INTRODUCTION TO E-PLEX MULTIPLEX SYSTEM
ARM YOUR BOAT
WITH COMPLETE ELECTRICAL
DESIGN SOLUTIONS FROM BASS.
E-Plex is a hardware and software solution for power distribution and system control.

• E-Plex Hardware “Modules” can be grouped in 6 categories:
  Electronic Control Modules
  DC Power Distribution & Digital IO
  AC Power Distribution
  Sensing
  User Interfaces
  Equipment Interfaces

• E-Plex “E-Logic” software has 3 purposes
  Design – How the system will function and look. Generate documentation.
  Program – Configuration of generic hardware for application specific purposes
    Test – Verify the system is operating as expected. Identify issues quickly.
Scalability:

• Systems can start as simple as tank and power monitoring and grow to add features and control.

Diagram:

- Tank and Power Monitoring
- DC Lighting Control
- AC Load Control
- Generator and HVAC Control
- System Wide Energy Management
• E-Plex is unique because it sends data and power over the same wire.
• Powered by a patented multiplexing technology that allows power and data to be transported over a simple, two-wire bus.
• With just two wires, E-Plex provides all the benefits associated with multiplexing with less cost, complexity and weight.
• Two Wires... Too Easy
• E-Plex operates from 7v-30v and uses full battery potential to generate its digital signal. Electrical noise induced onto the E-Plex bus can be easily distinguished from data signals. Costly shielding or termination resistors are not required.

• When E-Plex modules receive the command, data is transmitted in an appropriate time-slice and the clock immediately echoes it back. The node then checks the data received back from the clock for errors. The Clock and nodes on the bus calculate a checksum of the entire packet and data is rejected and immediately resent if these checksums do not match.

• If for any reason, a module on the E-Plex bus is removed, responding from the wrong location, or is sending an incomplete data packet, a data error is generated and displayed. At any time, an end-user can utilize the built-in diagnostics of the clock module to interrogate the network and further isolate the issue.
Circled modules “bridge” to distinct electronic protocols so as to provide system integration.
• There are numerous data communication jobs within a vehicle or vessel
• Distinct networks have been developed to perform these jobs optimally
• Trends show that more, not fewer, protocols are being deployed as vehicles become more complex
• Today’s average automobile has as many as 17 distinct protocols at work

Chart 1, Speed versus cost comparison of commercial protocols. Each of these protocols has distinct capabilities, making it suited for specific jobs.
• No single protocol does it all
• In general, speed/bandwidth drive cost
  – Cost vs Performance
  – The right tool For The Job
• The automotive industry has led the way in the deployment of lowspeed, flexible buses to achieve improved functionality at the lowest possible price

Chart 2, E-Plex and CAN have distinct attributes making them ideally suited for different jobs. Optimal performance at the lowest possible cost is achieved by using each appropriately.
<table>
<thead>
<tr>
<th>Protocol</th>
<th>Function</th>
<th>Speed</th>
<th>Bandwidth</th>
<th>Relative Cost per node / module</th>
<th>Electronics Cost / Sophistication</th>
<th>Physical Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-Plex</td>
<td>HVAC, AC &amp; DC Power Distribution, Tank Monitoring, Lighting, Pumps &amp; Motors, Temperature Sensing, Battery Monitoring</td>
<td>20 Kbps</td>
<td>Lack of messaging &amp; addressing overhead allows lower-baud rate to achieve high overall bandwidth</td>
<td>Low</td>
<td>Standard micro-processors utilized, master &quot;clock&quot; module</td>
<td>Twisted pair for data &amp; power, nodes &amp; modules. No termination resistors or shielding, multi-drop capable</td>
</tr>
<tr>
<td>CAN</td>
<td>Engine, Throttle &amp; Steering Control</td>
<td>&lt; 1.0Mbps</td>
<td>Messaging and addressing overhead places a great deal of data on the bus, consuming bandwidth</td>
<td>Medium</td>
<td>Crystal oscillators, ceramic resonators</td>
<td>Multiple wires for data &amp; power, termination resistors &amp; shielding required</td>
</tr>
<tr>
<td>Ethernet</td>
<td>Navigation, Radar, Stereo, Audio / Video</td>
<td>&gt; 1.0Mbps</td>
<td>Large packet size and extreme amount of data from audio / video requires high bandwidth</td>
<td>High</td>
<td>Similar to a typical computer LAN, Ethernet</td>
<td>Industry standard Cat5 cable,</td>
</tr>
</tbody>
</table>

**How Does E-Plex Compare With Other Protocols**
Message-Based relative to Master/Slave (E-Plex)

- In a message-based system each individual data packet contains all of the information needed to establish its priority and to make sure traffic on the bus is managed.
- Advantages – No “traffic cop”, Modules are independent.
- Disadvantages – Data collisions happen, high-speed on the bus required to manage large data packets.

- In a master/slave system a main controller manages data communication on the bus.
- Advantages – No data collisions, small data packets allow low-bandwidth general, speed/bandwidth drive cost.
- Disadvantages – Cost of “traffic cop”.
Power Distribution and System Control with Multiplexing
Multiplexed Approach (Master-Slave Architecture):

- Electronic Control Module
- Shared Communication Channel or Data Bus
- Distributed Smart Modules with Unique Addresses
Electronic Control Module

- Manages communication between modules (Traffic Cop).
- Maintains a copy of each module specific program
- Built in Diagnostics
- User Interface and Display
Shared Communication Channel or Data Bus
– Unique - Power and Data can be transmitted over the same 2 wires
– Communication and Interaction system wide
– Leverage Multiple Control & Display Points
– Multi-Function (Switch – Display Combo)
Distributed Smart Modules with Unique Addresses
– Generic off the shelf modules – Configured for each applications
– Manual Override on the AC and DC distribution modules
– Each module MUST have a UNIQUE Address
Multiplexing – The Important Points to Remember
Electronic Control Module
• Manages communication between modules.
• Maintains a copy of each module specific program
• Built in Diagnostics

Shared Communication Channel or Data Bus

Distributed Smart Modules with Unique Addresses
• Manual Over-ride on the AC and DC distribution modules – Limp Home
• **“E-Plex” Data Bus**
  Shared Communication Channel for Modules

• **Modules / Nodes**
  Hardware that collects data, operates devices and communicates on the shared communication channel or data bus.

• **Electronic Control Module (Clock)**
  The Main Controller (Traffic Cop)

• **Multiplexing**
  Transmitting multiple data signals across a shared communication channel.

• **Displays, User Interfaces**
  “Touch-points” between the user and “the system”.
  Where operators view data and control “the system”.
Think About:

• Complexity – Interactions and Integration.
• Autonomous – Monitoring and Control.
• Bells and Whistles – Commercial Appeal.
• End User Simplicity – Systems that are easy to use.
• Integration – Plays well with others.
• Adaptive and Flexible – Requirements Change.

and of course, with a …

• Shorter Time to Market.
• Lower Cost.
Introduction
The E-Plex 500CCM series combines master programmer and controller functionality with a color touch screen interface, producing a singular, robust display and control solution for any E-Plex System. Dynamic touch screen graphics and static touch overlays give you the ability to provide a unique appearance while maintaining a constant interface. The 500CCM is compatible with existing E-Plex modules and provides advanced system status and configuration capabilities. Combining the 500CCM with other AC distribution, DC distribution, digital I/O, sensing, user interfaces and system interface modules allows you to configure a system to meet your specific needs.

Key Features
• Helm mountable
• 7” diagonal color LCD touch screen with transmissive display
• 480 x 234 screen resolution, 16-bit true color
• 256KB of onboard memory including a master record of configuration data
• Rear USB service port
• Custom touch screen graphic design and layout created within E-LOGIC® software
• Custom dynamic and static graphics provided via color touch screen and touch overlay areas
• Landscape & Portrait Orientation Options
450 CLOCK

Introduction
The E-Plex 450ECM series combines a master programmer and controller functionality with a customizable touch-screen in one low-cost interface. The 450ECM is housed in a thin structure that extends less than 1/2" from the dash or wall surface. The 450ECM is capable of monitoring and controlling tanks, pumps, lighting, HVAC, gensets, engines and electronic systems.

A 128-character display (8 x 16) provides information, including alerts and diagnostics, from any of the modules within an E-Plex system. Customers have the opportunity to define custom artwork which is EL backlit within the touch-screen to provide the end user with an intuitive E-Plex system control interface.

Key Features
• 255 unique alpha-numeric characters, 64-position touch glass display
• System diagnostics and security lockout capabilities
• Electroluminescent (EL) backlight for night-time display
• 256KB of onboard memory including a master record of configuration data
• Custom artwork overlays and bezel finishes
• Rear 10-pin RS-232 monitor port and front USB service port (optional cables required)
• Same mounting and connection layout as the 400ECM series
439 DMAC

Introduction
The E-Plex 439DMAC series has been designed to simplify electronic systems wiring by providing more control over AC loads. The module provides AC distribution and control for 110 and 220 single phase applications. Hydraulic magnetic circuit breakers provide traditional circuit protection. The 439DMAC supports a combination of single and double pole breakers. Manual override capabilities are provided through the use of a user defined default relay state with operation via traditional circuit breakers. The 439DMAC can be combined with the 336PFM or the 442EMS for a robust AC energy management solution.

Key Features
- 75 amp max power source per bus
- Per channel: 40A normal open
- Per channel: 30A normal closed
- 16 channels maximum
- Isolation between high and low voltage systems
- Independent hydraulic magnetic circuit breakers
- Single and double pole breakers available
- Circuit breaker status monitoring
- User defined default relay state with operation via traditional circuit breakers providing manual override capabilities
436 MMX

Introduction
The E-PLEX 436MMX series is a 10 channel DC power distribution module. Eight channels are intended for lighting/resistive loads handling up to 8 amps each. Two channels incorporate diodes to allow for driving inductive loads and are capable of loads up to 15 amps each. The entire module is rated at 60 amps max. All channels have built in dimming providing a flexible solution for lighting without requiring additional external dimming hardware.

The 436MMX incorporates thermal, short circuit, and programmable overload protection in order to safeguard the module against very rare or severe conditions. When E-Plex is not present, local electronic overrides capabilities allow independent operation of the device loads which can be used for testing and verification during installation.

Key Features
• 10 channels of PWM dimming (60 amps total)
• 8 channels of 8 amp lighting / resistive loads
• 2 channels with 15 amp capability for inductive loads
• Status LED’s for each channel
• Thermal, short circuit, and programmable overload protection
• Local electronic override capabilities
• Reverse battery protected
Introduction
The E-PLEX® 428RSP series, a programmable, multi-color LED, rocker switch panel designed to operate within an E-PLEX® system. This innovative new product incorporates independently controlled LED’s, allowing custom-configured color selection on a per LED basis. Via E-Plex software, each LED is capable of being configured to produce up to 64 unique colors without the need for special ordering or assembly. The 428RSP utilizes optical interrupters to create a switch output, which means no electrical contacts within the switch. The 428RSP provides interchangeable cams, including 1 & 2 position momentary, 2 & 3 position stationary, 2 position momentary / 1 position stationary switches. These cams are designed on a simple snap-in platform that allows for easy and inexpensive assemblies and modifications. In addition, switch banks greater than eight positions can be combined by dovetailing multiple units together.

Key Features
- LED color configuration, choose from a 64-color palette via E-Logic
- Each LED can be configured with up to four unique system-status colors
- Laser-etched actuators (customer-specified legends)
- Rocker switch uses optical interrupters (no contacts)
- Interchangeable cams to create different switch modes
- Panel assembly is water-resistant
Introduction
The E-Plex 425DRM has been designed to simplify electronic systems wiring by providing the reversing function local to the motor devices thus eliminating long cable runs back to common control systems. This is accomplished with 4 DPST relays with the common connections of 2 relays wired to either side of a motor. When one relay is active, power is supplied in one direction. When the motor is reversed the relays switch states allowing the power to flow in the opposite direction. A solid state switch monitors the current draw of the motors which allows for intelligent feedback as to the condition of the motor.

A typical operation would show an initial surge of current as the motor begins to move which decays to a steady state level as the motor gets underway. When it reaches its limit the motor will again begin to draw additional current which can be detected and the power halted stopping the motor from further movement. For additional safety, in the unlikely event of a thermal runaway condition a thermal disconnect is used to remove power from the solid state outputs. Local electronic override capabilities allow independent operation of the device loads.

Key Features
• Relays switch polarities to drive motors in both directions
• Local electronic override operation
• 35A inrush capable
• Current sensing of loads
• LEN value 2
Introduction
The E-Plex 421QIM is an active low digital input module. It provides 4 channels of digital I/O in an encapsulated unit to detect inputs from equipment that switches to ground. The module has LEDs which will provide local verification of the status of the inputs.

Key Features
• 4 active low digital inputs
• Local LED status indication
• Operating Voltage : 10VDC to 32VDC
• Operating Current : 20mA to 45mA (with all LEDs active at max voltage)
• Input Low Threshold : -0.5VDC to 1.0VDC
• Input High Threshold : 4.6VDC to 32VDC
Introduction
The E-Plex 416TPS series has a resistive touch panel, with LED’s for status indication. The touch panel display also includes an audible alarm for switch input verification or alert conditions. Customizable artwork is available for button identification. The display’s electroluminescent (EL) backlight allows the entire touch screen to be illuminated uniformly, making them easy to view in various lighting conditions. The backlight can also be operated in a screen saver mode which will blank it when not in use to extend the life of the EL panel. In addition, the audible alarm can be muted.

Key Features
• 6 LED’s for status indications
• Up to 10 user-defined touch regions
• Piezo buzzer for alert notification
• Electroluminescent backlight for night-time display
• 3” diagonal resistive touch panel
• Custom artwork overlays with a variety of plastic bezel finishes for interior aesthetics
Introduction
The E-Plex 411BAM has been designed to simplify electronic systems wiring by monitoring the voltage and current on each of the port and starboard batteries and auctioneering or selecting whichever has the highest voltage available for critical device operations. 3 solid state outputs are capable of driving link solenoids and emergency bilge pumps from either the port or starboard battery bank. The 411BAM can be used with 12 or 24 volt batteries and will provide status information of each battery including the current draw (up to 100A) of that battery. 4 nickel plated brass M8 terminals are provided for main feeds and the distribution feeds. Local electronic override capabilities allow independent operation of the device loads. For additional safety, during a thermal runaway condition a thermal disconnect is used to remove power from the solid state outputs.

Key Features
• 2 solid state outputs capable up to 5 amps each
• 1 solid state output capable up to 12 amps total
• PORT & STBD power monitoring
• Local electronic override capabilities
• 2 active high inputs for PORT & STBD battery switch status indications
• Provides current sensing of loads
• Thermal, short circuit, and programmable overload protection
Introduction
The E-Plex 389DMAC series has been designed to simplify electronic systems wiring by providing more control and monitoring of AC loads. The module can be used in single-phase 110 or 220 applications. It allows the designer to take advantage of advanced energy management capabilities such as intelligent load shedding to prevent unnecessary resetting of circuit breakers. Built in redundancy incorporates resettable hydraulic magnetic circuit breakers for each channel. Local electronic override capabilities allow independent operation

Key Features
• 8 Relay Outputs up to 250VAC
• 20A Max per channel, 50A per L1/L2
• L1/L2 AC inputs can be tied together or separated
• Independent hydraulic magnetic circuit breakers for each channel
• Voltage feedback of circuit breaker status
• Current / voltage / frequency monitoring of AC inputs
• Optical isolation from low voltage systems
• Manual override capabilities
• LEN value 2
366 HMM

Introduction
The E-PLEX® 366HMM is a six channel DC power distribution module capable of handling loads of up to 15A per channel or 50A total. The six channels can be utilized as either inputs, outputs, or a combination of both. The individual channels may be combined in order to handle larger amperage loads. The 366HMM incorporates thermal, short circuit, and programmable overload protection in order to safeguard the module against very rare or severe conditions. Local electronic override capabilities allow independent operation of the device loads.
In addition, the 366HMM design allows for the ability to utilize up to two channels as dimmer circuits, providing a flexible solution for lighting without requiring additional external dimming hardware.

Key Features
• 6 channels with outputs capable to 15 amps each (50 amps total)
• 2 channels with PWM dimming capabilities
• Reverse battery protected
• Status LED’s for each channel
• Thermal, short circuit, and programmable overload protection
• Local electronic override capabilities
• Designed for motor loads
Introduction
The E-Plex® 350LCD series is a family of liquid crystal displays that have been designed to give the customer a choice of desired features without requiring a traditional operating system on a PC. An integrated touch screen interface allows for monitoring and controlling of different key subsystems, all from one location.
In addition to the system display and control features, the 350LCD series module can double as a video display for inputs from satellite TV, VCR, DVD, DVR, video game consoles, security cameras, and any other video source that supports RCA and S-Video connectivity. For example, you can watch your favorite DVD on the 350LCD, and with a quick touch of the screen, all the controls and monitoring of your system are available for you to access.

Key Features
• 640 x 480 color display
• 10.4” Diagonal transmissive display
• Supports NTSC and PAL video formats
• Integrated resistive touch screen
• LEN value 2
Introduction
The E-PLEX® 336PFM can be used to measure AC current up to 200 amps and voltage up to 220V AC, and frequency of the AC transformer. Furthermore, there is no need to use an external isolation transformer. The AC power monitor is capable of scaling the output values using E-Plex table builder. Table builder allows the end user to automatically create a profile of the input based on a set of data points.

Key Features
• Measures AC current up to 200A, voltage up to 220V AC
• Includes isolation transformer
• Measures frequency of AC line
• Output values can be scaled accordingly
331 BMI

Introduction
The E-Plex 331BMI battery monitor is an inductive monitor that senses both current and voltage output. The battery monitor is bi-polar in that the E-PLEX® network reveals if the battery is charging or discharging. Put the positive battery cable through the center of E-Plex battery monitor and secure it to the cable. Orient the 331BMI’s 1/4 " terminals away from the battery post for proper current direction indication by the E-Plex® system.

The battery monitor is available in two configurations, the 331BMI-01 has a single reference voltage wire for applications that have the battery negative terminal in common with the E-Plex return. The 331BMI-02 is an isolated version with 2 reference wires for applications that have multiple batteries where the battery monitored cannot be tied back to the E-Plex return. The wire is required to determine the differential. Calibration is provided through the E-Logic Software.

Key Features
• 100 / 200 amp monitor
• “Engine cranking” amps capable
• Charging and load current sensing to and from battery
• Voltage output sensing from battery
Introduction
The E-Plex 318PFTG series can be used in a wide variety of applications. The same tank sender can be used for diesel fuel, fresh water, grey water, or black water tanks. The tank gauge in its standard version can measure fluid up to a maximum depth of 2m, and measures pressure of fluid in a tank in one percent increments. Elevation has no effect on the output reading and tank shape has no effect on the accuracy of the pressure tank gauge, which makes it useful in applications where the tank shape is irregular.

The tank gauge can be used in multiple configurations, depending on the construction of the tank whether it is plastic or metallic.

The E-Logic software allows for accurate calibration by building a tank curve table during the initial fill process. A default table can be established if the tank parameters are already known.

Key Features
- Measures tank contents by sensing pressure
- Can be used for diesel, fresh water, grey water or black water
- Available in top entry and direct mount versions
- Robust stainless steel sensor
- Top entry version is adjustable for different depth tanks
801 IPLEX

Introduction

E-Plex's latest module brings all the functionality and sophistication of E-Plex directly to boat owner's iPad, iPhone or iPod Touch. The module works in conjunction with the iViewer App giving users a bi-directional touch screen interface for all their E-Plex monitoring and control. The 801 IPLEX module is a complete package with a Wi-Fi access point for up to 5 units, and a USB point to charge the main iPad. This exciting new addition to the range gives E-Plex the look and feel the iPad generation are used to, and happy with. Customers can choose to use their existing Apple hardware, making it a very cost effective option, and opt to have it in a fixed position, say within the helm panel, or keep it mobile. They can also continue to use their iPad or iPhone for all their normal tasks.

Key Features

- WiFi integration
- Ipad and iPhone compatible.

Please note these are not all modules available please consult Bass Products for a complete list and specs.