

# EmpirBus™

## EmpirBus™ Technical Overview

## **EmpirBus™ – A new dimension of electrical control**

The general idea behind the EmpirBus system is to reduce the amount of time for installation and material necessary for constructing various types of electrical installation using 9-32VDC. Also the time required for designing the system is reduced due to the functionality and the easiness of using the EmpirBus™ software.

Current installation techniques are rather old and require a cable to be pulled for each consumer via some kind of fuse. Other cables are required in parallel for controlling the consumer.

EmpirBus™ is using intelligent I/O modules interconnected with each other via a single 1-pair bus cable. This cable reduces the need for control cables to a minimum. The inputs and outputs are equipped with fuse capabilities, which furthermore reduce cabling and material since most conventional fuses in the system can be omitted. The bus is based on CAN, which is a widely accepted communication standard known for safe operation even in very harsh environments.

Each I/O is assigned a specific address. The I/O is then easily monitored and controlled by one or more other on the bus.

### **Advantages**

- Easy reconfiguration of the units both with respect to what they control and their properties. This enables the user to change the behaviour of the system without any changes done to the hardware.
- Reduced cost of material like fuses, cables, etc since all units are equipped with built-in fuse capabilities.
- Reduced weight and space requirements since most fuse boxes, fuses and relays are omitted.
- Reduced cost for engineering, design and installation.

The EmpirBus™ system consists of main units that are connected to the bus. Each main unit can be equipped with up to 4 sub units each consisting of 8 input or output channels. The designer can freely choose how each channel should be configured. Each channel can be controlled by up to 8 other channels, thus enabling the units to be controlled from different physical locations.

One of the main ideas during the development process of EmpirBus™ was that the system should be very easy to handle, even for non-professional users. This implies that it should not be considered as an alternative to conventional PLC systems. A PLC is intended for professional engineers and is only aimed at solving the control system.

EmpirBus™ on the other hand is designed to handle most control applications *as well* as taking care of the electric power distribution. Almost all contactors, fuses and terminals used in a conventional system can then be removed.

## Functionality

EmpirBus™ is far more advanced than a conventional electrical system, thus enabling more functions since EmpirBus™ is designed to control all types of consumers through the I/O modules. The system is not only controlling the I/O's, but is also, due to the built-in intelligence able to handle many functions that before needed complicated and more advanced installations.

EmpirBus™ manages these functions, among others, including the electric power distribution:

- *Fuses* – The system has built-in fuses (0.5 – 8A) which are set in the EmpirBus™ Config software. Conventional fuses are omitted and less space is required.
- *Dimmer* – EmpirBus has dimmer capabilities on all output channels. These are controlled by ordinary momentary switches.
- *Wind screen wiper* – Wind screen wipers can på connected onto the units without any extra relays or control boxes. EmpirBus handles any type of wiper with two speeds (high/low) and two interval times with synchronization and parking mode.
- *Interlock function* - Each channel, both in and out can be controlled by up to 8 other channels. This makes it possible to have one output channel subscribing to two input channels, where both need to be activated to operate the output channel. One of the channels is working as a master blocking the other channel if switched off. This function is useful on consumers like a windlass where large forces are in motion and an accidental release or activation could be dangerous.
- *Delay functions* – All in and output channels in the EmpirBus™ can be set with a delay. This function makes it possible to turn off the light having it lit for a set period of time. Long enough to lock and leave the boat with out having to tumble in the dark.
- *Default alarm* – All the output channels on the EmpirBus is equipped with a functionality alarm. This makes a diode indicate if a consumer like navigation light would stop working. Conventional ships are required to have this function on all its navigation lights.
- *On/Off indication* – The bus is equipped with a true running indication. This is activate, not only when the input channel is activated but when the output channel is delivering power. A dimming module can be used to decrease the light of the diodes when navigating at night.
- *Modifications* – EmpirBus™ makes it easy to modify and redraw the functions in a system. Since all units are controlled by the bus they can be reconfigured in the EmpirBus™ software with out having to rewire any cables or hardware.
- *Circuit diagram* – The EmpirBus™ Config software automatically generates a circuit diagram for the system. Changes could be printed at any time giving up to date installation diagrams to reduce errors.
- *Main switch* – The system is equipped with a main switch function. This should be used when leaving the boat at the dock. This functions as a master and deactivates all the other functions, both inputs and outputs in the system. Used right, this switch only leaves on the absolute necessary consumers when switch off.

### **Additional Functions**

The intelligent design of EmpirBus™ not only simplifies the installation of an electrical system but also enhance the functionality of the system. It is easy to incorporate other advance functions to the bus due to the specific design of EmpirBus™.

- *Remote control* – A remote control can be connected to any input channel thus making it possible to control any output channel. The remote could be controlling the anchor lift, the radio or the deck lights. Useful when returning to the boat after a visit to the nearby restaurant.
- *Mode Support "One Button Control"*– All consumers in the EmpirBus system can be controlled when using mode support functions. A mode could be anything form night mode or run mode to power save mode. In a mode all consumers wanted for the mode is set to be activated or deactivated at mode activation. At night mode all consumers as lamps and instruments could be turned off while an anchor light and a night light in the salon is lit up.
- *Burglar alarm* – By connecting a motion detector and a siren to the bus, a burglar alarm could easily be installed. The alarm could be controlled by a key or any sort of remote.
- *GSM-module* – A GSM-module linked to the system could be set to send a message if any alarm is activated on the boat. It will also make it possible to send and receive messages to the boat, regarding battery power, temperature or position.
- *Transducers* – Any kind of transducer can be used with the bus, making it possible to automatically activate the lanterns at dark or indicate a shortage of fuel or even control a power save mode when the battery power is low.

### **Output Module**

The output module consists of 8 output channels, each capable of continuously delivering up to 8A, with a maximum of 40A per module. The outputs are equipped with a fuse (0.5 – 8A) capability as well as a short circuit protection. The size of the fuse is easily selectable via the EmpirBus™ Config software in the PC. It is also possible to select between two fuse characteristics for quick or normal trip time. If a fuse larger then 8A is needed two channels are connected in parallel and the configuration is set to half the fuse size on each channel.

If desired, an under current alarm can be selected for each channel. This could be very useful for monitoring circuits and an indication diode could be lit if a consumer is not working.

Since the current consumed by each output is constantly measured it is possible to receive a true running indication. This information is transmitted onto the bus and making it possible to read at any location.

## **Input Module**

The input module consists of 8 input channels, individually configurable. The function of the input switch is selected via the EmpirBus™ Config software. There are several options regarding choice of input types. For example, it is possible to select momentary or maintained switches. The functions of the switch can also be selected. To this category normally open/closed, on/off, set and reset belongs. There are also a few special types, like main switch, activate, deactivate, interlock and alarm reset. The main switch acts as an interlock, which allows or disallows the outputs that subscribe to it to be activated. It is also possible to assign a time delay from 0 to 4.5 hours to all maintained inputs.

One of the main inventions regarding this module is the possibility to connect both the switch itself as well as a running indication LED and/or an alarm LED on the same physical input. The conventional way to do this is to have a separate conductor to each switch, an indication and a common conductor. To build a control panel consisting of 8 switches with equal amount of running indication and alarm lamps  $8 \times 3 + 1 = 25$  conductors are required. Implementing the same control panel using EmpirBus™ would require  $8 \times 1 + 1 = 9$  conductors.

The current drawn by each indication LED is regulated, thus eliminating the need for a current limiting resistor in series with the LED. The running indications are dimmable 0-100% by adding a dimmer unit somewhere on the bus.

## **Light Dimming Module**

Every running indication light in the system can be intensity adjusted. The dimming module is equipped with a rotary encoder input to which one or several rotary encoders can be connected. Each running indication can subscribe to any dimming module. When a rotary encoder is rotated the light intensity set point is changed between 0-100%. This set point is then transmitted to all running indications that subscribe to it. It is possible to create an unlinear voltage curve in order to adjust different types of light elements.

## **Wind Screen Wiper Module**

A window wiper module is available in order to meet the special requirements that this type of equipment has. This module has four outputs at 6A each. Thus making it possible to control up to four wipers with each module. The outputs are controlled via ordinary input modules and support two speeds (high/low) and two interval times with synchronization and parking mode.

The wiper engine is connected directly on to the module. Omitting any control units like relay and control boxes. The interval time is set in the EmpirBus Config software to be customized to any preferences.

## **EmpirBus™ Software**

The EmpirBus system is configured from a PC via an EmpirBus interface and the EmpirBus™ Config software. The software supplies a user friendly interface that can be easily understood even by non-professional users.

Besides configuring the system the EmpirBus™ Config software is able to monitor events on the bus making it possible to over view all the activity in the EmpirBus software activity log. It is also possible to read unusual happenings from the system. These activities are stored in a log and can be read whenever the EmpirBus software is connected to the system. These functions will also enhance problem

solving since extraordinary happenings and the present activity is read directly in the EmpirBus software via the interface.

The EmpirBus™ Config software automatically generates a circuit diagram with possibilities to add cable numbers and connections. This feature makes it easy to distribute up to date drawings after any modifications.

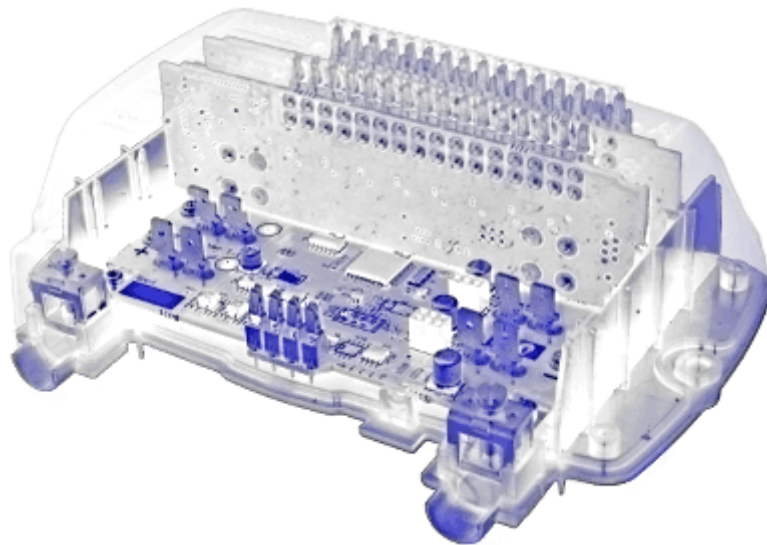
### **Main Features**

- Programming interface with the EmpirBus™ units.
- Downloading the configuration to the EmpirBus™ units.
- Uploading of the existing configuration in the EmpirBus™ units.
- Read events from selected units.
- Monitoring the CAN-bus traffic.

### **Special Features**

Via the EmpirBus™ Config software numerous features of the bus modules are accessed.

- Assigning base address for each unit.
- Changing base address for selected units.
- Reading the event log that is stored in each main unit. The event log stores up to 253 events and is logging communication errors, in which slots on slave modules are detected, the reason for start/reset of the system, if the configuration has been updated etc. It is also possible to clear the event list.
- It is possible to update the firmware in each main and slave unit via the bus.
- A complete set of electrical drawings of the units are automatically generated. It is then possible to manually add cable number and cable types and so forth.
- The EmpirBus™ software is prepared to be easily adapted to new languages. Currently the program supports English and Swedish.



**This is the cut away EmpirBus node. At the bottom there is the motherboard and on top two slave modules are installed.**