

DESCRIPTION

Waukesha Engine's Custom Engine Control (CEC) Detonation Sensing Module (DSM) has the ability to sense detonation occurring in a cylinder and retard timing as necessary on an individual cylinder basis. On 16 cylinder engines, two "paired" cylinders are controlled.

The DSM works directly through the CEC Ignition Module's (IM) expansion port to adjust timing. Timing is adjusted every second. Sensors located on or near the cylinder heads send a continuous signal to a DSM filter when the engine is operating.

The filter sorts out the signals that represent detonation, and relays that information to the DSM. The DSM evaluates the filtered signal and adjusts timing accordingly until detonation is eliminated or a maximum timing retard value is reached. For dual fuel applications or other applications where a change in timing is required, the DSM system automatically changes cylinder timing.

FEATURES AND BENEFITS

Optimum Performance - The DSM will advance timing to the nameplate timing value as engine conditions allow. This maximizes fuel economy, minimizes emissions, and provides maximum power under adverse conditions. Up to five percent more power is achievable than with other systems under adverse conditions.

No Scheduled Maintenance - The CEC DSM offers no scheduled maintenance operation. Once the DSM is programmed for a specific engine site, there are no required adjustments, and no moving parts to wear out.

Diagnostics - On board diagnostics will identify problems with any sensors or harnesses. LEDs allow for visual troubleshooting. Three LEDs give operators confirmation on power and system status (alarm and shutdown). Inside the DSM, an LCD continually shows the current status of the DSM system with numerical diagnostic codes. There is also a remote alarm feature to warn operators off-site of any alarm conditions.

Application Flexibility - With the addition of customer supplied external logic, the DSM system can be tailored to meet customer needs. The DSM system first retards timing if detonation occurs. If retarding the engine does not eliminate detonation, the DSM will provide a signal that may be used to trigger any number of actions such as change the engine's air/fuel ratio, reduce engine load, or sound an alarm. An RS-232 serial port is provided for remote monitoring and logging of all system data with a PC or other data management systems.

COMPONENTS

Waukesha's CEC DSM system consists of the electronic module, electronic filter, detonation sensors, and wiring harnesses. The module and filter can be located on or off engine.

RETROFIT CAPABILITY

DSM is standard on ATGL® and VGF® vee engines. Retrofit kits are available for ATGL and VGF vee engines.

Detonation Sensing Module



Custom Engine Control
DSM

- CSA Certification, Class I, Division 2, Group D
- Optimizes performance
- Detonation protection
- Controls individual cylinder timing
- Built-in diagnostics/operating status
- PC/PLC interface capability
- Continuous feedback monitoring
- Dual fuel capability

SPECIFICATIONS

Module Size

- 4.25" H
- 8.25" L
- 9.55"W

Mounting Centers

- 6" L
- 8.75"W



Waukesha CUSTOM[®] ENGINE CONTROL

IGNITION MODULE

The CEC Ignition Module (IM) is a microcircuit-based, digital ignition system. With no scheduled maintenance, and built in diagnostics, the IM is designed to enhance the reliability and performance of your Waukesha Engine while maximizing engine up-time.

DETONATION SENSING MODULE

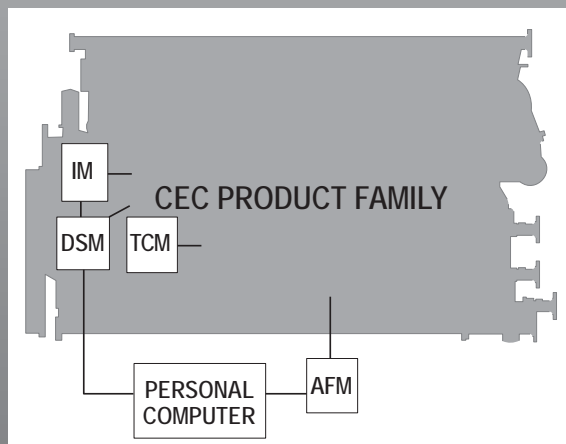
The CEC Detonation Sensing Module (DSM) works in conjunction with the ignition module to protect Waukesha spark ignited gas engines from damage due to detonation as well as maintain fuel economy and power output during adverse operating conditions.

AIR/FUEL MODULE

The CEC Air/Fuel Module (AFM) optimizes fuel consumption and emissions even when fuel composition and ambient conditions change dramatically.

TURBOCHARGER CONTROL MODULE

The CEC Turbocharger Control Module (TCM) improves turbocharger efficiency and enhances engine performance by precisely matching turbocharger output to engine needs under all operating conditions.



CEC Product Family

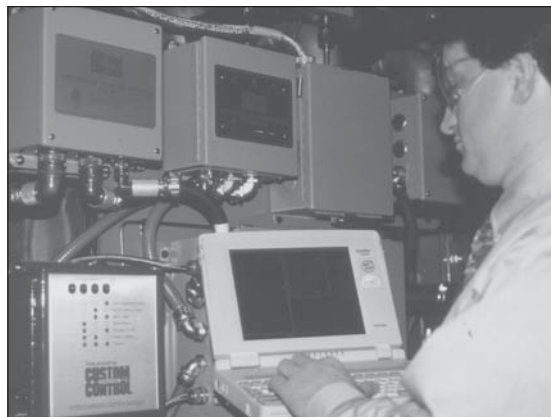
The CEC family consists of an Ignition Module (IM), Detonation Sensing Module (DSM), Air/Fuel Module (AFM), and, on ATGL engines, the Turbocharger Control Module (TCM). Together they form a comprehensive engine management system that optimizes engine performance. Even when large changes in operating conditions occur, there is no discernible difference in engine performance.



The Custom Engine Control Family includes (left to right) the Air/Fuel Module, Detonation Sensing Module, Turbocharger Control Module, and Ignition Module. Together, they form a comprehensive engine management system that optimizes engine performance.

Programming Tailored To Your Needs

The AFM, DSM and TCM programs can be tailored to meet your performance needs. Thus emissions, fuel consumption and engine response can all be optimized for a given application. The AFM has dual programming schedules to accommodate dual fuel applications. Performance can be tailored on each fuel. There is no need

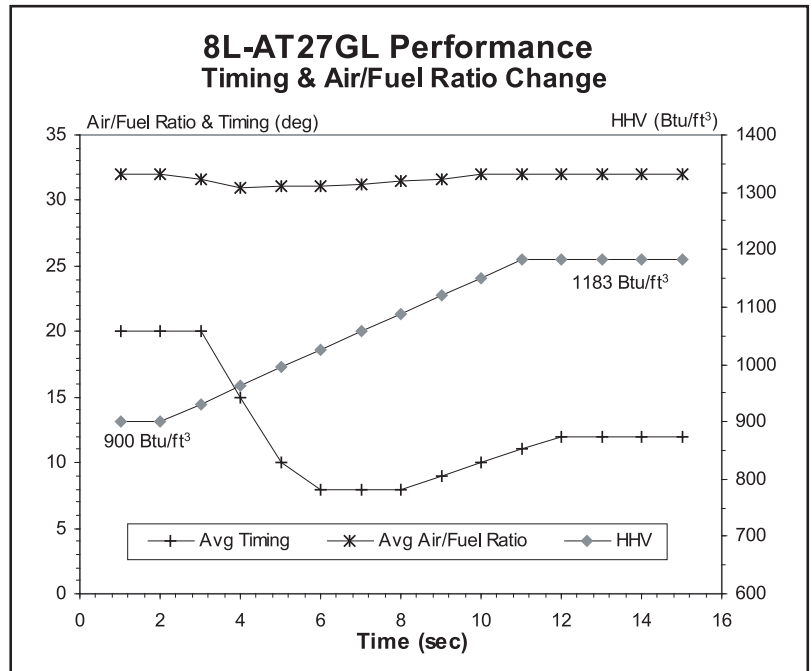


to compromise performance on one fuel due to operating limitations that might be imposed by the other. Similarly, the DSM has dual timing schedules which permit operation in two different timing ranges. This might be required in dual fuel or other applications where optimum performance

cannot be achieved with a single timing range. The operation of the TCM can be tailored to facilitate maximum engine response, maximum turndown capability, or maximum fuel efficiency whichever is most appropriate for the application.

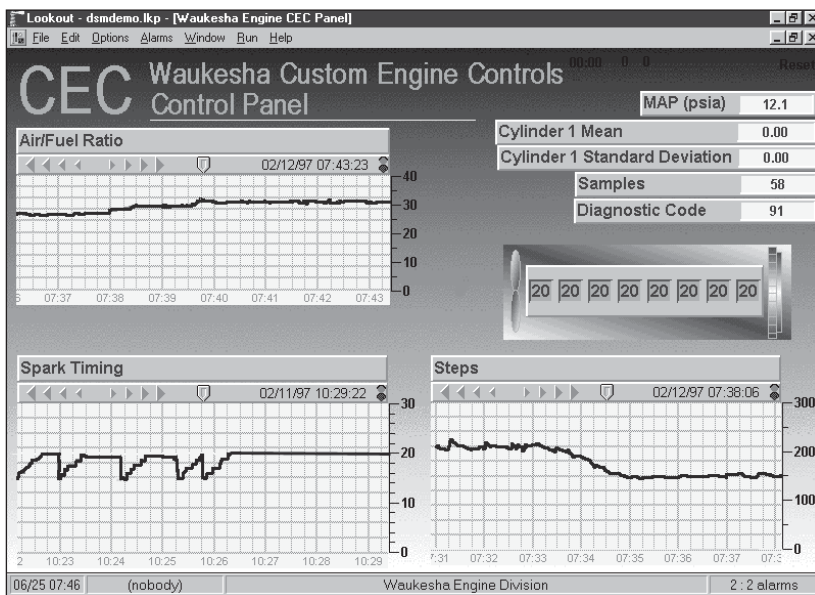
CEC PRODUCT PERFORMANCE

An example of system operation during significant changes in fuel composition is shown in the figure. In this severe test, the CEC family of products maintained peak engine performance under extreme conditions. Fuel composition was changed from a mixture with 900 Btu/ft³ and a Waukesha Knock Index™ (WKI™) value of approximately 94, to nearly 1200 Btu/ft³ with a WKI value of about 52 within 9 seconds. The CEC engine management system simultaneously adjusted all control parameters as required to keep the engine running smoothly, at rated power and the best fuel economy emissions possible. The AFM system kept the engine from becoming too rich. Only a slight change in air/fuel ratio occurred during the transition in fuel composition. Thus, emissions were maintained and the tendency for detonating was reduced (refer to the average air/fuel ratio curve in the figure at the right). At the same time the AFM was adjusting air/fuel ratio, the DSM system was monitoring the combustion process to see if a change in ignition timing was required. In this test, even with proper air/fuel ratio control, the huge change in WKI necessitated a change in ignition timing. The DSM system retarded and advanced engine timing, via the CEC Ignition Module, to the optimum level. Power was maximized while maintaining detonation free combustion (see the average timing curve in the figure above). This is just one example of how the CEC family of products can enhance engine performance under even the most difficult operating conditions.



ABOVE: An example of system operation during significant changes in fuel consumption. In this test, the CEC family of products maintained peak engine performance under extreme conditions.

The CEC family forms a comprehensive engine management system that optimizes engine performance.



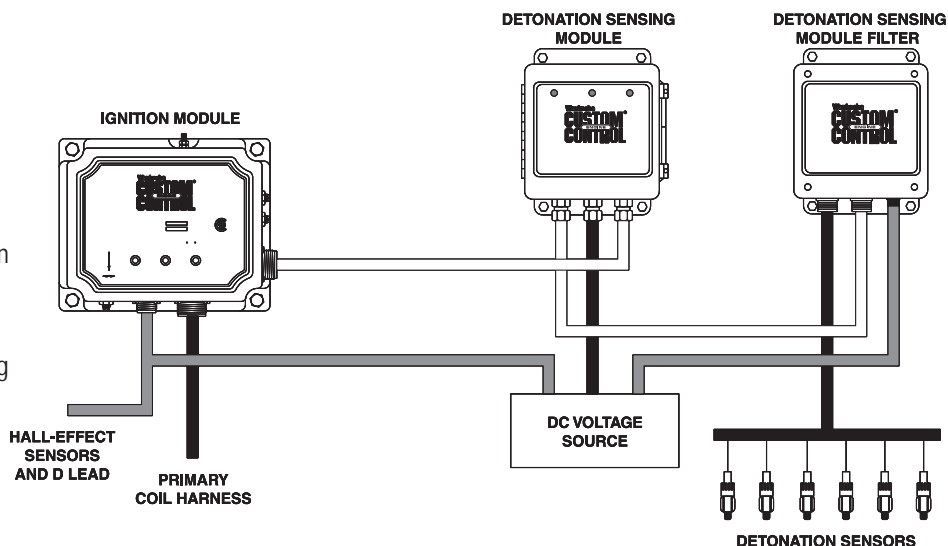
ABOVE: An example of a screen developed with data acquisition software which is used to display information and trend data on engine performance.

Data Acquisition Monitoring Capability

It is possible to acquire continuous streams of data about your engine's performance from the CEC product family using data acquisition software (provided by customer). The CEC data streams provide information such as knock sensor status, diagnostic codes, air/fuel ratio operating point, and individual cylinder timing. Through the use of a PC this information can be logged and used for system trending and analysis. The figure to the left is an example of a screen developed with data acquisition software which is used to display information and trend data on engine performance. The information format of the serial streams is available from Dresser Waukesha Application Engineering.

DETONATION SENSING MODULE (DSM) SYSTEM LAYOUT

- Single common unit for all engines, PC programmable
- Individual cylinder sensing and timing control (cylinder pairs on 16 cylinder engines)
- Front panel power, alarm, and shutdown LEDs
- Remote alarm and shutdown signals
- RS-232 serial port for remote monitoring
- 14-pin connection from IM



DSM FILTER	ENVIRONMENTAL
<ul style="list-style-type: none"> • 19-pin input connection from detonation sensors • 14-pin output connection to DSM • 3-pin power supply connection 	<ul style="list-style-type: none"> • Ambient Air Temp. Range -40° F (-40° C) to 150° F (66° C) • Enclosure..... NEMA Type 3R Design • Meets CSA Class I, Division 2, Group D, hazardous location requirements
DETONATION SENSORS	MINIMUM COMPUTER REQUIREMENTS
<ul style="list-style-type: none"> • ATGL and VHP have one sensor per cylinder. VGF Series engines have one sensor for two cylinders • Sensor harness connects to DSM filter • Identical sensors for all applications 	<ul style="list-style-type: none"> • Microprocessor 80286 - 12 MHZ • Floppy Disk Drive 3.5" 1.44 MB • Serial Port..... RS-232 • MS-DOS 3.3 or higher • Serial Cable DB-9
CUSTOM ENGINE CONTROL - IGNITION MODULE	OPERATOR INTERFACE
<p>(Required for DSM System Operation)</p> <ul style="list-style-type: none"> • Two 16-position ignition timing control switches (disabled when DSM is functioning) • 14-pin connection from DSM • 7-pin input connection for timing and power supply • Multiple-pin connection for power output to coils 	<ul style="list-style-type: none"> • Front Panel LED Display(Power, Alarm, Shutdown) • LCD Shows current system status • Data Stream FormatASCII • External Alarm Signal and Shutdown(1 amp, sinking) • The use of a power supply with a battery will eliminate the possibility of engine shutdown if main utility power is lost.
POWER REQUIREMENTS - DSM AND DSM FILTER	
<ul style="list-style-type: none"> • Voltage.....24 VDC • Operating Range 21.6 - 30 VDC • Ripple Peak-to-Peak.....less than 2 VAC • Operation Current..... 1.5 amps 	

Consult your local Waukesha Distributor for system application assistance. The manufacturer reserves the right to change or modify without notice, the design or equipment specifications as herein set forth without incurring any obligation either with respect to equipment previously sold or in the process of construction except where otherwise specifically guaranteed by the manufacturer.

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