

CPU-2000

ADVANCED DIGITAL IGNITION SYSTEM

- **Microprocessor-based, crankshaft-referenced**
- **Enhanced Engine Performance**
 - Precise timing for uniform peak pressures
 - Individual cylinder timing to balance engine
 - Selectable energy level for improved plug life
 - Multi-striking mode for emissions reduction
- **Comprehensive Display Capabilities**
 - Operating mode and diagnostic status
 - Ignition timing and cylinder offsets
 - Engine speed and overspeed setting
 - Diagnostic messages
 - Relative spark plug voltage (optional module)
- **Optional Diagnostic Module Features**
 - Relative spark plug voltage requirement
 - Diagnostic alarms based on spark plug voltage
 - Automatic energy adjustment
- **ModBus RTU Communications Protocol Supported**
- **Cost-effective retrofit from Altronic II-CPU**

The Altronic CPU-2000 is a 24 Vdc-powered, microprocessor-based digital ignition system for application to large natural gas-fueled engines. Advanced control, diagnostic, display, communications, and emissions-reduction features allow for monitoring and control of the engine's ignition and combustion. An optional Diagnostic Module, easily retrofit to existing CPU-2000 installations, enables users to monitor and act upon changes in spark voltage demand.

Critical operating parameters and diagnostic messages are displayed on the Logic Module's alphanumeric, backlit display. These include engine RPM, ignition timing angle, energy level, multi-strike mode, and system and pickup faults.

Most system features, including global and individual cylinder timing, ignition energy, multi-strike mode, and overspeed setpoint are accessible from the keypad as well as via an RS-485 serial port. Setup and application-specific adjustments are made through a standard personal computer.

The optional Diagnostic Module uses innovative technology to indicate relative spark plug voltage and the need for spark plug replacement on an individual cylinder basis. The patented Altronic approach requires no external sensors or connections to the high-tension leads. The system can automatically control system energy levels in relation to the monitored spark plug voltage requirement to provide higher energy levels only when needed, thus minimizing spark plug erosion.

Existing Altronic II-CPU coils, pickups and cables, primary harnesses, and junction boxes are reused with the CPU-2000 system allowing for simple and economical retrofit.



Advanced Display Capability

Typical Running Message

```
FIRING 11s 226RPM
15.0mA 10.0° Btdc
```

Typical Diagnostic Message

```
RING GEAR FAULT
351 TEETH READ
```

Description and Operation

The CPU-2000 system consists of the Logic Module, Output Module, two magnetic pickups and cables, wiring harnesses, and an ignition coil for each spark plug. Four-cycle applications incorporate a Hall-effect pickup and a magnet rotating at camshaft speed to determine the compression cycle.

Two magnetic pickups input two external signals:

- Counts from holes drilled in the engine flywheel or starting ring gear.
- A reset pulse generated once per engine revolution.

The system Logic Module, capable of being remotely-mounted or placed in an engine control panel, accepts and processes all pickup and timing control data. It initiates the firing of the appropriate outputs in the CPU-2000 output module in a “real time” relationship with the engine crankshaft. This process yields accurate ignition timing regardless of variations in engine speed.

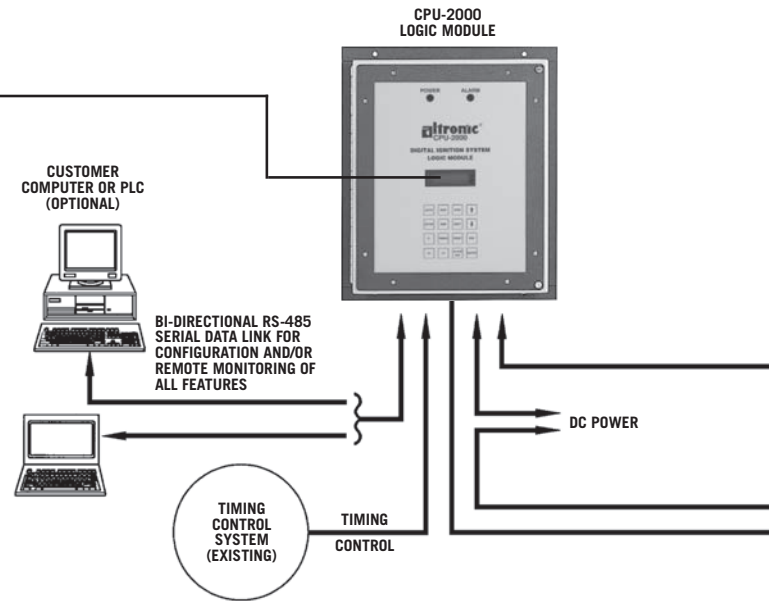
The internal EEPROM memory chip can be programmed at the factory with all of the appropriate engine data, including application firing pattern, number of holes or teeth, and timing control curves. Field configuration can be accomplished utilizing an IBM-compatible PC via the on-board serial port. The memory chip may be unplugged and moved from system to system to facilitate maintenance without reconfiguration.

Various other system features and functions, including the ability to adjust ignition energy levels and multi-strike modes (for improved starting or emissions control) can be accessed through the keypad/display or via the serial data link.

Advanced system diagnostics, also accessible through the system display and keypad, assures the prompt and accurate isolation of ignition system-related problems.

Primary and Secondary Discharge Diagnostics and Prognostics (U.S. Pat. No. 5,623,209)

The optional Diagnostic Module greatly expands the user’s on-engine, in-cylinder troubleshooting capability. Each ignition output is monitored on a continuous basis to provide both primary and secondary circuit analyses. Each diagnostic condition is annunciated on both the Logic Module display and RS-485 communications port. The patented Altronic approach requires no external



sensors or connections to the high-tension leads. The CPU-2000 Diagnostic Module continuously monitors, computes and makes available for display (or RS-485 serial output) the following:

Up to 16 cylinders on one screen show at a glance relative spark demand of each cylinder. Variance from average mode (shown) quickly conveys cylinders with high and low voltage demand.

```

# # # # # # # # # # # # # # # #
A B C D E F G H J K L M R S T U
  
```

INST – The current value of the cylinder spark reference number for the cylinder indicated. This is an indication of the voltage demand for that cylinder.

```
CYL A1 132 INST
MIN 120 142 MAX
```

MIN and MAX – The minimum and maximum values (since the last reset) for the cylinder spark reference number.

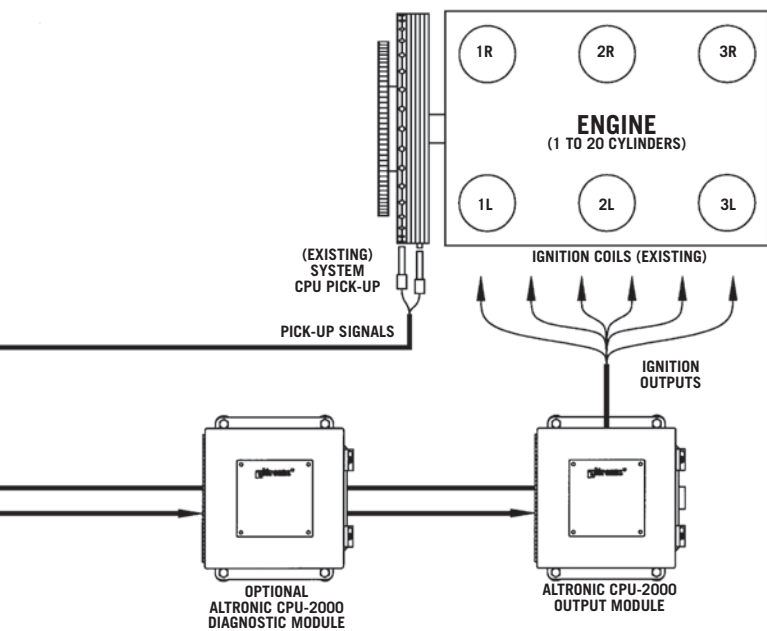
COV – The coefficient of variation of the spark reference number (indicates the relative stability of voltage demand on a “real-time” basis).

```
CYL A1 132 CAVG
COV 9 125 EAUG
```

CAVG – The average value of the spark reference number for the cylinder indicated.

EAVG – The average value of the spark reference numbers for all cylinders (engine average).

The operator may assign setpoints (based upon experience) for each of the above parameters. These setpoints result in diagnostic displays as indicated on the right hand side of this inset, indicating abnormal conditions (such as one cylinder exhibiting very high voltage demand or high level of instability) as well as trends (spark plugs eroded to the point where replacement is necessary to avoid a misfire).



Typical Primary and Secondary Diagnostic Displays

| | |
|-----------------------------|---|
| PRIMARY OPEN A D | Indicates an open circuit condition on outputs "A" and "D"; usually resulting from a broken wire, a high resistance connection, or a failed coil. |
| PRIMARY SHORT E | The CPU-2000 has detected a shorted condition on output "E"; may be the result of a "skinned wire" shorting to ground in the conduit or an improperly wired coil. |
| LO SPARK VOLT C | An unusually low demand for spark voltage has been monitored for output "C"; typically the result of a defective secondary lead or a shorted or fouled spark plug. |
| LO FROM ENGINE C | Similar to LO SPARK VOLT except the threshold is entered as a differential from the engine average figure. |
| HI SPARK VOLT D | High voltage demand exists on output "D"; normally seen when spark plugs are nearing the end of their service life, but also may be an indication of an in-cylinder anomaly such as an excessively lean air/fuel ratio or a "sticking" check valve in a pre-chamber engine. |
| HI FROM ENGINE D | Similar to HI SPARK VOLT except the threshold is entered as a differential from the engine average figure. |
| HI VARIATION F | Based upon a user-established threshold, output "F" has been diagnosed as experiencing excessively high cycle-to-cycle variation in spark voltage demand; possibly an indication of combustion instability within the cylinder. |
| NO SEC. SPARK E | No secondary spark on output "E"; usually the result of a disconnected secondary lead or voltage demand requirements in excess of the coil's output. |

Automatic Energy Adjustment Feature

The optional Diagnostic Module provides an automatic energy adjustment feature based on the monitored spark plug voltage. This enables the system to operate at its low energy setting (E1) when conditions permit. When conditions call for a higher spark demand (threshold is user adjustable), the system will automatically switch to the middle energy setting (E2); a higher threshold can be set to effect a similar transition to the highest energy (E3). In operation, the system selects the lowest energy level to satisfy current conditions, thereby minimizing spark plug erosion rates.

Comprehensive Display Capability

Two-line display indicates the following operating parameters:

- System status and mode
- Diagnostic messages
- Global timing (in degrees BTDC)
- Individual cylinder timing
- Value of timing control signal (4–20mA)
- Engine speed (in RPM)
- Engine overspeed setpoint

Spark Characteristic Control

For improved engine performance and combustion stability, or ignition of lean mixtures for emissions reduction:

- Multi-striking mode (selectable ON/OFF)
- Ignition energy level control
- Second spark plug cut-off control
- Automatic energy adjustment (optional)

Ignition Timing Control Modes

Local and remote control of ignition timing allows engine starting and running performance to be optimized.

- Keypad control (global or individual cylinders)
- Serial data-link control (global or individual cylinders)
- Analog 4-20mA control (global)
- Timing control vs. RPM

Serial Communications

All system features, display data, and configuration inputs are accessible by an integral RS-485 serial data-link. ModBus RTU communications are fully supported for integration into supervisory monitoring and control systems.

System Configuration

Engine-specific configuration parameters, including those listed below, are contained in a plug-in memory which can be unplugged and used in a spare unit if necessary. The memory can be configured at the factory or in the field by an IBM compatible computer connected to the serial data link.

- Engine firing pattern
- Number of gear teeth or flywheel holes sensed
- Timing control vs. 4-20mA or RPM

Diagnostics, Testing, and Shutdown

Advanced diagnostic, self-test, and alarm/shutdown capabilities are included in each CPU-2000 system.

- Status of system pickups
- Verification of number of teeth/holes
- Cylinder-specific primary and secondary discharge faults (optional)
- Test firing of selected cylinder(s)
- Overspeed condition
- Alarm and shutdown outputs

Installation/Retrofit to Altronic II-CPU

With many system components retained, conversion from an existing Altronic II-CPU to the CPU-2000 is simple and economical.

Specifications

INPUTS

Magnetic Pickups (2)

- 1 – flywheel holes or ring gear teeth
- 1 – reset (1/engine revolution)

Hall-effect pickup for compression stroke reference
(4-cycle applications only)

Timing Control Inputs

- Analog:4–20 mA control signal
- Digital: RS-485 serial data
- Manual: Logic Module keypad, misc. input terminal

RS-485 serial communications — ModBus RTU communications
protocol supported

OUTPUTS

16 or 32 ignition outputs

RS-485 serial communications — ModBus RTU communications
protocol supported

Output characteristics

- Maximum output voltage 47kV
- Spark duration 300–700 microseconds

DISPLAY

Backlit, alphanumeric 2 X 16 character

POWER REQUIREMENTS

24 Vdc, 1 to 4 Amps typical
(Current consumption varies by application)

TEMPERATURE

- 40° F. to +158° F.
- 40° C. to +70° C.

Ordering Information

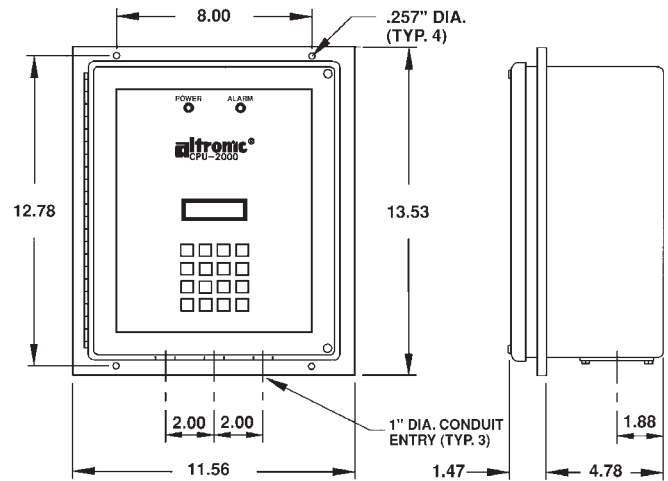
| | |
|----------------------------------|----------|
| CPU-2000 Logic Module | 291100-1 |
| CPU-2000 Output Module | |
| 16-output | 291116-1 |
| 32-output — standard | 291132-1 |
| 32-output — special | 291132-2 |
| CPU-2000 Diagnostic Module | 291105-1 |

See CPU-2000 application list for further details.



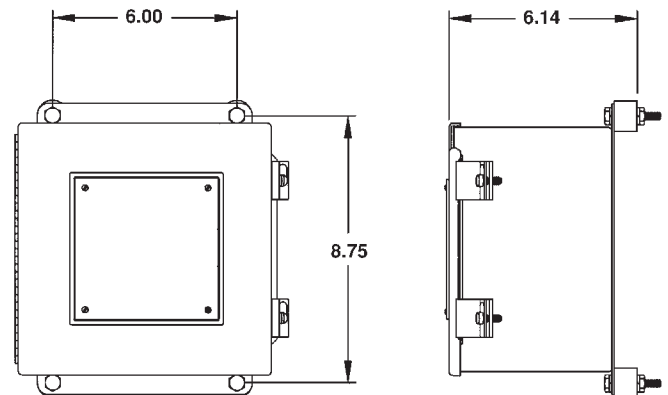
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Logic Module Dimensions



NOTE: PANEL CUT-OUT IS 10.12" X 12.12"
ALL DIMENSIONS ARE IN INCHES

Output Module Dimensions



Diagnostic Module Dimensions

