

# Phoenix AM/RT Combustion Analysis System



## The ideal instruments for optimal combustion analysis

The performance of an internal combustion engine depends largely on the processes taking place inside the combustion chamber and engine cylinder. The critical metrics include engine power, fuel economy and emissions compliance.

The A&D Phoenix combustion analysis product line offers the ideal instruments for optimal engine calibration. Built on more than 25 years of experience and an installed base of 300+ systems worldwide, Phoenix sets the standard for advanced combustion analysis systems.

The Phoenix AM (Acquisition Module) provides the foundation for any desired combustion analysis system configuration. The 12 high-speed analog input channels support engine speeds up to 20,000 rpm at 0.1° crank angle resolution. When required, two Phoenix AMs can be combined to create a 24-channel system.

By adding a Phoenix RT (Real Time) module, the system will support up to 48 channels and real-time cycle-by-cycle combustion analysis. The Phoenix RT also allows the streaming of the processed data to 3rd-party systems via standard communication interfaces (e.g. CAN, XCP on Ethernet, or UDP).

The Phoenix Combustion Analysis Software (CAS) provides the ability to configure the system hardware based on the specific testing needs of the application. Using the acquired data, Phoenix CAS calculates all of the typical combustion parameters, including Indicated Mean Effective Pressure (IMEP), Heat Release and full Knock evaluation. The results can be viewed with customizable display objects and stored in a variety of formats.



*A 24-channel Phoenix system consisting of two Acquisition Modules (AM) and one Real-Time (RT) module.*

## Benefits

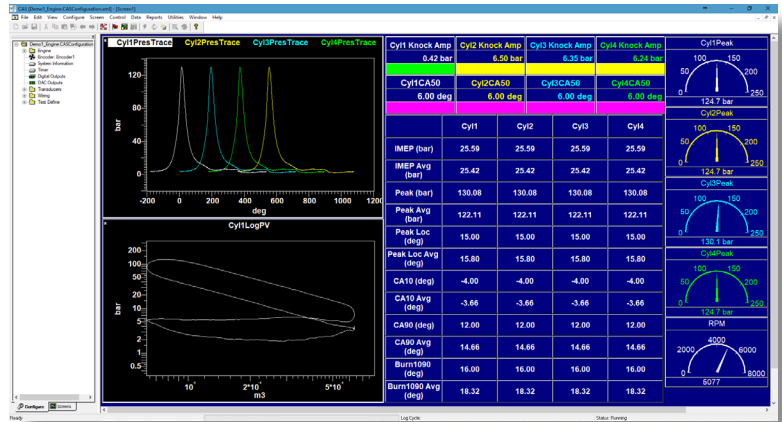
- Based on more than 30 years of experience, Phoenix systems include all the features necessary to meet today's dynamic combustion analysis requirements (details on back).
- Phoenix Acquisition Modules (AM) and Real Time (RT) Modules can be arranged in variety of configurations to support most combustion applications.
- Cycle-by-cycle combustion results can be streamed to third-party systems using multiple standardized protocols (XCP on Ethernet, UDP, CAN) for data collection and as feedback signals for closed-loop control.
- To provide flexibility for today's ever-changing industry, Phoenix offers user-defined cycle-by-cycle calculations and allows for implementation of proprietary algorithms (i.e. Knock).

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## Phoenix CAS

### Built-in Combustion Calculations

- Indicated Mean Effective Pressures (IMEP)
- Misfire Detection
- Full Knock Evaluation
- Start and End of Combustion
- Mass Fraction Burned and Heat Release
- Peak Pressure and Location of Peak Pressure
- Maximum Rise and Location of Maximum Rise Rate
- Combustion Noise Level Evaluation
- Ignition and Injection Timing
- Ignition Delay



### Benefits

- A variety of configurable display objects allow for clear and concise data review
- Compatible with industry-standard post-processing tools
- Calculate and view combustion parameters during testing for data analysis
- Graphical interface simplifies hardware configuration

## Typical Configurations

The Phoenix AM and RT modules can be combined in a variety of configurations, from a 12-channel to a 48-channel RT system.



24-channel Phoenix RT



36-channel Phoenix RT

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## Specifications

Category	Feature	Phoenix AM	Phoenix RT	Phoenix C3
High-Speed Analog Inputs	# Channels	12 per module up to 24	12 per module up to 48	2 on main processor 4 per input module Up to 12 channels
	Resolution	16-bit	16-bit	16-bit
	Acquisition Rate	20,000 RPM at 0.1° 2 MHz	20,000 RPM at 0.1° 2 MHz	8,000 RPM at 0.1° 2 MHz
	Low-pass filters	None, 12.5kHz, 25kHz, 50kHz	None, 12.5kHz, 25kHz, 50kHz	None, 12.5kHz, 25kHz, 50kHz
	Input Ranges	± 1 V, ± 2 V, ± 5 V, ± 10 V,	± 1 V, ± 2 V, ± 5 V, ± 10 V,	± 1 V, ± 5 V, ± 10 V
	Input Impedances	~25 kΩ (~100 kΩ on ± 50 V range)	~25 kΩ (~100 kΩ on ± 50 V range)	10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ
Low-Speed Analog Inputs	# Channels	N/A	N/A	2
	Resolution			12-bit
	Acquisition Rate			8,000 RPM at 1.0° 500 KHz
	Input Ranges			± 10 V
Analog Outputs	# Channels	N/A	16	N/A
	Resolution		16-bit	
	Update Rate		100 Hz	
	Output Range		± 10 V	
Digital I/O	# Channels (Up to four used by an encoder)	8 inputs	16 outputs	4 inputs or 4 outputs 4 per module, up to 12
	Input Ranges	TTL	N/A	± 5 V
	Maximum Encoder Resolution	0.1°		0.1°
Data & Analysis	Analysis Method	Data is streamed to host PC for analysis	Real-time cycle-by-cycle data is streamed to the DSP core on-board Phoenix RT for analysis	Real-time cycle-by-cycle data is streamed to the DSP core on board Phoenix C3 for analysis
	Analysis rate without missing an engine cycle	Lossless real-time analysis not guaranteed over 1,200 RPM	12,000 RPM at 0.1°	8,000 RPM at 0.1°
	System Memory	256 MB	2 GB	1 GB (plus SD card for data storage)
	Non-volatile logging	N/A	SD	SD
	Test Bench Interfaces	Winsocket	Winsocket, UDP, XCP and CANbus	XCP & CANbus
	Host PC Connection	1 Gigabit Ethernet	1 Gigabit Ethernet	1 Gigabit Ethernet
	Headless Operation	No	No	Yes
Power & Mechanical	Input Power	10 - 16 volts DC (50 watts @ 12VDC) 120/240 V 50/60 HZ VAC external power supply	10 - 30 volts DC (50 watts @ 12VDC) 120/240 V 50/60 HZ VAC external power supply	9-30 volts DC (20 watts @ 12VDC) 120/240 V 50/60 HZ VAC external power supply
	Dimensions (Single Module)	343mm (W) x 194mm (D) x 44mm (H) 13.5" (W) x 7.6" (D) x 1.8" (H)	343mm (W) x 200mm (D) x 44mm (H) 13.5" (W) x 7.9" (D) x 1.8" (H)	165mm (W) x 197mm (D) x 45mm (H) 6.5" (W) x 7.75" (D) x 1.75" (H)
	Weight (Single Module)	2.2 kg (4.9 lb.)	2.2 kg (4.9 lb.)	CPU board 1.0 kg (2.2 lb.) Add-on board 0.6 kg (1.4 lb.)
Environmental	Operating temperature	0 °C to 50 °C (32 °F to 122 °F)	0 °C to 50 °C (32 °F to 122 °F)	-40 °C to 70 °C (-40 °F to 158 °F)
	Operating humidity	0% to 95% humidity non-condensing	0% to 95% humidity non-condensing	0% to 95% humidity non-condensing