



FUEL FLOW METER



Product highlights

- **Compact** ultrasonic flow meter suitable for fuel flow measurement motorsport
- **Ultrasonic** flow meter with no moving parts subject to wear
- High **accuracy** and **repeatability**
- Flow **measurement frequency variable** 4.5 - 6 kHz
- **Anti-aliasing** features
- **Long lifetime** under rough operating conditions



Applications

- F1
- WEC
- IMSA
- WSBK
- Other motorsport competitions



Description

Allengra FFM is tailored for operation in the fuel line of internal combustion engines under high vibrations and quick pulsating flow conditions. Without moving parts or components subject to wear, a long lifetime can be guaranteed.

1. Technical data

1.1. FLOW MEASUREMENT

Measurement element:	Ultrasonic transducers	
Measurement range:	+/- 5 – 8000 ml/min	+/- 0.3 – 480 L/h
Calibrated flow range:	+/- 5 – 4000 ml/min	+/- 0.3 – 240 L/h
Accuracy:	< +/- 0.5% of measured value	
Repeatability:	< +/- 0.25%	
Response time:	< 1 ms	

1.2. TEMPERATURE MEASUREMENT

Measurement element:	2x Platinum chip resistor (PT1000)	
Measurement range:	0 – 110°C	
Accuracy:	0.15K	
Repeatability:	0.15K	
Response time:	T95 <2s	

1.3. PRESSURE MEASUREMENT

Measure element	Monolithic pressure sensor	
Measurement range:	-0.1 – 10 barG	
Accuracy:	± 0.1 bar	
Repeatability:	± 0.01 bar	
Response time:	< 1 ms	

2. Environmental data

2.1. OPERATING CONDITIONS

Mediums:	All types of gasoline blends incl. e-fuels
Operating temperature:	0 – 90°C
Thermal shock:	Up to 120 °C
Storage temperature:	- 40 – 100°C (without freezing liquids inside)
Operating pressure:	- 0.1 – 10 barG
Over pressure:	20 barG
Burst pressure:	60 barG
Protection class:	IP68
Relative humidity:	< 95% rh
Lifetime:	> 5 years (inspection > 1 year)

2.2. SUSTAINABILITY

RoHS:	Compliant
Reach:	Compliant

2.3. MATERIALS

Wetted parts:	AISI304, AISI316L, PEEK, FKM
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3. Electrical data

Supply voltage:	5.5 – 24 VDC
Current consumption:	<130 mA @ 12V <220mA @ 5.5V
Electrical connector:	Deutsch ASDD006-09-PA-FI-952K
Mating connector:	Deutsch ASDD606-09SA-FI-952K
PIN assignment:	1 – Supply voltage 2 – CAN1 +ve (TEAM) 3 – CAN1 -ve (TEAM) 4 – CAN2 +ve (FIA) 5 – CAN2 -ve (FIA) 6 – RS485 (ModBus A) 7 – RS485 (ModBus B) 8 – CAN Select (Loom resistor) 9 – GND

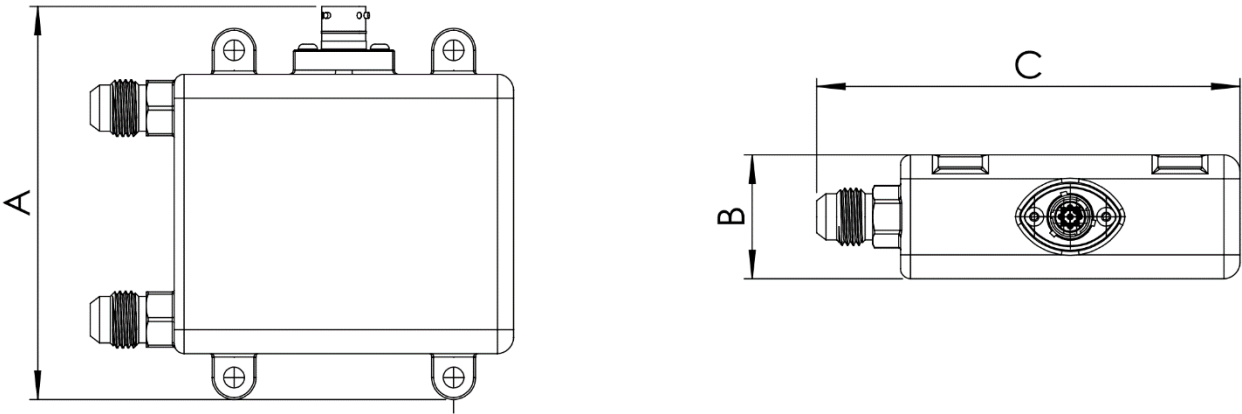
3.1. OUTPUT SIGNALS

CAN/CAN-FD	
Standard:	ISO 11898-2 (high-speed applications)
Message format:	2.0A (11 bit identifier)
Baud rate:	1 / 2 / 4 Mbit/sec
Termination resistor:	open
Base ID:	0x190 (CAN1) / 0x1B0 (CAN2)
RS485	
Designation:	Firmware update and configuration

4. Mechanical

Hydraulic connections:	2x 6AN male
Pressure loss:	200 mBar @ 100kg/h
Weight:	Approx. 390g
Fixation:	4x Ø5.2mm

4.1. DIMENSIONS



A	98.5 mm
B	31 mm
C	106 mm

5. CAN Details

5.1. CAN Select (Loom resistor)

Loom detect resistors	Base ID CAN1	Base ID CAN1
Open	0x190	0x1B0
10k	0x1A0	0x1C0
5k6	0x194	0x1B4
3k3	0x1A4	0x1C4
1k8	0x198	0x1B8
470R	0x19C	0x1BC

5.2. CAN message structure

Base ID + 0								
Message description:			Mass flow, Volume flow, Mass total					
Message ID:			Base ID + 0					
Message format:			Big Endian (MSB First)					
Message rate:			1000 Hz					
Message Type:			Continuous Transmit @ message rate					
Filter:			Filtered flow values (4th order low pass Butterworth with 25Hz – 3dB cut-off frequencies)					
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	
Volume flow (16 bit signed integer MSB first)		Mass flow (16 bit signed integer MSB first)		Total mass (32 bit signed integer)				
Base units: 0.5 ml/min per bit		Base units: 0.5 g/min per bit		Base units: 1g per bit				
Max: 16,384.0 ml/min Min: -16,384.0 ml/min		Max: 16,384.0 g/min Min: -16,384.0 g/min		MSB		LSB		
BASE ID + 1								
Message description:			Multiplexed debug and diagnostics message					
Message ID:			Base ID + 1					
Message format:			Big Endian (MSB First)					
Message rate:			100 Hz					
Message Type:			Continuous Transmit @ message rate					
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	
Speed of sound, 0.1 m/s/bit		0	CAN ID select (1, 2, 3, -)	Fuel temperature (0.01 degC/bit signed)		PCB temperature (0.1degC/bit signed)		
		1	CPU 1 SW Version	Min fuel temperature (0.01degC/bit signed)		Max fuel temperature (0.01degC/bit signed)		
		2	CPU 2 SW Version	Min PCB temperature (0.1degC/bit signed)		Max PCB temperature (0.1degC/bit signed)		
		3	Boot SW version	Hardware version (unsigned)		Supply voltage (0.1V/bit unsigned)		
		4		Diagnostics bitword (unsigned)		Seconds from hardware reset (s unsigned)		
		5	SW programming counter	Latched diagnostics bitword (unsigned)		Total time with flow / Service Indicator (min unsigned)		
		6	Calibration counter	Manufacturer status bitword (unsigned)		Elapsed time indicator (min unsigned)		
		7		Sensor serial number (unsigned)		resistor sense input voltage (0.01V/bit unsigned)		
		8	Density calibration counter	CPU software checksum (unsigned)		density calibration checksum (unsigned)		
		9	Reserved	Bootloader checksum (unsigned)		density value in use (0.1kg/m3/bit, unsigned)		
		10 (A)	Product identification	Configuration checksum (unsigned)		Reference density at a reference temperature (0.1kg/m3/bit, unsigned)		
		11 (B)		Calibration checksum (unsigned)		Reference temperature for density calibration (0.1degC/bit unsigned)		
		12 (C)		Third party calibration checksum (unsigned)		Slope (Density vs temperature) (0.001 kg/m3/degC/bit signed)		
		13 (D)		PCB Serial Number				
		14 (E)		CPU2 Software checksum (unsigned)				
		15 (F)				X axis accelerometers ABS integral (1g.s/bit signed)		
		16 (10)	Antialiasing Configuration		Y axis accelerometers ABS integral (1g.s/bit signed)		Z axis accelerometers ABS integral (1g.s/bit signed)	
		17 (11)			Pressure 1 (0.01 barG/bit signed)		Pressure 2 (0.01 barG/bit signed)	
		18 (12)			ΔPressure (0.001 barG/bit signed)			
	19 (13)							

*Blue marked values from multiplexed message are transmitted only during encrypted session.