



# VFX Product Family

## General Information

### **Warning**

Before beginning installation of this product:  
Read and follow all installation instructions.  
Please contact Eaton immediately if you have any questions.

Note: This manual was written with great care and precision. However, since the potential for error exists, we can provide no assurance of the absolute accuracy of its contents.

### **Warranty**

In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time.

A limited warranty is given with these Eaton products. Please see our website for details.  
[http://www.eaton.com/Eaton/ProductsServices/Hydraulics/WarrantyTermsConditions/PCT\\_612027](http://www.eaton.com/Eaton/ProductsServices/Hydraulics/WarrantyTermsConditions/PCT_612027)

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# VFX Product Family

## 1.0 INTRODUCTION

The Eaton VFX product family is a series of advanced, CAN-based displays for use with mobile and industrial equipment. These displays are offered in both 4.3" and 7" sizes, represented by the VFX40m and VFX70m, respectively. These displays enable functional viewing of many different facets of information using a standardized IEC 61131-3 programming environment. It is recommended that an individual have experience with control engineering and programming using the CODESYS 3.5 software package prior to use of these displays.

These units are intended for operation in the most adverse environments encountered and are designed for direct mounting. The displays feature I/O with a variable configuration architecture that is simple to manage. The displays also employ several advanced technologies designed to enhance ease of use and functionality. They are intended as displays for mobile and industrial applications, as well as being the centerpiece to a complete control solution, including other CAN-based devices.

## Key Acronyms and Abbreviations

CODESYS	Controller Development System
FW	Firmware
HW	Hardware
IDE	Integrated Development Environment
IP	Intellectual Property
POU	Program Organization Unit
RTS	Run Time System
SW	Software

# VFX Product Family

## 2.0 TECHNICAL SPECIFICATIONS

### VFX40m

#### Power Supply

Supply Voltage	6-32 VDC
Peak Supply Voltage	432 VDC
Max Power Consumption	10 W
Max Sleep Current	400 mA
Ignition Pin (K15)	Ignition pin, used to manage sleep mode in conjunction with application logic

#### Physical and Environmental

Dimensions	7.69 x 4 x 2.34 in
Weight	1.75 lbs
Case Material	ABS/Polycarbonate blend cases
Storage Temperature Range	-40°C to +85°C (-40°F - 185°F)
Operating Temperature Range	-40°C to +85°C (-40°F - 185°F)
Heater	No
IP Rating - Front	IP66, IP67
IP Rating - Back	IP66, IP67

#### CPU

CPU Type	Freescale i.MX357
Frequency	532 MHz
Bit Width	32 Bit
FPU	Vector floating point unit (VFP11)
Operating System	Linux

#### Memory

RAM	128 MB DDR2
Data Memory (RAM retain)	1 MB
Flash (ROM program & data combined)	256 MB

#### Standards

Temperature Environment	-40c to +85C (-40°F - 185°F)
Environmental	IP66 & IP67
Vibration	7.86 G RMS (5-2000 Hz) SAE J1455 Section 4.9.4.1
Shock	50g - SAE J1455 Section 4.10.4
Radiated Immunity	J1113-21 (150 V/m), J1113-26 (15 kV/m), EN61000-4-3 (10 V/m)
Radiated Emission	SAE J1113-41 (Class 4), EN50121-3-2, EN60945, EN61000-6-3
Conducted Immunity	J1113-2 (3.0 Vp-p), J1113-4 (200 mA), J1113-11 (Level 4), J1113-12 (Level 4), EN61000-4-4, EN61000-4-5, EN60945 Sec 10.3 (3 V/10 V RMS), EN50121-3-2 (10 V RMS)
Certifications	CE mark

#### Graphical Interface

Display Type	Bonded, color transmissive TFT LCD
LCD Size	4.3"
Resolution	480 x 272, WQVGA
Color Format Supported	16-bit color
Aspect Ratio	16:9
Orientation	Landscape
Display Backlight	LED, 500-650 cd/m2 (30,000 hr lifetime)
Sunlight Viewability	Direct sunlight

#### Touch Interface (Optional Feature)

Touch Screen Technology (VFX70m only)	Projected capacitive
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#### Video Interface (Optional Feature)

Video Type	2 NTSC/PAL
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# VFX Product Family

## Boot Up

Boot-up Screen	Customizable
Boot (first powered-on)	TYP. ~ 9 sec. to logo, 17 sec. to first screen
Wake (ignition switched)	TYP. ~1 sec.

## CAN Interface 1

CAN Specification	2.0 A, 2.0 B
Baud Rates	Configurable 125 KBPS, 250 KBPS, 500 KBPS or 1 MBPS
Protocols	J1939 and CANOpen Master

## CAN Interface 2

CAN Specification	2.0 A, 2.0 B
Baud Rates	Configurable 125 KBPS, 250 KBPS, 500 KBPS or 1 MBPS
Protocols	J1939 and CANOpen Master

## USB Interface

USB Specification	USB 2.0
Baud Rates	Supports USB full speed not high speed. Effective throughput will be about 6 megabits per second
Note	USB interface is not protected against battery level faults

## Real-time Clock

Estimated Battery Life	Minimum 300 day time/date retention between charges
Rechargeable	Yes, Li-ion (non-replaceable)

## Keypads

Number of Buttons	8
Button Style	Tactile feedback
Button Backlight	Yes

## Input

Resolution	10 bits (0-1023)
Accuracy	+/- 1% FS
Measuring Ranges	Digital, 0-5 V, 4-20 mA, Resistive
Scan Rate	10 Hz (100 ms)

## Digital Input

Type	High Side In
Input Impedance	100kohm
Switch-on Level	Configurable
Switch-off Level	Configurable

## Voltage Input

Input Impedance	10 kohm
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## Current Input (0-24 mA)

Input Impedance	200 ohm
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## Resistive (0-5 V)

Pull-up Resistance	400 ohm
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## Digital Output – 500 mA

Type	Low Side
Amperage	500 mA Max
Diagnostics	Open/Short circuit protection

## Mating Connector – 4 x 6 pin

Manufacturer	Deutsch
Model	DT06-6S
Contact Surface	Nickel plated

# VFX Product Family

## VFX70m

### Physical & Environmental

Dimensions	10.27 x 5.67 x 2.512 in
Weight	2.25 lbs
Case Material	Polycarbonate back case
Storage Temperature Range	-40°C to +85°C (-40°F - 185°F)
Operating Temperature Range	-40°C to +85°C (-40°F - 185°F)
Heater	Standard
IP Rating - Front	IP66, IP67
IP Rating - Back	IP66, IP67

### Power Supply

Supply Voltage	6-36
Peak Supply Voltage	36 VDC
Max Power Consumption	10 W
Max Power Consumption with Heater Option	22 W
Max Sleep Current	400 mA
Ignition Pin (K15)	Ignition pin, used to manage sleep mode in conjunction with application logic

### CPU

CPU Type	Freescale i.MX357
Frequency	532 MHz
Bit Width	32 bits
FPU	Vector floating point unit (VFP11)
Operating System	Linux

### Memory

RAM	128 MB DDR2
Data Memory (RAM retain)	1 MB
Flash (ROM program & data combined)	2 GB

### Standards

Temperature Environment	-40°C - +85°C (-40°F - 185°F)
Environmental	IP66 & IP67
Vibration	7.86 G RMS (5-2000 Hz) SAE J1455 Section 4.9.4.1
Shock	50g - SAE J1455 Section 4.10.4
Radiated Immunity	J1113-21 (150 V/m), J1113-26 (15 kV/m), EN61000-4-3 (10 V/m)
Radiated Emission	SAE J1113-41 (Class 4), CISPR 11 Class B/EN60945 Hybrid
Conducted Immunity	J1113-2 (3.0 Vp-p), J1113-4 (200 mA), J1113-11 (Level 4), J1113-12 (Level 4), EN61000-4-4, EN61000-4-5, EN60945 Sec 10.3 (3 V/10 V RMS)
Certifications	CE mark

### Graphical Interface

Display Type	Bonded, color transmissive TFT LCD
LCD Size	7"
Resolution	800 x 480, WQVGA
Color Format Supported	16-bit color
Aspect Ratio	16:9
Orientation	Landscape
Display Back Light	LED >1000 cd/m <sup>2</sup> (50,000 hr lifetime)
Sunlight Viewability	Direct sunlight

### Touch Interface (Optional Feature)

Touch Screen Technology	Projected capacitive
-------------------------	----------------------

### Video Interface (Optional Feature)

Video Type	3 NTSC/PAL
------------	------------

### Boot Up

Boot-up Screen	Customizable
Boot (first powered-on)	TYP. ~ 9 sec. to logo, 17 sec. to first screen
Wake (ignition switched)	TYP. ~1 sec.

### CAN Interface 1

CAN Specification	2.0 A, 2.0 B
Baud Rates	Configurable 125 KBPS, 250 KBPS, 500 KBPS or 1 MBPS



# VFX Product Family

Protocols	J1939 and CANOpen Master
<b>CAN Interface 2</b>	
CAN Specification	2.0 A, 2.0 B
Baud Rates	Configurable 125 KBPS, 250 KBPS, 500 KBPS or 1 MBPS
Protocols	J1939 and CANOpen Master
<b>USB Interface</b>	
USB Specification	USB 2.0
Baud Rates	Supports USB full speed not high speed. Effective throughput will be about 6 megabits per second
Note	USB interface is not protected against battery level faults
<b>Real Time Clock</b>	
Estimated Battery Life	Minimum 9.5yr (display never powered)
Rechargeable	No, Lithium (non-replaceable)
<b>Keypads</b>	
Number of Buttons	14
Button Style	Tactile feedback
Button Backlight	Yes
<b>Digital Inputs x5</b>	
Type	High Side in
Input Impedance	10 kohm
Scan Rate	10 Hz (100 ms)
Switch-on Level	4.01 V ( 80% Supply Voltage )
Switch-off Level	1.04 V ( 20% Supply Voltage )
Short Circuit Protection	28V or Ground
<b>Analog Inputs x3 (Software Configurable)</b>	
Resolution	10 bits (0-1023)
Accuracy	+/- 1% FS
Measuring Ranges	Digital, 0-5 V, 4-20 mA, Resistive
Scan Rate	10 Hz (100 ms)
<b>Digital Input</b>	
Type	High Side in
Input Impedance	100 kohm
Switch-on Level	Configurable
Switch-off Level	Configurable
<b>Voltage Input 0-5V</b>	
Input Impedance	100 kohm
<b>Current Input 0-24mA</b>	
Input Impedance	200 ohm
<b>Resistive 0-5V</b>	
Pull-up Resistance	400 ohm
<b>Frequency Input</b>	
Type	3.6 VAC – 120 VAC
Input Impedance	14.02 Kohm
Input Frequency	2 Hz – 10 kHz
Switch-on Level	2.10 V
Switch-off Level	1.17 V
<b>Digital Output 500mA</b>	
Type	Low Side
Amperage	500 mA Max.
Protection	Short circuit protection
<b>Frequency Output</b>	
Type	Square wave
Duty Cycle	50%, non-adjustable
Frequency Range	2 Hz to 3 kHz
<b>Mating Connector – (2) 23 pin</b>	
Manufacturer	AMPSEAL
Model	AMP770680-1, AMP770680-4
Contact Surface	Nickel plated

# VFX Product Family

## 3.0 KEY FEATURES

- Completely protected outputs (thermal and overcurrent)
- Reverse polarity protection
- Up to 11 inputs, depending on model
- Up to 2 outputs, depending on model
- Programmable via USB
- Two CAN ports
- Sleep input for improved power management

## 4.0 SAFETY CONSIDERATIONS

Please note: These instructions are intended for use by a competent programmer, electrician, technician or engineer. These instructions should be read and kept as a reference prior to display installation and use. Incorrect operation of the display can present a significant threat to both individuals and equipment. In the event of a break down, do not attempt to repair the display as there are no user serviceable parts inside the enclosure. Any evidence of tampering will invalidate the warranty.

## 5.0 APPLICATION

This operating and installation manual should be used in conjunction with the online help provided with the Pro-FX Control 1.1 development environment. Together, this information should form a basis for the simple configuration of the display and the creation of programs specific to your application needs. The correct operation and function of the display is dependent on the program that is created and ultimately downloaded to the hardware, therefore extensive testing is required. Customers programming the display possess the responsibility of ensuring that the display performs as intended.

Please note: These displays require the installation of appropriate firmware and a hardware-specific description file and libraries before initial use in the application environment.

## 6.0 HARDWARE DESCRIPTION

The Eaton VFX product line consists of two display models, offered in 4.3" and 7" sizes (VFX40m, VFX70m). Each of these units are designed to function over an extended operating range of supply voltage, from 6 – 36 VDC supply.

The two integrated CAN ports support CAN Layer 2, SAE J1939 and CANOpen. The first CAN port also has a software configurable termination.

USB connection provides for updates via a USB flash drive or a USB Ethernet adapter kit. The VFX40m and VFX70m each have a unique number of I/O.



The unit shown above is the VFX40m.

The I/O for the VFX40m is as follows:

- 1 USB
- 2 CAN Serial Ports – J1939/CANOpen
- 8 Button Illuminated Keypad
- 1 Power Input
- 1 Ignition Input
- 1 Digital Output
- 1 Analog Input
- Video – Optional

# VFX Product Family



The unit shown above is the VFX70m.

The I/O for the VFX70m is as follows:

- 1 USB
- 2 CAN Serial Ports – J1939/CANOpen
- 14 Button Illuminated Keypad
- 1 Power Input
- 1 Ignition Input
- 1 Digital Output
- 5 Digital Inputs
- 3 Analog Inputs
- 1 Freq Input (0-10 kHz)
- 1 Freq Output (2-3 kHz)

## 7.0 SOFTWARE DESCRIPTION

Software for the VFX family of displays is provided in the form of the VFX Platform Support Package. This is distributed as a zipped file and contains the following elements:

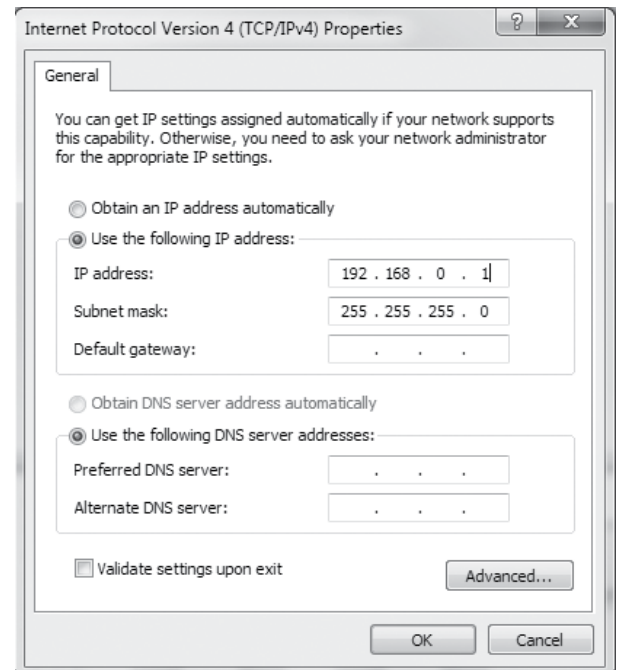
- Firmware: The same firmware file is used for all VFX variants.
- Device description package for Pro-FX Control: The VFX package file is installed using the Pro-FX Control Package Manager. Once it is installed, any of the VFX devices can be used within Pro-FX Control.
- Gateway file: Gateway.cfg defines how Pro-FX Control connects to the VFX device.

## 8.0 PRO-FX CONTROL

Pro-FX Control connects to the VFX using an Ethernet link. This section describes the steps required to set up that link. These instructions cover the use of the ASIX USB/Ethernet adaptor provided with the VFX Programming Kit.

### 8.1 Install USB/Ethernet Driver on PC

- 8.1.1 Ensure that the USB/Ethernet device is not plugged in to the PC.
- 8.1.2 Install the USB driver that was delivered with the device: CP210x\_VCP\_Win\_XP\_S2K3\_Vista\_7.exe
- 8.1.3 Plug device in to the USB port and wait for Windows to successfully load the drivers.
- 8.1.4 Go to 'Network and Sharing Center'.
- 8.1.5 Click 'Change Adapter settings'.
- 8.1.6 Find the Asix adapter and "Right-click -> Properties".
- 8.1.7 Select "Internet Protocol Version 4 (TCP/IPv4)".
- 8.1.8 Select Properties.
- 8.1.9 Reference the screenshot below to configure and click "OK" to close all open windows.



# VFX Product Family

## 8.2 Install Pro-FX Control

8.2.1 Install Pro-FX Control if it is not already installed.

## 8.3 Install the Pro-FX Control Gateway File for VFX

8.3.1 Copy the file 'gateway.cfg' from the file Gateway directory of the VFX Platform Support Package over the one that exists at {ProgramFiles (x86)}\3S CODESYS\GatewayPLC. This file configures the settings that will be used by Pro-FX Control when connecting to the display.

8.3.2. In order for the gateway changes to take effect, you must stop and restart the gateway. This can be done by right-clicking on the gateway icon in your system tray bar next to the clock.



## 8.4 Install the VFX Target Definitions

8.4.1 Launch Pro-FX Control and select Tools->Package Manager. You will need to run Pro-FX Control with Administrator privileges.

8.4.2 Click the "Install..." button.

8.4.3 Highlight the VFX package file and select Open.

8.4.4 Follow the prompts to finish the installation. Close the Package Manager.

## 9.0 GETTING STARTED

### 9.1 Create Your First Project

9.1.1 Click File->New Project.

9.1.2 Select "Standard Project". Click "OK".

9.1.3 Select the appropriate device for the display you will be using for your project. Click OK.

### 9.2 Connect and Program Your Display

9.2.1 Plug one ASIX adapter into a USB port on your PC and the other to the USB port on the VFX. Connect the two adapters with an Ethernet cable.

9.2.2 Ensure that the VFX is powered-up.

9.2.3 In the Pro-FX Control "Devices" tree view, double click on the "Device".

9.2.4 Click on the "Communication Settings" tab.

9.2.5 Click on the "Gateway-1" and then click "Scan Network".

9.2.6 One VFX should appear. Click on it and select "Set Active Path". If you have problems with this step, please see the troubleshooting steps in Appendix A.

9.2.7 Select Online->Login and then acknowledge any prompts that are displayed.

9.2.8 Click Debug->Start.

9.2.9 You have now programmed an empty project to your display and are connected for the first time. A blank page is displayed.

# VFX Product Family

## 10.0 SOFTWARE UPDATE WITH USB DRIVE (FIRMWARE, APPLICATION, LOGO)

### 10.1 Update Process

- 10.1.1 Firmware, Application, and Logo can all be updated from a USB drive. Begin by loading the required file or files to the drive.
  - 10.1.1.1 Firmware: Copy the file update.tar.gz from the firmware directory of the VFX Platform Support package to the root directory of the USB drive. Do not change the name of this file.
  - 10.1.1.2 Application: Copy the entire contents of the boot application output directory to the root directory of the USB drive. This will include the files 'Application.app' and 'Application.crc' and a directory named 'visu'. There may be additional files and directories. The process for creating the boot application is given below.
  - 10.1.1.3 Logo: Place a file called Logo.png in the root directory of the USB drive. It must be an image file in .PNG format, sized appropriately for the display.
- 10.1.2 Power OFF the display unit.
- 10.1.3 Connect the flash drive to USB connection on the display.
- 10.1.4 Press and hold any button except the lower left or right buttons.
- 10.1.5 Power ON the display while continuing to hold the button until the config icon (picture of a wrench lying across a screwdriver) appears on the display, then release.
- 10.1.6 For each option (Firmware, Application, Logo) present on the USB drive, the display will prompt the user to press the bottom left button to update that option. Each prompt will time out after 5 seconds.

10.1.7 The chosen options will be installed. If no options are selected, the display will continue to boot normally.

10.1.8 An updated logo may not appear until the next reboot.

### 10.2 Create Application File

- 10.2.1 During development, application download is normally managed within the Pro-FX Control development environment. To download with the USB drive, it is necessary to first create an application file. This is called a Boot Application.
- 10.2.2 With your project open in Pro-FX Control, select Online->Create boot application.
- 10.2.3 Save the file with the default name 'Application.app' in an otherwise empty directory.
- 10.2.4 When loading the application to the USB drive, include all files and subdirectories in from this directory.
- 10.2.5 Note: A "fonts" directory must be manually added in the USB stick root directory along with the 'Application.app' files generated by Pro-FX Control when generating a boot application. Copy the desired fonts into the fonts folder. The following file types are supported: qpf, .ttf, .ttc, .pfa, and .pfb.

### 10.3 Failsafe Kernel

- 10.3.1. In the event that the kernel becomes corrupted, it can be repaired using the failsafe kernel. Follow the procedure to update the firmware with the USB drive, except hold the bottom left button during display power-up. The rest of the process is the same.

# VFX Product Family

## 11.0 FUNCTIONALITY AND BASIC OPERATION

### 11.1 Sleep Mode

Ignition pin is required for initial power up of the display. Once the display is powered, it provides a mechanism to have a controlled shutdown of the display in conjunction with a user application. This is beneficial because the unit can be put into an idle state where less current is required, thus extending battery life. It is also of benefit in applications where parameters are required to be set to a safe state and retained prior to shutdown. Ignition input is hardware-debounced and sets the IgnitionPin variable at approximately 6.6 V.

The display will enter sleep by setting the sleep variable "enterStandby" (System Config > System Config I/O Mapping > System State > enterStandby) anytime that the IGN is low or not connected. The display will awaken from sleep if the IGN is high.

### 11.2 Task Configuration

The display supports the following tasks:

- Cyclic
- Freewheeling
- Event
- Status

### 11.3 Watchdog Operation

This watchdog monitors the specific task. The time is user configurable via the 'Task Configuration/MainTask' tab – see screen below.

### 11.4 Display Memory

Both VFX40m and VFX70m displays utilize a Freescale i.MX357 32-bit processor operating at 532 Mhz.

### 11.5 ROM Flash

The VFX40m offers 256 Mbytes of Flash (ROM memory) while the VFX70m offers 2 Gbytes of Flash.

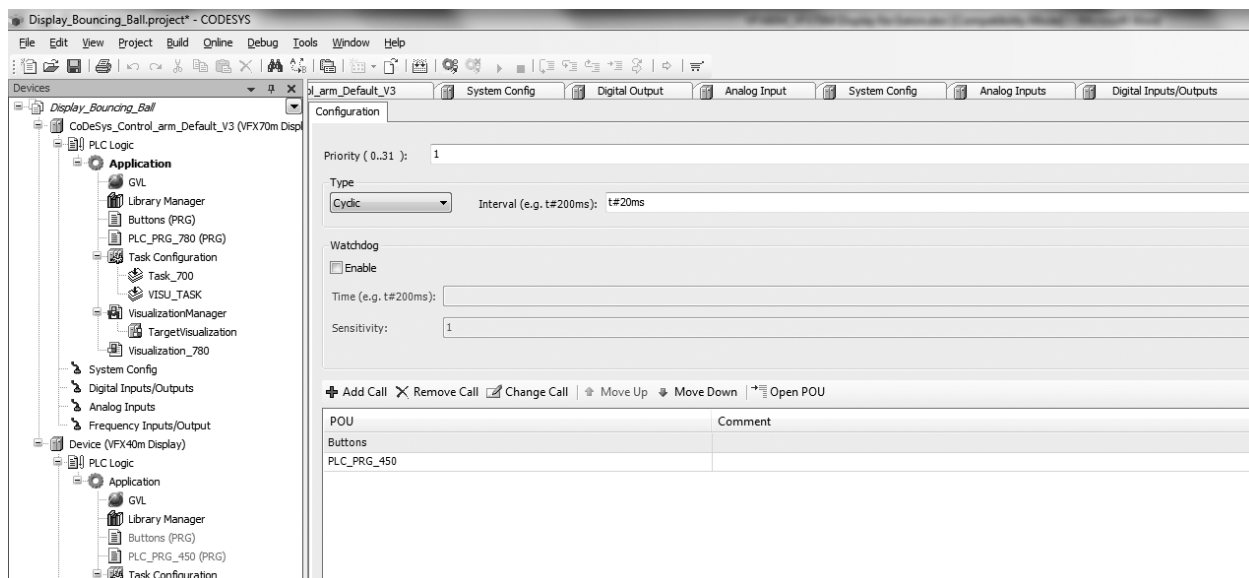
Both platforms reserve 40 Mbytes of storage for the system. These components include:

- bootloader
- primary kernel
- primary filesystem
- failsafe kernel
- failsafefilesystem
- Splash log

The remainder of the space is available for IEC application.

### 11.6 DDR2 128 Mbytes

The VFX40m and VFX70m both provide 128 Mbytes of DDR2 memory for operating system functions and IEC program execution.



# VFX Product Family

## 11.7 Remanent Variables

These are variables that can retain their value throughout the usual program run period. They are declared as 'Retain Variables', or even more stringent, as 'Persistent Variables'. For each case, a separate memory area is used.

The declaration determines the degree of "resistance" for a remanent variable in the case of resets, downloads or a reboot of the PLC. In applications, the combination of both remanent flags will be required.

The following table indicates how variables behave:

After Online command	VAR	VAR RETAIN	VAR PERSISTENT / VAR RETAIN PERSISTENT / VAR PERSISTENT RETAIN
Power cycle	-	X	X
Reset warm <application>	-	X	X
Reset cold <application>	-	-	X
Reset origin <application>	-	-	-
Download <application>	-	-	X

## 11.8 File System Operation

In addition to providing storage for the operating system, the flash file system also provides storage for additional information (e.g. configuration, license files for libraries, calibration, hardware or software details, options, etc.).

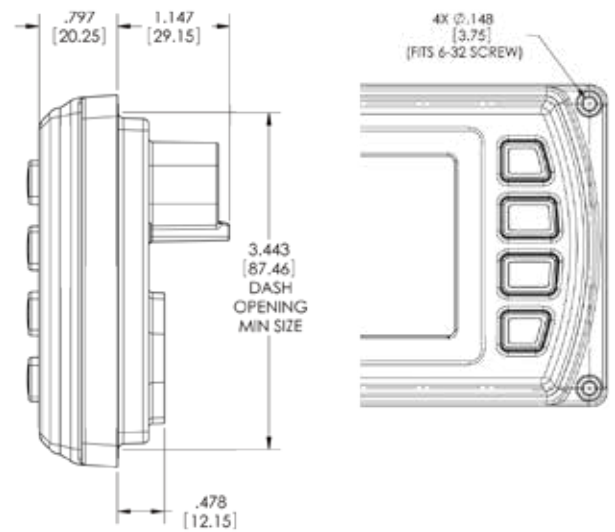
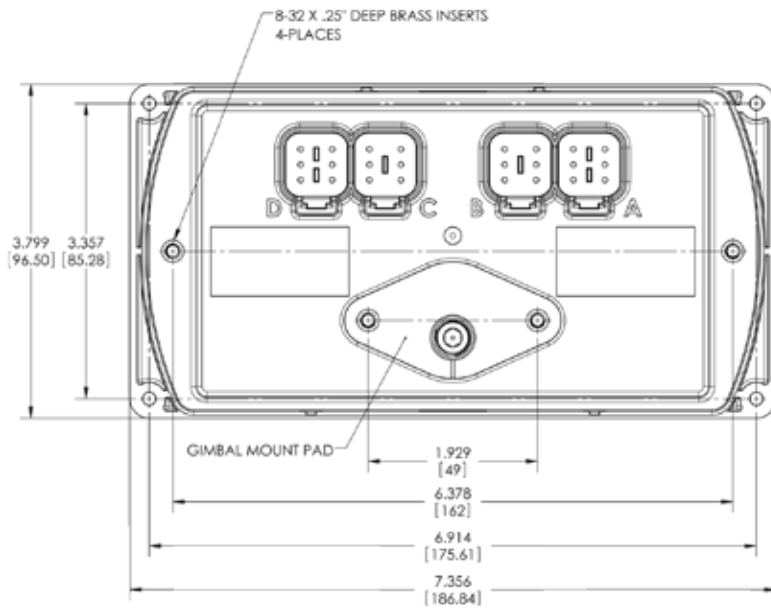
Pro-FX Control has a graphical interface for transferring files between the PC and the display.

Programmable access to the file system is managed through libraries such as the SysFile library (e.g. SysFileOpen, SysFileRead, SysFileWrite functions). The maximum directory and file name size is 16 characters.

## 12.0 INSTALLING THE DISPLAY

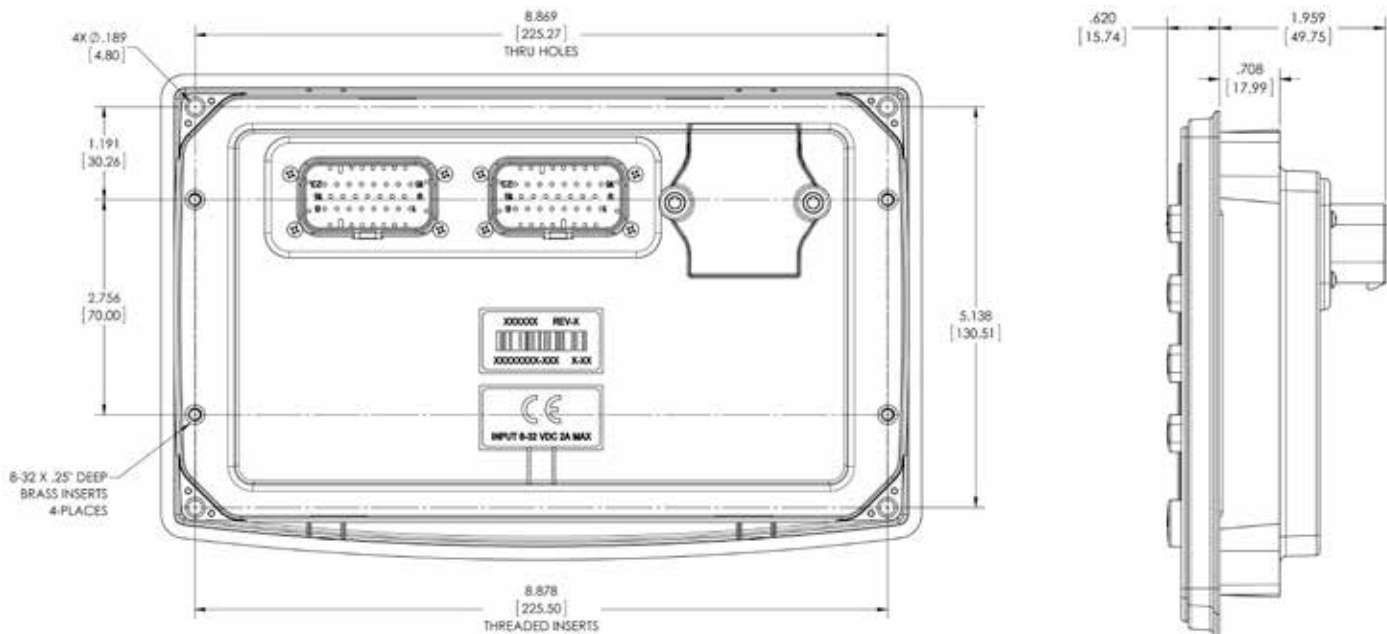
### 12.1 Product Dimensions

Ideally the display should be mounted on a vertical flat surface with connector facing down. Use four standard threaded fasteners (6-32) to secure the display to the surface.



VFX40m Dimensional data

# VFX Product Family



**VFX70m Dimensional Data**

## 12.2 Recommended Wiring Practices

This section contains information about the display connectors and pin outs. Please use the following recommended wiring practices when installing and using the display:

- Ensure correct and adequate single point ground to prevent ground loops.
- Use twisted or twisted shielded pair cable for CAN per the applicable standard.
- Confirm that the CAN network is properly terminated using 120 Ω resistors.
- Ensure the appropriate sized conductor cross section is specified for the intended load current in the harness design.  
Note: Please review individual overcurrent shutdown values in the configuration and use the correct wire gauge conductor to accommodate maximum load current configured.
- Make sure that voltage drops are kept within reasonable levels under maximum continuous load conditions (e.g. 1 volt on 12-volt systems and 2 volts on 24-volt systems).
- Verify that the harness is constructed to meet the needs of the application environment (e.g. shock, vibration, moisture, temperature, chemicals and impact).

- Make certain that the harness is designed and constructed to minimize induced interference resulting from EMI coupling between signal wires.
- Separate power circuits from low-level signals.
- All splices (soldered or crimped) should use adhesive-lined heat shrink tubing.
- Make provisions for drip loops to attach devices in exposed locations and prevent moisture entry and formation.
- Provide sufficient clearance from moving parts.
- Wires routed through holes in the vehicle body/chassis should use grommets.
- Avoid sharp metal edges, fasteners and other abrasive surfaces or use protective shielding when routing harness assembly.
- Route wires to avoid exhaust system components or other high temperature areas. Use appropriate heat shielding or other insulation where routing is a problem.
- Avoid routing near wheel wells or provide adequate mechanical protection to the assembly.
- Use a protective fuse sized appropriately for the display supply current.  
Note: 5A fuse maximum is typical. Verify that wiring can handle more current than the fuse rating.

### **⚠ Warning: Prior to Welding**

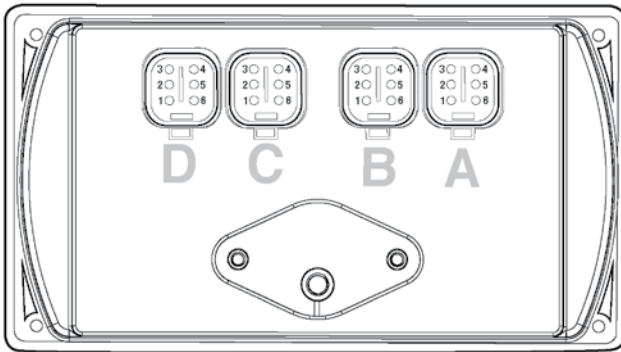
In order to avoid damaging the HFX controller ensure that all electrical connectors are fully disconnected from the HFX controller prior to welding on the machine.



# VFX Product Family

## 13.0 ELECTRICAL CONNECTION INFORMATION

### 13.1 Wiring Pin Out VFX40m



#### Plug A

Type	Deutsch
Pin	Function
1	USB 5V
2	USB D+
3	USB D-
4	USB 1D
5	USB Shield
6	USB Ground

#### Plug C

Type	Deutsch
Pin	Function
1	Not Connected
2	CAN2 H
3	CAN2 L
4	Analog Input Ground
5	Analog Input
6	Not Connected

#### Plug B

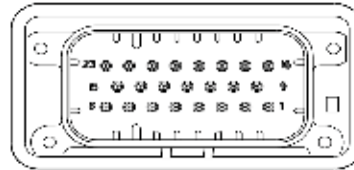
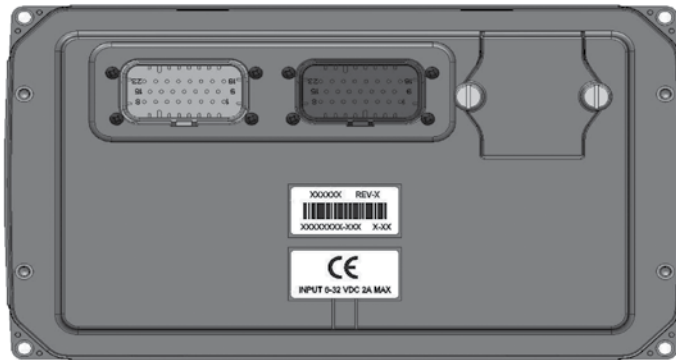
Type	Deutsch
Pin	Function
1	Battery
2	CAN1 H
3	CAN1 L
4	Open-Drain Battery Output
5	Ignition Input
6	Ground

#### Plug D

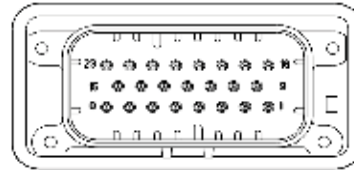
Type	Deutsch
Pin	Function
1	Video Ground 1 (*Not Connected)
2	Video Ground 2 (*Not Connected)
3	Not Connected
4	Not Connected
5	Video Input 2 (*Not Connected)
6	Video Input 1 (*Not Connected)

# VFX Product Family

## 13.2 Wiring Pin Out VFX70m



View into Connector on PCB  
Mating connector PN: AMP  
770680-4



View into Connector on PCB  
Mating connector PN: AMP  
770680-1

### Connector 1

Type	Deutsch	AMP770680-1 (Black)
<b>Pin</b>		
1	Digital Input 1	
2	Analog Input 3	
3	Analog Input 2	
4	Analog Input 1	
5	CAN1 L	
6	CAN1 H	
7	Battery	
8	Ground	
9	Analog Input 3 Ground	
10	Analog Input 2 Ground	
11	Analog Input 1 Ground	
12	Digital Input 3	
13	Digital Input 2	
14	Analog Gauge Output 1	
15	Ignition In	
16	Not Connected	
17	Not Connected	
18	CAN2 L	
19	CAN2 H	
20	Digital Input 4	
21	Digital Input 5	
22	Digital Output	
23	Not Connected	

### Connector 2

Type	Deutsch	AMP770680-4 (Grey)
<b>Pin</b>		
1	Video Input 1 (*Not Connected)	
2	Video Input 2 (*Not Connected)	
3	Video Input 3 (*Not Connected)	
4	Not Connected	
5	Not Connected	
6	Not Connected	
7	Not Connected	
8	Not Connected	
9	Video Input 1 Ground (*Not Connected)	
10	Video Input 2 Ground (*Not Connected)	
11	Video Input 3 Ground (*Not Connected)	
12	USB ID	
13	Frequency Input	
14	Frequency Return	
15	Not Connected	
16	USB D-	
17	USB D+	
18	USB 5 V	
19	USB Ground	
20	USB Shield	
21	Not Connected	
22	Not Connected	
23	Not Connected	

# VFX Product Family

## 14.0 CONFIGURATION

### 14.1 System Configuration

The display features an advanced view into the hardware through the System Config I/O Mapping tab. There are numerous predefined variables associated with the display that are accessible via the application program. This dramatically simplifies programming. All of these variables are pre-mapped with a relevant name linked with their respective channel. This name can be changed by the user if desired. Each variable also has an associated address, type and description all intended to help the programmer. The System Config I/O Mapping is organized into folders of related variables (e.g. the system state folder contains information such as supply voltage, ignition pin voltage, etc). The other folders consist of system information such as firmware rev, equipment type and backlight control (see image below).

The above variables can be monitored in the application program to alter display response. For example, if the battery voltage falls below a predefined limit, the programmer can choose to initiate a warning. Some variables can also be manipulated in the application control program to impart additional information to the user.

Note: The variable radio button "Always update variables" should be checked. If this is deselected, only variables used by the IEC application will be updated.

The System Configuration has a second tab, the System Config Configuration, that enables the user to configure settings for battery voltage sample rate.

Note: That depending on the parameter, double clicking the value in the appropriate value field will either open a drop down menu to select, allow direct editing or toggle the variable.

### 14.2 Input Modes

The display has inputs available for use depending on the selected model. The inputs are as follows:

- Analog In
- Digital In
- Digital Out
- Frequency In
- Frequency Out

These different configurations are possible through selection of the appropriate mode in the PLC configuration tab in the IDE (see screens below).

System Config I/O Mapping		System Config Configuration				
Channels						
Variable	Mapping	Channel	Address	Type	Unit	Description
[-] System State						Variables that indicate system voltages and various other parameters
[-] batteryVoltage	<input checked="" type="checkbox"/>	Battery V...	%IW0	Word	mV	The system or battery voltage
[-] ignitionPin	<input checked="" type="checkbox"/>	Ignition S...	%IX2.0	BIT		Indicates whether the ignition pin is high or low (pin black-15)
[-] enterStandby	<input checked="" type="checkbox"/>	Enter Sta...	%QX...	BIT		If the IGNITION pin is low and this bit is high, then the device will enter s...
[-] Backlight Control						Control of backlight for LCD and keypad
[-] screenBacklight	<input checked="" type="checkbox"/>	Screen Ba...	%QD1	Real	%	Screen Backlight (0 - 100%)
[-] keypadBacklight	<input checked="" type="checkbox"/>	Keypad B...	%QD2	Real	%	Keypad Backlight (0 - 100%)
[-] System Information						Firmware version, device description version, and equipment type variables
[-] equipmentType	<input checked="" type="checkbox"/>	Equipmen...	%IW2	Enum...		Description of the current connected device
[-] firmwareVersion	<input checked="" type="checkbox"/>	Firmware...	%ID2	DWord		System firmware version
[-] kernelVersion	<input checked="" type="checkbox"/>	Kernel Ve...	%ID3	DWord		Kernel local SVN version

# VFX Product Family

## 14.3 Analog Configuration

Variable	Mapping	Channel	Address	Type	Unit	Description
analogIn1		Analog IN1	%ID6			Analog and digital input values for AIN1 (pin 4, black)
analogInValue1		Analog Value	%ID6	Real	mV  ...	Analog value with units dependent on the configured...
analogInBinaryVal...		Digital Value	%DX28.0	BIT		Digital value after rising/falling voltage thresholds ar...
analogIn2		Analog IN2	%ID8			Analog and digital input values for AIN2 (pin 3, black)
analogInValue2		Analog Value	%ID8	Real	mV  ...	Analog value with units dependent on the configured...
analogInBinaryVal...		Digital Value	%DX36.0	BIT		Digital value after rising/falling voltage thresholds ar...
analogIn3		Analog IN3	%ID10			Analog and digital input values for AIN3 (pin 2, black)
analogInValue3		Analog Value	%ID10	Real	mV  ...	Analog value with units dependent on the configured...
analogInBinaryVal...		Digital Value	%DX44.0	BIT		Digital value after rising/falling voltage thresholds ar...

Above is the Analog I/O Mapping tab.

This is the area where analog values are mapped to addresses. The variables are all accessible in the application program.

Variables:

- analogInValueX: Analog value with units dependent upon configured mode.
- analogInBinaryX: Digital value after debounce and rising/falling voltage thresholds are applied.

The Analog value has a name, value, address, type and description associated. The name can be altered by the programmer if desired. Analog Inputs are displayed in actual engineering units depending on the mode configuration (either Voltage – mV, Current – mA, Resistance -  $\Omega$  or Temperature  $^{\circ}\text{C}$ ). Binary inputs are evaluated as true or false.

Parameter	Type	Value	Default Value	Unit	Description
<b>Analog IN1</b>					
Analog Input #1 configuration					
AIN mode	Enumeration of Byte	0-5V	0-5V		Analog input mode - determines configuration of resistor pull-up/downs and scaling
Pull-up enabled	Bool	FALSE	FALSE		Enable or disable the pull-up to 5V (standard value is 400 $\Omega$ )
Current shunt enabled	Bool	FALSE	FALSE		Enable or disable the 200 $\Omega$ current shunt pull-down to ground
Sample Rate	Word	100	100		Sample Rate of input (100 ms resolution)
Sample Avg Count	Byte	1	1		Number of samples to average
DIN rising threshold	Word	2500	2500		Rising voltage threshold for digital "high" value (only applies to "Digital Value" parame...
DIN falling threshold	Word	1000	1000		Falling voltage threshold for digital "low" value (only applies to "Digital Value" paramet...
<b>Analog IN2</b>					
Analog Input #2 configuration					
AIN mode	Enumeration of Byte	0-5V	0-5V		Analog input mode - determines configuration of resistor pull-up/downs and scaling
Pull-up enabled	Bool	FALSE	FALSE		Enable or disable the pull-up to 5V (standard value is 400 $\Omega$ )
Current shunt enabled	Bool	FALSE	FALSE		Enable or disable the 200 $\Omega$ current shunt pull-down to ground
Sample Rate	Word	100	100		Sample Rate of input (100 ms resolution)
Sample Avg Count	Byte	1	1		Number of samples to average
DIN rising threshold	Word	2500	2500		Rising voltage threshold for digital "high" value (only applies to "Digital Value" parame...
DIN falling threshold	Word	1000	1000		Falling voltage threshold for digital "low" value (only applies to "Digital Value" paramet...
<b>Analog IN3</b>					
Analog Input #3 configuration					
AIN mode	Enumeration of Byte	0-5V	0-5V		Analog input mode - determines configuration of resistor pull-up/downs and scaling
Pull-up enabled	Bool	FALSE	FALSE		Enable or disable the pull-up to 5V (standard value is 400 $\Omega$ )
Current shunt enabled	Bool	FALSE	FALSE		Enable or disable the 200 $\Omega$ current shunt pull-down to ground
Sample Rate	Word	100	100		Sample Rate of input (100 ms resolution)
Sample Avg Count	Byte	1	1		Number of samples to average
DIN rising threshold	Word	2500	2500		Rising voltage threshold for digital "high" value (only applies to "Digital Value" parame...
DIN falling threshold	Word	1000	1000		Falling voltage threshold for digital "low" value (only applies to "Digital Value" paramet...

Above is the Analog Inputs Configuration tab.

# VFX Product Family

The programmer changes the configuration of an individual input using the AIN mode value drop down selection. Note that if any of the following auto configurations is selected offline, the state of the corresponding pull-up, pull-down and current shunt will change once the program is downloaded into the application controller.

Variables:

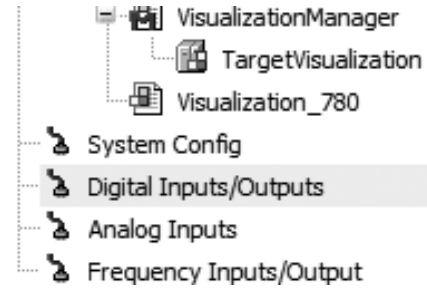
- AIN Mode: This represents the type of input connected.
- Pull-Up Enabled: This is used in manual mode to activate the Pull-up resistor.
- Pull-Down Enabled: This is used in manual mode to activate the Pull-down resistor.
- Current Shunt Enabled: This is used in manual mode to activate the Current shunt resistor.
- DIN Rising Threshold: This sets the lower limit voltage level necessary for the input to register as high.
- DIN Falling Threshold: This sets the upper limit voltage level necessary for the input to register as low. Used in conjunction with the above DIN rising threshold, an appropriate hysteresis level can be defined.

- Sample Rate: This sets the sample rate of input (i.e., ## ms/revolution).
- Sample Average Count: This sets the number of samples to average.

Make sure to take into consideration the effect of hysteresis (e.g. have some margin between rising and falling thresholds).

## 14.4 Sample Rate and Count

To establish the sample rate and count for the Digital Inputs/Outputs and Analog Inputs, access the appropriate selection on the left of the screen.



For Digital, the following Configuration screen will appear:

Parameter	Type	Value	Default Value	Unit	Description
[-] Digital Input #1					Digital Input #1
[-] Digital Input #1 Enable	Enumeration of DWORD	Disable	Disable		Digital Input #1 Enable/Disable
[-] Digital Input #2					Digital Input #2
[-] Digital Input #2 Enable/Disable	Enumeration of DWORD	Disable	Disable		Digital Input #2 Enable/Disable
[-] Digital Input #3					Digital Input #3
[-] Digital Input #3 Enable/Disable	Enumeration of DWORD	Disable	Disable		Digital Input #3 Enable/Disable
[-] Digital Input #4					Digital Input #4
[-] Digital Input #4 Enable/Disable	Enumeration of DWORD	Disable	Disable		Digital Input #4 Enable/Disable
[-] Digital Input #5					Digital Input #5
[-] Digital Input #5 Enable/Disable	Enumeration of DWORD	Disable	Disable		Digital Input #5 Enable/Disable
[-] Digital Output					Digital Output
[-] Digital Output Enable/Disable	Enumeration of DWORD	Disable	Disable		Digital Output Enable/Disable
[-] Digital Input #1 Sample Rate	Word	100	100	ms	Digital Input #1 Sample Rate (100 ms resolution)
[-] Digital Input #2 Sample Rate	Word	100	100	ms	Digital Input #2 Sample Rate (100 ms resolution)
[-] Digital Input #3 Sample Rate	Word	100	100	ms	Digital Input #3 Sample Rate (100 ms resolution)
[-] Digital Input #4 Sample Rate	Word	100	100	ms	Digital Input #4 Sample Rate (100 ms resolution)
[-] Digital Input #5 Sample Rate	Word	100	100	ms	Digital Input #5 Sample Rate (100 ms resolution)

The Sample Rate can be set or changed in the Value column. Double click the value and change if desired.

# VFX Product Family

The Digital Inputs/Outputs I/O Mapping screen will appear as follows:

Variable	Mapping	Channel	Address	Type	Unit	Description
digitalIn1		Digital Input #1	%IX20.0	BIT		Digital Input #1 (0=off,1=on)
digitalIn2		Digital Input #2	%IX20.1	BIT		Digital Input #2 (0=off,1=on)
digitalIn3		Digital Input #3	%IX20.2	BIT		Digital Input #3 (0=off,1=on)
digitalIn4		Digital Input #4	%IX20.3	BIT		Digital Input #4 (0=off,1=on)
digitalIn5		Digital Input #5	%IX20.4	BIT		Digital Input #5 (0=off,1=on)
digitalOut		Digital Output	%QX12.0	BIT		Digital Output (0=off,1=on)

For Analog, the following Configuration screen will appear:

Parameter	Type	Value	Default Value	Unit	Description
[-] Analog Input #1					Analog Input #1
Analog Input #1 Enable/Disable	Enumeration of DWORD	Disable	Disable		Analog Input #1 Enable/Disable
Analog Input #1 Sample Rate	DWORD	100	100		Analog Input #1 Sample Rate (100 ms resolution)
Analog Input #1 Sample Avg Count	DWORD	1	1		Analog Input #1 Sample Avg Count
[-] Analog Input #2					Analog Input #2
Analog Input #2 Enable/Disable	Enumeration of DWORD	Disable	Disable		Analog Input #2 Enable/Disable
Analog Input #2 Sample Rate	DWORD	100	100		Analog Input #2 Sample Rate (100 ms resolution)
Analog Input #2 Sample Avg Count	DWORD	1	1		Analog Input #2 Sample Avg Count
[-] Analog Input #3					Analog Input #3
Analog Input #3 Enable/Disable	Enumeration of DWORD	Disable	Disable		Analog Input #3 Enable/Disable
Analog Input #3 Sample Rate	DWORD	100	100		Analog Input #3 Sample Rate (100 ms resolution)
Analog Input #3 Sample Avg Count	DWORD	1	1		Analog Input #3 Sample Avg Count
[-] Analog IN1					Analog Input #1 configuration
AIN mode	Enumeration of Byte	0-5V	0-5V		Analog input mode - determines configuration of resistor pull-up/downs and scaling
Pull-up enabled	Bool	FALSE	FALSE		Enable or disable the pull-up to 5V (standard value is 400Ω)
Current shunt enabled	Bool	FALSE	FALSE		Enable or disable the 200Ω current shunt pull-down to ground
Sample Rate	Word	100	100 ms		Sample Rate of input (100 ms resolution)
Sample Avg Count	Byte	1	1		Number of samples to average
DIN rising threshold	Word	2500	2500 mV		Rising voltage threshold for digital "high" value (only applies to "Digital Value" paramet...
DIN falling threshold	Word	1000	1000 mV		Falling voltage threshold for digital "low" value (only applies to "Digital Value" paramet...
[-] Analog IN2					Analog Input #2 configuration
AIN mode	Enumeration of Byte	0-5V	0-5V		Analog input mode - determines configuration of resistor pull-up/downs and scaling
Pull-up enabled	Bool	FALSE	FALSE		Enable or disable the pull-up to 5V (standard value is 400Ω)
Current shunt enabled	Bool	FALSE	FALSE		Enable or disable the 200Ω current shunt pull-down to ground
Sample Rate	Word	100	100 ms		Sample Rate of input (100 ms resolution)
Sample Avg Count	Byte	1	1		Number of samples to average
DIN rising threshold	Word	2500	2500 mV		Rising voltage threshold for digital "high" value (only applies to "Digital Value" paramet...
DIN falling threshold	Word	1000	1000 mV		Falling voltage threshold for digital "low" value (only applies to "Digital Value" paramet...
[-] Analog IN3					Analog Input #3 configuration
AIN mode	Enumeration of Byte	0-5V	0-5V		Analog input mode - determines configuration of resistor pull-up/downs and scaling
Pull-up enabled	Bool	FALSE	FALSE		Enable or disable the pull-up to 5V (standard value is 400Ω)
Current shunt enabled	Bool	FALSE	FALSE		Enable or disable the 200Ω current shunt pull-down to ground
Sample Rate	Word	100	100 ms		Sample Rate of input (100 ms resolution)
Sample Avg Count	Byte	1	1		Number of samples to average
DIN rising threshold	Word	2500	2500 mV		Rising voltage threshold for digital "high" value (only applies to "Digital Value" paramet...
DIN falling threshold	Word	1000	1000 mV		Falling voltage threshold for digital "low" value (only applies to "Digital Value" paramet...

The Sample Rate can be set or changed in the Value column. Double click the value and change if desired.

# VFX Product Family

The Analog Inputs I/O Mapping screen will appear as follows:

Variable	Mapping	Channel	Address	Type	Unit	Description
analogIn1		Analog IN1	%ID6			Analog and digital input values for AIN1 (pin 4, black)
analogInValue1		Analog Value	%ID6	Real	mV  ...	Analog value with units dependent on the configured...
analogInBinaryVal...		Digital Value	%IX28.0	BIT		Digital value after rising/falling voltage thresholds ar...
analogIn2		Analog IN2	%ID8			Analog and digital input values for AIN2 (pin 3, black)
analogInValue2		Analog Value	%ID8	Real	mV  ...	Analog value with units dependent on the configured...
analogInBinaryVal...		Digital Value	%IX36.0	BIT		Digital value after rising/falling voltage thresholds ar...
analogIn3		Analog IN3	%ID10			Analog and digital input values for AIN3 (pin 2, black)
analogInValue3		Analog Value	%ID10	Real	mV  ...	Analog value with units dependent on the configured...
analogInBinaryVal...		Digital Value	%IX44.0	BIT		Digital value after rising/falling voltage thresholds ar...

## 14.5 Frequency Configuration

Above is the Frequency Inputs/Outputs I/O Mapping Tab.

Variable	Mapping	Channel	Address	Type	Unit	Description
frequencyIn		Frequency Input	%IW24	Word	Hz	Frequency Input (2 to 10000)
frequencyOut		Frequency Output	%QW7	Word	Hz	Frequency Output (2 to 3000)

The tab displays the following: the Mapping, Channel, Address, Type, Unit and Description for Frequency In and Frequency Out.

Above is the Frequency Inputs/Output Configuration tab.

Variable	Mapping	Channel	Address	Type	Unit	Description
frequencyIn		Frequency Input	%IW24	Word	Hz	Frequency Input (2 to 10000)
frequencyOut		Frequency Output	%QW7	Word	Hz	Frequency Output (2 to 3000)

This tab allows the user to configure the frequency I/O channels Sample Rate and Avg Count.

# VFX Product Family

## 14.6 CAN & SAE J1939

- Each device added to the J1939 manager represents a physical device on the bus.
  - So a "local device" represents the local mobile controller. This is the message the controller will be \*transmitting\*. See the "local device" checkbox in the general tab.
  - A non-"local device" represents a physical device on the bus. Thus its "Tx Signals" are what the device is sending and the mobile controller is received.
  - Thus you should generally add one "device" to the tree to represent each device that is on the physical bus, including the "local" device.
  - Also make sure you have the "local device" checked for the node that you want to be transmitting signals. While this is not intuitive at first, it makes complete sense once you are aware of it.
- There are no function blocks and everything happens automatically in the background. You just get scaled variables you can read or write from code.
- All transmission happens automatically per the configuration for each PGN. The "TransmissionMode" tab specifies the interval. Relevant options are "Change of State" and "Cyclic", but the default is change of state so the packet will not be sent unless one of the variables changes (i.e. from your code). Cyclic is the more traditional J1939 method and better for testing.
- The "I/O" mapping tab represents all the variables available in the device. These can be used in code for either inputs or outputs depending on whether it is a transmitted or received packet.
- You can automatically convert and scale variables by clicking on the SPN in the "Tx Signals" page, and then enabling the "Conversion" option. This lets you deal in engineering units (i.e. %, rpm, mph, etc) as opposed to the raw data bytes.
- Variables in the I/O mapping tab will not be updated unless physically used in code. This is an optimization done by the 3S compiler to reduce computation for unused variables. For debugging, you can check the "Always update variables" box and it will instruct the compiler/debugger to always display and update the values.
- The CAN "Network" option is base-zero. Thus Network 0 represents the first CAN bus, Network 1 represents the second CAN bus, and Network 2 represents the third.



# VFX Product Family

## 15.0 APPENDIX

### 15.1 Supported & Unsupported CODESYS Features

Since CODESYS is a generic broad-based software environment that supports a multitude of different products, not all features are relevant with a given product. In the case of our VFX series displays, the following list indicates features that are and are not supported:

#### Supported

1. Debug variable viewing
2. Login
3. Logout
4. Download (single application)
5. Run
6. Stop
7. Reset (warm, cold, origin)
8. Logger
9. Files and directories (24KB max storage and 16 character names or directories)
10. Write values
11. Create boot application
12. Visualization
13. Task monitor

14. Remanent variables
15. Task Timing – cyclic, freewheeling, event, status
16. Dynamic IO configuration.
17. Debug > display mode
18. Simulation
19. IEC task watchdog
20. IEC 61131-3 programming languages
21. Microsecond time resolution
22. Force/unforce

#### Not supported

1. Show call stack
2. Display flow stack
3. PLC shell
4. Users and groups
5. Access rights
6. Source download
7. Data server
8. Alarm manager
9. Text editor
10. Path3D
11. Cam displayer
12. Task timing – external event

# VFX Product Family

## 16.0 DEVICE COMMUNICATION TROUBLESHOOTING

The following is a list of things to check, in order of priority, if you are having problems connecting to your display from Pro-FX Control.

1. Make sure the device is powered up.
2. Make sure the USB port is connected, and Windows has properly loaded the drivers.
3. Make sure that the gateway.cfg file has been properly installed per the instructions in this document. Installation of a non-approved device gateway may have overwritten this file.
4. In the Pro-FX Control Communication Settings, select None for the Filter. Then rescan for the device. If something new appears, then it could be that the device variant being used by your project is different than the connected device. Pro-FX Control will only let you connect to a device variant that matches the configuration of your project. To switch to the appropriate device, right click on it in the Devices project tree and select Update Device.
5. Stop and start the gateway. Plug and unplug the USB port.
6. Restart Pro-FX Control.
7. Restart your PC.
8. In some cases, Windows will automatically assign a high COM port number to the USB device. If the device manager shows something higher than COM20 then you should reassign it to something lower. Then restart the gateway and unplug and plug the USB port.
9. Each time a unique device is connected to your PC, Windows will provide two new COM port numbers. In some cases, Pro-FX Control appears to have problems automatically discovering the device's COM port when the value gets too high. In this case, there are two options:
  - From the device manager, click the COM port's properties, select Port Settings tab, click Advanced and select a Com Port Number that is below COM20. Then restart the gateway and replug the USB device to ensure changes are applied properly.
  - You can alternately edit the gateway.cfg to manually assign your device's COM port number. Open the gateway.cfg file located in the Pro-FX Control install directory, and change the line that begins with Com.0.Port. After making this change, restart the gateway.  
Note: After making this change, your installation will no longer automatically detect other displays so this must be repeated for all unique displays that are connected to your PC.

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