



Vx Aviation™

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V-Speed™ Auxiliary Display System

External AoA Indicator For Dynon and GRT EFIS Systems

Installation and Application Guide



Figure 1-1. V-Speed ADS

1. Features

- ❑ Displays Angle of Attack (AoA) information as generated by the Dynon™ and Grand Rapids Technologies (GRT) Electronic Flight Information Systems (EFIS).
- ❑ Displays slow flight and cruise flight speeds according to user-programmable threshold information.
- ❑ Provides a flaps retraction warning when V_{fe} exceeded and flaps extended
- ❑ Easily mounts on the glare shield with hook-and-loop fasteners for convenient line-of sight viewing in either horizontal or vertical orientation
- ❑ Compact 2.25" x 1.6" x 0.75" display unit with bright LED display
- ❑ Auto-dimming for night operations
- ❑ Easy to connect: power, ground, serial transmit bus and optional Flap sensor

Description

The V-Speed ADS is a glare shield mounted auxiliary display that replicates and enhances information sent on the serial RS-232 air data bus from compatible EFIS instruments. The ADS provides a line-of-sight display of Angle-of-Attack (AoA) information and certain slow-flight and cruise flight information, as programmed by the installer.

The display is mounted horizontally or vertically on the glare shield by using the provided hook-and-loop fasteners. Connections to the serial bus, power and optional flap sensor are made with the provided shielded cable.

An internal ambient light sensor provides automatic dimming for night operation.

When equipped with the optional AoA probe, the Dynon EFIS provides AoA information on its serial data bus. The V-Speed ADS interprets this information and uses it to provide a corresponding indication on the LED lamp display. The Dynon EFIS also provides airspeed information, so that even without the AOA probe, the ADS can be programmed to display slow-flight and cruise speed information. In some installations, display of slow flight information (for example, V_x , V_{ref} , V_{so} and V_{s1}) is preferable to AoA information. Cruise speed information is used primarily for V_{fe} , V_a , V_{no} and V_{ne} indications. If the optional flap sensor input is activated, lamps on the ADS display will flash to warn when airspeed exceeds V_{fe} . Grand Rapids Technologies also supports the Dynon air data stream, included computed AoA. Contact GRT for more information.

The ADS AoA display may not exactly correspond to the EFIS's internal display, due to variations in individual calibration of the EFIS. In addition, the ADS display is organized slightly differently than the EFIS display. It provides an expanded 'caution' zone using yellow lamps in order to allow for more precise AoA control.

In order to accommodate individual preferences or calibration variations of AoA, the ADS display may be field customized by simple data downloads from an external computer. External data downloads are also the method for setting slow flight and cruise speed thresholds. See Section 3 for more information.

2. Installation



Figure 2-1. V-Speed ADS Mounted on Glare Shield in Horizontal Configuration

Mounting

Mount the unit in a convenient place on the glare shield using the hook and loop fasteners provided. Route the power/data cable through a 3/8" hole drilled in the glare shield and with an SB375-4 snap bushing or rubber grommet inserted in the hole to protect the wiring. The unit may be mounted in either a vertical or horizontal orientation.

Power and Data

Make the power and data connections as illustrated in Figure 2-1. Use a maximum 5 amp fuse or circuit breaker for the power connection. Since the V-Speed ADS draws less than 200 mA, it is also acceptable to use an existing circuit that has the appropriate size fuse or breaker.

Assuming that there is an existing panel jack for EFIS programming (9 pin D-Sub connector or similar), wire the serial data input to the ADS as shown in Figure 2-2. It is recommended that the isolation switch be included to allow the ADS to be programmed without interfering with the EFIS. The 'Set' position allows the ADS to be programmed, the 'Run' position allows the ADS to operate normally, and for the EFIS to be programmed.

The isolation switch may be mounted anywhere convenient, and does not need to be accessible in flight.

When programming the ADS, ensure that the EFIS is turned off.

Although not shown, consideration should be made to using crimp-on 'bullet' or 'fast-on' terminals to splice in the ADS harness to the aircraft wiring. This will allow the ADS to be readily removed for servicing. The cable assembly should be able to pass through the glare shield grommet to allow removal.

Optional Sensor Input

A flap sensor may be optionally installed. Use a grounded sensor, such as a lever or pin switch that is closed (grounded) when the flaps are deployed. The sensor switch and extra wiring for this application are not provided. If not used, it is acceptable to leave the wire disconnected.

The flap sensor isn't needed for basic operation, however, it is used in cruise flight mode to flash certain indicator lamps when flaps are deployed and the airspeed exceeds the first programmed threshold (normally Vfe).

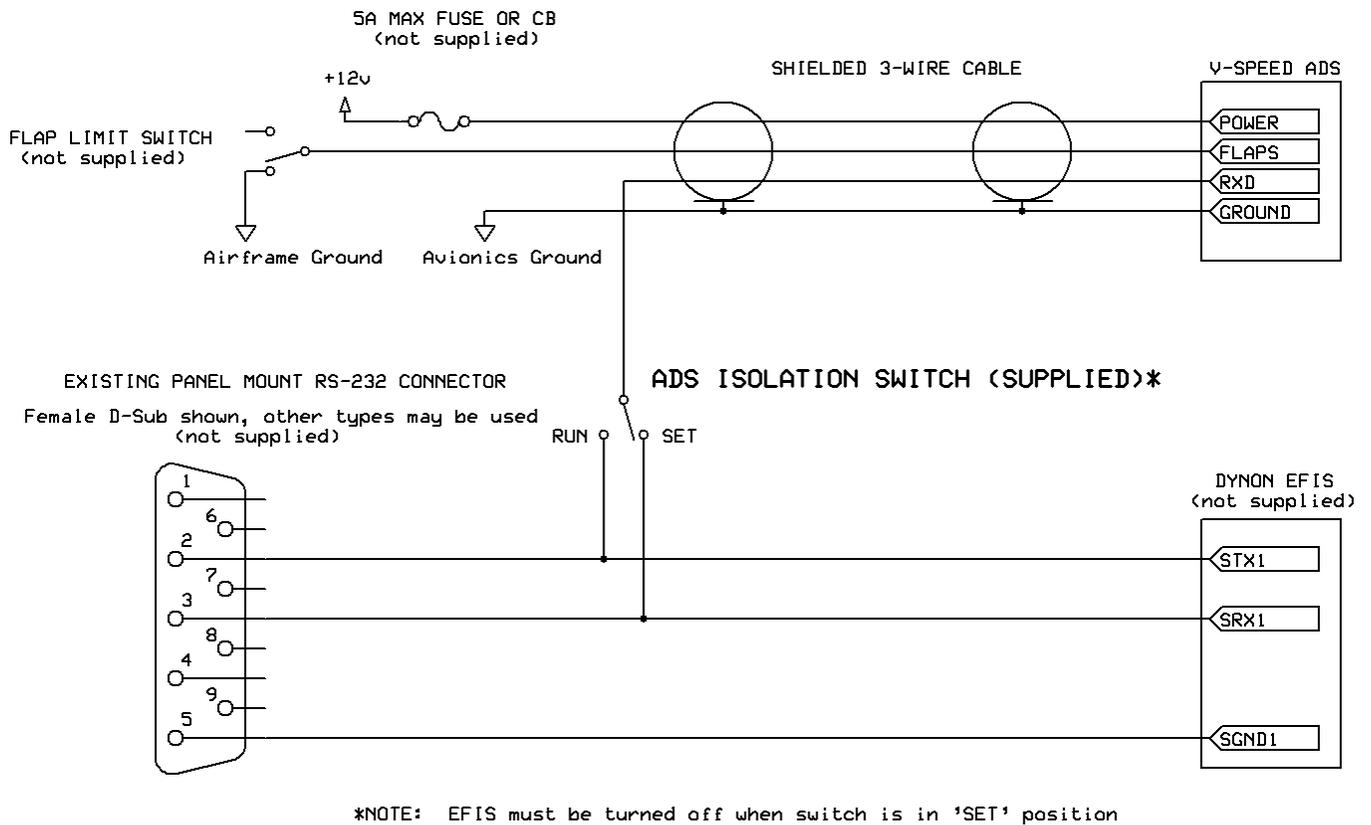


Figure 2-2. Panel Jack Installation Wiring

3. Application Information

Field Programming

The unit is factory programmed with AOA setpoints as described below. These are customizable after installation by using a computer connection as described in Section 2. From the factory, *slow flight* and *cruise speed* indications are **disabled**, but may be enabled and customized using the computer connection.

The setpoint parameters for the eight indicator lamps are programmed with a standard Windows software application called HyperTerminal, which also is also available from <http://www.hilgraeve.com>. Other terminal emulators may be used as well, depending on personal preference.

Configure HyperTerminal as follows :

Connect direct to : <available serial COM port>
Bits per second : 115,200
Data bits : 8
Parity : None
Stop Bits : 1
Flow Control : None

The V-Speed ADS is connected to the COM port on your computer using the existing panel jack and cable that you used to program the Dynon EFIS. GRT EFIS connections are similar, please contact them for details.

Turn on the aircraft main power and avionics power, as required. Turn the EFIS off, and configure the V-Speed ADS isolation switch to the 'Set' position.

Setting AoA

Once the cable has been connected, the ADS and computer are powered up and configured, and the isolation switch positioned to 'Set', the following strings may be typed or sent¹ to the COM port from HyperTerminal .

First, confirm that the slow flight mode is disabled by sending the following string :

[S:0000 0000 0000 0000 0000 0000 0000 0000]

Then, the AOA setpoints can be configured by sending :

[A:n1 n2 n3 n4 n5 n6 n7 n8]

(note: you must include the '[' and ']' characters)

Where n1 through n8 are the two-digit AOA percentage values for lamps 1 to 8, respectively, separated by spaces. For example, factory default settings can be restored by sending or typing :

**[S:0000 0000 0000 0000 0000 0000 0000 0000]
[A:20 40 55 60 65 70 78 87]**

You must pause after sending each line until the unit flashes. The string starting with '[S:' is used to disable the slow flight mode, and only needs to be sent if slow flight has been previously enabled (see below).

Nothing will be seen on the computer screen while this information is being sent. Once the '[' is typed at the end of each string, the V-Speed ADS display will light all of the lamps briefly, indicating the completion of the programming. If you make an error, or the unit does not flash after programming, recycle the power to the ADS and repeat the programming step.

The unit must be flight tested to confirm proper configuration !

Note 1 : For convenience, each programming string can be created and maintained in any text editor, then selected, copied and pasted to HyperTerminal.

Angle of Attack Display Factory Setpoints*

Lamp #	Color	AOA	Comment
8	Red	87%	Flashes
7	Red	78%	Flashes
6	Yellow	70%	Flashes
5	Yellow	65%	Flashes
4	Yellow	60%	
3	Yellow	55%	
2	Green	40%	
1	Green	20%	

*subject to change without notice

Setting Slow Flight

For slow flight indication, first disable the AoA mode by sending the following to the ADS from the computer :

[A:99 99 99 99 99 99 99 99]

Then, slow flight setpoints are programmed by sending the following to the ADS from the computer:

[S:v1 v2 v3 v4 v5 v6 v7 v8]

All of the speeds (v1 to v8) must be in **decimeters per second**. Conversion from mph or knots to decimeters per second is as follows:

$$\text{Dm/s} = \text{knots} * 185.2 / 36$$

$$\text{Dm/s} = \text{mph} * 160.9 / 36$$

$$\text{Dm/s} = \text{km/h} * 100.0 / 36$$

A programming example is as follows. **Important! Every aircraft will require different setpoints, and the values are also dependent on individual preferences.**

[S:0370 0350 0329 0288 0278 0268 0257 0226]

Example Slow-Flight Thresholds

Lamp #	Color	Speed	Comment
8	Red	Vs0 + 1 (44 knots)	Flashes
7	Red	Vs1 + 1 (50 knots)	Flashes
6	Yellow	52 knots	Flashes
5	Yellow	54 knots	Flashes
4	Yellow	Vref (56 knots)	
3	Yellow	64 knots	
2	Green	68 knots	
1	Green	Vx (72 knots)	

At the completion of each programming step, the V-Speed ADS display will light all of the lamps briefly. If you make an error, or the unit does not flash after programming, recycle the power to the ADS and repeat the programming step.

As with the AoA programming, the unit must be flight tested to confirm proper configuration !

Setting Cruise Flight

Cruise flight thresholds are programmed by sending the following to the ADS :

[C:v1 v2 v3 v4 v5 v6 v7 v8]

All of the speeds must be in **decimeters per second**. Conversion from mph or knots to decimeters per second is as follows:

$$\text{Dm/s} = \text{knots} * 185.2 / 36$$

$$\text{Dm/s} = \text{mph} * 160.9 / 36$$

$$\text{Dm/s} = \text{km/h} * 100.0 / 36$$

A programming example is shown below.

Important! Every aircraft will require different setpoints, and they are dependent on individual preferences. The Lamp 1 threshold setpoint must be set to Vfe or slightly below Vfe for the flap warning indication to operate properly.

[C:0401 0530 0808 0839 0875 0905 0936 0962]

Example Cruise Flight Thresholds

Lamp #	Color	Speed	Comment
8	Red	Vne + 5 (187 knots)	Flashes if flaps extended or if speed is above setpoint limit
7	Red	Vne (182 knots)	Flashes if flaps extended or if speed is above setpoint limit
6	Yellow	176 knots	Flashes if flaps extended above Vfe
5	Yellow	170 knots	Flashes if flaps extended above Vfe
4	Yellow	163 knots	Flashes if flaps extended above Vfe
3	Yellow	Vno (157 knots)	Flashes if flaps extended above Vfe
2	Green	Va (103 knots)	Flashes if flaps extended above Vfe
1	Green	Vfe (78 knots)	Flashes if flaps extended above Vfe

Note : flap extension warnings require optional user-supplied flap limit switch.

At the completion of each programming step, the V-Speed ADS display will light all of the lamps briefly. If you make an error, or the unit does not flash after programming, recycle the power to the ADS and repeat the programming step.

As with the all programming, the unit must be flight tested to confirm proper programming !

Cruise flight indications are differentiated from AoA or slow flight indications by the operation of the lamps. In AoA or slow flight modes, the lamps are progressively lit, starting with lamp 1 and ending with lamp 8.

In cruise flight mode, lamps 1 and 2 are exclusively lit and lamps 3 through 8 are progressively lit. Hence, in normal flight only lamp 1 or 2 will be on. However, when V_{no} is exceeded, lamps 3 through 8 will progressively light, and lamps 1 and 2 will be off.

In all Slow Flight or AoA modes, lamps 5, 6, 7 & 8 will flash and indicate normally according to the programmed setpoints. In Cruise Flight, only lamps 7 & 8 will flash and indicate normally, *unless the optional flap sensor input is active and V_{fe} is exceeded*. In this case, **ALL** eight lamps will flash until the flaps are retracted to restore proper setpoint indication.

4. Flight Operation

THE V-SPEED ADS IS AN AUXILIARY DISPLAY, AND IT MUST NOT BE RELIED UPON AS THE SOLE SOURCE OF ANGLE-OF-ATTACK OR AIRSPEED INFORMATION.

The pilot in command must use his or her best judgement at all times when in control of the aircraft, including using the primary flight instruments and external visual references to maintain proper attitude and airspeed.

The ADS is dependent on the proper installation, calibration and operation of the EFIS AoA system, it's own setpoint parameter programming, the integrity of the wiring, the quality of the external power, the ambient temperature, vibration and the ambient lighting conditions. In-flight failures are possible, and the pilot must be able to detect when the ADS is not operating properly. Once familiarity with the ADS operating characteristics has been achieved, it may then be incorporated into the flight regimen as an additional source of attitude and airspeed information.

It is important to perform additional familiarization flights in any new installation, after recalibration of the EFIS, after reprogramming of the ADS setpoint parameters, after any change to the aircraft pitot/static system or after any software upgrades to either the EFIS system or the V-Speed ADS.

5. Electrical Characteristics Over Specified Operating Temperature

Parameter	Symbol	Min	Typ	Max	Units	Conditions
Power Input	V _{CC}	10		18	V	200 mA operating current
Ambient Operating Temperature	T _A	-20		+55	°C	Non-Condensing
Storage Temperature	T _S	-40		+85	°C	Non-Condensing

6. Ordering Information

Part Number	Description
VX-06001xx-D1-14	V-Speed ADS For EFIS Systems

The following items are included with the V-Speed ADS:

- V-Speed ADS display,
- 5' shielded cable with one end unterminated,
- Hoop-and-Loop fasteners for glare shield mounting,
- Isolation slide switch.

Items to be provided by installer:

- Programming connector (may be shared with existing installation),
- Various installation dependent fast-on and bullet connectors,
- Snap Bushings as required,
- Extension wiring, and
- Flap sensor.

7. Warranty and Support

This product is warranted for a period of one year after purchase against defects in materials or workmanship. Warranty returns will be replaced with new or refurbished product at the sole discretion of Vx Aviation. Customers shall be responsible for the shipping costs of the returned product. Under no circumstances shall Vx Aviation be responsible for damages of any kind whatsoever resulting from the use of its products. Total liability is limited to the purchase price of the product. Customers take sole responsibility for fitness of use, application and installation. As a condition of purchase, the customer agrees to accept complete liability for the product and its use.

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8. Document Revision History

Issue Number	Date	Purpose
VXD-0604001A1	April 30, 2006	Initial Release reflecting version A2 product design.
VXD-0604001A2	October 26, 2006	Lamp operation description updated.
VXD-0604001A3	March 29, 2011	Added information on GRT EFIS support.

