Vertical Power VP-X

Implementation Guide

VP-X_Implementation_Guide

Version 2.0

(for VP-X Pro/Sport Software Release 1.0
& VP-X Gen 1 Software Release 1.3)

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Revisions

Version	Authors	Description of Version	Date
1.0	John Haynes	Initial version.	4/26/2010
1.4	John Haynes	Updated for Gen 2 hardware	8/3/2010

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1 Introduction

1.1 Scope

This document provides guidelines to implementers planning to integrate the Vertical Power VP-X product family with an external system such as an Electronic Flight Information System (EFIS).

1.2 Overview

This document is organized into 5 sections. Section 1 provides a document overview and lists referenced documents, definitions, and acronyms. Section 2 provides general recommendations to external system developers. Sections 3 and 4 provide specific implementation suggestions along with example interface screens. Section 5 provides a set of implementation guidelines for specific VP-X features. Appendices A, B, and C provide summary tables of system devices, recommended pin names, and system fault codes.

1.3 Hardware Releases

The VP-X product family is comprised of three hardware products, all running nearly identical software interfaces (the Generation 2 products include an extra message which includes pin name labels and related data. Gen 1 products do not include support this label). Each hardware platform can be identified by its unique hardware version number, available through the API.

Version Number	Description
1	VP-X (Generation 1 product release)
2	VP-X Pro (Generation 2 product release)
3	VP-X Sport (Generation 2 product release)

1.4 Referenced Documents

Document	Date/Version No.	Description
VP-X Installation and Operating Manual	January 1, 2010	VP-X Installation and Operations Manual
VP-X Interface Control Document	April 23, 2010/Version 1.1.k-2	VP-X Interface Control Document (ICD)

1.5 Definition and Acronyms

External System – the system connected to the VP-X through its serial port, typically an EFIS

Circuit or Device – an output pin on the VP-X connected to a specific device (e.g., landing light, alternator, EFIS, GPS, etc.)

IAS – Indicated airspeed (typically in knots)

Ground Speed – GPS ground speed, or ground speed as calculated by a GPS

2 General Recommendations

2.1 General Recommendations for EFIS Developers

There are several ways to implement the feature set described in the VP-X interface control document. The VP-X is designed, for the most part, to work autonomously from the EFIS. While the EFIS is needed for setup (Gen 1only) and to clear faults, the VP-X provides switching functions, trim and flap control and circuit protection on its own.

The required feature set listed in the next section should be implemented in its entirety. If your EFIS integration was announced prior to Jul 2010 you should support the Gen 1 set of features as the EFIS is required for software upgrades and configuration. Gen 2 products (announced in July 2010) have an Ethernet port that connects directly to a laptop PC and an application provided by VP allows the user to configure the VP-X directly. The configuration settings can be stored to and retrieve from the PC. The EFIS then simply reads the configuration values from the VP-X at startup (this is described in detail separately in the ICD).

The design of the electrical system page is at the discretion of the EFIS developer.

2.2 Scope of Integration Effort

2.2.1 EFIS Developer – Required Items

The following table describes the feature set that is required to be implemented for the VP-X with an EFIS:

Feature	Required to support Gen 1 product	Required to support Gen 2 products
Fault presentation and acknowledgement (ie fault display on main EFIS screen similar to standard engine alarms, etc)	X	X
Stream basic data to VP-X (airspeed, RPM, etc)	X	X
Push software upgrade package to VP-X	X	Note 1
VP-X configuration (CB values, switch assignment, etc.)	X	Note 1
Electrical system page display of enabled pins, including display of volts and total amps	X	X
Display of secondary alternator status, if configured.	X	X
Circuit control via display (soft keys for on/off, trim and flap control and reset)	X	X
VP-X configuration save/restore	X	Note 1
Presentation of trim and flap position	X	X
Pin name definition	X	Note 1
Aux battery voltage display	X	X
Starter annunciator display.	X	X
Display of VP-X hardware and software versions in EFIS setup section	X	X

Note 1: This function is provided via the PC application provided by Vertical Power.

2.2.2 Vertical Power VP-X interfaces available

The VP-X interface provides the following functionality for use by EFIS developers:

- Circuit protection
- Circuit switching
- Actions based on inputs from panel switches

- Generates alarms for circuits, trim, flaps
- Wig-wag steady control
- Trim control and associated functions, including position
- Flap control and associated functions, including position and overspeed alarm
- Individual device detail, including (Gen 2 only) pin name
- Status of starter circuit
- Aux battery voltage measurement and reporting
- Starter annunciator input and reporting
- Alternator management
- Over-voltage protection

2.2.3 VP-X Gen 1 Setup Items Required in EFIS

1. Enable or disable VP-X functionality within EFIS
2. Set serial IO port that talks to VP-X
3. Enable/disable display of aux battery voltage
4. Configure trim and flaps (including ability to operate trim and flaps from setup menu to aid in setup)
5. Push application package
6. Configuration of CB values, switch assignment, etc.
7. Save and restore settings
8. Define pin/device names

2.2.4 VP-X Gen 2 Setup Items Required in EFIS

1. Enable or disable VP-X functionality within EFIS
2. Set serial IO port that talks to VP-X
3. Enable/disable display of aux battery voltage
4. Display VP-X hardware and software versions

2.2.5 VP-X Configurator Application Overview

The configurator application is provided by Vertical Power to end users free of charge and runs on a Windows PC. The application provides all setup and configuration functions, including settings save/restore and software updating. The PC connects to the VP-X Pro and Sport via an Ethernet cable. The Gen 1 VP-X does not include the capability to connect to the PC configurator app.

The application can be found on the VP web site in the support/software section (on or after November 2010).

3 Specific Recommendations

As part of the agreement to interface with the VP-X, the EFIS shall limit functionality to only those features directly presented by the interface. For example, the ability of the EFIS to send on/off commands to a device shall be limited to allowing the user to manually turn a device on or off from the EFIS screen. The EFIS shall not, for example, automatically turn on the nav lights once the engine is running. Many of the automated features are covered functionally in the VP-200 product and protected by US patent filings. If the EFIS manufacturer desires to add such features, please contact Vertical Power to discuss.

3.1 Specific Implementation Recommendations

The following list is a set of specific recommendations when implementing support for the VP-X, Pro and Sport from an EFIS.

1. The EFIS should present to the user the pin identifiers (for example 5A-1, 10A-3) and the device name (for example Strobe, Beacon). The constant or actual physical pin (J4-3) should not be presented to the user.
2. The EFIS is responsible for determining the severity of the alarms and determining how to present them to the user and receive user feedback.
3. The EFIS should not assume the VP-X settings are the same or persistent across power cycles. The EFIS should query the VP-X on startup to retrieve settings for all devices. With a new system, the VP-X is populated with default values that need to be changed by the EFIS.
4. The EFIS should display both the error description and error code when report configuration errors to the user. (For a complete list of configuration errors, see **Error! Reference source not found.**.)
    - The fault displayed should read [pin name] – [fault] . For example, it should display “Land Lt – Short Circuit” or “Pitot Heat – Current Fault”. Error messages like “VP-X fault” are generally meaningless to the pilot.
    - The fault should be displayed on the main EFIS page and other pages in a similar manner to engine faults (like High Oil Temp) and use a similar ACK mechanism.
    - When a fault is cleared on the electrical page, it should also clear the fault alert to the pilot, if the alert has not already been cleared using the standard clearing method.
5. The VP-X stores “user-friendly” pin names such as “landing Light” or “Garmin 430”. These names are read by the EFIS at power on. Each pin also includes an enabled/disabled flag. If disabled, that circuit should not be shown on the display.
6. Only one pin can be configured as the field wire on the secondary alternator (Field_Sec).
7. Wig Wag Steady Soft Key – a soft key on the EFIS should toggle between “Wig-Wag Steady” and “Wig-Wag Auto”. Pressing the key alternates between the two

functions. Pressing the key causes the Wig-Wag steady flag to be set appropriately and toggles the soft key to the other function. When the Wig-Wag steady flag is set, the lights will not wig wag. Normally, pressing the key also exits to the main soft key menu (TBD by EFIS).

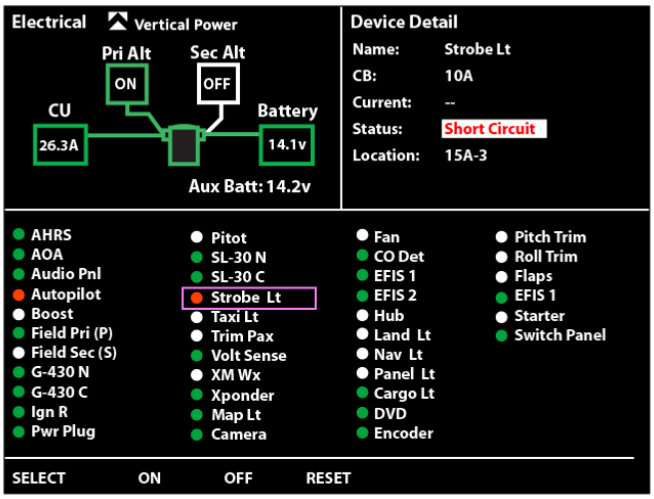
8. The EFIS determines whether a low voltage condition exists (not reported by the VP-X), and if so the battery display on the electrical page can be turned yellow.

The following items refer to Gen 1 only

1. The EFIS should have some mechanism to record and save the VP-X settings.
2. The EFIS setup should have a section showing the status of the 16 discrete inputs (grounded, un-grounded).
3. The EFIS should have a mechanism to restore saved settings to the VP-X. Prior to restoring settings, the EFIS should issue the EEPROM_ERASE command.
4. The EFIS should *not* automatically restore settings without user interaction.
5. The VP-X (Gen 1) does not store or use "user-friendly" pin names. Each circuit is referenced via a binary code tied to a specific functional circuit (for example 5A-1, the first 5 amp circuit). The EFIS should allow the user to define "user friendly" pin names such as "landing Light" or "Garmin 430". Either the user can enter their own names, or the EFIS can allow the user to select from a pre-defined set of names. A list of pre-defined names is shown in Appendix C.
6. Access to the electrical system setup should not be allowed while RPM>0 (valid data) or IAS/GS is >1 knot (valid data).
9. The EFIS electrical system setup pages should display the VP-X software version number.
10. The EFIS should have two sections related to the VP-X electrical system:
    - VP-X setup as an extension of the standard setup menus
    - Electrical system information page showing electrical system diagram and individual pin status. This page should be accessible at all times like the attitude, moving map, and/or engine pages.

4 Example Electrical System Screens

The EFIS should design an electrical system page that best fits with the existing EFIS design. The design below is for reference only.



Screen showing graphical display and individual device status and control.

The interface may also show the current draw next to each item so that the user does not have to scroll to that item to see the current draw.

4.1 User Interface Recommendations

The following list contains a set of recommendations for implementing the electrical system user interface for the VP-X:

1. The ON/Off/Fault summary status should be shown in real time for all devices.

2. Pin/device names should be sorted in alphabetical order. Trim and flaps should be grouped on their own. Volts and amps should be displayed on their own.

3. Only enabled pins should be displayed.

4. The soft keys allow the user to manually turn on or off a device, overriding the switch until the switch is cycled. The reset button is dimmed unless there is a fault on the selected device. When the selected device is faulted then the on/off buttons should be dimmed.

5. The Trim and Flap items, when selected, show up/down or left/right as appropriate for that device.

6. The starter item cannot be turned on or off from the EFIS, only reset.

7. The Aux Battery voltage, if enabled, should be displayed.

8. Amps should be shown inside the VP-X icon and volts inside the battery icon.

9. The Vertical Power logo should be displayed on the page somewhere (please contact us for a white on black logo).

10. The colors used are: green=on, white=off, red=faulted.

11. If communications are lost with the VP-X, the display should clearly indicate the condition and not display “old” and possibly inaccurate data.

12. For a dual alternator system, the alternator that is on should be green and the other alternator white.

13. For additional implementation details, we recommend watching the product videos at http://www.verticalpower.com/videos.html.

5 Implementation Guidelines

5.1 Overview

The following sections provide several guidelines for interfacing the VP-X (Gen 1 and 2) with an external system such most of this information is contained in the VP-X ICD and the Installation Manual, it is presented here for clarity and to provide a high-level overview of certain features of the VP-X API that may not be obvious from reading the ICD.

5.2 VP-X Configuration

VP-X provides persistent storage of configuration information in its own dedicated EEPROM. The external system shall query the VP-X for configuration settings on startup rather than pushing settings to the VP-X automatically as the "push" model introduces several issues that may not be obvious at first glance.

The first issue with automatically pushing settings is that the external system must check to see if any devices are faulted before settings are pushed to the VP-X. Re-configuring a device will automatically clear its fault state, so automatically pushing settings may result in a device fault being reset without the user being aware that a fault has occurred. The second issue is that the VP-X will automatically power the EFIS pin if a device fault is detected at startup, regardless of the state of the external switch to which the EFIS circuit is assigned. If the external system pushes settings that re-configures the EFIS circuit and sets the switch setting to an external switch that is off, the EFIS circuit will then be turned off immediately after the VP-X is reconfigured. Additionally, when configured, the VP-X Sport will return faults for the pins that do not exist.

For these reasons we recommend that the external system query the VP-X at startup for its current configuration rather than automatically pushing settings that are stored on the external system.

5.2.1 Device Configuration

Each device in the VP-X, with a few notable exceptions, has the following assignable parameters: external switch id, circuit breaker value, and current fault flag. The external switch id can be any value between 0 and 11. Values 1-10 correspond to an external switch. A value of zero indicates that the device will be off at system start but can be powered by a command from the external system. A value of 11 indicates that a device will automatically be turned on at system start but can subsequently be controlled by commands from the external system.

The current fault setting controls whether the VP-X will detect and report absence of current for that circuit. Absence of current is defined as any current value less than 100 milliamps. If current above this value is not detected when the device is powered, the VP-X will fault the circuit and turn it off. This is reported to the external system as a current fault, and the exter-

nal system should present this condition clearly to the user and make sure it is not confused with either a short circuit or over current condition.

Not all devices allow each of the above parameters to be configured. These restrictions are contained in Appendix B of the ICD but will be summarized again here.

Table 1. Device Configuration Exceptions

Circuit	Exceptions
Flaps	Switch ID not assignable, current fault not supported
Starter	Switch ID set to 11 and not changeable, current fault not supported
Primary Alternator	Current fault not supported
Roll Trim	Switch ID not assignable, current fault not supported, circuit breaker value set to 2 amps and not changeable
Pitch Trim	Switch ID not assignable, current fault not supported, circuit breaker value set to 2 amps and not changeable

5.3 Fault Handling

The VP-X provides fault handling for all circuits. Faults include short circuit, over-current, and current fault. A short circuit occurs when a device draws more than 25 amps for approximately 80 milliseconds. An over-current condition occurs when a device draws less than 25 amps but more than its configured breaker value. A current fault occurs when a device draws less than 100 milliamps and current faulting has been enabled for that circuit.

In addition to the above faults, the VP-X will also detect an over-voltage condition for the primary alternator circuit and any device assigned as the secondary alternator. If the voltage on either circuit goes above the level selected as the system overvoltage limit (either 16 or 32V) the circuit will be faulted and turned off.

If the VP-X faults a circuit it will be turned off and must be reset by the external system. Faults persist across VP-X power cycles, so even after a reboot the external system must still clear the fault before the device will operate normally again.

If the device is still faulted when the external system attempts to clear the fault, the VP-X will automatically re-fault the circuit and turn it off.

5.3.1 General Fault Handling

The external system should use the following guidelines when handling VP-X device faults. For an EFIS, the fault should be displayed on the current screen using assigned circuit name

(e.g., Landing Light) and the fault type (e.g., Short Circuit). If a device has not been assigned a name then the system name (e.g., 10A-1) should be used. The device ID should not be used in the external system user interface as this is an internal implantation value and is meaningless to the user. The physical pin location J3 pin 2 also should not be used as this can change across hardware platforms.

When a fault occurs, the external system should provide a quick and easy way to reset the fault. For an EFIS, this could be switching to the electrical system screen and hi-lighting the faulted circuit so it can be reset. The preferred way of resetting a fault is single button press once the faulted circuit has been selected (if not automatically selected).

Note that if the external system chooses to implement fault handing with an automatic screen switch, this feature should be user configurable to allow the pilot to turn off the screen switch under certain circumstances (for example, when flying an approach in IMC). A clean way to solve this is to implement a split screen display.

5.3.2 System Faults

In addition to the device faults described in the previous section, the VP-X also detects and reports several system faults. These include total system current >48A, total system current > 60A, warm reset, data integrity failure, and external data missing.

If the VP-X detects total system current above 48 and 60 amps, the corresponding fault flags will be set in the System Status message. This flag will automatically be cleared once total system current drops below 60 and 48 amps respectively.

If the VP-X reboots without having power removed (aka a warm reboot) then the 'Warm Reboot' flag will be set in the System Status message. The flag will automatically clear upon the next full power cycle.

The VP-X calculates and retains an internal checksum for each piece of data stored in EEPROM memory. If EEPROM memory becomes corrupted the VP-X will set the 'Data Integrity' flag in the System Status message during the data integrity checks performed at VP-X system startup. If a data integrity error is detected at a startup the Data Integrity Error Code will also be set in the System Status message to indicate in which data set the error was detected. It is recommended that the external system prompt the user to re-save settings if a data integrity error is encountered during system startup.

If the external system does not send the VP-X an External Data message for at least 2 seconds, the 'External Data' flag will be set in the System Status message. This is intended to warn the external system that the VP-X is not receiving external data so features such as flap overspeed protection, variable speed trim, wig-wag, and starter inhibit will not be available.

5.3.3 Handling Faults at System Start-Up

The VP-X checks all circuits during system startup for both power state and faults. If a circuit has previously been faulted the VP-X will preserve this information between power cycles and the external system must clear the fault before the circuit can be powered back on.

If the case that a circuit is not faulted, the VP-X will read the state of the switch assigned to that circuit and power the circuit according to the external switch state (in other words, if the assigned external switch is on, then the circuit will be powered).

If a circuit has been previously faulted or a new circuit fault is detected during startup, the VP-X will automatically turn that circuit off and fault the circuit. The fault flag for the circuit will be set in the Fault Status message and the circuit must be reset by the external system to clear the fault.

Additionally, it is important to note that if a fault is detected during VP-X system startup, the EFIS circuit is *automatically* powered to ensure that the EFIS is turned on and the user can see any faults detected during system start.

5.4 Displaying VP-X Status Information

The VP-X sends four data streams to the external system starting immediately on system power up. These data streams are the Device Status stream, the Device Fault stream, the Flap/Trim Status stream, and the System status stream. All data streams are sent at a rate of 1Hz with the exception of the Flap/Trim status stream which is sent at a rate of 10Hz.

The external system can use these streams to provide an accurate and responsive representation of all circuits managed by the VP-X system as well as overall VP-X system state.

5.4.1 System Status

The System Status stream is sent by the VP-X at a rate of 1Hz and contains the following information: state for each external switch (off/on), system fault state, and miscellaneous flags. The miscellaneous flags include the starter annunciator flag (indicating that the starter annunciator circuit is active), the wig-wag mode flag (auto or steady), the wig-wag active flag (no/yes), and the software update flag. The software update flag is set during reboot if the VP-X detects that system software has been updated during the previous power cycle.

5.4.2 Device Status

The device status stream contains the power state (off/on) for all circuits and the total amount of current drawn by each circuit. If the circuit is off the current field for that circuit will be zero (0.0). Also note that the VP-X can only detect current down to around 100 milliamps, so devices that are on but have a power draw of less than 100 milliamps will report a current draw of zero.

5.4.3 Fault Status

The fault status message contains the fault flag (no/yes) for each circuit as well as the corresponding fault code. Possible faults include short circuit, over current, and current fault for all circuits, and additionally the primary alternator and device assigned as the secondary alternator may report an over voltage fault as well.

5.4.4 Flap and Trim Status

The Flap/Trim Status message contains both current state and configuration information for the flaps and both trim circuits. Configuration information is included in this message as a convenience to the external system developer so a separate configuration query does not have to be performed when reading the Flap/Trim status message.

In addition to current state and configuration information, the Flap/Trim status message also includes fault flags specific to the flap and trim circuits. These include flags for flap/trim runaway, flap/trim disable, flap overspeed, and flap down switch inhibit. Additional details concerning flap and trim faults will be provided in subsequent sections.

5.5 Flaps

5.5.1 Configuration

Flap configuration for a new installation is typically an interactive process. For example, the pilot will set the flap endpoints and motor polarity and run the flap motor interactively to observe how far the flaps travel and whether the flaps are traveling in the correct direction.

Because this is typically an interactive event, we strongly recommend that EFIS developers provide a way to not only configure the flaps but run the flaps from the flap setup screen. This will allow the user to make corrections to the flap configuration in real time right from the cockpit during system configuration and setup.

5.5.2 Flap Faults

In addition to the standard faults applicable to all circuits (short circuit, over current, current fault), the flaps have additional fault conditions that are monitored by the VP-X. These include flap runaway, flap disable, and flap active faults.

Runaway

A flap runaway condition is detected if both the flap up and flap down switches are engaged at the same time. If the VP-X detects this condition, the flap circuit is turned off and the flaps are faulted with the runaway fault code. The external system must send a fault clear message to re-enable the flaps after a fault.

Disable

If the VP-X detects that either the flap up or down switch is engaged at system startup, the flap circuit is turned off and the flaps are faulted with the disable fault code. Unlike other faults, the disable fault cannot be reset simply with the Device Clear command. To reset a flap disable fault, power must first be cycled to VP-X and then the external system must send a Device Clear message to re-enable the flaps.

Active

If the flaps are faulted with the disable fault code and external system sends a fault clear message but one of the flap switches is still engaged, the flaps will be re-faulted, this time with

the active fault code. This code is used to indicate that a fault clear was attempted but one or both flap switches are still engaged.

5.5.3 Flap Overspeed Alarm

If the VP-X is receiving external data and the speed (airspeed if available, otherwise ground speed) is above the value set in the flap overspeed setting, and the flap position is below the flap overspeed position, then the flap overspeed warning flag will be set. Unlike a regular fault, the flap overspeed warning does not disable the flaps and the flap circuit does not have to be reset. This alarm is used for reporting purposes only.

5.5.4 Flap Switch Inhibit

If the VP-X is receiving external data and the speed (airspeed if available, otherwise ground speed) is above the value set in the flap overspeed setting, the flap down switch will be inhibited automatically. The flap down switch will automatically be enabled once the speed drops below the overspeed setting. This behavior does not fault the flap circuit, and the flap circuit does not need to be reset when this alarm occurs.

5.6 Trim

In addition to the standard faults applicable to all circuits (short circuit, over current, current fault), the trim circuits have additional fault conditions that are monitored by the VP-X. These include trim runaway, trim disable, and trim active faults.

5.6.1 Trim Faults

Runaway

A trim runaway condition is detected if both the trim switches (either up/down or left/right) are engaged at the same time. If the VP-X detects this condition, the corresponding trim circuit is turned off and the trim is faulted with the runaway fault code. The external system must send a Device Clear message to re-enable the trim circuit after a runaway fault.

Disable

If the VP-X detects that any of the trim switches are engaged at system startup, the corresponding trim circuit is turned off and the circuit is faulted with the disable fault code. Unlike other faults, the disable fault cannot be reset simply with the Device Clear command. To reset a trim disable fault, power must first be cycled and then the external system must send a fault clear message to re-enable the trim(s) after a disable fault.

Active

If the trim(s) are faulted with the disable fault code and external system sends a Device Clear message but one of the trim switches is still engaged, the trim(s) will be re-faulted, this time with the active fault code. This fault code is used to indicate that a fault clear was attempted but one or both trim switches are still engaged.

5.6.2 Variable Speed Trim

The pitch trim circuit on the VP-X supports a variable speed function that engages if external data is available and if the speed (airspeed, or ground speed if airspeed is not available) is above the trim speed setting in the pitch trim configuration. The motor speed will be reduced to the power value specified in the pitch trim configuration (40-90%). (Note that setting the power to a value outside this range will result in a pitch trim configuration error.)

5.7 Secondary Alternator

The VP-X has a dedicated primary alternator circuit and also allows the user to assign a device as the secondary alternator. While almost any device can be assigned as the secondary alternator, there are some restrictions to be aware of. The device assigned as the secondary alternator must not be specified as one of the devices in the wig-wag configuration. Additionally, the secondary alternator cannot be assigned to the starter, EFIS, primary alternator, flaps or trim, or the 3A regulated circuit (3A-1).

Once a secondary alternator device has been assigned, the VP-X will ensure that the primary alternator and secondary alternator circuit are never power at the same time. To ensure this, if the primary alternator is on and the VP-X receives a request to turn on the secondary alternator, the primary will automatically be turned off before powering the secondary alternator device. Likewise, if the secondary alternator device is on and the primary alternator is turned on, the VP-X will automatically turn off the secondary alternator before powering the primary.

A further restriction is that the device assigned as the secondary alternator cannot have the same switch assignment as the primary alternator. Attempting to assign a device as a secondary alternator assigned to the same switch as the primary alternator will result in a configuration error.

5.8 Device Wig-Wag

The VP-X supports assigning devices for the pulsing or "wig-wag" function. Typically, these devices are the landing light and taxi light, however the system provides the flexibility to assign almost any device as a wig-wag device with a few exceptions. Restricted devices, or devices that cannot be assigned as a wig-wag device include the starter, the EFIS, the primary alternator, a device assigned as the secondary alternator, the flap and trims, and any device with a switch assignment of zero.

Also note that if external data is not available, the wig-wag function will be disabled.

5.9 External Data

As mention in previous sections, certain features will not be available if the VP-X is not receiving data from the external system at a rate of at least 2Hz. These features include variable speed trim, flap overspeed warning, flap down switch inhibit, starter inhibit, and wig-wag.

6 Appendix A – System Device Table

Table 2. VP-X, Pro, Sport System Device Table

Device ID	System Name	Amps	Default Circuit Breaker	Current Fault Support	Switch	NOT in VP-X Sport (HW ver 3)	Notes
0x00	Flaps	1-10	7	No	Flaps		Switch not assignable.
0x01	Starter[1]	1-10	5	No	Always On		Switch not assignable.
0x02	EFIS	1-5	2	Yes	Any		Switch defaults to always on.
0x03	Field_Pri	1-5	5	No	Any		Switch defaults to always off.
0x04	5A-1	1-5	2	Yes	Any	X	Switch defaults to always off.
0x05	5A-2	1-5	2	Yes	Any	X	Switch defaults to always off.
0x06	5A-3	1-5	2	Yes	Any	X	Switch defaults to always off.
0x07	5A-4	1-5	2	Yes	Any	X	Switch defaults to always off.
0x08	5A-5	1-5	2	Yes	Any	X	Switch defaults to always off.
0x09	5A-6	1-5	2	Yes	Any	X	Switch defaults to always off.
0x0A	5A-7	1-5	2	Yes	Any	X	Switch defaults to always off.
0x0B	5A-8	1-5	2	Yes	Any		Switch defaults to always off.
0x0C	5A-9	1-5	2	Yes	Any		Switch defaults to always off.
0x0D	5A-10	1-5	2	Yes	Any		Switch defaults to always off.
0x0E	5A-11	1-5	2	Yes	Any		Switch defaults to always off.
0x0F	5A-12	1-5	2	Yes	Any		Switch defaults to always off.
0x10	5A-13	1-5	2	Yes	Any		Switch defaults to always off.
0x11	10A-1	1-10	2	Yes	Any	X	Switch defaults to always off.
0x12	10A-2	1-10	2	Yes	Any		Switch defaults to always off.
0x13	10A-3	1-10	2	Yes	Any		Switch defaults to always off.
0x14	10A-4	1-10	2	Yes	Any		Switch defaults to always off.
0x15	10A-5	1-10	2	Yes	Any		Switch defaults to always off.
0x16	10A-6	1-10	2	Yes	Any		Switch defaults to always off.
0x17	15A-1	5-15	2	Yes	Any		Switch defaults to always off.
0x18	15A-2	5-15	2	Yes	Any		Switch defaults to always off.
0x19	15A-3	5-15	2	Yes	Any		Switch defaults to always off.
0x1A	3A-1	1-3	2	Yes	Any		Switch defaults to always off.
0x1B	2A-1	1-2	2	Yes	Any		Switch defaults to always off.

0x1C	2A-2	1-2	2	Yes	Any		Switch defaults to always off.
0x1D	Trim_R	2	2	No	Roll Trim		Switch not assignable, circuit breaker value not changeable.
0x1E	Trim_P	2	2	No	Pitch Trim		Switch not assignable, circuit breaker value not changeable.

Notes:

1. The starter circuit is "always on" with regard to the outside system's ability to control it. It cannot be turned off by the outside system. The VP-X turns off power to this pin when engine RPM is valid and above 500RPM. The status of the starter circuit is accurate when queried and in the status data stream.
2. The VP-X and VP-X Pro share identical I/O. The Pro includes an additional message set with pin names.

7 Appendix B – Pre-Defined Pin Names

Below are examples of pin names that can be used if implementing a pre-defined list of names. This is not all-inclusive, and the EFIS developer may modify the list as appropriate.

Table 3. Pre-Defined Pin Names

EFIS 1	Strobe Lt	Gear
EFIS 2	Nav Lt	Flaps
EFIS 3	Beacon	Trim
PFD	Landing Lt	Seat Heat 1
PFD 1	Taxi Light	Seat Heat 2
PFD 2	Cabin Lt	Defrost
MFD	Baggage Lt	Fan
Backup AI	Map Lt	Fan 1
HSI	Wing Tim R	Fan 2
CDI	Wing Tip R	Fan 3
CO Detect	Headset	Misc 1
Autopilot	Headset 2	Misc 2
Audio	Glow Strip	Misc 3
Audio Panel	Panel Lt	Aux 1
Comm 1	Alternator	Aux 2
Comm 2	Alternator 1	Aux 3
Nav 1	Alternator 2	Smoke
Nav 2	Main Alt	Starter
Comm/Nav 1	Standby Alt	Boost
Comm/Nav 2	De-Ice	Boost L
GPS 1	Brake	Boost H
GPS 2	Canopy	Boost Pump
Transponder	Ignition L	Pitot
AHRS	Ignition R	
Weather	Warning	
ADC		
429 Conv		
EIS		
Eng Mon		
AOA		
Intercom		
Ethernet		
Annunciator		

8 Appendix C – System Fault Codes

Table 4. System Fault Codes

Fault Code	Name	Description	Action	Clears
0x00	NO FAULT	No device fault.	N/A	N/A
0x01	RESERVED			
0x02	RESERVED			
0x03	RESERVED			
0x04	RESERVED			
0x05	RESERVED			
0x06	OVER_VOLTAGE[1]	Device over voltage.	Device faulted and disabled, FAULT_STATUS message broadcast.	The faulted pin remains off until cleared by the external system.
0x07	SHORT_CIRCUIT	Device short circuit.	Device faulted and disabled, FAULT_STATUS message broadcast.	The faulted pin remains off until cleared by the external system.
0x08	OVER_CURRENT	Device overcurrent.	Device faulted and disabled, FAULT_STATUS message broadcast.	The faulted pin remains off until cleared by the external system.
0x09	CURRENT_FAULT	Device current fault.	Device faulted and disabled, FAULT_STATUS message broadcast.	The faulted pin remains off until cleared by the external system.
0x0A	FLAP_RUNAWAY	Runaway condition on the flaps.	Flaps faulted and disabled, FAULT_STATUS message broadcast.	The flaps remain off until cleared by the external system.
0x0B	FLAP_ACTIVE	Flaps active when clearing fault. Indicates fault could not be cleared because flap switch is active.	Flaps faulted and disabled, FAULT_STATUS message broadcast.	The flaps remain off until cleared by the external system.
0x0C	FLAP_DISABLED	Flaps disabled. Occurs when both flap switches simultaneously active on system start.	Flap input switches are disabled.	When system is power cycled and condition no longer exists.
0x0D	RESERVED			

0x0E	TRIM_RUNAWAY	Runaway condition on the pitch or roll trim circuit.	Pitch or roll trim faulted and disabled, FAULT_STATUS message broadcast.	The faulted trim remains off until cleared by the external system.
0x0F	TRIM_DISABLED	Trim disabled. Occurs when both pitch trim switches or both roll trim switches are simultaneous active on system start.	Trim input switches are disabled.	When system is power cycled and condition no longer exists.
0x10	TRIM_ACTIVE	Trim active when clearing fault. Indicates fault could not be cleared because trim switch(es) is active.	Trim faulted and disabled, FAULT_STATUS message broadcast.	The trim remain off until cleared by the external system.

Notes:

1. This fault condition is only applicable to the primary alternator and the device assigned as the secondary alternator.

