DE-4000

Next-Generation Safety Shutdown & Control System

- State-of-the-art control system specifically designed to monitor and control critical rotating machinery, including gas compressors, pumps, and generators.
- Highly scalable and expandable system allowing for use across a range of low, medium, and high-spec applications.
- “Configurable-Customizable” approach allows for simple system setup and easy integration of advanced features.
- Integral auto-start functionality for unmanned or highly-cyclic applications.
- All system inputs can be individually configured for:
  - Sensor Type: Analog transducer input (4-20mA or 0-5VDC), thermocouple input (type J or K), or digital (switch) input.
  - Sensor Class: Class A, B, or C logic.
  - Digital Input Sensor Run/Fault Status: Normally-open or Normally-closed.
- Automatically and continuously optimizes compressor efficiency and throughput via speed and capacity control.
- User configurable system requiring no additional software or hardware.
- Alternative control strategy for simplified and reliable interface to popular OEM-provided engine controls.
- Programmable via LUA scripting engine, allowing custom advanced algorithms and logic.

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The DE-4000 Configurable Safety Shutdown and Control System utilizes state-of-the art microcontrollers and microprocessors as well as a robust software stack to provide users of compressors and other critical rotating equipment with a sophisticated, yet reliable, means of protecting and controlling both the prime mover and the load machine (compressor, pump, etc.). Incorporating an “intelligent” add-on board system, the DE-4000 system is fully scalable, allowing users to incorporate a single control system technology across a wide range of applications.

The base DE-4000 configuration offers 12 digital and 4 analog outputs, as well as 32 inputs that can be individually configured for use with switch contacts, thermocouples, or analog transducers. A maximized DE-4000 configuration provides 44 digital and 20 analog outputs and 160 configurable inputs. This approach also allows for a single control system to be used across a fleet of units, thus simplifying maintenance and part stocking requirements, along with system training requirements for operating personnel.

Ease of system setup and configuration sets the DE-4000 apart from other PLC-style or competitive controllers. Ethernet-based connectivity to the device and an intuitive, Web-based configuration tool for system configuration eliminate the need for any knowledge of ladder logic or other functional programming languages. Ethernet communications are fully supported for remote monitoring and/or control applications.

CERTIFIED
CLASS I, DIVISION 2,
GROUPS C and D

II 3 G
Ex ec IIB T4 Gc
-40°< Ta < 85°C

DE-4000 Description & Operation

The innovative, CSA-certified DE-4000 control system comprehensively starts, protects, monitors, and controls critical rotating equipment such as reciprocating engines, compressors, and pumps. This scalable and expandable microprocessor-based system includes a touchscreen display, Controller Module and Terminal Module(s). Each device is typically mounted in an associated control panel, with the display installed for simple operator access, and the Controller Module and Terminal Module(s) DIN-rail mounted in the rear of the enclosure.

System Overview

15" Touchscreen Display — Input power requirement is 10-32VDC, 1 amps max. The display is a 15" LCD widescreen panel with LED backlight. The operating temperature range is -30 to +75°C.

The display serves as the user interface enabling end-users to quickly navigate through setup menus, view process data, and edit application parameters. Additionally, the nature of detected alarms and shutdowns is available to aid in troubleshooting via the robust touchscreen display. The display is connected to the ACM-4000 via a HDMI cable and USB-A to USB-B cable.

Controller Module — Input power requirements are 10-32VDC, 5 amps max. Over-current protection is provided with an easy-to-replace 5 amp automotive blade fuse. The module has 4 isolated 52VDC, 1.2 amp discrete outputs. The discrete outputs can be used for on/off control of on-engine processes such as starting motors, fuel, and ignition firing. There are 4 state-indicating LEDs for the RUN state (green), TIMERS ACTIVE state (yellow), ALARM state (orange), and STOP state (red). Wi-Fi is available for on-site personnel to connect to the DE-4000 system remotely with a Wi-Fi-enabled device. System configuration information is stored in non-volatile memory as are the associated system data logs.

Available communication ports are as follows:

- ×5 – Ethernet ports reserved to connect up to 5 Terminal Modules
- ×1 – Ethernet port reserved to connect to the 8" Legacy Display (if used)
- ×1 – Ethernet port reserved to connect to the ACM-4000 and/or outside network
- ×1 – CAN port
- ×2 – RS485 ports

Terminal Module(s) — Input power requirement is 10-32VDC, 5 amps max. Over-current protection is provided with an easy-to-replace 5 amp automotive blade fuse. The operating temperature range is -40 to +85°C. Channel-to-channel isolation has been added to aid with troubleshooting. A base system with one (1) Terminal Module can be expanded substantially by adding up to 4 additional Terminal Modules. Each Terminal Module has the following I/O:

- ×32 – inputs channels; individually configurable for use as NO/NC discrete inputs, J or K thermocouple inputs, or as analog inputs (0-5V or 4-20mA)
- ×2 – speed inputs (0-10KHz)
- ×4 – analog outputs (4-20mA)
- ×8 – high- or low-side discrete outputs (45V, 2 amp max)
- ×8 – 5V, 100mA supplies available to power field sensors

System Operation

The scalable and expandable nature of the DE-4000 allows it to be used on the simplest safety-shutdown-oriented applications, on mid-range applications with minimal or moderate auto-start or capacity control requirements, and on highly-complex units where a significant number of points must be monitored and functions controlled simultaneously.

Safety-Shutdown Functions — At its core, the DE-4000 is an annunciator that directly monitors parameters such as temperatures, pressures, speeds, and vibration levels against a set of pre-set alarm and shutdown thresholds. Once detected, the DE-4000 will take the necessary actions (as configured by the user) to alert the operator and/or shut down the engine by interrupting the flow of fuel and disabling the ignition system.

Control Functions — Full auto-start capabilities, including crank disconnect, are available in the DE-4000. On-board 4-20mA PID or linear-control outputs (up to 20) and digital outputs (up to 44) offer a range of sophisticated capacity control options.

In a typical operation, the DE-4000 starts and warms up the engine/compressor, raises it to load-carrying speed, and then automatically applies the load by actuating compressor slide valves or other capacity control devices. Should the control setpoint not be met at the minimum load-carrying speed, the compressor speed is automatically raised in an effort to meet the desired process pressure setpoint. This control strategy is governed by a number of user-adjustable load and speed limits which can inhibit the application of additional load beyond what is deemed to be safe, force the system to shed load, and shut the engine/compressor down in the event that a maximum speed is exceeded.

DE-Series Datalogging, Trending, and Communications

DE-4000 systems incorporate an innovative toolset for operating data management, display, and communication. A unique, user-customizable datalogging and trending package is accessible to allow for specific parameters of interest to be captured and analyzed directly within the display and/or remotely via Modbus and a connected telemetry system. Like all DE and ACM functionality, the trending and datalogging setup and dashboarding environment is deployed in a web browser environment thus eliminating the need for any discrete terminal program.

Altronic Multi-Device Interface (MDI)

Utilizing the Altronic Web Interface (AWI), the Altronic Multi-Device Interface (MDI) offers ACM-4000 users a means of effectively integrating the functionality and control dashboards with other Altronic systems as well as virtually any other communications-enabled, third-party device. MDI delivers configurable system monitoring and control to a common display in any ACM-equipped DE-4000 control panel, eliminating the need for additional hardware or placing limits on the user's ability to integrate critical operating data from connected devices. The MDI also adds the extensive data trending and data display package (described above) to the DE/ACM environment that has received specific interest from users during the field validation phase.

NOTE: Please see the ACM-4000 MDI Manual for additional information on Trending and Data Logging Capabilities.

Innovative Configuration and Customization

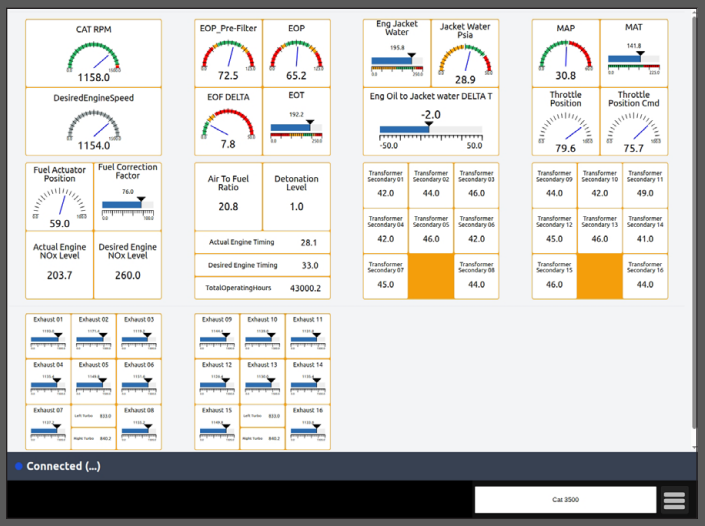
The DE-4000 system can be easily configured in the field with the ingratiated, web-based, guided configuration tool. This allows for simple configuration and adjustment without the need for complex programming changes or specialized software. The user is guided to configure each channel with key parameters such as setpoints, sensor type, shutdown class, etc. While not required for normal operation, custom functionality can be implemented in the DE-4000 system through the use of a popular scripting language known as LUA. This additional functionality allows for the introduction of custom algorithms to perform advanced calculations or implement custom functions.

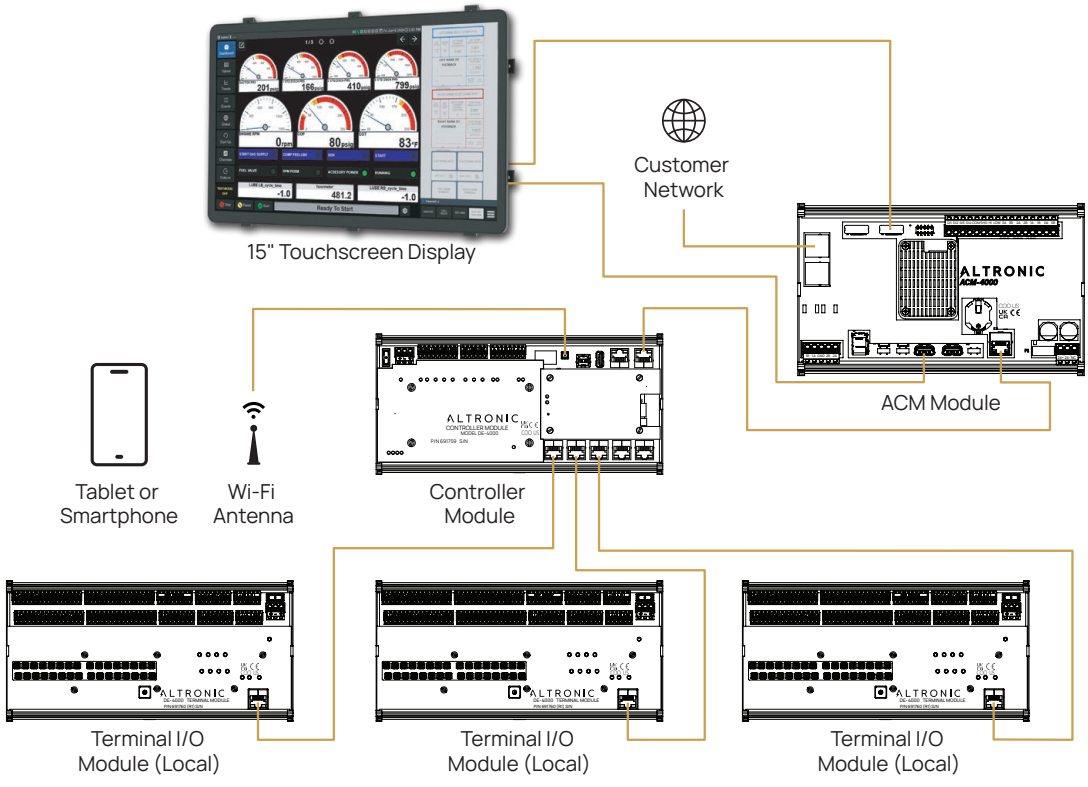
Advanced Application Modes

The integration of the ACM-4000 Altronic Compute Module into a DE-4000 system offers standard-setting functionality and value for gas compression equipment operators.

ACI Services Express Lite© Compressor Monitor – Incorporating data and algorithms developed in cooperation with the compressor OEMs, the ACI Express© family of solutions offers unparalleled monitoring and control capability. The integration of this software package directly into the ACM-4000 eliminates the need for expensive additional hardware in the panel—a capacity exclusive to Altronic—and allows for this ground-breaking technology to be cost-effectively deployed on virtually any gas compression package regardless of horsepower or service. Valve condition and safety and monitoring (including rod load and pin-non reversal), liquids prevention, shutdown avoidance, verification of actual vs. theoretical performance, and continuous protection to ensure operation in the "safe neighborhood" of the load are all easily accessible in a standard dashboard.

Direct Integration of Engine Data – Caterpillar© and Waukesha© Engines – Consolidation of critical engine data, including engine speeds, pressures, temperature, timing, actuator/throttle positions, and charge burn times can be simply integrated into an ACM-4000-equipped DE-4000 system. Doing so supports the centralization of major package components (engine/compressor/package process) into a single system and display for simpler operation and expedited unit troubleshooting when required. Modern engine controls, including those used on the Caterpillar© G3500 and G3600 engines and the Waukesha© ESM-equipped VHP units, can be directly accessed without additional cost or complexity in DE/ACM systems.





To Order

15" Touchscreen Display[1] 691814-15
Controller Module 691759-1
Terminal Module (32 input) 691759-1

RJ45 ETHERNET CABLE ASSEMBLIES

CAT5, 0.3m (12") 693221-1
CAT5, 1.0m (39") 693221-2
CAT5, 2.0m (79") 693221-3
CAT5, 3.0m (118") 693221-4

General Specifications

COMMUNICATION PORTS

×5 – Ethernet ports reserved to connect up to 5 Terminal Modules
×1 – Ethernet port reserved to connect to the 8" Legacy Display (if used)
×1 – Ethernet port reserved to connect to the ACM-4000 and/or outside network
×1 – CAN port
×2 – RS485 ports

15" TOUCHSCREEN DISPLAY

15" LCD Widescreen Panel with LED Backlight

AMBIENT OPERATING TEMPERATURES

15" Touchscreen Display. . . . . –30 °C to +75 °C (–22 °F to +167 °F)
Controller & Terminal Modules. . . . . –40 °C to +85 °C (–40 °F to +185 °F)
ACM-4000 . . . . . –40 °C to +85 °C (–40 °F to +185 °F)

POWER REQUIRED

15" Touchscreen Display. . . . . 10-32 VDC, 1 amp max
Controller & Terminal Modules. . . . . 10-32 VDC, 5 amps max
ACM-4000 . . . . . 10-32 VDC, 3 amps max

HAZARDOUS AREA CERTIFICATION

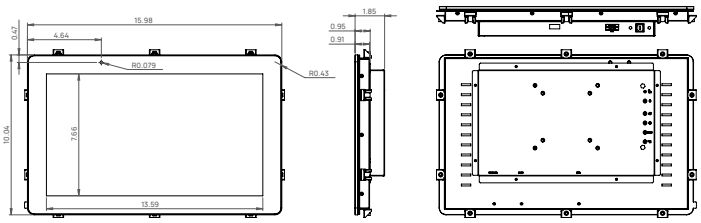
Standard DE-4000 System:
Class I, Division 2, Groups C and D
II3G EX ec IIB T4 Gc -40 °C < Ta < 85 °C

Controller Module:
Class I, Division 2, Groups C, D; T4
II3G EX ec IIB T4 Gc -40 °C < Ta < 85 °C

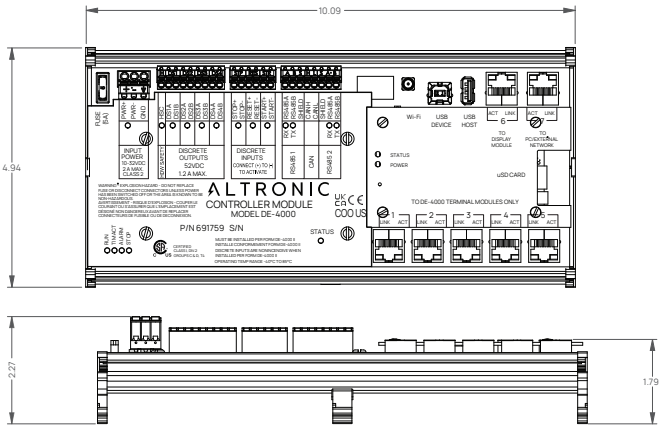
Terminal Module:
Class I, Division 2, Groups C, D; T3C (Terminal)
II 3 G EX ec IIB T4 Gc -40° C < Ta < 85 °C

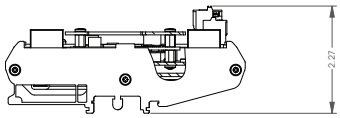
15" Touchscreen Display:
Class I, Division 2, Groups A, B, C, D

Dimensions

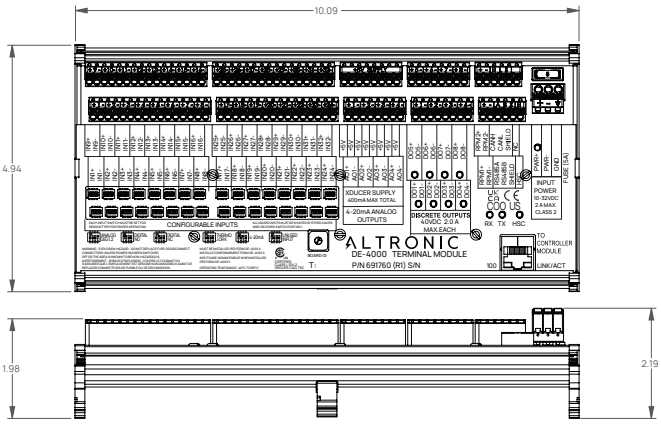


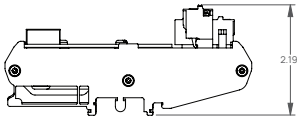
15" Touchscreen Display[1]





Controller Module





Terminal Module

1 Subject to change based on availability and/or design standard changes.

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