

FIREFLY

GlobalMRV is proud to continue the Firefly™, a permanently embedded mini-PEMS specifically geared for HaaS advantages.

GlobalMRV introduces the latest mini “Portable Emissions Measurement System” (mini-PEMS) / integrated PEMS (iPEMS) for real-time, real-world vehicle performance and emissions monitoring and data collection.

The Firefly measures mass flow emissions of CO, CO₂, NO, HC, O₂ in real-time while simultaneously collecting and combining ECU and GPS data that provides:

- Accurate and timely data for informed decision-making
- Large fleet data set collection (ask about HaaS Swarms)
- Minimal set-up time
- Rapid deployment and swap outs
- Data available in ready-to-use format
- Pre-configured formats
- User-defined for customized reports

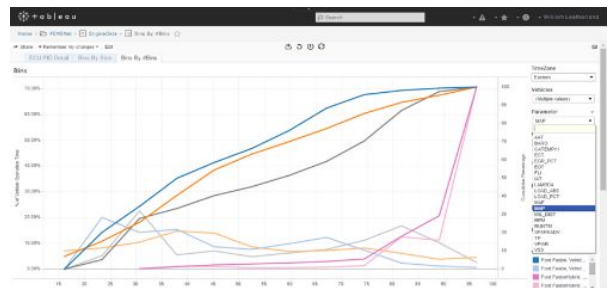
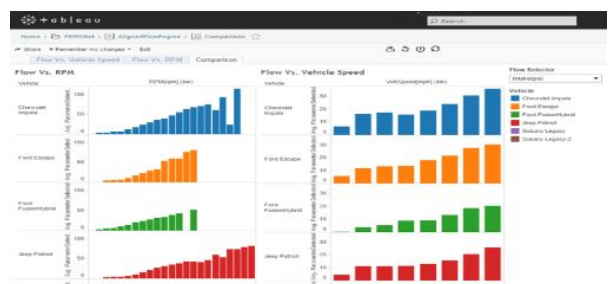
GMRV’s Firefly is powered by LabVIEW®-based proprietary software and easily syncs with CAN broadcast software, such as INCA from ETAS, to provide municipalities, researchers, and OEMs with a fully comprehensive data package for measurement verification and predictive analysis.

The Firefly proprietary software translates emissions data into grams per X (mile, gallon, kilometer, etc.)

Patented indirect exhaust flow measurement provides accurate PEMS flow data. On-board engine information is captured and aligned with engine computer link hardware and software.

Redesigned to include:

- **Optimal setup for HaaS model performance**
- Electromagnetic Interference (EMI) Protection from external devices that may cause erroneous readings
- Multiple USB connections for integration with external devices and additional vehicle data collection products
- Remote data collection, analysis, and storage in real-time for increased security from data loss
- PM and PN Capabilities
- Multi-point calibrations for more accurate range testing



Gas	Range	Accuracy	Repeatability	Noise	Resolution	Measurement and T90
HC Propane	0 - 4000 ppm 4k to 10kppm 10k to 30kppm	±8 ppm abs or ±3% rel ±5% rel ±10% rel	±6ppm abs or ± 2% rel ±3% rel ±5% rel	4ppm abs or 0.8% rel	1 ppm	NDIR < 3.5 sec
CO	0.00 - 10.00% 10.01 to 15.0%	±0.02% abs or ±3% rel ±5% rel	±0.02% abs or ± 2% rel ±3% rel	0.01% abs or 0.8% rel	0.001 vol. %	NDIR < 3.5 sec
CO 2	0.00 - 16.00% 16.01% to 20%	±0.3% abs or ±3% rel ±5% rel	±0.1% abs or ± 2% rel ±3% rel	0.1% abs or 0.8% rel 2% rel	0.01 vol. %	NDIR < 3.5sec
NO	0 - 5000 ppm	±15 ppm abs or ±3% rel	±2% rel	5 ppm abs or 1% rel	1 ppm	Electrochemical < 5s
O2	0.00 - 25.00%	±0.02% abs or ±1% rel	±0.02% abs or ±1% rel	0.02% abs or 1% rel	0.01 vol. %	Electrochemical < 6s
Optional Add-Ons to Select Devices						
NO	0 – 3000 ppm	±2ppm abs or ±2% rel	±2ppm abs or ±2% rel	<2ppm abs or 2% rel	0.1 ppm	UVRAS < 3 sec
NH ₃	0 – 500 ppm	±2ppm abs or ±2% rel	±2ppm abs or ±2% rel	<2ppm abs or 2% rel	0.1 ppm	TDLS < 2s
PM and PN						
	PM and PN			PM		PM
Operating Principle	Laser Scattering			Laser Scattering		Laser Scattering
Measurement Range	0~30,000µg/m³ (0~30mg/m3)			0~50,000µg/m³ 0~50mg/m³ Maximum display 1000mg/m³		0 - 250,000µg/m³ (0-2,500mg/m3)
Output Channels	PM1.0, PM2.5, PM4.25(optional), PM10 and TSP			PM2.5, PM10 and TSP		PM2.5, PM10 and TSP
Resolution	1 µg/m³ (0.001 mg/m³)			1 µg/m³ (0.001 mg/m³)		1 µg/m³ (0.001 mg/m³)
Working Condition	-30°C ~ 70°C,0-95%RH (non-condensing)			-30°C ~ 70°C,0-95%RH (non-condensing)		0-55°C (32°-131°F)
Particle Measurement Results						
PM1.0 [ug/m3]	Yes			No		Optional
PM2.5 [ug/m3]	Yes			Yes		Optional
PM10.0 [ug/m3]	Yes			Yes		Yes
TPS [ug/m3]	Yes			Yes		Optional
0.3um [ct/L]	Yes			No		No
0.5um [ct/L]	Yes			No		No
1.0um [ct/L]	Yes			No		No
2.5um [ct/L]	Yes			No		No
5.0um [ct/L]	Yes			No		No
10.0um [ct/L]	Yes			No		No
Global MRV Compatibility Matrix						
Axion R/S	Yes			Yes		No
Axion R/S+	Yes			Yes		Yes
Axion R/S+ NH3	Yes			Yes		Yes
Axion GO	Yes			Yes		No
Backpack	Yes			Yes		No
Firefly	Yes			Yes		No
Rack or Cabinet	Yes			Yes		Yes
SCS	Yes			Yes		No

Dimensions: 16"L x 12"W x 5"H (407mm x 305mm x 127mm)

Weight: 17lbs. (8.2kgs.)

Trigger Power: 12-14 VDC

Continuous: 12VDC

Amperage: 3-5 Amperes

Data Reporting Rate: 1 Hertz

ECU Data Rate: 1 Hertz Recorded

Sample Flow: 1 to 3.2 liters per minute

System Computer: Windows 10 Embedded

User Interface:

- Direct USB Connection
- Remote Cellular/Wi-Fi via GlobalMRV secure databases, servers, and Tableau Business Information software

Data Output:

- ECU, GPS, and emissions data alignment
- Secure upload to GMRV servers with private, secure access by user
- Access by Tableau business information software

Measured Parameters:

- Via ECU: RPM, IAT, MAP, MAF, Torque%, etc.
- Via GPS: Longitude, Latitude, Altitude, etc.
- Via GA: HC, CO, CO₂, NO, O₂
- Via Ambient Sensor: Temp, Pressure, Humidity

Additional Parameters:

- Grams of pollutant
- Intake airflow
- Exhaust Air Flow
- Fuel Consumption
- Additional as defined

Optimal Instrument Conditions:

- 0°C to 45°C (32°F to 113°F)
- 0-95% relative humidity (RH), non-condensing

Emission Collection:

- Exhaust Condensation Bowl
- Exhaust Sample Probe
- Exhaust Hoses

Applicable Operational Engines: GlobalMRV, Inc. successfully deploys Firefly technology to measure, report, and verify the operations of light-duty and heavy-duty vehicles. Vehicles include passenger vehicles, commercial vans, backhoes, cranes, marine vessels, semi-trucks, and locomotives operating in their normal driving conditions. Firefly collects and allows for the combined analysis of previously untapped engine, GPS, and emissions data.

Optional Modules:

- CAN Output
- PM Module:
 - PM10
 - PM2.5
- Particle Number Module
- Weather Station Module:
 - Temperature
 - Humidity
 - Pressure