

FUSION™

A Marine Fuel Accountability & Management System

Description

The FUSION™ system is an advanced purpose-built Marine Vessel Fuel Accountability and Management System that provides a means to accurately measure, record, report and display the fuel consumption and fuel efficiency of marine vessel diesel engines. The system accepts an input from an existing GPS serial data output (NMEA 0183) allowing the vessel crew to select the optimum throttle position based on the real-time display of fuel efficiency.

Measures Fuel Consumption

FUSION™ is designed to measure the fuel consumption of propulsion engines, with an option to measure the fuel consumption of generator engines. The system is configurable for mechanical and electrical drive propulsion systems, and fixed or controllable pitch propellers. As such FUSION™ can be configured to monitor the effects of engine RPM, controllable pitch propeller angle, generator power, and/or drive shaft torque on the fuel efficiency of a vessel.

Applications

The FUSION™ system is designed for use on marine vessels such as oil and gas offshore supply and support workboats, ferries, fishing trawlers, ocean and river tugs, Coast Guard cutters, offshore drilling ships, cruise ships, tankers, and cargo ships. The flow meters are sized for main engines between 1000 HP and 5000 HP each, and diesel generators of 750 kW to 3730 kW. The standard fuels are #2 diesel, MGO, or MDO, but the flow meters can be sized for larger engines and/or calibrated for other fuels upon request.



FUSION™ Wheelhouse Data Acquisition Unit

Features

- Designed specifically for the professional marine operator
- Customizable configuration for each unique vessel
- Real-time wheelhouse display of fuel consumption and efficiency parameters of the user's choice
- Optimize fuel usage for any given weather or sea conditions
- Log of fuel consumption and efficiency data for analysis
- Stainless steel flow meter construction with fail-open geometry for uncompromised vessel safety
- Armored cable interconnections in engine room for highly robust and enduring installation
- Excellent speed of response
- Repeatability of $\pm 0.05\%$
- Temperature compensated fuel flow meter measurement accuracy better than $\pm 0.25\%$
- Volume flow measurements referenced to 60° F

Typical System

A typical FUSION™ system consists of temperature compensated fuel supply and fuel return flow meters for the main propulsion engines, RPM sensors, one engine room junction box to tie all engine room sensors to a central location, one wheelhouse Data Acquisition Unit with a dimmable, touch screen display, one DIN rail terminal strip, and one set of armored cable for all system component interconnections. The fuel supply and fuel return flow meters are a “fail open” design, allowing full fuel flow in the unlikely event of a meter lockup.



FUSION™
Flow Meter



FUSION™
Wheelhouse DAU



Engine Room
Junction Box

FUSION™ Event Manager



The Fusion Event Manager allows the Vessel Operator to access the fuel consumption related data. It triggers the production of reports that include totalized fuel consumption as well as other user selected average results. The report produced is a .CSV file that can be easily interfaced with other data analysis programs such as Excel® and Access®.

A simple to use configuration page allows the Operator to set up how often the fuel consumption related data is sampled. This can vary between 1 minute and up to 24 hours.

The same configuration page also lets the user set up how often the data set is stored and, if required transmitted to the operators land based facilities. The storage and transmission can be set up to occur between 5 minutes and up to 7 days.

So, for example, the operator can configure the Event Manager to send a fuel consumption report once every 24 hours with data sampled every 5 minutes. In this case the report will contain 288 lines of data. Another option might be to receive the data weekly with a data sample rate of 1 hour in which case 168 data lines will be provided.

The totalized fuel consumption related data and selected average results are stored directly in the Fusion DAU. Since the DAU can be networked with other existing vessel computers the data can be copied or moved to these other computers. From there the data report can be emailed to the operators land based facilities. (The Fusion DAU can also directly email the data if it is directly connected to the vessel's modem).

In this way an operator can configure the Fusion systems so that the operation centers automatically receive regular fuel consumption reports. Typical Event Manager data is:

- Vessel name
- Date & time when the data was recorded
- Total vessel fuel consumption
- Total engine fuel consumption
- Distance travelled
- Average engine and vessel efficiency (Galls/Nm)
- Average engine RPM
- Position (latitude & Longitude)
- System healthy status

Once the report is received it can be read as is, or it can easily be converted into spreadsheet or database files for more detailed analysis. The data can be presented in tabular or graphical format.

These fuel consumption reports can be used throughout an operator's organization allowing Management, Operations, Engineering, Maintenance, and Accounting to access the particular fuel consumption or vessel performance data needed.

Specifications

Materials of Construction

Turbine Flow Meter

Flow Meter Housing	316 SST
Rotor	430F SST
Ball Bearings	440C SST
Pickoff Housing	303 SST
PCB Enclosure	Epoxy-coated Aluminum (NEMA 4X rated)

RPM Sensor

Sensor Housing	303 SST
PCB Enclosure	Epoxy-coated Aluminum (NEMA 4X rated)

Engine Room Junction Box

Enclosure	Fiberglass/Polyester (NEMA 4X rated)
Cable Glands	Aluminum

Interconnection Cable

Cable Wiring	Two twisted shielded pair, 18-gauge stranded plated copper cable
Cable Armor	Aluminum interlock armor
Armor Jacket	PVC

Hardware Description

Turbine Flow Meter

Calibration	10 points over flow meter operating range
Viscosity Range	1.2 to 12 cst
Standard Fuel	#2 diesel
End Connections	Male thread per AS4395 (see Flow Meter Capacity chart for individual sizes)
Temp. Compensation	RTD integrated in flow meter
Geometry	Turbine provides fuel flow to engine in the event of turbine seizure

Flow Meter Transmitter

Input Power	24 VDC
Signal Output	RS-485
Operating Temperature	-40° to 185° F (-40° to 85° C)
Enclosure	NEMA 4X rated epoxy coated aluminum with cable gland connections for water proof seal

Data Acquisition Unit & Display

Serial Ports	1 RS232, 1 RS 485, 2 USB
GPS Interface	Serial data NMEA 0183
Display	12.1" color TFT LCD
Sunlight Readable	Yes
Dimmable Screen	Yes
Viewing Angle	130° H / 120° V
Human/Computer Interface	Touch screen

Mounting Configuration	Panel or VESA
Operating Temperature	-10° to 122° F (-10° to 50° C)

Main Engine RPM Sensor

Sensor Thread	5/8" – 18 UNF-2A
Thread Length	2"
Signal Output	RS 485
Operating Temperature	-40° to 221° F (-40° to 105° C)
Enclosure	NEMA 4X rated epoxy coated aluminum with cable gland connections for water proof seal

Analog Sensor Input Module

Channels	8 independently configurable
Input Impedance	Voltage: 20 Mega Ohms Current: 120 Ohms
Inputs	4-20 mA, 0-5 V, 0-10 V
Operating Temperature	14° to 158° F (-10° to 70° C)
Enclosure	Junction box with 4 cable gland input connections, 1 cable gland output

System Specifications

Operating Temperature Range

Standard Engine Room (1)	-40° to 185° F (-40° to 85° C)
Complex Engine Room (2)	14° to 158° F (-10° to 70° C)
Wheelhouse	32° to 104° F (0° to 40° C)

Filtration Needed	10 Micron
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Performance

Calibration Accuracy	±0.05%
Repeatability	±0.05%
Flow Meter Accuracy	±0.25% typical
Viscosity Coefficient	±0.016%/cst
Reference Temperature	60° F

Flow Meter Capacity

Flow Meter	Minimum Flow (GPH)	Maximum Flow (GPH)	End Connection (3)
FT4-8AEU2-LEAT5	12	180	-8
FT6-8AEU2-LEAT5	30	300	-8
FT8-8AEU2-LEAT5	45	480	-8
FT-08AEU2-LEAT5	60	600	-8
FT-10AEU2-LEAT5	75	900	-10
FT-12AEU2-LEAT5	120	1500	-12

Notes:

- 1) A standard engine room monitors only engine RPM and engine fuel consumption.
- 2) A complex engine room monitors existing analog signals such as kW, torque, and/or propeller angle.
- 3) End connections are male per AS4395.
- 4) Flow meter end connections are male per AS4395.

FUSION™ Component Part Numbers

Data Acquisition Unit & Display (DAU)

Part Number 11-67965-104
Description 12.1" TFT LCD with
resistive touch screen interface

Controller Software for DAU

Part Number 09-68063-104
Description FUSION system operating
software, loaded & configured
on DAU

Event Manager Software for DAU

Part Number 09-69744-101
Description FUSION Event Manager software,
loaded & configured on DAU

DAU Mounting Bracket

Part Number 39-69209-104
Description Wall mount bracket

Part Number 39-69209-103
Description Ceiling mount bracket

DIN Rail Assembly

Part Number 03-100464-101
Description Consists of power cable, GPS cable,
and 485 cable

Engine Room Junction Box

Part Number 74-67951-101
Description NEMA 4X rated interconnection
junction box with connections
for up to 6 Fusion sensors

Part Number 74-67951-102
Description NEMA 4X rated interconnection
junction box with connections
for up to 10 Fusion sensors

Main Engine RPM Sensor

Part Number 01-67953-101
Description RPM proximity sensor and
transmitter for main engines

Analog Sensor Input Module

Part Number 01-69189-101
Description RS-485 converter for up to 8
analog signals from existing
vessel instrumentation

Turbine Flow Meter

Part Number FT4-8AEU2-LEAT5
Description 12-180 GPH range,
-8 male AN fittings

Part Number FT6-8AEU2-LEAT5
Description 30-300 GPH range,
-8 male AN fittings

Part Number FT8-8AEU2-LEAT5
Description 45-480 GPH range,
-8 male AN fittings

Part Number FT-08AEU2-LEAT5
Description 60-600 GPH range,
-8 male AN fittings

Part Number FT-10AEU2-LEAT5
Description 75-900 GPH range,
-10 male AN fittings

Part Number FT-12AEU2-LEAT5
Description 120-1500 GPH range,
-12 male AN fittings

Flow Straightener Set

FT4-8 thru FT-08: 44-68400-102
FT-10: 44-68400-103
FT12: 44-68400-104

End Fitting Copper Seal

FT4-8 thru FT-08: 50-82425-08
FT-10: 50-82425-10
FT-12: 50-82425-12

Flow Meter Transmitter

Part Number 01-67952-101
Description RS 485 output transmitter in
epoxy coated aluminum
enclosure, mounted on meter

Armored Interconnection Cable

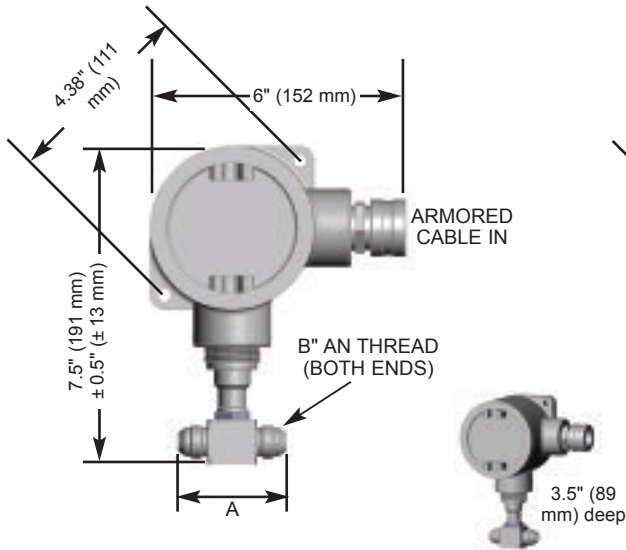
Part Number 19-68143-102
Description 250' ±10% spool of 18 gauge, two
twisted pair cable with aluminum
interlock armor for all engine
room connections

Non-Armored Interconnection Cable

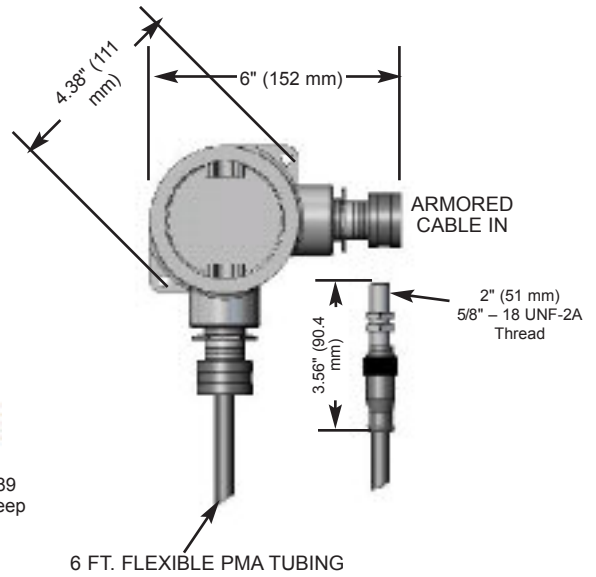
Part Number 19-68144-104
Description 250' ±10% spool of 18 gauge, two
twisted pair cable for connection
from engine room to wheelhouse

Dimensions

Flow Meter

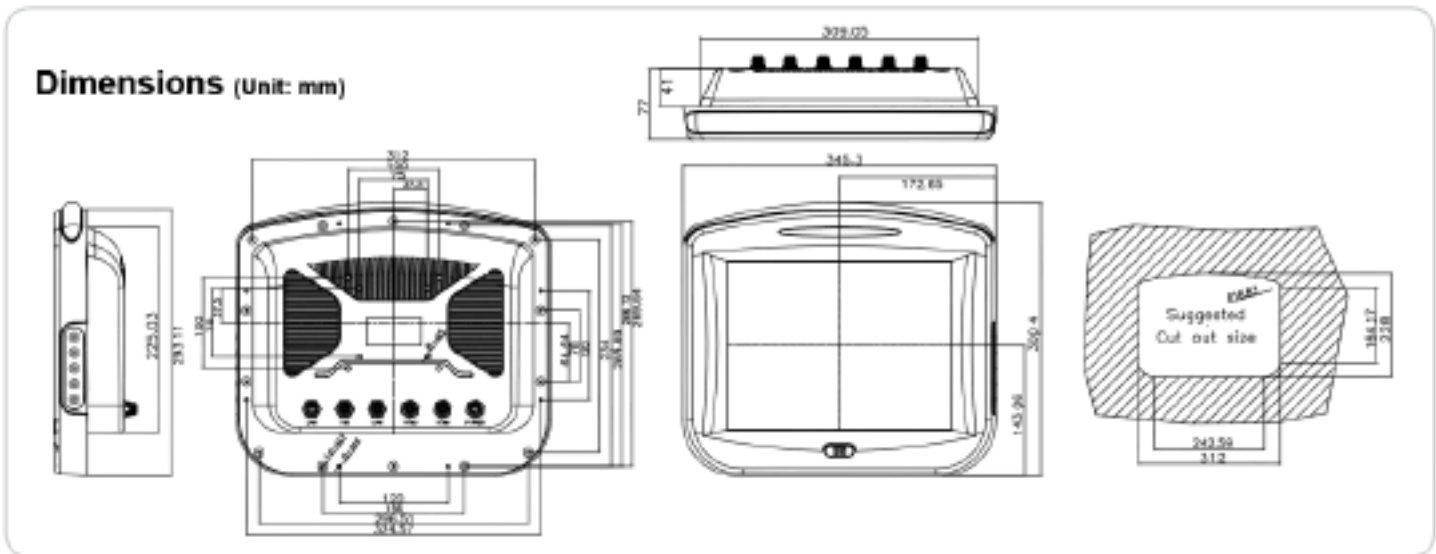


RPM Sensor



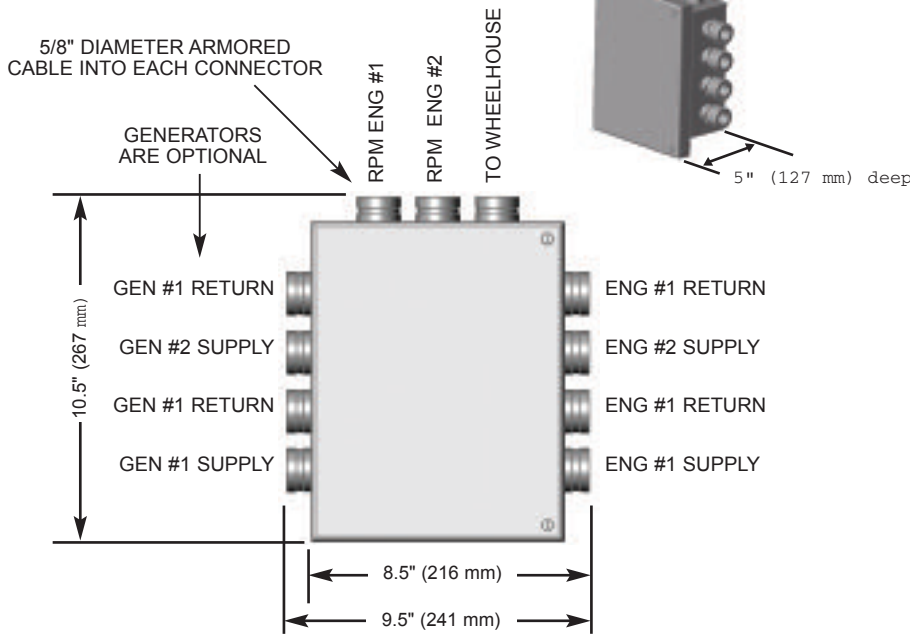
Flow Meter	Dimension A	Thread B
FT4-8AEU2-LEAT5	2.45" (62 mm)	-8
FT6-8AEU2-LEAT5	2.45" (62 mm)	-8
FT8-8AEU2-LEAT5	2.45" (62 mm)	-8
FT-08AEU2-LEAT5	2.45" (62 mm)	-8
FT-10AEU2-LEAT5	2.72" (69 mm)	-10
FT-12AEU2-LEAT5	3.25" (83 mm)	-12

Wheelhouse Display Dimensions

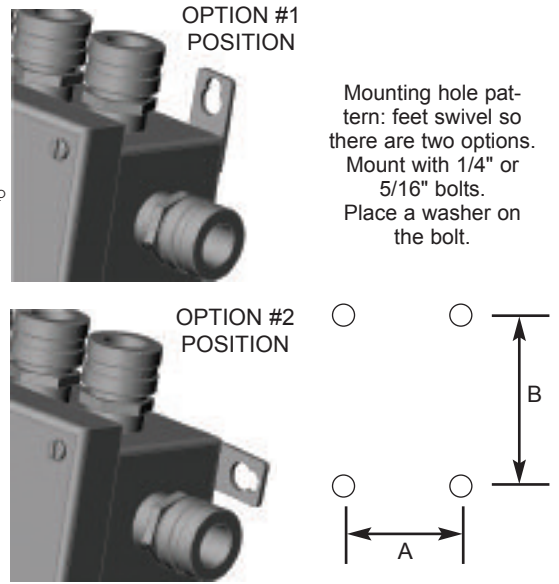


Dimensions (cont'd)

Engine Room Junction Box

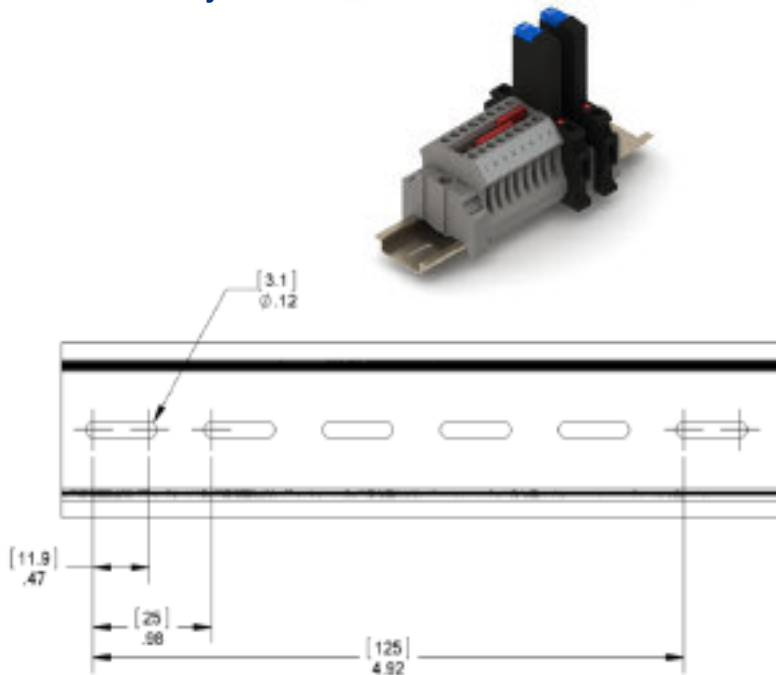


Junction Box Mounting Holes



	Dimension A	Dimension B
OPTION #1	5.00" (127 mm)	9.12" (232 mm)
OPTION #2	7.12" (181 mm)	6.90" (175 mm)

DIN Rail Assembly



Specifications are for reference only and are subject to change without notice.

Local Representative:



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