



New Microprocessor Control Technology

GForce™

GF - GEA FES Systems – a well known industry leader in the world of industrial refrigeration.

Force – strength, formidable at times and, in some cases, unmatched. Reliable and predictable, especially when the power is leashed into a useful and not destructive purpose.



These definitions describe the newest in the line of FES Systems' reliable, feature-packed, and cost-effective control panels for industrial refrigeration control.

FES, the first to provide microprocessor-based controls for compressors, has once again taken calculated steps in the development of its latest panel. Rather than rushing into the use of latest technology, FES wanted to make sure 3rd party hardware and software had reached a level that would meet the tough demands of the industry—not only cost, but more importantly, performance, robustness and longevity.

Such is the case with the new GEA FES Systems GForce™ Control Panel.

Built on an industrial processor hardware platform and utilizing the proven Microsoft Windows® XP Embedded operating system software, the GForce™ Panel will meet the reliability required by the Industry.

But, It doesn't stop with reliability...the new FES GForce™ Control Panel is loaded with extra features—features that are wanted by the Industry. The development team at FES has taken advantage of aspects of the widely-

accepted operating system and hardware to program in functions that make the GForce™ panel one of the most Operator-friendly, practical, and useable in the Industry.

Features like:

- Panel Data storage and retrieval to and from an ordinary USB Flash Memory Drive makes the GForce™ Panel very flexible and accommodating to its User. Operating program, parameters, historical trend data, compressor manual and drawings, even a User's own document or picture in PDF format (SOP's, equipment service photo, etc.) can be stored in the GForce™ memory for viewing.
- A direct Ethernet TCP/IP communication port makes the GForce™ panel very open to outside communications.
- The ability to serve up its screens as HTML Web pages to Java-enabled web browsers makes the GForce™ panel very easy to view remotely; no additional software is needed.
- Screw Compressor Control that is a direct translation of the programming used in the FES Micro-III control panel makes the GForce™ panel very predictable and dependable; satisfying the demands of a facility's refrigeration utility group.
- Diagnostic utility screens, on-screen manuals, drawings and troubleshooting guides, "Rx-Trend" historical data capture and graphical display of *all* analog and digital status with the capability of e-mailing the data for diagnosis makes the GForce™ panel very understandable and serviceable to the refrigeration technician troubleshooting a problem.

How Operator Friendly is it?

The GEA FES Systems GForce™ Control Panel has a 15" diagonal, full 32-bit-color, LCD display with 1024x768 resolution, 120° viewing angle, and resistive touch-screen capability making it the most Operator-friendly in the refrigeration control world.

The display is clear and crisp, and there are no additional keypad buttons or indicators; just one screen with indicated touch areas. Navigating the screens is clear to the Operator. Service technicians who were not familiar with the GForce™ panel have been able to successfully install the panel, setup the operating parameters, and get the compressor running quickly with little or no assistance from the factory.

GForce™ screens have an intuitive “feel” to them. When an Operator wishes to access all parameters related to Suction Pressure, a simple touch to the Suction Pressure Display near the suction inlet of the compressor’s graphical view will jump to a display of these parameters. Likewise, when additional information on the motor monitoring is needed, a touch of the Motor Status area will display all motor-related parameters. In fact, display of all panel information is only one to two screen touches away at the most!

View it Your Way!--

The GForce™ panel is flexible. A choice of three main operating screens is available to the Operator, tailoring it to the way the Operator likes to see it—Compressor, OmniView, and Classic View.

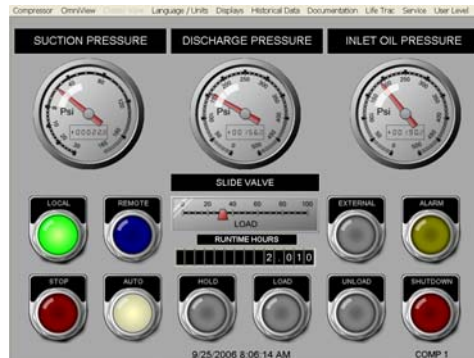
The **Compressor** screen is a graphical representation of the compressor with operating aspects displayed near the pertinent area of the compressor. Touching any of these aspect areas will take you to the detailed parameter screen that applies.



The **OmniView** screen provides a tabular display of operating data, parameters and alarm/shutdown annunciations--almost everything you want to know about the compressor—on a single screen. Individual scroll bar windows of the screen provide convenient access to data and parameters that are not shown. This same screen can be used for parameter entries, sensor calibrations, and verified operation.



The **Classic View** screen, a favorite of people who have worked with refrigeration systems for a long time, shows gauges, lamps and pushbuttons typical of an electro-mechanical panel to provide basic operating data, indicators and controls. As one “seasoned” refrigeration expert put it, “Give me a gauge any day!”



Need more details on its reliability and construction?

The GForce™ industrial processor is made for tougher environments, designed for control purposes, not for desktop PC use. The processor is based on a 1.5GHz Intel Celeron M processor used in many products, and is expected to be available and supported for more than 10 years. The GForce™ panel design will allow for replacement of a malfunctioning processor with a newer style processor, which means the life of the panel is well beyond this time estimate.

There is no rotating hard disk for program and data storage. Mass storage uses “disk on chip” type flash memory with wear-leveling technology, which means it will provide reliable data storage for a long time to come. The mass-storage memory in the GForce™ is manufactured by the inventor and patent-holder of flash-memory technology.

The screen is UV and chemical resistant, and can withstand even a high-speed impact from a blunt object. Its expected life is tens of thousands of hours, and after a period of no touch activity, the screen backlight will turn off and the entire screen goes blank to lengthen its life.

Integral to the monitoring and control provided by the GForce™ panel is an I/O Interface Board custom-designed by FES for interfacing directly to the compressor’s field devices. The industrial processor accesses all field devices by communicating with the I/O Interface Board via a robust RS485 network connection using the Modbus protocol. This provides a very reliable means for directing the outputs and reading the state of the inputs.

The I/O Interface Board, with its own microprocessor, has the capability of overriding the main processor communications interface and shutting off the outputs for failsafe operation. It will direct all control outputs to their safe state if a hardware, software, or control voltage problem is detected. Three levels of “watchdog” protection are designed into the panel hardware and software to ensure that the compressor (or other equipment) is only driven when the panel is working properly. If a loss of watchdog signal is detected, the outputs will be shut off. Even the inside panel temperature is monitored, and will generate an alarm if too high.

Each I/O Interface Board provides (16) analog inputs, (4) analog outputs, and can drive (2) I/O Racks with (24) digital input/output module positions. A protection circuit with reset-able circuit-breaker and LED indicator provides over-current protection for the 24VDC supplied to the analog sensors.

The analog inputs can be used for a variety of signal types:

- ICTD (Integrated Circuit Temperature Device)
- Up to 4 channels that provide 0.1°F resolution with an ICTD for process control applications

- 1-5VDC
- 0-20mA
- 4-20mA
- Motor current monitoring will be a 4-20mA input (a CT will require a 4-20mA converter)

The analog outputs are 0-24mA limited through software to 4-20mA and can be driven by an external 24VDC power source.

Rounding out the hardware is the I/O Rack, which has a ribbon cable connection to the I/O Interface Board. The rack has space for 24 I/O modules configured as inputs or outputs by the configuration held in the panel program. The most commonly supplied solid state digital input and output module are 120VAC, but these can also be 24VDC, 240VAC and dry contact type depending on the application. Universally-available digital modules are used with built-in fuse, built-in LED indicator, and available with built-in H-O-A toggle switch. The I/O rack includes a fuse tester circuit and space for spare fuses.

The I/O Interface Board has been designed with a multi-drop communications interface, which gives the ability to provide distributed/remote I/O. Multiple I/O Interface Boards can be connected to the GForce™ Processor. Space is provided in the standard GForce™ enclosure for one I/O Interface Board and two I/O racks. Large enclosures will support higher I/O counts for refrigeration “system” type control applications. Smaller remote enclosures will support lower I/O counts required for applications like control of one or two evaporator air units.

The standard GForce™ Panel is designed and built to meet UL/cUL 508A, Type 4 rating. The carbon steel enclosure is the same size as the standard FES Micro-III Control Panel—30”H x 26”W x 8”D—and has a metallic silver, powder-coat finish. The face of the panel includes the processor’s touch screen and for increased safety, a red Emergency-Stop mushroom style switch which is hard-wired to the compressor motor starter circuit. Optional enclosure features will include oversized enclosures, Nema 4X stainless steel or fiberglass, and internal panel heater.

And the software?

The GForce™ Panel’s operating application software was developed by directly converting the FES Micro-III panel’s programming; therefore, its functionality has been well-tested and proven having been first introduced in the mid 1990’s. This application software interfaces to Microsoft’s Windows® XP Embedded Operating System, which has been custom tailored for the selected hardware described above. The Windows® XP Embedded operating system and software development tools, used to develop the GForce™ application software, are used by many companies in many, many products operating throughout the world, making the GForce™ panel’s software very reliable. By using proven operating

system software and proven development tools, the FES GForce™ development team has been able to concentrate their main efforts on implementing and testing the control and monitoring of the compressor, not the support software.

Added features like viewing drawing and document files saved in the GForce™ Panel's memory, entering data into User document files stored in the panel memory, and communicating over the Internet can be implemented using 3rd party developed software that is also proven and widely used by many others.

Other features—

- Easy way of getting data into and out of the panel memory—USB 2.0 interface to USB flash memory drive—for User files, parameter backup, historical data, Rx Trend data, compressor operating and maintenance manual, information for operation, maintenance, and troubleshooting.
- Multi-language support is included—English, Spanish, Chinese; adaptable for almost any language supported by Microsoft Windows® character sets.
- Panel is able to serve up HTML web pages of the screens with Java scripting for operational aspects (web browser must be Java enabled).
- 10/100 Mbps Ethernet Port supports both HTML server and Modbus/TCP/IP communications for access from web browser as well as MicroLINK Supervisory Computer, End User's Supervisory System or DCS.
- Integrated FES LifeTrac™ Vibration Monitoring/Analysis System— The LifeTrac™ unit is installed in reserved space inside the GForce™ enclosure; Ethernet hub/switch inside panel will connect LifeTrac™ unit to the GForce™ for access of screen data; no separate display is needed— just touch “LifeTrac™” selection on main GForce™ screen to bring up screen from LifeTrac™ unit.
- The Maintenance Scheduler provides a list of maintenance tasks, with time interval between service operations, time stamping when service is done, and tracking of time remaining (in Run-time hours) until next time service is due.
- The Maintenance Log provides a way for Users to enter date-and-time-stamped notes into the panel for future viewing. This can be used to let others (perhaps the next shift) know what has been done as well as just for record purposes.
- Various tasks can be done while compressor is running—parameter access; viewing drawings or documents; making maintenance log entries;

updating maintenance scheduler; viewing historical trend data; saving parameters, program, User data or trend data; loading User data.

- GForce™ program updates are easily shipped or emailed from FES and transferred to the GForce™ processor in the field through the USB connection.
- Intelligent linking from control interface to view of support documents like manuals and drawings is provided as a trouble-shooting tool.
- 3 levels of security accessible via password entry
 - Basic
 - Able to view operating conditions & navigate screens
 - Clear alarm & shutdown annunciations
 - Stop compressor
 - Cannot make any changes
 - User
 - All that Basic access allows
 - Able to change operating parameters
 - Start & Stop compressor
 - Transfer data from panel to USB flash memory drive
 - Transfer PDF files to User directory in panel memory
 - Cannot change service-related items or tasks
 - Service
 - All that User access allows
 - Able to load programs & parameters
 - Able to calibrate sensors & perform other service tasks
 - Able to make entries in Maintenance Log
 - Able to make changes in Maintenance Scheduler
 - Clear Anti-recycle time
- A Washdown mode which puts the panel screen into a mode where it accepts no touches so that it can be cleaned. After cleaning is completed, a series of touches at specific points indicated in sequence by the panel software will return the panel's screen to its normal responsive mode.

So...What about Serviceability?--

What happens when the compressor shuts down unexpectedly? What can an Operator do to find out why this happened?

- The Shutdown Failure annunciation provides the actual shutdown condition.
- The "Rx-Trend" graphical screen displays the status of all analog and digital control signals recorded at ½ second intervals for the 10 minutes

prior to the shutdown occurrence. Analyzing this display may help indicate the source of the problem.

- If additional help is needed, a technician can use a common USB flash memory drive to transfer the “Rx-Trend” data from the panel, and then can e-mail this information to FES or others for analysis and support assistance.
- If sensor or interface hardware failure is suspected, diagnostic screens are available for further diagnosis to help pinpoint the problem.
- If the technician remembers this same shutdown occurring last week, he can view that Rx-Trend historical data from last week, which is still stored on the GForce™ panel. Comparing the two graphs may help indicate if the same thing occurred.
- Once the source of the problem is determined and if a part is needed, the technician can access FES-supplied drawings, data sheets and parts lists to locate the part that must be ordered, again right at the GForce™ panel.
- Finally, the service technician can enter the repair into the panel’s own User-customized, date-stamped Maintenance Log for future reference.

How’s that for service?!

