ABLE

FLAREMASTER™

FLARE METERING WITH REDUCED UNCERTAINTY

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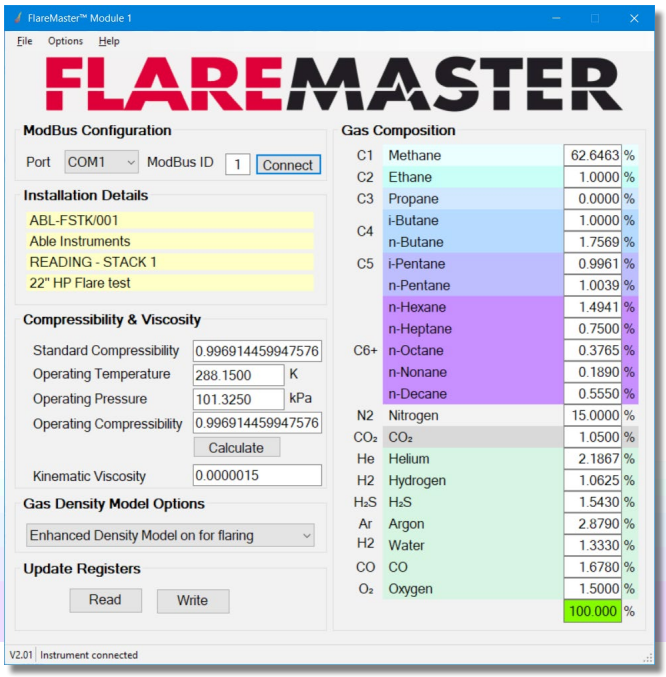
Flare Metering With Reduced Uncertainty

FlareMaster Flare Metering Enhancement Tool

The ABLE FlareMaster, in its fully realised form, is a dual redundancy, supervisory system designed to optimise the performance of the current generation of ultrasonic flare gas meters (FGM) by significantly reducing measurement uncertainty and ensuring sustainability of measurement during the most challenging process upsets and anomalies. This is achieved by applying a high level of processing capacity and an enhanced layer of analytics to the data being generated by the base FGM. FlareMaster is able to data mine and harvest the myriad signals routinely produced by an FGM that aren't normally visible or accessible to a standard, associated flow computer. FlareMaster utilises self-calibration and decision making techniques (AI) to repair and reconstruct flow measurements whenever the base FGM fails.



Flaremaster is a modular system comprising the following elements: **FlareMaster Enhanced Density Module (EDM)** is able to provide the FGM with full flare gas composition inputs in order to negate the effects of density distorting gas compositions. Typically, this will improve accuracy by a factor of 5%, consequently preventing over-reporting of Green House Gas (GHG) emissions and assisting with Tier 3 compliance.

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

aegex TECHNOLOGIES

FlareMaster DataFlow is a data gathering and analysis tool which can be used in conjunction with the EDM hardware. DataFlow facilitates remote interrogation and parallel monitoring of multiple FGMs from a safe area as depicted by the topology diagram on the following page. The operator is provided with a real time display of process data, including mass and standard volume flow, velocity, process temperature and pressure. Historical records of measured and calculated data are easily accessible.

AI

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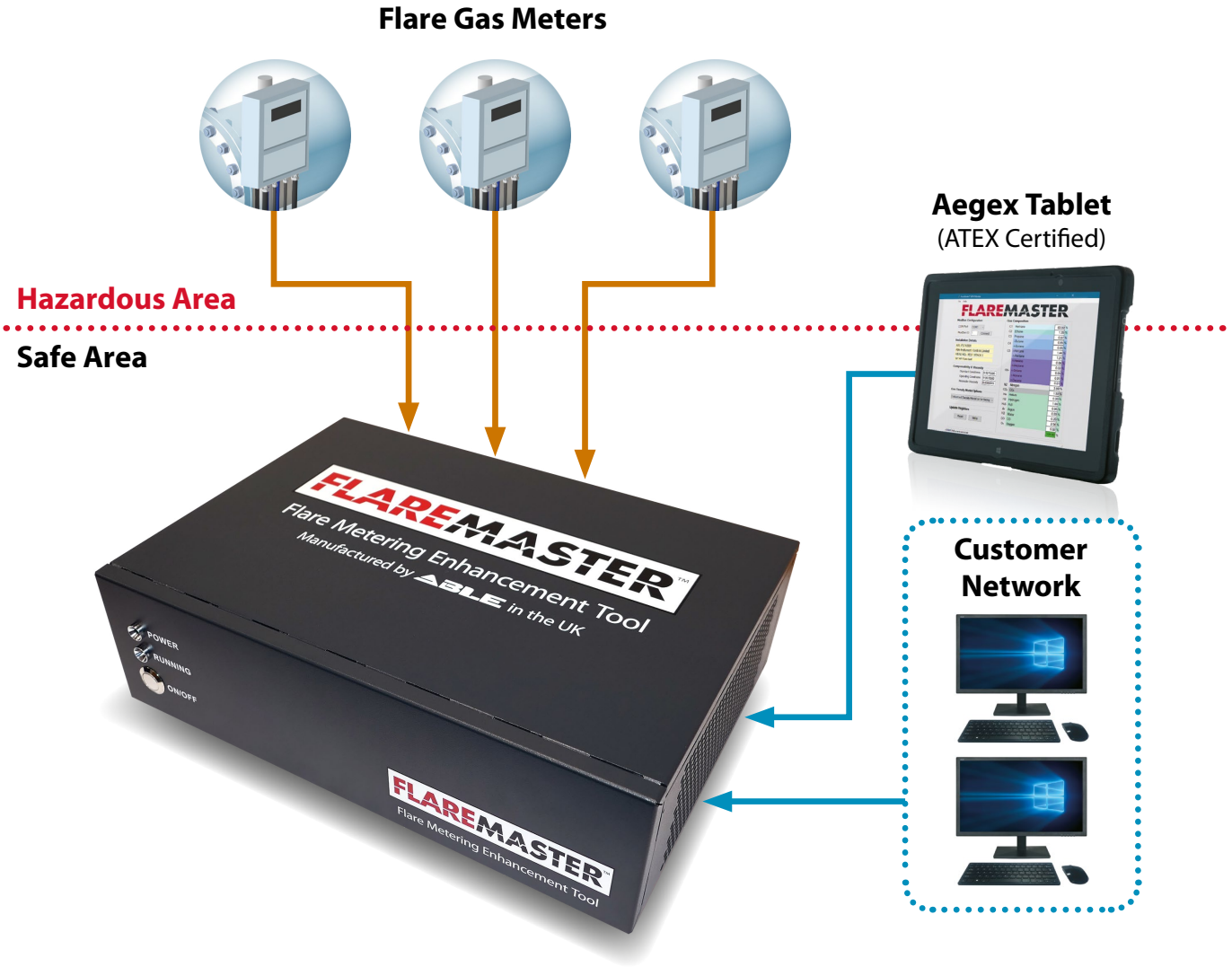
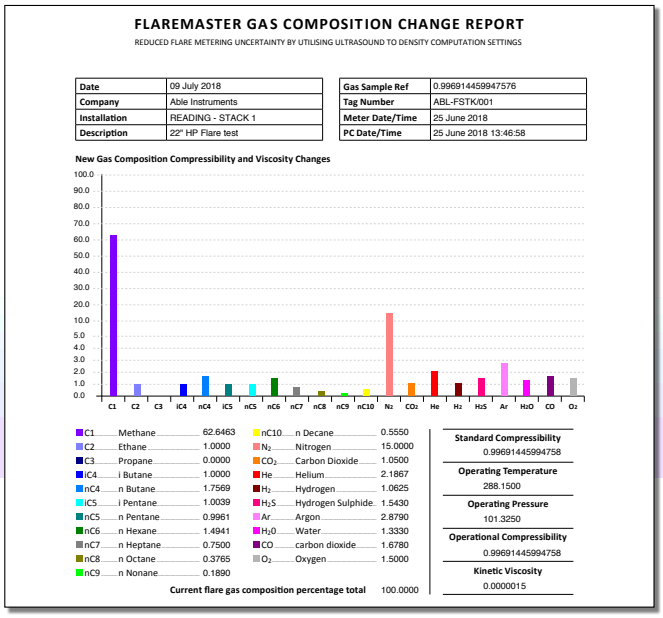
Topology Diagram



FlareMaster System Option I incorporates a state-of-the-art compact processor which facilitates dynamic gas compressibility adjustment, an extended velocity range and comprehensive communication protocol selection.

System Option II equips the FlareMaster with a supplementary, non-invasive sensor array which confers additional redundancy and an advanced software feature set. This imbues the FGM with sustainability of measurement and optimum accuracy under all process conditions, including extreme flare stack blowdown, which can involve flow velocities of up to 1000m/sec. In this configuration, the FlareMaster provides the full dual redundancy, supervisory system referenced above.



FLAREMASTER GAS COMPOSITION CHANGE REPORT

REDUCED FLARE METERING UNCERTAINTY BY UTILISING ULTRASOUND TO DENSITY COMPUTATION SETTINGS

Date	09 July 2018
Company	Able Instruments
Installation	READING - STACK 1
Description	22" HP Flare test

Gas Sample Ref	0.996914459947576
Tag Number	ABL-FSTK/001
Meter Date/Time	25 June 2018
PC Date/Time	25 June 2018 13:46:58

New Gas Composition Compressibility and Viscosity Changes

C1	Methane	62.6463	nC10	n Decane	0.5550	Standard Compressibility	0.996914459947576
C2	Ethane	1.0000	N_2	Nitrogen	15.0000	Operating Temperature	288.1500
C3	Propane	0.0000	CO_2	Carbon Dioxide	1.0500	Operating Pressure	101.3250
IC4	i Butane	1.0000	He	Helium	2.1867	Operational Compressibility	0.996914459947576
nC4	n Butane	1.7569	H_2	Hydrogen	1.0625	Kinetic Viscosity	0.0000015
IC5	i Pentane	1.0039	H_2S	Hydrogen Sulphide	1.5430		
nC5	n Pentane	0.9961	Ar	Argon	2.8790		
nC6	n Hexane	1.4941	H_20	Water	1.3330		
nC7	n Heptane	0.7500	CO	carbon dioxide	1.6780		
nC8	n Octane	0.3765	O_2	Oxygen	1.5000		
nC9	n Nonane	0.1890					
		Current flare gas composition percentage total			100.0000		

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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 **Volumetric Flow**	According to pipe dimensions for the above velocity range
Application Types	Suitable for stratified gas and multiphase flow conditions

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
Wireless communication*/**
IOT Ready

DATAFLOW*
SYSTEM OPTION I**
SYSTEM OPTION II***

Processor

Rockwell Automation Allen-Bradley CompactLogix 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
- Enhanced accuracy flow velocity measurement up to 1000m/sec***
- Significant reduction in flare gas measurement uncertainty
- Potential decrease in reported flare gas totals and consequent financial penalties
- Remote interrogation and parallel monitoring of multiple FGM systems in safe area
- Real-time display of flare gas process data including mass and standard volume flow, totalized flow, velocity, process temperature and pressure
- Stores historical records of measured and calculated data
- Customizable graphs for process parameters with graph template save option
- Remote alarm setting for all instruments or a specific FGM
- 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
- Dual redundancy of measurement**
- Flow calibration curve and linearization functions

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