penalties.


aegex TECHNOLOGIES

An aegex10™ intrinsically safe tablet constitutes a wireless hazardous area approved interface with the module, allowing personnel to monitor data and analytics in real time.

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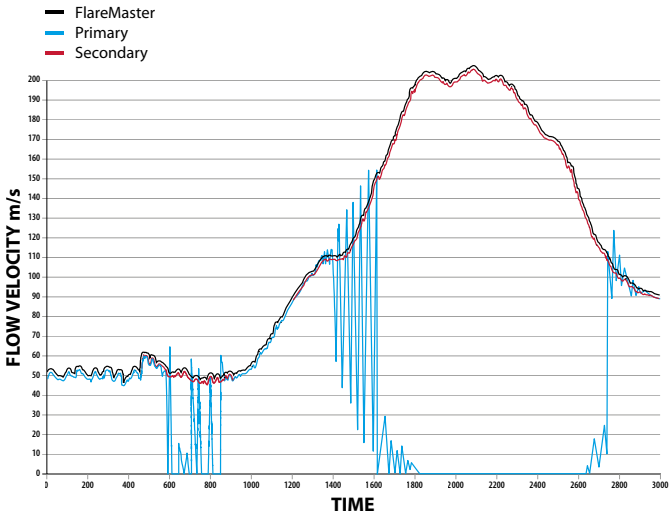
## Module II – Implementation of the Complete Dual Redundancy Supervisory System

Module II comprises a supplementary, non-invasive sensing array and, in conjunction with Module I, equips the flare gas meter with the complete FlareMaster Dual Redundancy Supervisory System. Module II can be installed on a 'live' flare with minimal mechanical disruption.

The fully implemented FlareMaster will provide sustainability of measurement under all process conditions, including extreme flare stack blowdown. FlareMaster will operate in both high and low temperature applications and flow velocities up to 1000m/sec. This enhancement will also deliver accurate, repeatable performance during low flow, gas stratification episodes.




# Specifications

Rockwell Automation

### Applicability

| | |
|---|---|
| **Meter Compatibility** | Any ultrasonic flare gas meter |
| **Operating Temperature** | -100°C to 350°C |
| **Pipe Sizes** | 2" to 82" |

### Measurements & Ranges

| | |
|---|---|
| **Velocity** | 0.03 to 1000m/sec |
| **Mass Flow**<br>**Volumetric Flow** | According to pipe dimensions for the above velocity range |
| **Application Types** | Suitable for stratified gas and multiphase flow conditions |

**Additional Measurement Parameters:**

- Standard & actual volume flow
- Mass flow
- Totalised standard volume flow
- Totalised mass flow
- Molecular weight
- Standardised density
- Actual density
- Pressure
- Temperature
- Gas velocity

### HMI Software Suite / Wireless Hazardous Area Interface

Windows 10 / Aegex10™ Zone 1 ATEX Tablet
IOT Ready

### Processor

Rockwell Automation Allen-Bradley Compact Logic Controller

### Power

24VDC
Consumption: 2.5 amps on start-up, 1.5 amps on operation

### Certification

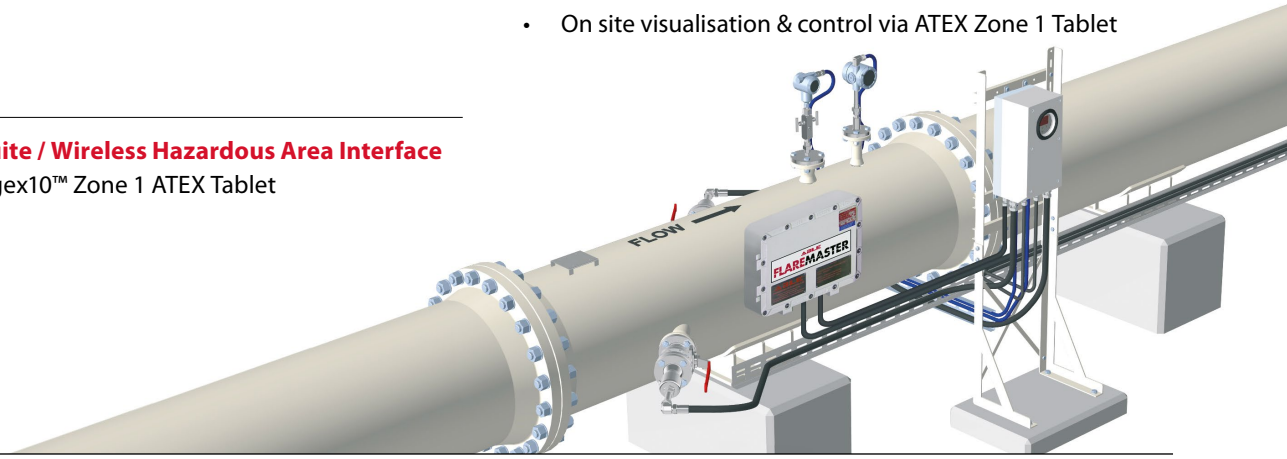
ATEX Zone 1

### Weights & Dimensions

See drawing CS100227 (attached)

### Operation Summary & Features

- Reliable and repeatable flare gas flow measurement during process upsets and extremes
- Effective operation during gas stratification and gas density variation
- Measurable flow velocity up to 1000m/sec
- Significant reduction in flare gas measurement uncertainty
- Potential decrease in reported flare gas totals and consequent financial penalties
- Can be installed on 'live' process without shutdown
- Primary flare gas meter can be interrupted for service without loss of measurement
- On site visualisation & control via ATEX Zone 1 Tablet

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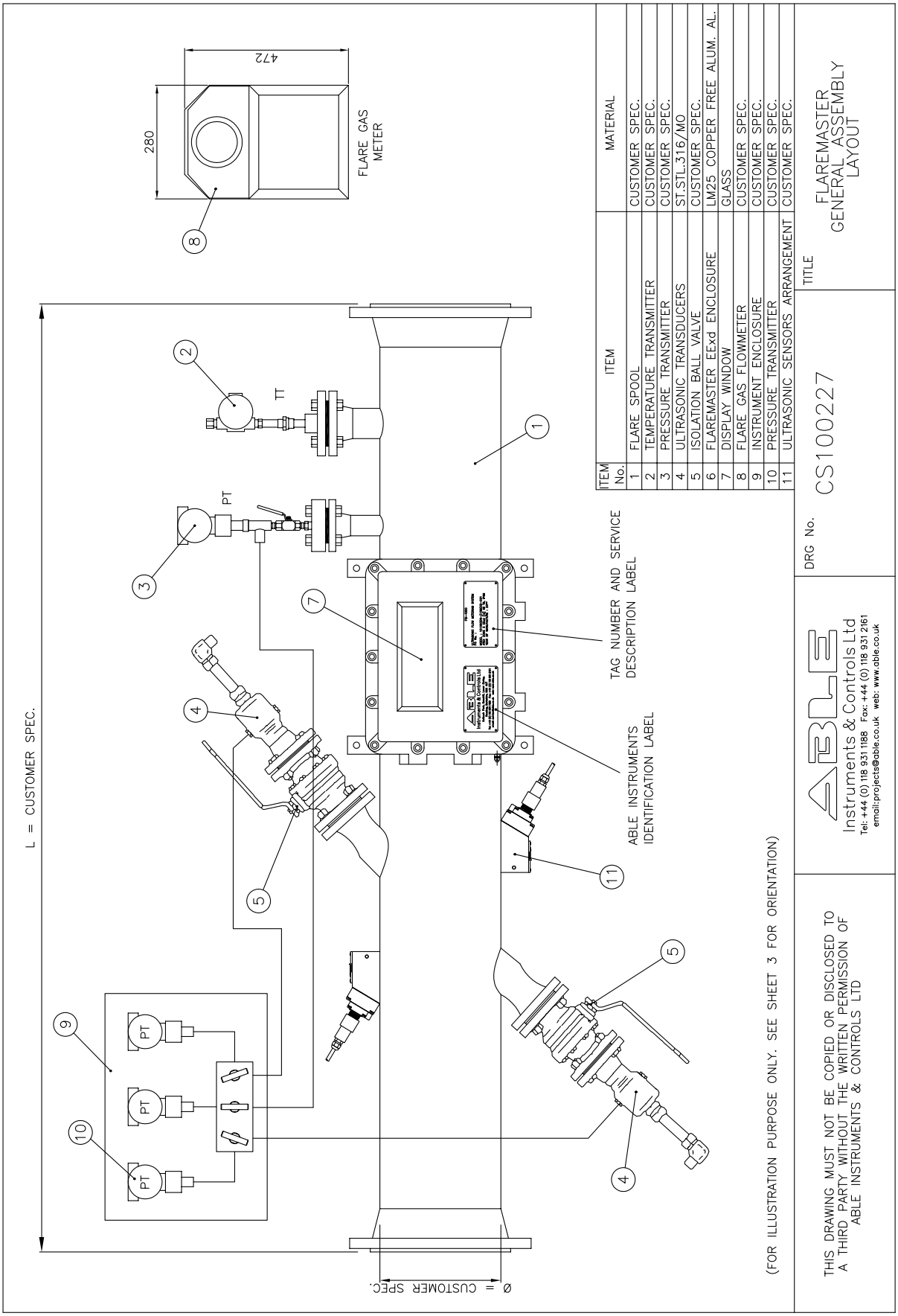


| ITEM No. | ITEM | MATERIAL |
|---|---|---|
| 1 | FLARE SPOOL | CUSTOMER SPEC. |
| 2 | TEMPERATURE TRANSMITTER | CUSTOMER SPEC. |
| 3 | PRESSURE TRANSMITTER | CUSTOMER SPEC. |
| 4 | ULTRASONIC TRANSDUCERS | ST.STL.316/MO |
| 5 | ISOLATION BALL VALVE | CUSTOMER SPEC. |
| 6 | FLAREMASTER EExd ENCLOSURE | LM25 COPPER FREE ALUM. AL. |
| 7 | DISPLAY WINDOW | GLASS |
| 8 | FLARE GAS FLOWMETER | CUSTOMER SPEC. |
| 9 | INSTRUMENT ENCLOSURE | CUSTOMER SPEC. |
| 10 | PRESSURE TRANSMITTER | CUSTOMER SPEC. |
| 11 | ULTRASONIC SENSORS ARRANGEMENT | CUSTOMER SPEC. |



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DRG No. CS100227

TITLE FLAREMASTER GENERAL ASSEMBLY LAYOUT