



# MICHIGAN CUSTOM MACHINES, INC.

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[www.mcm1.com](http://www.mcm1.com)

## Product Highlight:



**XCITE**, the programmable fuel injector driver, provides the consumer with a means of firing a gasoline/petrol GDI or diesel fuel injector in a manner that duplicates the vehicle application.

### Background

A typical modern electronic diesel or GDI injector requires much more power and control than a typical PFI injector. Usually, the current delivered to the injector must be delivered at a rate, held and then reduced once the injector actuator has moved. The reduction in current keeps the injector solenoid from overheating once the work from the solenoid has been done and greatly extends its life. During the holding phase, the current is dithered at a high frequency to minimize the hysteresis within the injector. This sequence is called a shot. To complicate matters, modern engines utilize complex strategies that require several "shots" within the combustion phase to achieve emission goals, quiet operation and improved performance. The timing of these waveforms is also critical and directly affects the performance of the injector and engine. The combination of OEM accuracy and control for a variety of injectors has made the task of a common ECU a challenge for the testing industry until now.



Feature	Benefit
Fully configurable through serial or Ethernet port using our <b>XCITE</b> companion software	No need to learn programming
Able to duplicate OEM waveforms easily	No need to learn how to integrate multiple controllers
Able to synchronize with rotating mass or fire asynchronously	Commonality using same controller for multiple product types
Compact, self-contained design is not much larger than OEM controller	Fits in your machine if needed
Open communication protocol allows easy interface to machine control	Integrates into your custom application
Ethernet IP device compatible for PLC integration	Ease of use for PLC programmers
Included software package	Allows easy configuration from PC or Laptop
Able to store up to 4 multi-shot waveforms for instant recall from digital inputs	Integrates easily with non-computer controlled machines
Open or shorted injector connection detection	Protects itself from damage

**Seamless integration with Ethernet IP enabled PLCs**



### Description

**XCITE** can be used to fire an injector with a precise waveform that is fully configurable by the end user. Synchronization with a cam or crank is possible with several input options such as encoder, once-per-rev or engine timing wheel with sensor. Communication is available using Ethernet I/P or RS-232, using an open protocol. Drivers for Visual Studio applications are available as well as a configuration tool called XCITE Companion that allows real time editing of control variables. The module is designed to retain parameters in non-volatile memory for simpler applications that require infrequent configuration and no communication, including 4 waveforms that can be recalled using digital inputs on the connector.

### The module was designed for:

- OEM future product development, giving extended experimental range over the production ECU
- Test bench integration for endurance testing fuel injectors
- Production test machine integration for in-line and end-of-line testing
- Lab bench or audit bench integration
- Expanded use with custom firmware
- Customers that test several injector types and brands on the same equipment
- Retrofitting older machines for upgraded control of electronic fuel injectors

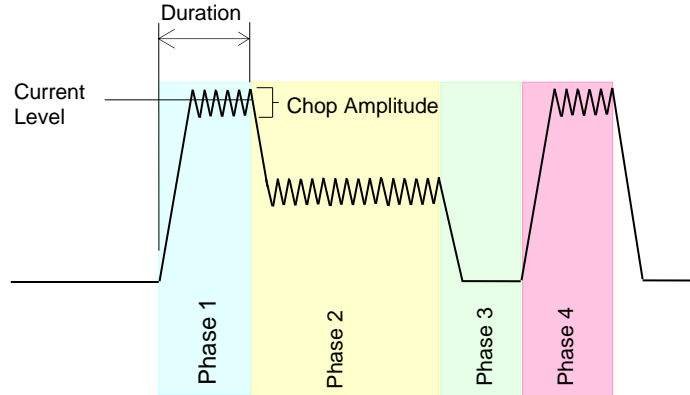
Using **XCITE** for your application eliminates the need to address proprietary OEM communication protocols on a platform that has been designed and calibrated for precision, exceeding production hardware.

Please contact us at [sales@mcm1.com](mailto:sales@mcm1.com) for more information.



**Flexibility**

No matter what your requirements, **XCITE** can deliver. The following waveform is an example of a waveform for a pilot and main injection for an injection cycle. The various controllable and programmable features are numerically labeled and described in the following table. Though this example shows two current levels and two splits, virtually anything else is possible up to 20 phases. A phase is a length of time with a voltage, current, chop amplitude and boost voltage. The following example of two splits demonstrates 4 phases.



**Programmable Features**

Phase Feature	Name	Description	Range	Resolution
Current	Current	Current driven to the solenoid. Typically, there is a higher current to initially begin movement of the actuator and then current is dropped to maintain the opened condition. Phase 1 shows an example of pull-in. Phase two shows an example of hold-in.	0-30A	100 mA
Voltage	Boost	For each phase the Boost voltage can be set to a target, turned off so that battery voltage is used or set to the default value that is set under the general parameters.	0-110V	1 Volt
Time	Duration	The time that the phase current is applied for <sup>1</sup> .	0.001 ms to 30 ms	1µsec
Duration	Delay	This phase would have a current of 0 and is demonstrated in Phase 3.	0.05-100 ms	1µsec
Voltage	Rise Rate	The rise rate is a function of the voltage applied and solenoid characteristics of the injector <sup>2</sup> . The module controls the applied voltage in each phase.	Supply voltage to 110V	1 Volt
Zener Voltage	Fall Rate	This is the rate at which the current is reduced at the injector, using our protected technology. Fall rate is a function of the applied Zener voltage and characteristics of the solenoid on the injector <sup>3</sup> . This is adjustable per phase.	Supply voltage +10 to 110V	1 Volt
Chop Amplitude	Chop Amplitude	This is the level of current regulation in the hold state of the waveform phase.	100 mA-1A	10 mA
	Actuation Speed	When firing asynchronously, the module dictates the firing rate	100-6000 CAM RPM	1 RPM

<sup>1</sup> Note that improper parameters could result in solenoid damage

<sup>2</sup> Rise rate is defined as the applied voltage divided by the inductance of the injector solenoid (varies by type)

<sup>3</sup> Fall rate is defined as the control voltage divided by the inductance of the injector solenoid (varies by type)



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### BIP Mode

The **XCITE** driver also supports older diesel injectors that run on battery voltage which is typically 12-24VDC. In this mode (called BIP mode) the injector monitors the injector current for an inflection when it is fired. When the inflection is detected the current chops at battery voltage for the duration programmed minus the time that it took for the injector to pull in. This technique is used because the lower battery voltage causes the injector to pull in slower and in a less repeatable fashion. Note that when in BIP mode, subsequent phases from the first are not processed.

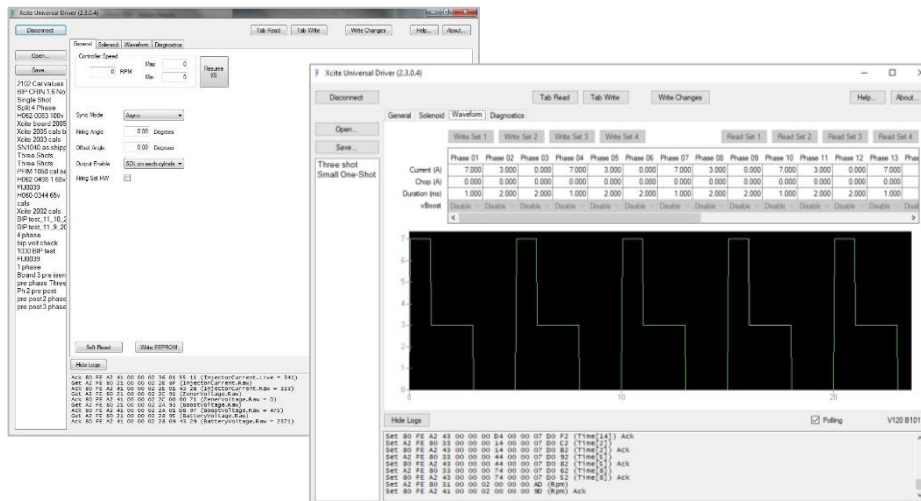


### Specifications

<b>Utilities</b>	
Electrical Power	12-24 VDC, 5A
<b>Specifications</b>	
Maximum number of injectors	1
Maximum injector current	30A
Maximum boost voltage to injector	110V
Communication	RS232 and Ethernet IP
Serial protocol	Structured, loosely based on SAE J1708 protocol
Maximum speed	6000 RPM
Environment temperature	10 – 45 C (50 – 113 F)
<b>Connections</b>	
Serial port	RJ11 (DB9 to RJ11 cable and software included)
Ethernet IP	RJ45
Power	Screw terminals on removable connector
Injector	Screw terminals on removable connector
Wave form selection	Screw terminals on removable I/O connector
Hall effect switch, OPR	Screw terminals on removable I/O connector
<b>Mechanical</b>	
Dimensions	210 x 313 x 82mm (8.25 x 12.5 x 3.25")
Mounting	4 adjustable mounting feet
Weight	1.36 kg (3 lbs.)
Construction	Powder coated aluminum housing

### XCITE Companion Software

Allows complete configuration for your program



Please contact us at [sales@mcm1.com](mailto:sales@mcm1.com) for more information.



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### Dimensions

