

FlightDEK-D180

Combined EFIS and EMS



Pilot's User Guide

P/N 100601-000, Revision E
For use with firmware version 5.0

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Dynon Avionics

This product is intended for the experimental and Light Sport aircraft categories and is not approved for installation in type certificated aircraft

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1. INTRODUCTION

Thank you for purchasing the Dynon Avionics FlightDEK-D180. This section provides some important cautionary information and general usage instructions for this manual.

Before You Fly

We strongly recommended that you read this entire guide before attempting to use the FlightDEK-D180 in an actual flying situation. Additionally, we encourage you to spend time on the ground familiarizing yourself with the operation of the product. While first learning to use the instrument in the air, we recommend you have a backup pilot with you in the aircraft. Finally, we encourage you to keep this manual in the aircraft with you at all times. This document is designed to give you quick access to information that might be needed in flight. **CAUTION:** in a flying situation, it is the pilot's responsibility to use the product and the guide prudently.

OEM Installations

If your FlightDEK-D180 is installed by an OEM distributor, you may find that you are unable to access some menus and settings. Some Dynon distributors customize various areas of the FlightDEK-D180 firmware to maintain a consistent pilot experience and minimize integration issues across a large number of installations. Currently, OEMs can customize access levels to the following settings on Dynon systems: EMS GLOBAL setup menu, EMS SENSOR setup menu, fuel calibration, trim calibration, flaps calibration, GPS/NAV setup menu, screen configurations, data logging, and checklists/data panels. OEM distributors have the option of customizing some or all of these areas. Please contact your aircraft's manufacturer if you have any questions about how your unit has been customized.



Warning

Dynon Avionics' products incorporate a variety of precise, calibrated electronics. Except for replacing the optional internal backup battery in EFIS-based products per the installation guide, our products do not contain any field/user-serviceable parts. Units that have been found to have been taken apart may not be eligible for repair under warranty. Additionally, once a Dynon Avionics unit is opened up, it will require calibration and verification at our Woodinville, WA offices before it can be considered airworthy.

About this Guide

This guide serves two purposes. The first is to help you configure and get acquainted with the FlightDEK-D180's many functions. The second is to give you quick access to vital information. For detailed technical and installation information, please refer to the FlightDEK-D180 Installation Guide.

In the electronic (.PDF) version of this manual, page and section references in the Table of Contents and elsewhere act as hyperlinks taking you to the relevant location in the manual. The latest version of this manual may be downloaded from our website at www.dynonavionics.com.

The following icons are used in this guide:

-  Any text following this icon describes functionality available only with the HS34 HSI Expansion Module connected to your system.
-  Any text following this icon describes functionality available only with the AP74 Autopilot Interface Module connected to your system.
-  Any text following this icon describes functionality that is possible when multiple Dynon Avionics products are networked together via the Dynon Smart Avionics Bus (DSAB).
-  Any text following this icon refers to a setting or situation which merits particularly close attention.

2. PRODUCT OVERVIEW

This section provides a general overview of the various parts of the FlightDEK-D180 as well as a theory of operation. The information in this section serves as a reference only and helps familiarize you with the inner workings of the unit. It should not be used for diagnostic or reparative work.

FlightDEK-D180 Hardware

The FlightDEK-D180's versatile design accommodates a wide range of engines and sensors. You may configure the system to meet your monitoring requirements covering both air- and water-cooled engines with up to six cylinders. Its warning capabilities provide early notification of problems that might otherwise go unnoticed. The FlightDEK-D180 uses solid-state sensors to provide accurate and reliable information about your flying environment in an easy-to-use interface.

POWER

The FlightDEK-D180 requires between 10 and 30 volts DC for operation and has inputs for an external backup power supply and a keep-alive voltage. It is acceptable to have the FlightDEK-D180 turned on during engine start.

The FlightDEK-D180 can be ordered with an optional internal battery which allows the instrument to continue to operate in the event of an external power failure. This lithium-ion battery is rechargeable and is managed by the FlightDEK-D180. If the always-on Keep Alive circuit is connected, the FlightDEK-D180 continues to charge its internal battery even if the instrument is turned off. This ensures that your internal emergency battery is always fully charged. Under normal conditions, the internal battery should have a voltage between 13 and 16.8 volts. When the battery's voltage drops below 13 volts, the FlightDEK-D180 displays a low battery warning. When new, a fully charged internal battery is rated for a minimum of 1.5 hours of normal operation with the FlightDEK-D180. If the FlightDEK-D180 has switched to its internal emergency battery due to a power loss in your aircraft, it is advised that you land as soon as possible.



SENSORS AND INPUTS

Attitude information is obtained from 3 solid-state gyrometers, 3 solid-state accelerometers, and the airspeed pressure sensor. Heading information is obtained from 3 solid-state magnetometers housed in the EDC-D10A. Airspeed, altitude and angle of attack are obtained from three separate pressure transducers.

HSI information can be displayed when connected to Dynon's HS34, a Garmin SL30, or a compatible GPS unit.

When connected to the appropriate sensors, the FlightDEK-D180 displays RPM, manifold pressure, oil temperature and pressure, exhaust gas temperature (EGT), cylinder head temperature (CHT), fuel levels for up to 4 tanks, voltage, current, fuel pressure, fuel flow, carburetor air temperature, coolant pressure and temperature, outside air temperature, flaps, trim, and the status of up to two external contacts. Fuel endurance and economy information can be obtained when a compatible GPS unit is connected to your system.

DYNON SMART AVIONICS BUS

If you have multiple Dynon Avionics products in your aircraft, they may be networked together via the Dynon Smart Avionics Bus (DSAB). Units networked via DSAB have the ability to transmit information to each other. Any product's data can then be viewed on any other screen in the DSAB network. For example, an EFIS has the ability to display engine monitor information if it is connected to an EMS or FlightDEK-D180.

Note that the failure of a unit in a DSAB network may cause the loss of some or all data shared between units. In the above example, if the connected EMS/FlightDEK-D180 were to fail, the EFIS would no longer be able to behave as an engine monitor. For more information on DSAB-specific alerts, refer to the DSAB Alerts section on page 8-4.

OUTPUTS

The FlightDEK-D180 has outputs to drive external customer-supplied audible and visual devices for engine, AOA (if installed) and altitude alerts.



A serial output is also provided for serial altitude encoder data. An optional Serial-to-Gray Code Converter is available for connection to Mode C Gray Code transponders.

AP74**HS34**

A connected HS34 or AP74 can output voice annunciations for many of the alerts generated by the FlightDEK-D180.

DISPLAY

The display is a 7-inch, 854 by 480 pixel, 400 nit or 800 nit LCD screen, depending on the model.

BUTTONS AND KNOBS

User interaction takes place via the six buttons along the bottom of the front panel of the unit.

AP74

When an AP74 Autopilot Interface Module is configured to control the FlightDEK-D180, its VALUE knob changes values when in various EFIS menus. When no menus are displayed the AP74 can adjust the barometer, altitude bug, and heading bug. The AP74's buttons control the Autopilot operation mode (Heading Hold, Track Hold, GPS horizontal navigation, altitude hold), and allow you to engage and disengage the Autopilot.

HS34

When an HS34 is configured to control the FlightDEK-D180, its VALUE knob changes values when in various EFIS menus. When no menus are displayed the HS34 can adjust the barometer or altitude bug. The HS34's HEADING and COURSE knobs affect their respective parameters on the HSI page. The HS34's GPS and NAV buttons cycle through the available GPS and NAV sources connected to it.

Theory of Operation

The primary flight instruments on your EFIS display are generated using a group of calibrated sensors. All of them are solid state – that is, there are no moving parts. These sensors include accelerometers, which measure forces in all three



directions; rotational rate sensors, which sense rotation about all three axes; pressure transducers for measuring air data; and magnetometers on all three axes for measuring magnetic heading.

The table below describes which inputs and sensors are used within the EFIS to generate the different displayed instruments. It is not meant to enable in-flight troubleshooting, but is provided to convey how much of an integrated system your EFIS is.

	Pitot	Static	AOA	Magnetometers	Rate Sensors	Accelerometers
Ball						X
Altitude		X				
Airspeed	X	X				
AOA	X	X	X			
Turn Rate	X	X			X	X
Heading	X	X		X	X	X
Attitude	X	X			X	X

AN IMPORTANT NOTE ABOUT AIRSPEED

As depicted above, your FlightDEK-D180 depends on airspeed (pitot and static) for many of the primary flight instruments. If a problem develops with your airspeed reading, treat all of the instruments on your EFIS with skepticism – especially attitude. Also, know that without airspeed, the EFIS instruments that depend on it are most prone to error when the aircraft is accelerated. Hence, the less the aircraft is maneuvered (power application/reductions, and changes in direction), the better the EFIS performs.



COMPASS ACCURACY AND AUTOPILOT PERFORMANCE

If you are using your FlightDEK-D180 to control Dynon's Autopilot, it is critical that the magnetic heading be as accurate as possible for comfortable operation in HDG mode and the upcoming radio-based VOR/NAV mode. The aircraft's compass must be installed correctly, calibrated, and operating well *in all attitudes*.

3. PRODUCT OPERATION

After reading this section, you will be familiar with the basics of how to use your FlightDEK-D180. For details regarding specific procedures (e.g., adjusting display brightness, using the fuel computer, setting the clock, etc.) please refer to the EFIS Operation and EMS Operation sections.

Front Panel Layout

All normal operation of the FlightDEK-D180 happens via the front panel. The front panel contains buttons and a display.

- **Buttons** – There are six buttons on the front panel of the FlightDEK-D180. Throughout this guide, these buttons are referred to as one through six, with button one being the leftmost and button six being the rightmost. FlightDEK-D180 buttons are used to turn the instrument on and off, cycle between screens, scroll through menus, and adjust instrument parameters.
- **Display** – The display shows EFIS information and engine parameters, menus, and data obtained from other connected products.



User interaction takes place via the FlightDEK-D180 main display and the six buttons beneath. Note: buttons are not labeled on actual product



Display

The FlightDEK-D180 display is the most obvious and commonly used output of the device. It is capable of displaying EFIS, HSI, and/or engine data simultaneously.

SCREENS AND PAGES

The terms in the following bulleted list are used in this section and are defined as follows:

- Screen/Screen Configuration – Screens consist of one or two pages from the FlightDEK-D180 or from another DSAB-connected Dynon Avionics product.
- Page – A page is a section of the screen that contains a collection of related data. Pages may occupy the total area of the screen (i.e., 100%) or share the screen with other pages (e.g., 2/3, 1/3 split). Pages that occupy 1/3 of the screen area are sometimes abbreviated versions of their full size (100% or 2/3) counterparts.
- Screen Rotation – The rotation is the list of screen configurations which can be cycled to via the hotkeys. Your rotation is usually smaller than the total list of available screen configurations.



Screens contain one or two pages and pages contain groups of similar information.



The FlightDEK-D180 has several pre-defined screen configurations. The basic layout of a screen configuration is represented by one of three icons on D100-series product. The table at right shows the three icons and their meaning.

The predefined screen configurations with their respective icons are as follows:

Icon	Left Page Area	Right Page Area
	2/3	1/3
	1/3	2/3
	One page that occupies all of the screen area	

The SCREEN LIST Menu uses icons to illustrate the layout for each screen configuration.

	EFIS/EMS (default FlightDEK-D180 boot-up screen; in default rotation)
	EFIS/AUX (in default screen rotation)
	EFIS/FUEL (in default screen rotation)
	EFIS/TIMES (in default screen rotation)
	EFIS/HSI (in default screen rotation)
	EMS/EFIS
	EMS/AUX
	EMS/TIMES
	EMS/FUEL
	EMS/HSI
	EFIS
	EFIS/EMS
	EMS/EFIS
	HSI/EMS

CYCLING BETWEEN SCREENS

There are two methods for cycling between pre-defined screens: via the menu and via hotkeys.

Screen Cycling Using the SCREEN LIST

Navigate to the SCREEN LIST menu by holding button six for at least two seconds when no menu is present (see the figure to the right). Note that if you only press button six momentarily, the display cycles to the next screen in your screen rotation. Use the DOWN▼/UP▲ buttons to move the caret (>). The caret denotes the selected screen. Press GOTO▶ to remove the SCREEN LIST and display the selected screen. If you wish to stay on the same screen, you may either select your currently displayed screen with the caret and press GOTO▶, or press CANCEL.

Screen Cycling Using Hotkeys

With no menu displayed, press button one to cycle to the previous screen in your rotation. Likewise, press button six to cycle to the next screen in your rotation (see the figure on the next page). Cycling via hotkeys only allows you to display screens that are in your screen rotation. They are meant to give you quick access to the screen configurations that are most important to you. If you wish to access screens that are not in your rotation, use the SCREEN LIST as described above.



With no menus displayed, pressing button six for two seconds displays the SCREEN LIST menu, from which you may switch to, and set up, various screen configurations.



Changing the Screen Rotation

You may use the out-of-the-box screen rotation or define your own. If you desire to use the initial rotation, no user configuration is required. If you desire to use a custom cycling order, then user configuration is necessary.

To configure a custom rotation, navigate to the SCREEN LIST menu page by pressing button six for approximately two seconds when no menu is present. Press SETUP, then press ROTATN to display the menu used to change the boot and rotation screen. Scroll through the pre-defined screens using the DOWN ▼/UP ▲ buttons.

Press the BOOT* button on any selected screen configuration to make it the screen that is shown immediately after the instrument is turned on. Only one screen may be designated as the boot screen. Next, press the TOGGL⇅ button on any selected screen to toggle the “⇅” icon. All screens that show the “⇅” icon are included in the rotation. Any screen in the rotation may be accessed via the button one and six hotkeys. Press BACK to save any settings.

Changing the Screen List Order

You may wish to change the order in which screen configurations are displayed in the SCREEN LIST, thus changing the order they are cycled to via hotkeys. To do this, navigate to the SCREEN LIST menu page by pressing button six for approximately two seconds when no menu is present. Press SETUP, then press ORDER to display the menu used to change the screen order. Scroll through the pre-defined screens using the DOWN ▼/UP ▲ buttons. Press the MV DN ▼



Buttons one and six cycle to the previous and next screens, respectively.

button to move the selected screen down in the screen list. Likewise, press the MV UP ▲ button to move the selected screen up in the screen list.

Menus

All interaction with the FlightDEK-D180 is accomplished through the use of its menu system. The menu system is accessed and navigated via the six buttons located on the front of the unit.

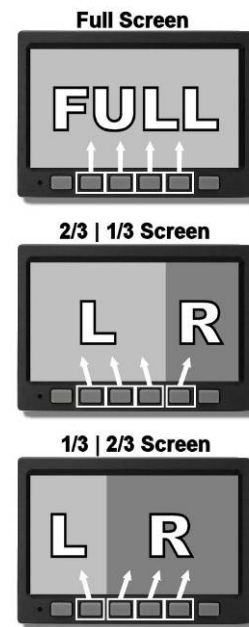
PAGE-SENSITIVE MENUS

On a screen where no menu is already present, buttons two through five are used to display a menu. With no menu displayed, pressing any one of these buttons causes the menu for the page above it to show at the bottom of the screen. For example, if a screen is divided into two pages with the left page occupying 2/3 of the screen and the right page occupying 1/3 of the screen, then pressing FlightDEK-D180 buttons two, three, or four (all below the left 2/3 of the screen) displays the main menu for the left page and pressing button five (below the right 1/3 of the screen) displays the main menu for the right page (see the figure to the right).

FUNCTIONALITY

A menu consists of two rows of gray boxes containing text. The upper row contains one tab that denotes the currently displayed menu. The lower row contains six labels that denote the function of the button below it. Many of the onscreen elements move up to avoid the menu. This prevents the menu from obscuring useful data while it is up. Upon exiting the menu, the screen returns to its normal appearance.

Pressing a button either displays another menu or adjusts a parameter. If there is no



The configuration of the pages on the screen determines which buttons are used to display a page's menu.



text above a button, then that button does not have a function in the context of that menu. Occasionally, a button label spans two or more buttons. In this case, any button below the label invokes the command.

If a menu contains more options than there are buttons, the MORE label is displayed over button five. Pressing this button shows you the next set of options in the current menu.

In any menu, press the BACK button to return to the previous menu and save any changes. In all top-level menus, button six is the EXIT button. Pressing EXIT removes the menu system and moves many of the onscreen elements down to their original positions.

FLOW

Each page has its own main menu, which may contain options for navigating to other menus or choosing and adjusting parameters. For example, the EFIS Main Page menu contains an EFIS menu tab and button labels for MENU►, BARO, BUGS, LISTS, MORE, and EXIT. Pressing MORE reveals the rest of the EFIS menu. This menu contains options for SETUP, INFO, DIM, TIMER, MORE, and EXIT. Pressing MORE on this menu simply returns you to the first part of the EFIS menu.

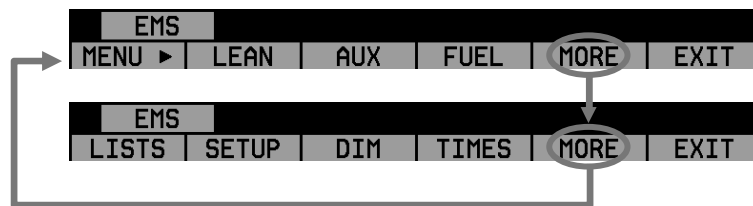
In all top-level page menus (EFIS, EMS, AUX, TIMES, FUEL, and HSI), the leftmost button is the MENU button. If you have opened up the left page's menu, the label reads MENU►. Pressing the button switches the menu to display the right page's menu, and the label switches to read ◀MENU. The arrow on this button always points to the side of the screen whose menu is displayed when pressing the button.



Each menu consists of labels above each button denoting their function.



All EMS 1/3 pages (AUX, TIMES, FUEL) have shortcuts to their page and menu from within the EMS Main Page menu. This means that if you only want to glance at a parameter on another page, quickly returning to your original screen configuration, simply enter the EMS menu, and press the button for the page you'd like to momentarily view. For example, if your current screen configuration is 2/3 EMS on the left, 1/3 FUEL on the right, pressing the AUX button in the EMS menu displays the AUX page in place of the FUEL page and the AUX page menu. Pressing BACK returns you to the main EMS menu, and your original screen configuration (i.e., EMS/FUEL).



In any menu with more options than will fit on a line, the MORE button displays the rest of the menu.

If you press the SETUP button on the EMS menu, the SETUP menu is displayed. The SETUP menu contains a menu tab and button labels for CLOCK, VRSION, GLOBAL, SENSOR, FUEL, and BACK. Pressing CLOCK displays options for specifying time format (i.e., standard AM/PM vs. military) and clock adjustment.

To exit the menu system, press the BACK button as many times as is needed to reach an EXIT button. This varies based upon how deep you are into the menu system.

DESCRIPTIONS IN THIS GUIDE

Throughout this guide, the “>” character is used to indicate entering a deeper level of the menu system. For example, “EFIS > INFO > LEFT” indicates entering the EFIS menu, pressing MORE, then pressing INFO, and then pressing LEFT to enter the left info item menu. Note that the MORE button is not included in the sequence, since pressing MORE reveals more options in the same level of the menu system.

4. AVAILABLE PAGES

The EFIS main pages use various tapes, digital displays, and other indicators overlaid on an artificial horizon. On the 2/3 and full-screen pages, you may also display up to two “info items” on the left and right side of the main page. HSI pages use text and a DG style compass by itself or overlaid with lines and arrows of different colors.

Note: HSI pages use data that is obtained from a source external to the FlightDEK-D180. Refer to the FlightDEK-D180 Installation Guide for a list of compatible equipment.

The EMS pages use various combinations of circular gauges, vertical and horizontal bars, tic marks, and text to display EMS data. Appropriate units of measurement accompany their respective values. Color indicators (green, yellow, and red) are used to denote normal and abnormal operational ranges.

Both the EMS Main Pages and the EMS Auxiliary Page allow for “info items,” user-configurable elements such as vertical info bars, contact input readouts, flaps/trim indication, and text-only items. Vertical info bars can display volts, amps, fuel pressure, carburetor air temperature, coolant temp/pressure, and outside air temperature. Contact input readouts can display discrete data (e.g., open/closed, on/off, etc.). Flaps and trim displays display icons indicating the absolute position of the flaps and trim. Vertical info bars, contacts, flaps/trim indicators, and text-only items are defined at time of installation and instrument setup. Text info items include fuel economy, engine timers, and times. For more information on configuring this display (as well as info items on the EMS Main Page), see the Info Item Configuration section on page 10-6. Menu, Checklist, and EFIS pages may be displayed and are described in the following sections.



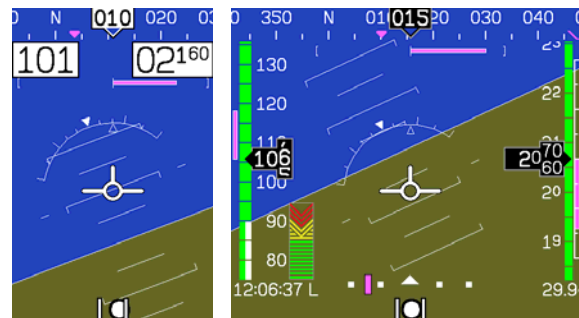
EFIS Main pages

Available in 1/3, 2/3 and full formats

The FlightDEK-D180 default screen rotation includes only 2/3 EFIS pages combined with the various EMS and HSI pages described below. However, you may also choose screen configurations that use 1/3 and full-screen pages. The 2/3 and full-screen pages can display EFIS- and EMS-related info items on the left and right side of the screen. You can enable any of the non-default EFIS screens as described in the Changing the Screen Rotation section on page 3-5. Some of the displayed items described below may not be onscreen, depending on whether or not they have been enabled in the CLUTTR menu.

Beginning with firmware revision 3.0, Dynon adopted a dramatically different EFIS display format than it had previously used. If your EFIS display does not resemble the layouts shown at right, first ensure that you are using firmware version 3.0 or higher. Then, ensure that the setting at EFIS > SETUP > STYLE is set to MODERN. If you prefer the previous display style, you can change this setting to CLASSIC. The classic display format is documented in previous revisions of this manual, which can be found at our website. No further development will occur on the classic display format.

The following sub-sections describe the displayed items in detail.



Horizon line, pitch and roll indicators

Bounded on the top by blue, and on the bottom by brown, the horizon line behaves in much the same way as a traditional gyro-based artificial horizon. Unlike a mechanical artificial horizon, the FlightDEK-D180's horizon has no roll or pitch limitation. The horizon line stays parallel to the Earth's horizon line regardless of attitude. The parallel lines above and below the horizon line are the pitch indicator lines, with each line indicating 5 degrees of pitch. The end of each 10° pitch indicator line has a hooked barb that points towards the horizon line to aid attitude awareness.

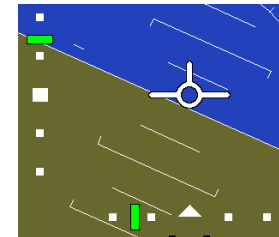


The roll scale has tic marks at 10, 20, 30, 45, 60, and 90 degrees of roll. In the CLUTTR menu (described on page 5-7), you can choose between a stationary roll indicator and one that rotates along with the horizon. The stationary roll indicator (type 1 in the EFIS > SETUP > CLUTTR > ROLL menu) has an internal arrow which moves to stay perpendicular to the horizon, like a jet EFIS presentation. The moving roll indicator (type 2) rotates the scale about a stationary internal arrow which points to the current roll angle on the scale, like most mechanical attitude instrument presentations.

CDI/Glideslope Indicators

When the FlightDEK-D180 is receiving CDI or glideslope information from a GPS or nav radio, they can be displayed on the main EFIS display as well as the on the full HSI page (as described in the HSI Operation section on page 6-1). The data source is chosen on the HSI page using the NAVSRC button; the EFIS and HSI CDI/GS displays are always synchronized to the same source. There is no way to change the source on the EFIS screen.

On the EFIS page, these two items are enabled via the EFIS > SETUP > CLUTTR menu under a single item, which can be set to either CDI:N, CDI:Y, or CDI+GS.





The CDI is located just above the slip/skid ball when displayed, and behaves much as described in the HSI Operation section on page 6-1. The CDI needle is green when sourced from a nav radio and magenta when sourced from GPS. When to/from information is available, the center of the CDI is an arrow; when on an ILS, it is a filled-in square.

The glideslope indicator is located to the left of the roll scale tape, and behaves much as described in the HSI Operation section on page 6-1. The GS needle is green when sourced from a nav radio and magenta when sourced from GPS, and appears only when tuned to an ILS or a GPS source with vertical guidance.

Due to screen space limitations, turning on the glideslope prevents a left info item from being displayed on the 2/3-screen EFIS page. Additionally, at extreme roll angles, the glideslope is hidden to provide space for other screen elements.

Stabilized heading tape and digital readout

Located at the top of the EFIS page, the heading indicator functions much like a standard slaved directional gyro. North,



East, South, and West directions are labeled on the tape, “N,” “E,” “S,” and “W,” respectively. The digital readout displays your current heading, while the surrounding tape scrolls beneath its arrow. You may set a yellow bug on this tape as a heading reminder. The pointer in the digital readout is hollow to allow the GPS ground track indicator, displayed as a magenta arrow, to show through. A difference between the ground track arrow and the current heading indicates that some wind is present. The currently set course heading is represented by a “V,” colored green when sourced from a nav radio and magenta when sourced from GPS. When the CDI is centered, aligning the ground track pointer within the course pointer compensates for all wind and takes you directly to the waypoint or VOR. For course and ground track to be displayed on the heading tape, they must both be enabled in the CLUTTR menu.

Like a conventional gyro-stabilized magnetic compass, magnetic heading reacts immediately to turn rate so that heading changes are reflected immediately. It then uses magnetometer data over the long term to ensure that it remains correct. Additionally, heading is corrected for attitude so that it is accurate as you pitch and roll.



Turn rate indicator

Centered just below the heading digital readout, the turn rate indicator displays the aircraft's current rate of turn with respect to the ground. The magenta bar grows in the direction that the aircraft is currently turning, and is anchored at a white vertical anchor line. The brackets on either side of the bar's anchor line represent the turn rate which results in a standard rate turn. Turn rate takes attitude into account. This means that even when you are highly banked, it still shows rate of turn in relation to the aircraft's heading.



The turn rate indicator is scaled to indicate a 6-second heading trend. In the example above, the trend indicator is showing that the aircraft will be pointed at 17° in 6 seconds if the rate of turn does not change.

Altitude tape, digital readout, and VSI

The altitude tape scrolls beneath the altitude digital readout and arrow. The digital readout's digits scroll up and down, simulating an analog altimeter and giving a sense of the direction of movement. Thousands of feet are displayed using large numbers while hundreds of feet are displayed in smaller numbers. The FlightDEK-D180 accurately displays altitudes from -1200 to 30,000 ft (-365 to 9144 m).

The graphical Vertical Speed Indicator is located next to the altitude tape. The magenta bar grows in the direction of – and in proportion to – the rate of climb or descent. The numbers on the scale represent thousands of feet per minute. In the CLUTTR menu, the VSI scale can be set to display 1000 ft/min, 2000 ft/min, and 4000 ft/min. The 2000 ft/min scale is linear throughout the range, while the 1000 ft/min and 4000 ft/min are non-linear as shown on the scale. When set to display 2000 ft/min, the VSI bar is scaled to indicate a 6-second altitude trend based on its position with relation to the altitude bar. When set to display 4000 ft/min, the VSI bar is scaled to indicate a 6-second trend only up to 1000 ft/min. When set to display 1000 ft/min, the VSI bar is scaled to indicate a 12-second trend up to 500 ft/min.





During the first 30 seconds of operation, the altitude tape and digital readout are not displayed as the unit needs a small amount of time before altitude measurements are deemed accurate.

Winds aloft arrow

Located in the lower right corner of the EFIS page, the winds aloft arrow indicates the wind direction relative to your current direction of flight. The number indicates the current absolute wind speed in the current airspeed units. If the FlightDEK-D180 cannot make an accurate winds aloft calculation, the arrow is not displayed and the numbers are replaced by dashes. The display of winds aloft requires an active GPS connection and an OAT probe. In very light winds, the wind speed number is not displayed, although the arrow is.



Angle of attack (AOA) indicator

The angle of attack indicator – available only with Dynon’s AOA Pitot Probe – displays the aircraft’s current AOA relative to the stall AOA. The AOA calibration process should result in the lowest angle of attack stall (usually the “clean” configuration) occurring between the yellow and red lines and the higher angle-of-attack stall (usually the “dirty” configuration) occurring at the top of the red. As your aircraft’s angle of attack increases, the bars in the indicator disappear, leaving the empty outline. As your aircraft’s AOA approaches stall, downward-pointing arrows are left. Depending on your installation and configuration, an audible alarm may also occur when near or in the stall. This audio alarm is accompanied by a flashing red triangle at the top of the AOA display. To judge when a stall will occur, remember that the AOA indicator is showing actual AOA, and the stall AOA changes with configuration. Because of this, a stall could occur anywhere inside the yellow range, but will occur at the same point every time given a specific configuration. Refer to the FlightDEK-D180 Installation Guide for more information on calibrating the AOA indicator.



Airspeed tape, digital readout, and trend

The airspeed tape scrolls beneath the airspeed digital readout and arrow. The digital readout's digits scroll up and down, simulating an analog airspeed indicator and giving a sense of the increase or decrease in speed. The FlightDEK-D180 is factory-calibrated to be accurate for airspeeds between 15 and 325 knots (17 to 374 mph). As airspeed increases from 0 knots, the indicator becomes active at 20 knots. The indicator remains active until airspeed drops below 15 knots. The FlightDEK-D180 may display airspeeds above 325 knots, but it is not guaranteed to be accurate.

The airspeed tape utilizes 4 colors to give you a graphical representation of your speed with relation to your aircraft's limits. By default all of the color thresholds are set at 0, causing a grey tape to be displayed. You must set the values of the airspeed color thresholds via the SETUP menu. Refer to the FlightDEK-D180 Installation Guide for more information on setting the airspeed color thresholds.



The airspeed trend indicator is located to the left of the airspeed tape. The magenta bar grows in the direction of—and in proportion to—the rate of acceleration or deceleration. The trend indicator is scaled to indicate a 6-second airspeed trend. In the example at right, the trend indicator is showing that the aircraft will reach 124 knots in 6 seconds if airspeed does not change.

Bugs

Bugs may be set to mark a desired heading, airspeed, or altitude. These bugs are represented by a yellow inverted arrow located at the desired value on the tape. If the set heading, altitude, or airspeed is currently off-screen, the bug icon appears at the edge of the moving tape closest to the desired value. Your airspeed, heading, or altitude is at its set bug value when the bug's inverted triangle encloses the triangle of the digital readout's pointer. The altitude bug also acts as an altitude alerter; see BUGS – Setting Bug Markers on page 5-1 for more information.





When a Dynon Autopilot is installed and configured, the heading and altitude bugs are repurposed as the target heading (in HDG mode), ground track (in TRK mode), and altitude (in ALT mode). With an AP installed, all bugs are hollow when not engaged in their respective AP modes, and filled in when they are. See Autopilot Operation on page 7-1.

Slip/skid ball

The slip/skid ball works much like a standard mechanical gauge. It is a visual representation of lateral acceleration. If the ball is within the two vertical lines, then you are in coordinated flight.



Altimeter setting display

The current altimeter setting is displayed at the bottom right of the screen below the altitude tape. The value is shown in either inches of Mercury or millibars depending on your preference set in the EFIS > BARO menu.



Clock/timer

The clock is displayed in the lower left-hand corner of the screen, below the airspeed tape. To set the clock, enter the EFIS > SETUP > CLOCK submenu. When a count-down or count-up timer is enabled, it is displayed in place of the clock until the timer is stopped. The character next to the clock indicates whether the unit is displaying Local time (L), Zulu time (Z), or a timer (T). If a GPS is connected to your Dynon network and is outputting time information, the Zulu time of all connected products is auto-set to that reported by the GPS.



Autopilot Status Indicator

When a Dynon Autopilot is installed and configured, an AP Status Indicator is displayed at the bottom left of the EFIS page. It provides information about whether the Autopilot is engaged and what mode(s) it is engaged in. See Autopilot Operation on page 7-1.





HSI Page

Available in 1/3 format

Your FlightDEK-D180 can function as a Horizontal Situation Indicator (HSI) when it is receiving data from Dynon's HS34 (connected to a nav radio), an external GPS, or Garmin SL30 Nav radio. The HSI information is overlaid on a directional gyro (DG) representation of the EFIS's stabilized magnetic heading information. If no GPS or nav radio source is present in the system, the HSI page will still display the DG, but without any additional navigation information.

For detailed information on using the HSI page, please see the HSI Operation section on page 6-1.

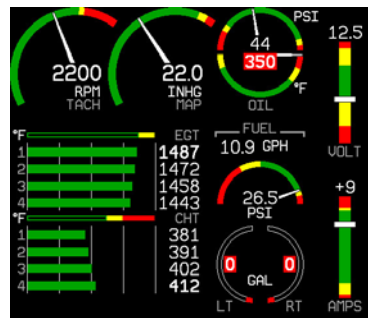
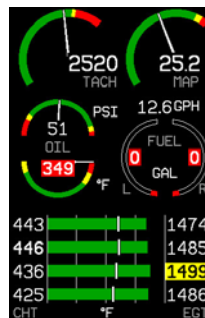


EMS Main Pages

Available in 1/3 and 2/3 formats

This page displays RPM, manifold pressure (MAP), oil temperature, oil pressure, exhaust gas temperature (EGT), cylinder head temperature (CHT), fuel level, fuel pressure and fuel flow. On the 2/3 page version, up to two user-configurable info bars may be displayed. For information on configuring the function of these info items, see the EMS Operation section on page 10-1.

Up to six EGT/CHT channels may be displayed simultaneously. Green horizontal bars depict exhaust gas temperatures with their respective values to the right of the bars. In the combined EGT/CHT display, cylinder head temperatures are denoted by the white vertical tic marks overlaying the EGT bars with their respective numeric values to the left of the bars. In the split EGT/CHT display (two and four cylinder engines only) CHTs are displayed using their own set of green bars on a different scale than EGTs with





their respective numeric values displayed to the right of each bar. When displayed as a 1/3 page, with the exception of two cylinder engines, the EGT/CHT display is shown in combined mode.

EMS Auxiliary Page

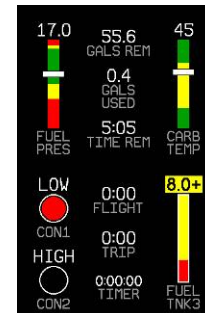
Available in 1/3 format

This is a customizable page where you may display up to six different info items. You may choose from any of the available info items. For more information on configuring this display (as well as info items on the EMS Main Page), see the Global Configuration Settings section on page 10-4.

Some info items, when displayed on the Aux Page, have quick commands in the AUX menu. This menu is populated with commands in the order that the items appear on screen (from top left to bottom right). The commands are listed below.

Info item quick commands

- TIMERS info item – TRPRST (resets the trip timer), TIMER (shortcut to the general purpose timer menu)
- FUEL – FUEL (shortcut to the add fuel menu)





EMS Times Page

Available in 1/3 format

The Times Page is divided into three sections: TIME, TIMERS, and ENGINE TIMERS.

- The TIME section shows the present time (both local and Zulu) and can be displayed in either standard or military time formats.
- The Flight Timer shows the total amount of time that oil pressure is above 15 PSI since the FlightDEK-D180 was turned on; it does not reset until the next time the FlightDEK-D180 is power-cycled and oil pressure reaches 15 PSI. The Trip Timer shows cumulative flight time since a manual reset. The third line of this section contains the general purpose Timer which can be used for a variety of functions including a tank timer.
- The Tach Timer keeps track of engine time (normalized to the user-configured cruise RPM). The Hobbs Timer records the duration of time engine oil pressure is at 15 PSI or higher.

TIME	
LOCAL	0:38:11
ZULU	0:38:11
TIMERS	
FLIGHT	0:00
TRIP	0:00
TIMER	0:00:00
ENGINE TIMERS	
TACH	0.0
HOBBS	0.0

When ENGINE TYPE is set to ROTAX (in EMS > SETUP > GLOBAL), only Hobbs time is displayed in the ENGINE TIMERS section; Tach time is not displayed, due to specific manufacturer recommendation.

Refer to the EMS Operation section on page 10-3 for instructions on adjusting clock and timer settings.



EMS Fuel Computer Page

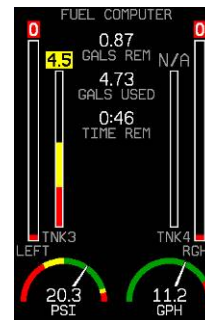
Available in 1/3 format

This page displays fuel tank levels, fuel flow, fuel pressure, fuel remaining, fuel used, and time remaining. If a compatible GPS is connected to your Dynon system as described in the FlightDEK-D180 Installation Guide, this page also displays current distance per unit fuel, fuel at waypoint, and distance to empty (range). Analog gauges display sensor information and textual readouts display computed data. Much of the computed data is reliant on the optional fuel flow sensor, available from Dynon Avionics.

To obtain accurate data, you must reset the fuel computer every time you add fuel to the aircraft. Note that “fuel used” resets itself when the unit detects that oil pressure has exceeded 15 PSI for the first time after being powered on. This allows you to view the fuel used value from your last flight.

Some user input is required for the FlightDEK-D180 Fuel Computer to function properly. Refer to the EMS Operation section on page 10-2 for instructions on adjusting various Fuel Computer parameters.

WARNING: The Fuel Remaining, Time Remaining, Distance per Fuel Unit, Fuel Remaining at Waypoint, and the Calculated Range Remaining values are not directly measured. These values are calculated based upon measured flow rates and *user input* of fuel quantity. Do not use these values as primary indicators.





Lists Pages

Available in 2/3 format

This page displays user-defined checklists and data panels to be used for waypoint information, lists of radio frequencies, or other purposes. You may define up to twenty-five lists. Each checklist/data panel can contain up to 14 lines of text and 40 characters per line.

Checklists/data panels must be defined and uploaded to the FlightDEK-D180 as described by the Dynon Product Support Program. Reference the help file that accompanies this software for more information. To download the Dynon Product Support Program, visit our website.

```
EXAMPLE CHECKLIST - DO NOT USE
(EDIT THIS PAGE W/DYNON SUPPORT PROGRAM)

START CHECKLIST
AUTOPILOT (OFF)      MASTER (ON)
CARB HEAT (OFF)     MAGS (START)
BEACON (ON)         OIL PRESSURE
PRIME               FLAPS (RETRACT)
MIXTURE (FUL RICH)  AVIONICS (ON)
THROTTLE (SLIGHT)  NAV LGHTS (AS REQ)
BRAKES             ATIS/AVOS
PROP (CLEAR)       ALTIMETER (SET)

EXAMPLE CHECKLIST - DO NOT USE
PRESS ANY KEY TO EXIT THE START LIST
```

Menu Pages

Available in 1/3 and 2/3 formats

Some setup menus require a 1/3 or 2/3 page to display all the available options. Menu Pages use a caret symbol (">") to indicate the currently selected line. Use the DOWN ▼ and UP ▲ buttons to scroll through the list of options.

Any line on a Menu Page that is followed by ► has more options to configure inside of it. Press SEL ► to expand the menu into another list of options to the right.

Any line on a Menu Page that *is not* followed by ► indicates that its value can be modified using the SEL ►, DOWN ▼, and UP ▲ buttons.

```
GLOBAL
-PILOT SETUP-
UNITS: ENGLISH ►
PUR ON ALARMS: ON
ALARM TEST ►

-SCREEN SETUP-
>INFO ITEM CONFIG ►
ROTATION ►
ORDER ►

-INSTALL SETUP-
# OF CHT: 4
# OF EGT: 4
CYL DISP: SPLIT
# OF FUEL TANKS: 4
-- MORE --

INFO ITEMS CONFIG
ENS MAIN PAGE
ITEM 1: VOLTS
ITEM 2: ANPS
ENS AUX. PAGE
ITEM 3: FUEL PRES
ITEM 4: FUEL THRS
ITEM 5: CARB TEMP
ITEM 6: CONTACTS
ITEM 7: FLT THRS
ITEM 8: FUEL TNK3

SETUP
DOWN ▼ UP ▲ SEL ► BACK
```


5. EFIS OPERATION

This section guides you through each of the EFIS main page menu selections and their sub-menus. To enter the EFIS menu system, press any button (except for buttons 1 and 6) directly beneath an EFIS main page. If no EFIS main page is displayed, you must switch to a screen configuration that includes an EFIS main page as described on page 3-4.

POWER – Power on/off

When the FlightDEK-D180 is turned off but still has a power source via one of the three power inputs, press the far left button to turn the unit on. Likewise, once the unit is on and no menus are displayed, *push and hold* the leftmost button to turn it off. While power is still connected, the unit is never fully turned off. It simply enters an extremely low-power state, allowing it to keep track of time. It is acceptable to have the FlightDEK-D180 on during engine crank. It immediately powers on upon application of external power.

BARO – Changing Altimeter Setting

In the EFIS > BARO menu, you can adjust the altimeter setting. When the BARO menu is displayed, the value-setting box shows the current altimeter setting. The DEC- and INC+ buttons change the altimeter setting by 1/100th inHg or 1 mbar, depending upon your selected units. As you change the altimeter setting, the altitude indicators change accordingly. Adjust the altimeter setting until the altitude indicators display the correct altitude for your location or the altimeter setting matches the current barometric pressure value.



The altimeter setting can be set in units of inches of mercury (inHg) or millibars (mb). To change the units, simply press buttons 1 or 2, corresponding to the UNITS label. To reset the altimeter setting to standard day pressure (29.92 inHg), press button 3, corresponding to 29.92 (inHg) or 1013 (mb).



HS34 The BARO setting can be changed using the HS34's VALUE knob, depending on the configuration settings in EFIS > SETUP > HSI > VALUE KNOB.

AP74 The BARO setting can be changed using the AP74's VALUE knob, depending on the configuration settings in EFIS > SETUP > AP > VALUE KNOB.

The current indicated altitude is preserved across a power cycle. When powered down, the instrument saves the indicated altitude. When it is powered up again, the instrument automatically adjusts the altimeter setting by exactly enough to preserve that saved value. This is not a replacement for modifying the altimeter setting by the pilot before takeoff; it makes it very close to the correct value, minimizing the amount of adjustment needed. To turn auto-set on or off, enter the EFIS > SETUP > BARO menu and set the ADJUST AT BOOT option to ON or OFF.

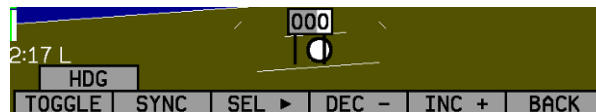
BUGS – Setting Bug Markers

You can set a marker – or “bug” – to display on any or all of the three tapes. To do this, enter the EFIS > BUGS menu (or EFIS > AP > BUGS, if an AP is installed), and choose the type of bug to configure: HDG (heading), IAS (Indicated Airspeed), or ALT (altitude). Note that if a bug is not currently displayed, changing its set value causes it to display on the relevant tape.



HEADING

In the BUGS menu, press HDG. Press the TOGGLE button to turn on or off the heading bug display on the horizontal heading tape. Note that this affects the display of the heading bug on the HSI page as well.



In the HDG bug menu the value-setting box is displayed in the lower part of the display. Press SEL ► to select which digit to change and DEC- and INC+ to change the selected digit. Press the SYNC button to synchronize the heading bug



to your current heading. As you increment or decrement the heading bug value it rolls over at 360 degrees, returning the value to 001. If you have the heading bug displayed, the marker moves left or right along the tape as you change its value.

DSAB The heading bug can be adjusted on any EFIS page displayed in the system and is synchronized across all EFIS-based units.

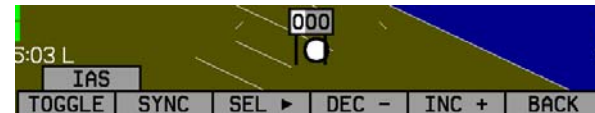
HS34 The heading bug can be adjusted at any time by rotating the HS34's HEADING knob. If the bug is currently toggled off, rotating the HEADING knob causes the bug to be displayed on the heading tape. To sync the bug to your current heading, press the HEADING knob briefly. To toggle the heading bug on or off, push and hold the HEADING knob for more than 1 second.

AP74 When in the BUGS > HDG menu, rotate the AP74's VALUE knob to quickly change the bug's set value. The heading bug can be adjusted at any time by pushing the AP74's VALUE knob until the HDG pop-up box is displayed, and then rotating the VALUE knob to select the desired heading.

AIRSPEED

In the BUGS menu, press IAS. Press the TOGGLE button to turn on or off the airspeed bug display on the airspeed tape.

In the IAS bug menu the value-setting box is displayed in the lower part of the display. Press SEL ► to select which digit to change and DEC- and INC+ to change the selected digit. Press the SYNC button to synchronize the airspeed bug to your current indicated airspeed. If you have the airspeed bug displayed, the marker moves up or down the airspeed tape as you change its value.



DSAB The airspeed bug can be adjusted on any EFIS page in the system and is synchronized across all EFIS-based units.

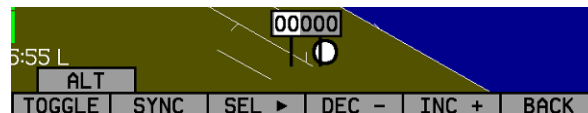
**AP74****HS34**

When in the BUGS > IAS menu, rotate the AP74's or HS34's VALUE knob to quickly change the bug's set value.

ALTITUDE

In the BUGS menu, press ALT. Press the TOGGLE button to turn on or off the altitude bug display on the altitude tape.

In the ALT bug menu the value-setting box is displayed in the lower part of the display. Press SEL ► to select which digit to change and DEC- and INC+ to change the selected digit. Press the SYNC button to synchronize the altitude bug to your current altitude. If you have the altitude bug displayed, the marker moves up or down the altitude tape as you change its value.

**DSAB**

The altitude bug can be adjusted on any EFIS page in the system and is synchronized across all EFIS-based units.

AP74**HS34**

When in the BUGS > ALT menu, rotate the AP74's or HS34's VALUE knob to quickly change the bug's set value. Alternately, the altitude bug can be adjusted at any time by pushing the HS34's or AP74's VALUE knob until the ALT pop-up box is displayed, and then rotating the VALUE knob to select the desired altitude.

Toggling the altitude bug on activates the altitude alerter function with the bug value as the target altitude. While climbing or descending toward the target altitude a level-off alert sounds when passing through 500 feet from the target altitude. The target altitude is considered captured when altitude is within 150 feet of the target. Flying more than 200 feet away from the target triggers a short audio alert and alternates the bug in red and yellow as a visual alert. When below the 200-foot window, a rising tone is sounded; when above the 200-foot window, a descending tone is sounded.



The visual climb or descend alert clears after recapturing the target altitude or 30 seconds. Flying back inside the 150-foot capture window re-arms the alerter without any user interaction.

AP74**HS34**

If your system is configured to output voice via an HS34 or AP74 module, the voice alerts “climb” or “descend” are sounded, instead of tones.

To simulate the altitude alerter on the ground, SYNC the altitude bug to your current altitude and then adjust the altimeter setting up or down. When you adjust the altimeter setting enough that the altitude is outside the 200-foot window, observe that the audio alert triggers and the bug alternates red and yellow.

LISTS – Using Checklists and Data Panels

Note that the lists accessed from the EFIS and EMS menus are the same. Only one set of lists are uploaded via the Dynon Support Program.

The Dynon Support Program allows you to enter your own checklists or select from included data panels. These checklists and data panels can then be uploaded to your FlightDEK-D180 for quick access from the main menu or from your screen rotation. Data panels and checklists can be included beneath 5 user-configurable categories and each category can contain up to 5 checklists or data panels. By default the FlightDEK-D180 is loaded with the following 5 categories: CHKLIST, RADIO, POH, EMGNKY and MISC. Each checklist/data panel can contain up to 14 lines of text and 40 characters per line.

To load checklists and data panels onto your FlightDEK-D180, you must upload them as described in the Dynon Product Support Program help file. Pushing the LIST button displays the 5 main categories as set up in the Dynon Support Program. Press a button corresponding to the desired category to show the checklists and data panels beneath it. When you display a checklist, the right 2/3 of the screen displays the checklist while the left side displays a 1/3 format EFIS



page. See the Dynon Support Program for more detailed information on entering checklists and data panels. It can be downloaded from our website at www.dynonavionics.com/downloads.



SETUP – Setting Preferences

Enter the EFIS > SETUP menu to make changes to preferences. Many of the settings in this menu should only be changed by the installer, and are described in the FlightDEK-D180 Installation Guide. The preferences and settings that are relevant to the pilot and in-flight operation are explained below.



CHANGE DISPLAYED UNITS

In the UNITS submenu, you may change the system-wide displayed units for the following units. See the following table for a list of available units for each displayed parameter.



Parameter	Available units
Airspeed (IAS)	Knots, miles/hour, kilometers/hour
Altitude (ALT)	Feet, meters
Temperature (TEMP)	Celsius, Fahrenheit
Barometric Pressure (BARO)	inHg, mbar
Distance (DIST)	Nautical miles, statutory miles, kilometers

DSAB

In a DSAB network, unit preferences are shared between all connected instruments.

SET THE CLOCK

You may set the clock from either the EMS setup menu or the EFIS setup menu. The two menus set the same clock.

Entering the EFIS > SETUP > CLOCK menu displays the local and Zulu times in the value-setting box. Because local time is usually an offset in hours from Zulu time, set the minutes value in the Zulu time portion of the box; notice that the local time minutes setting change at the same time. Then, set the hours for local and Zulu times independently. Once you have set Zulu time, you should never need to change it, as it is





independent of daylight saving time. When connected to a GPS which is outputting time information, Zulu time is synchronized to the GPS and cannot be set on the FlightDEK-D180.

DSAB In a DSAB network, you can only set the Zulu time on the DSAB master, and only if it is not synchronized to GPS time. You can set the local time on all units individually.

To change the local clock when moving through time zones or to enter daylight saving time, simply change only the hours (and, if necessary for the time zone, the half-hour offset) for the local time. Be aware that connecting to the FlightDEK-D180 with the Dynon Product Support Program resets the time; do not set the time until you have performed all of the PC interface operations. Refer to the following set of tips as you set the clock:

- Set both the local and Zulu times in military time. You have may display the time in either military or standard 12-hour format, as described below.
- SEL ► moves the highlight to the next set of digits. The order of selection is 1. Local hours, 2. Local minutes (adjustable only as ½-hour offsets from Zulu minutes), 3. Zulu hours, 4. Zulu minutes. When connected to a GPS, you are not permitted to adjust the Zulu time on the FlightDEK-D180
- DEC- and INC+ change the selected set of digits. To speed up the process, press and hold the desired button. If you pass the desired value, you may simply back down to it by pressing the button corresponding to the opposite direction.
- Incrementing or decrementing the minutes digits resets the second count.
- In the CLOCK > FORMAT menu, press LC/ZU to change between local and Zulu time display on the EFIS page. Press 12/24 to change between standard and military time display on the EFIS page



SHOW/HIDE DISPLAY ITEMS

In the EFIS > SETUP > CLUTTR menu, you can turn on or off almost every item displayed on the EFIS page. As with all other menu items, these options are abbreviated to commands containing 6 letters or fewer. Pressing a button corresponding to one of these options turns the respective onscreen item on or off. The following table summarizes the display item abbreviations and their function.

Abbreviation	Display Item	Function
ALTBAR	Altimeter Bar	Toggles the display of the graphical altitude tape.
ALTDIG	Altimeter Digital	Toggles the display of the digital altitude window.
IASBAR	Indicated Airspeed Bar	Toggles the display of the graphical airspeed tape.
IASDIG	Indicated Airspeed Digital	Toggles the display of the digital airspeed window.
HDG	Heading	Toggles the display of the heading tape and digital display.
BALL	Slip/skid Ball	Toggles the display of the slip/skid ball and associated center markers.
TURNRT	Turn Rate	Toggles the display of the turn rate indicator and associated scale markers.
AOABAR	AOA Bar	Toggles the display of the angle of attack indicator. The AOA indicator requires the use of a Dynon heated or unheated AOA probe.
CLOCK	Clock	Toggles the display of the clock. Setting Zulu/local and 12/24 hour time is done in the EFIS > SETUP > CLOCK menu.
BARO	Altimeter setting	Toggles the display of the current altimeter setting (also known as the Kollsman setting). This display is not required to set the altimeter setting. While in the EFIS > BARO menu, a separate value-setting box appears, allowing adjustments to be made.



Abbreviation	Display Item	Function
ROLL	Roll Scale	Toggles and configures the display of the roll scale. When set to “N”, the roll scale is not displayed. When set to “1,” the roll scale stays fixed on the screen and the pointer moves along the scale, like a jet EFIS presentation. When set to “2”, the roll scale moves with the horizon, while the pointer stays fixed on the screen, like most mechanical attitude instrument presentations.
GTRK	Ground Track	Toggles the display of the ground track indicator on the heading tape. The track indicator is a magenta arrow and is only displayed when the FlightDEK-D180 is receiving valid GPS data from an external source. If the GTRK button status displays “Y” and no ground track arrow is displayed, the FlightDEK-D180 cannot detect your GPS, or the GPS does not yet have a satellite lock.
WIND	Winds Aloft	Toggles the display of the wind arrow and speed indicator. The display of winds aloft requires an active GPS connection and an OAT probe. If the WIND button status displays “Y” and no wind indicator is displayed onscreen, the FlightDEK-D180 cannot detect your GPS, the GPS does not yet have a satellite lock, the FlightDEK-D180 does not have a connection to the remote compass (EDC) or the FlightDEK-D180 does not have an OAT.
ASTRND	Airspeed Trend	Toggles the display of the 6-second airspeed trend indicator next to the IAS tape.
VSI	Vertical Speed Indicator	Toggles and configures the display of the VSI tape next to the altitude tape. The VSI can be hidden (“N”), or can be set to 1k, 2k, or 4k ft/min scaling. The 2000 ft/min display is linear throughout the range, while the 1000 and 4000 ft/min displays incorporate a non-linear scale to increase low vertical speed resolution.



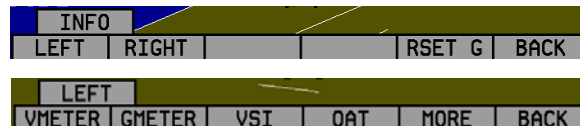
Abbreviation	Display Item	Function
CDI	Course Deviation Indicator	Toggles and configures the display of the CDI and glideslope. Choosing “CDI” causes the course deviation indicator to display above the slip/skid ball. Choosing “CDI+GS” causes both the CDI and glideslope indicators to display, with the glideslope indicator displayed next to the roll scale. If the CDI button status displays “Y” or “CDI+GS” and no CDI or glideslope is displayed onscreen, the FlightDEK-D180 cannot detect your nav radio or GPS, there is no active course, or there is no NAVSRC chosen on the HSI page.
CRS	Course Pointer	Toggles the display of a “V”-shaped course pointer on the heading tape. Like the CDI, this can only be displayed when the FlightDEK-D180 is receiving a valid course from the nav source selected on the HSI page. If the CRS button status displays “Y” and no course pointer is displayed on the heading tape, the FlightDEK-D180 cannot detect your nav radio or GPS, there is no active course set, or there is no NAVSRC chosen.

CHECK FIRMWARE VERSION

The EFIS > SETUP > VRSION menu gives you two important pieces of information: your FlightDEK-D180’s current firmware version; and the number of hours the FlightDEK-D180 has been on. If you require technical support or other assistance from Dynon, please have your firmware version ready when you call or write.

INFO – Informational Items

In the EFIS > INFO menu, you have the option of displaying an informational display item on either the left or right side, or both. You may display a voltmeter (VMETER), g-meter (GMETER), vertical speed indicator (VSI), OAT/true airspeed/density altitude (OAT), and engine RPM/MAP info (ENGINE). More detail about each of these is given below.





Voltmeter

The voltmeter displays 3 rows of information corresponding to the three power inputs on the FlightDEK-D180. The first row, labeled M, displays the Master Switch voltage. The second row, labeled E, displays your optional external backup voltage. The third row, labeled I, displays the FlightDEK-D180 internal battery voltage. If any of the 3 voltage inputs are not present, 00.0V is displayed for the respective voltage values. The letter V follows all three values, denoting the fact that voltages are being displayed. The FlightDEK-D180 alerts you when the internal battery is low by displaying a low battery alert.



G-meter

The *g*-meter displays the current vertical acceleration experienced by the FlightDEK-D180 measured in *g*'s, where 1 *g* is the amount of acceleration due to the earth's field experienced by an object at sea level. Positive *g*-force is defined as upward vertical acceleration, making you feel heavier. Negative *g*-force is defined as downward vertical acceleration, making you feel lighter. As can be seen in the picture, there are three rows of text that make up the *g*-meter. The top row, labeled MX, is the maximum positive *g*-force experienced by the FlightDEK-D180 since reset. The middle row, labeled CR, is the current *g*-force experienced by the FlightDEK-D180. The bottom row, labeled MN, is the minimum *g*-force experienced by the FlightDEK-D180 since reset.



To reset the max and min *g*-force values to the current *g*-force value, enter the EFIS > INFO menu and press the RSET G button.

VSI (Rate of Climb)

The vertical speed indicator (VSI) consists of a single line with your current rate of climb or descent. If you are currently gaining altitude, an up arrow is displayed to the right of the vertical speed value. If you are losing altitude, a down arrow is displayed to the right of the vertical speed





value. The units of VSI are feet/minute. Note that in the MODERN display (EFIS > SETUP > STYLE), found in FlightDEK-D180 firmware version 3.0 and higher, VSI can be displayed as a graphical indicator next to the altitude tape.

OAT (Outside Air Temperature)

The FlightDEK-D180 supports the connection of an OAT to its EDC-D10A and/or an OAT connected directly to the EMS connector. If neither type of OAT is connected to the FlightDEK-D180, or to any other device in a DSAB system, you may manually set the outside temperature.



The OAT info item displays 3 lines of text, containing outside air temperature, density altitude, and true airspeed. To use the TAS/DA calculator without an OAT installed, manually enter the outside air temperature in the EFIS > OATSET menu. When a temperature is manually input via the OATSET menu, a box is displayed around the temperature in the info item, as shown in the image above.

DSAB

When multiple units are connected to a DSAB network, one primary OAT is shared between all units. This can be an OAT connected to an EFIS or an EMS. If the FlightDEK-D180 is displaying an OAT provided by another unit in the system, changing the OAT type or install status on the FlightDEK-D180 has no effect on the displayed OAT. This change is only used if the primary OAT (or entire DSAB network) fails and the EFIS switches to the locally connected OAT.

ENGINE (Manifold Pressure and RPM)

The engine informational item allows you to display engine manifold pressure and RPM on the EFIS page. This requires that the manifold pressure sensor and tachometer pickoff are properly installed and configured in the EMS > SETUP menu.



DIM – Changing screen brightness

In the EFIS > DIM menu, press BRITR or DRKR to change the brightness of the display. It is not possible to turn the screen completely black. Note that if power to the FlightDEK-D180 is cycled, the screen is reset to full brightness.

The DIM function also exists in the EMS main page menu. You may dim the display via either menu.

DSAB

All screens in a DSAB network share a common dim level. Pressing BRITR or DARKR on one unit changes the brightness level on all screens if the change is possible. If you have any D100-series bright screen units in the system, you must press BRITR on any bright screen unit to get the bright screen units to their final step of brightness.

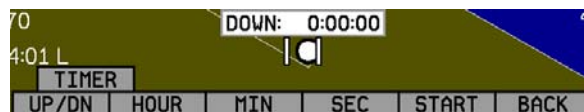
AP74

HS34

The HS34 and AP74 have built-in light sensors which can be used to automatically dim all of the screens connected to a DSAB network (if both installed, their sensor values are averaged). To turn this function on, press AUTODIM. When you enable auto-dim, the screen does not immediately change brightness. Instead, the system records the unit's current brightness level as the desired brightness. From that point on, all networked units react to changes in light intensity and maintain perceived brightness at the desired level. If auto-dim is enabled and the screen is too bright or dark, continue to use the BRITR or DARKR buttons as you would without auto-dim. The system records the new set level as the desired brightness, and auto-adjusts around the new set point.

TIMER – Setting and using a timer

Enter the EFIS > TIMER menu. In the value setting box, the DOWN or UP label is displayed, depending on which timer type is currently selected. The currently running timer is displayed on the Times Page, as described on page 4-11. Use the following





points as you work with the timer.

- The UP/DN button toggles the menu and timer between an up timer and a down timer. When switching to an up timer, the timer set value resets, allowing the up timer to count up from 0:00:00.
- To reset the timer, press the UP/DN button twice.
- To start the timer, press START. Once started, the button's label changes to STOP. To stop the timer, press STOP.
- To set the down timer, press HOUR, MIN, and SEC to adjust the timer to the desired value.
- You may not have an up timer and a down timer running at the same time.

DSAB

Multiple Dynon products connected via a DSAB network share one timer. Starting, stopping, or configuring the timer on one instrument causes all other instruments to reflect the change.

OATSET – Setting Temperature Offset

If you did not purchase an EFIS or EMS outside air temperature sensor from Dynon Avionics, you may still manually adjust the OAT to an approximate value. With this manually entered information, the FlightDEK-D180 calculates and displays true airspeed (TAS) and density altitude as it does when an OAT is connected. Ensure that you have indicated that an EFIS OAT is not installed; enter the EFIS > SETUP > OAT menu and press INSTALLED until the value is “N.”

In the EFIS > OATSET menu, press INC- or DEC+ until the value-setting box above the menu displays the current outside air temperature. This value is then used in the OAT/TAS/DA info item on the EFIS screen. For more information on setting up that display, see page 5-13.

6. HSI OPERATION

This chapter explains how to use the FlightDEK-D180's HSI functionality.

Required Connections

To display an HSI on the screen, an external receiver is needed. The currently supported data sources are a Garmin SL-30 Nav/Comm radio via a serial connection (Nav data), a Garmin GNS-430/530 GPS/Nav/Comm (GPS data), or any GPS that outputs in either NMEA-0183 or aviation format. Please refer to the FlightDEK-D180 Installation Guide for instructions on how to connect these devices to your Dynon network. Also, ensure your GPS device is configured to output magnetic heading since all calculations and displays are done in reference to the local magnetic heading.

HS34

The HS34 supports a variety of connections to navigation receivers via serial, ARINC-429, and analog connection. A connection to the HS34 generally carries more information than a serial-only connection to an EFIS- or EMS; when an HS34 is installed, connections to navigation receivers and GPSs must be made to it. Please see the FlightDEK-D180 Installation Guide for detailed installation and connection information.

Accessing the HSI /DG Page

The HSI is displayed as a 1/3 page, next to either a 2/3 EFIS or 2/3 EMS page. If the HSI is defined as part of a screen setup in your rotation, display the HSI page using either of the screen rotation hotkeys (buttons 1 and 6) until the appropriate page is displayed. If no screen configuration including the HSI is in your rotation, you can access the HSI by holding down the



right button with no menus displayed and selecting a screen that includes the HSI. See page 3-2 for more information on screen configuration.

DSAB

All HSI screens in a DSAB network share their configuration and are identical to one another at all times. Changing the source of information on one HSI page affects all units, as does changing scaling, bugs, or bearing pointers. It is not possible to show a NAV radio on one screen and a GPS on another screen.

HSI Display Basics

There are three possible sources of information on the HSI page: GPS, NAV, and internal EFIS data. It is important to know what equipment is sourcing your data, so most displayed data is color coded so that it is easy to identify the source of the data. Data that is sourced from a GPS unit is color coded in magenta, and includes course direction, course deviation, vertical guidance, ground track, ground speed, altitude, distance to waypoint, and other data. Data that comes from a navigation radio (VOR / LOC) is green in color and includes the course, course deviation, glideslope, nav mode, to/from, OBS setting, tuned frequency, station identifier, and more. The final data source is information that comes from the EFIS itself and is color coded in white. The EFIS-sourced data includes magnetic heading, true airspeed, winds, and various other data points. Below are some of the basics

1. Mode flag. This indicator, located at the upper left of the HSI page, tells you what mode the radio and display are in. There are five options for this indicator.
 - a. “GPS” in magenta text: This indicates the data source for the overlay is a GPS stream.
 - b. “NAV” in black letters on a green background. This indicates that the system is in NAV mode, but there is no active VOR or localizer tuned. This is the same as a cross hatch indicator in the TO/FROM flag on a mechanical CDI. Do not rely on any indications on this page except for the DG and TAS when this flag is set.





- c. “VOR” in green text. This means the radio is tuned to a standard VOR station and is giving a valid TO or FROM indication.
 - d. “LOC” in green text. This indication means that the radio is tuned to a localizer. The glideslope scale is visible as well, but may be flagged invalid.
 - e. “BC” in yellow text. This indication means that the radio is tuned to a localizer and is in back course mode. The glideslope scale is visible as well, but may be flagged invalid. **Note:** when flying a back course on an HSI, no reversal is needed since the CDI indicator spins with the DG. If the course is set to the runway heading of the ILS, when flying the back course, the CDI is flipped 180 degrees and indicates properly with no reversal needed. If you put the SL-30 into back course mode, you need to set the course to the heading of the back course runway. Setting the course to the heading of the primary ILS runway causes the CDI needle to be reversed.
2. Digital heading indicator. The number in this box is the current magnetic heading of the aircraft in degrees from 001 to 360. The accuracy of this data depends on the accuracy of the heading calibration for your FlightDEK-D180.
3. Directional Gyro (DG). The ring of tick marks and numbers acts as a traditional directional gyro. The current magnetic heading of the aircraft is the heading that is at the top of the page and is being pointed to by the heading indicator.
4. Bug indicator. This user-settable bug also appears on the EFIS heading tape. Colored yellow, it can be toggled on and off using the HSI menu or the main EFIS menu.

**HS34**

The HEADING knob on the HS34 always controls the heading bug. Turning the knob when the bug is not displayed switches the bug to the on state. Press the HEADING knob to sync the bug to the current heading.



5. True Airspeed Indicator. If it is possible to calculate true airspeed on the device then it is displayed here. In order to do this the device must have access to an outside air temperature from an EFIS or an EMS.
6. Winds aloft. This indicator, located at the bottom of the HSI page, appears only when you have GPS data and true airspeed available to the instrument. The arrow is the wind direction relative to your aircraft. It is always the same size and only indicates wind direction. The numbers below are absolute wind direction (magnetic) and absolute wind speed. Below that, labeled as “XW” is the crosswind component of the wind. Wind data is calculated while in stable flight with very little turn rate. It uses the GPS ground speed and track to compare to the magnetic heading and the true airspeed that the EFIS calculates. In order for winds to be correct, the airspeed, OAT, and compass on the EFIS must all be accurate.

030°/20 KTS TAS 092 KTS
XW 10 KTS

Navigation Radio Overlay

The figure at right shows an HSI page with information sourced from a navigation radio. This data could be a VOR or a localizer. The various elements are described below.

1. Text displays. The text displays (located at the top of the HSI Page) provide a variety of information. Displayed here is the course/OBS setting, the active frequency that the SL-30 is tuned to, the identifier for the tuned frequency, and the bearing to the active and secondary frequencies. When the data is not available or is not valid, the various data fields in this area are replaced by dashes.
2. Course indicator. The green course indicator (shown pointing to 273° at right) has an arrow at its end which points to the currently selected course (OBS) on your nav radio. This setting is also shown in the text area as “OBS.” When tuned to a VOR, this is the radial that you wish to fly. When tuned to an ILS, this is set to the runway heading. In a situation with no winds, keeping the course indicator pointed straight

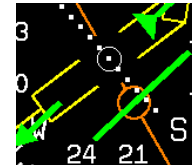


up and in line with the heading pointer keeps the aircraft on course. This indicator is fixed to the rotation of the DG, so it is easy to see which way you must turn to get on course. The course indicator is only present when you are tuned to a VOR or a localizer. If the nav radio indicates that you are not currently tuned to an active frequency, this indicator is not displayed. The direction of this course is set externally using the knob that is on the SL-30 when in VOR mode. When in ILS mode, the SL-30 disables the OBS knob, and thus you must use the soft keys below the HSI in order to set the course.

HS34

When using the HS34 you can set the OBS using the course knob; the HS34 can communicate with the NAV radio instead of just receiving data from it, as with a standard serial connection. The HS34 sends the course change to the NAV radio, just like a mechanical HSI or CDI does. In the case of the SL-30, either the OBS knob on the SL-30 or the HS34 may be used.

3. **Course Deviation Indicator (CDI).** When tuned to a VOR, the CDI indicates how far to the left or right of your selected radial you are. Full scale deviation indicates ten degrees of deviation from the radial that has been chosen as the course. When tuned to a localizer, full scale represents 2.5 degrees of deviation. When on course, the course indicator and the CDI make a solid line, making it easy to see when there is little error in your aircraft's position. Unlike a CDI indicator found in basic aircraft, the CDI needle on an HSI rotates with the DG and course indicator. By turning the aircraft towards the CDI needle you reduce your deviation.
4. **To/From indicator.** Because an HSI rotates the course line on top of the DG, the to/from indicator always points TO the physical VOR or localizer transmitter. If it is pointing the same direction as the arrow at the end of course line, then that is a "to" indication. If it is pointing the opposite direction of the arrow at the end of the course line, then that is a "from" indication. This data comes from the to/from flag indicator provided by your Nav radio. In the image above, the to/from indicator is showing a "from" indication.



5. Glideslope Indicator. This appears only when tuned to an ILS. It displays deviation as 0.5 degrees when deflected full scale. This does not have an indicator on it unless the glideslope is valid as defined by the glideslope flag.
6. Glideslope flag. This appears when the radio is tuned to a localizer and the glideslope is not valid. When this is active, there is no indicator mark on the GS scale.
7. Bearing To indicators. These arrows show you the bearing to the active and standby VORs. This is the direction that you would need to fly to go directly from where you are to the transmitter. When flying directly on course, your bearing and course lines overlap one another. The primary bearing indicator is depicted by a yellow diamond and the standby indicator is depicted by an orange circle. These elements only appear when the active and/or standby VORs are tuned to an active frequency. A numerical display of your primary (labeled NAV) and standby (labeled SBY) bearings and a reminder of which symbol represents each bearing is in the text area of the page.

**HS34**

The HS34 adds the possibility of having many more bearing sources in the system, so the behavior of the BRG SRC button is dependent on how many devices you have connected. When you press this button, if you have only one possible bearing source, the bearing source toggles on and off. If you have two or more bearing sources, pressing the BRG SRC button highlights the first bearing source. Turning the VALUE knob allows you to choose your bearing source from all options. Pressing the bearing source again chooses the second bearing source. If you wait more than 5 seconds without adjusting anything or pressing any buttons, the selection self-clears.

GPS Overlay

The figure at right shows an HSI page with information sourced from a GPS receiver while the GPS has an active flight plan between two points. The various elements are described below.

1. Text displays. In this area a variety of information is displayed in text format. Displayed here is the ground track (TRK), the course (CRS), ground speed (SPD), distance to next waypoint (DTW), and up to two bearing pointer selections.
2. Course indicator. The course indicator points in the direction of the course that the GPS is reporting*. This is usually the direction of the line between the start and end waypoints. This setting is also shown in the text area as “CRS.” In a situation with no winds, keeping the course indicator pointed straight up and in line with the heading pointer keeps the aircraft on course. This indicator is fixed to the rotation of the DG, so it is easy to see which way you must turn to get on course. The course indicator is only present when you have an active flight plan in your GPS and are navigating to a point.
*Some GPS units do not report course direction. In this case, a COURSE menu item is made available in the HSI menu to manually set it.
3. Course Deviation Indicator (CDI). When a flight plan is active in the GPS, the CDI indicates how far to the left or right of your selected ground course you are (CDI in large oval at right). Depending on the scale that you are in, each dot indicates 0.06 n.m. (Approach), 0.2 n.m. (Terminal), or 1.0 n.m. (Enroute). When on course, the course indicator and the CDI make a solid line, making it easy to see when there is little error in your aircraft’s position. Unlike a CDI indicator found in basic aircraft, the CDI needle on an HSI rotates with the DG and course indicator. By turning the aircraft towards the CDI needle so the CDI needle is “on top” of the course line you reduce your deviation.





4. To indicator. There is no “from” indication with GPS data, since the GPS is the source of the course line. This arrow always points the same way as the course line, as indicated in the small oval in the previous figure.
5. Vertical Guidance Indicator. When connected to a Garmin 396/496 the glideslope indicator mimics the GPS’s vertical guidance display. This appears only when a VNAV profile is active on the GPS.

HS34

When the HS34 is connected to a WAAS-enabled GPS that can provide vertical guidance, this vertical guidance is displayed as specified by your GPS user manual.

6. Bearing to waypoint (BTW) indicator. This thin yellow diamond shows the bearing to the destination waypoint. The diamond points in the direction you would need to fly from your present location to the waypoint. When flying directly on course, your BTW and course lines overlap one another. The text area of the page contains a numerical display of this bearing and a diamond icon to signify its symbol on the display.

HS34

The HS34 adds the possibility of having many more bearing sources in the system, so the behavior of the BRG SRC button is dependent on how many devices you have connected. When you press this button, if you have only one possible bearing source, the bearing source toggles on and off. If you have two or more bearing sources, pressing the BRG SRC button highlights the first bearing source. Turning the VALUE knob allows you to choose your bearing source from all options. Pressing the bearing source again chooses the second bearing source. If you wait more than 5 seconds without adjusting anything or pressing any buttons, the selection self-clears.

7. Scale indicator. This shows you what scale the CDI is using. Since serial GPS streams do not indicate the correct scaling mode, this must be configured manually with the “scale” button under the HSI menu. The three options are “E” for enroute (5 n.m. full scale), “T” for terminal (1 n.m. full scale), and “A” for approach (0.3 n.m. full scale). The current scale name and full scale range is indicated on the screen.



**HS34**

When the HS34 is hooked to a GPS unit via ARINC-429, the system can read the scaling from the ARINC-429 connection. When connected this way, the scaling auto-updates and follows the GPS. The indication on the screen for mode and range should match the mode and range of the GPS at all times. When in this mode, the range is not limited to just 5/1/0.3nm, as the GPS may slide between scales, so it would not be unexpected to see a number such as 0.8 on the screen. Because of this behavior, on the final phases of an approach, a GPS hooked to the HS34 via ARINC-429 acts much like a VOR receiver would with the CDI acting as angular deflection, not linear distance. There are still only three master modes of Enroute, Terminal, and Approach, which are annunciated on the screen.

8. Track indicator. This indicates your direction over the ground as reported by the GPS. This is different than your magnetic heading when there are crosswinds present. Since this is your actual ground track, keeping this directly above your course pointer (when the CDI is centered) keeps you on course, even if your magnetic heading is different. As long as a valid GPS source is detected by the system, the ground track indicator can be displayed. This is not dependent on the currently set nav source.



HSI Menu Structure

NAVSRC - This is used to choose what navigation source is displayed on the HSI page and the EFIS main page. Pressing this button steps through the three options: DG, NAV, and GPS. This button cycles through only the overlays that are available in the system; NAV or GPS pages are not available if these data sources are not hooked up.

HS34

The NAV SRC button on the HS34 performs the same function as this NAVSRC menu button, but may cycle through NAV1, NAV2, etc, if you have multiple units connected. The NAV SRC button on the HS34 only works when the HSI page is displayed on the DSAB master. If it is pressed when no HSI is displayed, it has no effect.



BUG - This is the same menu as EFIS > BUGS > HDG. This menu allows you to adjust and toggle a heading bug that appears on the DG display as well as the EFIS heading tape.

HS34 The heading bug can be adjusted at any time by rotating the HS34's HEADING knob. If the bug is currently toggled off, rotating the HEADING knob causes the bug to be displayed on the HSI display. To sync the bug to your current heading, press the HEADING knob briefly. To toggle the heading bug on or off, push and hold the HEADING knob for more than 1 second.

COURSE (Nav mode, Localizer active) - This is used to set the OBS/course. The SL-30 does not allow you to adjust the OBS when tuned to a localizer so this must be done locally on the instrument.

HS34 When you have an HS34 with any NAV instrument, the course knob on the HS34 adjusts the course/OBS. You can adjust the course when in NAV or localizer mode. When using a GPS such as the 430/530, that allows an external course command to control the instrument, this course adjustment also works. If the GPS or NAV device is in a mode where it is ignoring course commands, turning the course knob results in no change on the screen. This is true when you are in most GPS modes.

SCALE (GPS mode) - This is used to cycle through the three GPS scale modes.

HS34 The scale button only exists if the source you are connected to is not providing scale information.

7. AUTOPILOT OPERATION

This section guides you through the indicators and operation of Dynon's EFIS-based Autopilot (AP) system. This section assumes that the AP has already been installed, configured, and tuned according to the FlightDEK-D180 Installation Guide. Additionally, it assumes that you are already familiar with the operation of the FlightDEK-D180 menu system, documented throughout this guide.

Introduction and Resources

Dynon Avionics' Autopilot (AP) system is a competitively priced product for the Experimental & Light Sport Aircraft (LSA) aircraft market. Unlike standalone AP systems, Dynon's AP is an enhancement to the Dynon Avionics EFIS-D10A, EFIS-D100, and FlightDEK-D180 products (beginning with firmware version 5.0). The Dynon Avionics AP provides roll (aileron) and/or pitch (elevator) control, leveraging the proven sensors, algorithms, and display systems of Dynon's modern EFIS products. Another innovative element of the Dynon Avionics AP is that the servomotors (servos) responsible for actuating the control surfaces are "smart" devices. Dynon's servos not only accept commands from the AP but also report "health," resistance to commanded movements, motor override (or "slip"), and many other data elements back to the EFIS. This level of communication between AP control and motors provides the pilot with an unprecedented degree of awareness of the overall performance of the AP.

Updated documentation, FAQs, diagrams, and more are available at wiki.dynonavionics.com. Users are able (and encouraged) to contribute to the material available there. Because the Dynon Avionics AP is a new product and we expect to see it installed in a huge variety of aircraft, the collaborative wiki will be a valuable resource for pilots of rare aircraft to help each other with tips on installing the Dynon AP successfully.

The **Dynon Avionics Customer Forum** at forum.dynonavionics.com is another useful resource for those installing and configuring the autopilot system. Dynon personnel and enthusiastic customers monitor the Forum, participate in



discussions, and answer support questions there. The forum is particularly useful for customers with technical support issues who cannot contact Dynon by phone during our normal hours of operation.

All Dynon instruments connected via DSAB must be running the same firmware version. This applies to the servos and AP74 as well, which are updated via the Bus Master EFIS. See the Autopilot Installation and Configuration section in your FlightDEK-D180 Installation Guide for more information.



As with any autopilot, Dynon's AP is no substitute for the pilot remaining in full control of the aircraft. The AP is a supplement in the operation of the aircraft. While the AP is engaged, you should not engage in activities (such as sleeping, reading, etc.) that detract from your overall situational awareness.



The Dynon Avionics AP requires an accurate magnetic heading to operate efficiently and comfortably in HDG mode and the upcoming radio-based VOR/NAV mode. Therefore it is critical that the aircraft's compass be installed correctly, calibrated, and operating well *in all attitudes*. If you currently have an EFIS-D10A, and are only using the internal magnetic compass, Dynon strongly recommends the installation and use of the EDC-D10A remote-mounted digital magnetic compass, and properly calibrating it per the instructions found in the latest FlightDEK-D180 Installation Guide.

EFIS AP Indicators

When 1 or more servos are installed and configured, the FlightDEK-D180's EFIS presentation includes some new indicators, described below. If these indicators do *not* appear on the EFIS page, the AP installation procedure must be performed per the AP Installation and Configuration chapter of the FlightDEK-D180 Installation Guide.

AP MENU AND STATUS INDICATOR (LOWER LEFT CORNER)

When 1 or 2 servos are installed, a new AP menu is available, replacing the BUGS menu on the EFIS main menu (BUGS is now available below the AP menu).



Additionally, an Autopilot status indicator is always displayed at the lower left side of the EFIS page, as shown at right. In a 2-axis system, the left indicator displays the state of the roll servo, and the right indicator displays the state of the pitch servo. If only a pitch or only a roll servo is installed, that axis' indicator is shown just to the right of the "AP:" display. When either the roll or pitch axis is engaged, the entire indicator has a black background. The following table describes the different states for each axis and the relevant text descriptions in the AP status indicator.



- Example 1: **AP:OFF-OFF** (Roll and Pitch servos installed, AP disengaged)
- Example 2: **AP:HDG-ALT** (Roll and Pitch servos installed, AP engaged in HDG + ALT mode)
- Example 3: **AP:ALT** (Only Pitch servo installed, AP engaged in ALT mode, display of Roll mode suppressed)
- Example 4: **AP:HDG** (Only Roll servo installed, AP engaged in HDG mode, display of Pitch mode suppressed)

AP Status Indicator Modes		
AP State	Roll Display	Pitch Display
Status: Servo disengaged	OFF	OFF
Status: Heading Hold Mode; AP uses HDG Bug as target magnetic heading	HDG	N/A
Status: Track Hold Mode; AP uses HDG Bug (colored magenta) as target	TRK (Magenta Text)	N/A
Status: Control Wheel Steering Mode (When CWS is configured, and AP Disengage/CWS button held for more than 2 seconds). See: EFIS > SETUP > AP > BUTTON CONFIG.	CWS	CWS
Status: Currently in middle of 180 degree turn	180	ALT
Status: GPS Horizontal Navigation Mode	GPS (Magenta Text)	N/A
Status: Altitude Hold Mode; AP uses Altitude Bug as target altitude	N/A	ALT
Warning: Servo slipping	Mode display with yellow background	Mode display with yellow background



AP Status Indicator Errors		
AP State	Roll Display	Pitch Display
Warning: Servo has been calibrated but not tested (See: SETUP > AP > SERVO TEST)	TST <i>(red text)</i>	TST <i>(red text)</i>
Warning: Airspeed outside min or max airspeed. See: SETUP > AP > PITCH SERVO.	SPD <i>(red text)</i>	SPD <i>(red text)</i>
Warning: Servo error condition detected, or servo not found. Check DSAB configuration, wiring, and servo power.	ERR <i>(red text)</i>	ERR <i>(red text)</i>

Any axis that is in any of the above error states cannot be engaged.

FAILURE MODES

The EFIS continuously monitors the overall operation of the AP as well as the state of incoming GPS data. If an error is detected, the subsystem where the error has occurred is restricted and reported. Some examples:

- If an error in the Pitch servo is detected, the AP reports an error in the Pitch servo, but continues operation of the Roll servo.
- If, while flying in GPS NAV mode, the user cancels the active waypoint or the GPS sends malformed navigation data, the AP fails over to TRK mode.
- If, while flying in HDG mode and compass data is lost, the AP fails over to TRK mode (if valid GPS data is present).
- If, while flying in NAV or TRK mode and GPS data is lost, the AP fails over to HDG mode (if valid compass data is present).



BUGS DISPLAY (LOWER RIGHT CORNER)

Whenever either the heading or altitude Bug is toggled ON (via the BUGS menu or the AP74) its current value is displayed in the lower right corner of the EFIS page.

Example: **005°/2250FT** (HDG bug toggled ON, set to 005° and ALT bug toggled ON, set to 2250 Feet). In the example at right, the heading bug is toggled on (i.e., displayed on the heading tape), but the AP HDG mode is currently disengaged.



BUGS GRAPHICAL APPEARANCE

When an AP is installed and configured, the appearance of the IAS, HDG, and ALT bugs is changed to reflect AP status. When the Autopilot is *not* engaged for a given axis, the respective bug is hollow (as shown at right). When the Autopilot is engaged for a given axis (HDG, TRK, ALT), the respective bug is solid, or “filled in.” Because the Autopilot does not currently have a settable airspeed mode (coming with the AP76), the IAS Bug is always displayed as a hollow outline.



AP Modes

The Autopilot can be engaged in the following modes. During AP-controlled heading/ground track changes, the AP turns the aircraft at the target turn rate specified in the EFIS > SETUP > AP > ROLL SERVO menu. The AP will not exceed the maximum bank angle, set in that menu. See the FlightDEK-D180 Installation Guide for detailed information on configuring these parameters.

HDG: HEADING MODE – ROLL SERVO

When the AP is engaged in Heading Mode, it synchronizes the heading bug to the current magnetic heading, and uses the roll servo to control the aircraft’s magnetic heading. You may then adjust the heading bug, causing the AP-controlled



aircraft to turn toward the new target heading. The AP's goal in the roll axis is to align the triangle of the numeric magnetic heading box with the inverted triangle of the heading bug.

TRK: GROUND TRACK MODE – ROLL SERVO

When the AP is engaged in Track Mode, it synchronizes the heading bug (colored magenta to signify GPS mode) to the current ground track, and uses the roll servo to control the aircraft's ground track. You may then adjust the heading bug, causing the AP-controlled aircraft to turn toward the new target ground track. In Track Mode, the AP's goal in the roll axis is to align the magenta ground track triangle with the inverted triangle of the heading bug.

180: 180° TURN MODE – ROLL AND PITCH SERVOS

This special mode is a way to initiate a "quick turnaround." When 180 Mode is initiated, the AP immediately engages in Altitude and Track Hold modes with the heading bug set to 180° from current ground track. (If a GPS is not connected or available, it engages in Heading Hold Mode.) The AP then turns the aircraft to the left until it is flying in the opposite direction, and then remains in Track and Altitude Hold Modes.

NAV: GPS NAVIGATION MODE – ROLL SERVO

To use the GPS-based NAV mode, your connected GPS must have an active waypoint (and must be outputting course and course deviation information). Additionally, the EFIS's HSI screen must have the GPS selected as the current NAVSRC (i.e., the CDI and other HSI information is colored magenta). When the AP is engaged in GPS Navigation Mode, it takes its instruction from the GPS unit's horizontal navigation information. The AP's goal in the roll axis is to center the CDI, flying you to the active waypoint on the desired course.

ALT: ALTITUDE MODE – PITCH SERVO

When the AP is engaged in Altitude Mode, it synchronizes the altitude bug to the current indicated altitude, and uses the pitch servo to control the aircraft's altitude. You may then adjust the altitude bug, causing the AP-controlled aircraft to climb or descend toward the new target altitude at the average vertical speed defined during setup. In Altitude Mode, the



AP's goal in the pitch axis is to align the triangle of the numeric altitude box with the inverted triangle of the altitude bug.

During AP-controlled altitude changes, the AP causes the aircraft to climb or descend at the target vertical speed specified in EFIS > SETUP > AP > PITCH SERVO. When the AP is engaged and aircraft airspeed rises above the maximum, the AP enters an airspeed hold mode, pitching the aircraft up to prevent exceeding the maximum airspeed. When the aircraft's altitude rises above the target ALT bug and the AP cannot pitch the aircraft down without going above the maximum airspeed, the EFIS presents the prompt:

MAX AIRSPEED – REDUCE POWER

Likewise, when the AP is engaged and aircraft airspeed drops below the minimum, the AP enters an airspeed hold mode, pitching the aircraft down to prevent dropping below the minimum airspeed. When the aircraft's altitude drops below the target ALT bug and the AP cannot pitch the aircraft up without going below the minimum airspeed, the EFIS presents the prompt:

MIN AIRSPEED – ADD POWER

When the Autopilot is flying the aircraft in Altitude Mode, an out-of-trim indicator can appear to the right of the AP Status Indicator. This alerts you when the pitch servo detects excessive load on the elevator which would result in a large pitch excursion when the AP is disengaged. The indicator instructs you in the direction to trim the nose to produce more neutral trim. In the example at right, the indicator appears until the pilot trims the aircraft nose up until neutral trim. During turbulence and small bumps the trim indicator may flash on and off. Do not take action based on the trim indicator until it remains on for several seconds.



02:40:51 L
AP:OFF-ALT UP▲



AP Control Methods

The AP can be controlled and monitored in a number of ways (described in detail in the sections below):

- EFIS menus: Set HDG and ALT bugs (AP targets), change AP modes, engage/disengage AP
- AP74 AP Control Panel: Set HDG and ALT BUGS (AP targets), arm AP modes, engage/disengage AP
- HS34 HSI Control Panel: Set HDG and ALT BUGS (AP targets)
- Disengage/Control Wheel Steering (CWS) pushbutton: engage/disengage AP

EFIS Autopilot Control

This section describes the various AP control functions available via the EFIS > AP menu.

With an AP installed and configured, the AP menu is shown on Button 3 (hereafter, shown in documentation as “EFIS > AP”). This replaces the BUGS menu (relocated under the AP menu).

The AP menu includes the following buttons and functionality:

- **BUGS:** Works as the BUGS menu has in previous firmware versions and is documented on page 5-2. The HDG and ALT bugs now control the targets for the autopilot’s HDG/TRK and ALT modes, respectively.
- **MODE-(H, T, or N):** The MODE button is followed by the currently active lateral mode: H (HDG), T (TRK), or N (NAV). When the roll axis of the AP is engaged (by pressing button 3, the lateral engage button), it flies in the mode set in this menu. Pressing this button brings up another menu where you can select the armed AP mode. As soon as you select a mode, the AP menu is immediately displayed again.
- **(HDG, TRK, or NAV)OFF/ON:** The menu label also reflects the currently active lateral mode, and whether or not the AP is engaged in that mode. Pushing this button toggles between ON and OFF, activating and deactivating the





roll servo in the specified mode. ALT and HDG modes can be enabled independently of each other. When the Autopilot is engaged in HDG or TRK mode, the heading bug is synchronized to the current heading or ground track, respectively. The heading bug can then be adjusted while the AP is engaged.

- **ALT OFF/ON:** The menu label reflects whether the AP is currently engaged in Altitude Mode. Pushing this button toggles between ON and OFF, activating and deactivating the pitch servo in altitude mode. When the Autopilot is engaged in ALT mode, the altitude bug is synchronized to the current altitude. The altitude bug can then be adjusted while the AP is engaged. When ALT mode is deactivated, the altitude bug is toggled off.
- **180:** Puts the AP into 180 Mode TRK (or HDG, if no GPS available) and ALT modes, and sets the heading bug to 180° from the current ground track. While in 180 Mode, the 180 button is highlighted, and the AP Status Indicator displays “180” in the roll axis position.

AP74 Autopilot Control

This section describes how to control the Autopilot via the AP74. When an AP74 is installed, the Autopilot can still be controlled via the EFIS-based AP menu. The AP74 has all the functionality of the EFIS > AP menu, while providing a more efficient way to interpret and use the Autopilot. It also provides some additional features, such as the ability to arm modes prior to engagement, and easy adjustment of AP targets via its dedicated knob.

AP74 INDICATORS

The AP74's button indicators (red lights) have the following meanings:

- AP button indicator: ON when *any* Autopilot axis is active (i.e., servo controlling aircraft).
- HDG button indicator: ON when lateral/roll servo is armed or active in Heading Mode. If the AP button indicator is on, the roll servo is *active* in Heading Mode. If the AP button indicator is off, the roll servo is *armed* in Heading Mode.
- TRK button indicator: ON when lateral/roll servo is armed or active in Track Mode.
- NAV button indicator: ON when lateral/roll servo is armed or active in Navigation Mode.
- ALT button indicator: ON when vertical/pitch servo is armed or active in Altitude Mode.

AP74 CONTROLS

Each of the four mode buttons on the AP74 is only usable if the associated modes are enabled, and configured, and the necessary device(s) are connected. For example: if a GPS is not connected to the system, the TRK and NAV buttons cannot be used; if a pitch servo is not installed, the ALT button cannot be used. The mode buttons and indicators correspond to the Autopilot modes described on page 7-5.





AP Button: When its indicator is off, pressing the AP button engages the AP in the mode(s) indicated by the Horizontal and Altitude Mode button indicators below. If HDG mode is armed, pressing the AP button synchronizes the heading bug to current magnetic heading; if TRK mode is armed, pressing the AP button synchronizes the heading bug to current ground track; if ALT mode is armed, pressing the AP button synchronizes the altitude bug to current altitude.

When the AP button's indicator is on, pressing the AP button disengages all axes of the AP, but leaves the last-used modes armed. If you push and hold the AP button for 2 seconds, the AP engages in 180 Mode.

VALUE Knob: When no menus are displayed, the VALUE knob changes the BARO, ALT bug, and HDG bug settings. When in any EFIS menu which adjusts a numerical value, turning the VALUE knob adjusts the selected parameter. Pressing the VALUE knob when in any menu exits the menu system completely. Pushing and holding the knob while changing a bug synchronizes the bug to the current value. Pushing and holding the knob while changing the BARO sets the barometer to 29.92 inHg. Further behavior can be configured, as described on page 7-12.

HDG Button: When its indicator is off, pressing the HDG button arms the roll servo in Heading Mode and turns on the indicator. If the AP is already engaged, pressing the HDG button activates the roll servo in Heading Mode and synchronizes the heading bug to the current magnetic heading. The heading bug can then be adjusted while the AP is engaged.

When its indicator is on, pressing the button disarms/deactivates the roll servo and turns off the button's indicator.

TRK Button: When its indicator is off, pressing the TRK button arms the roll servo in Track Mode and turns on the indicator. If the AP is already engaged, pressing the TRK button activates the roll servo in Track Mode and synchronizes the heading bug to the current GPS ground track. The heading bug can then be adjusted while the AP is engaged.

When its indicator is on, pressing the button disarms/deactivates the roll servo and turns off the button's indicator.

NAV Button: When its indicator is off, pressing the NAV button arms the roll servo in Navigation Mode and turns on the indicator. If the AP is already engaged, pressing the NAV button activates the roll servo in Navigation Mode and immediately begins following the navigation instructions being outputted by the GPS.



When its indicator is on, pressing the button disarms/deactivates the roll servo and turns off the button's indicator.

ALT Button: When its indicator is off, pressing the ALT button arms the pitch servo in Altitude Mode and turns on the indicator. If the AP is already engaged, pressing the ALT button activates the pitch servo in Altitude Mode and synchronizes the altitude bug to the current altitude. The altitude bug can then be adjusted while the AP is engaged.

When its indicator is on, pressing the button disarms/deactivates the pitch servo and turns off the button's indicator. When ALT mode is deactivated, the altitude bug is toggled off, disabling the altitude alerter.

VALUE KNOB CONFIGURATION

The VALUE knob's default behavior is configured in the EFIS > SETUP > AP > VALUE KNOB ► menu. When no menus are displayed, the VALUE knob changes the BARO, ALT bug, and HDG bug settings. When in any EFIS menu which adjusts a numerical value, turning the VALUE knob adjusts the selected parameter. Pressing the VALUE knob when in any menu exits the menu system completely.

The VALUE knob can be configured to require an initial push before rotating the knob has any effect (REQUIRE PUSH: YES/NO).

The default mode of the VALUE knob is configured by changing the FIRST ACTION: BARO/ALT/HDG setting.

If REQUIRE PUSH is set to YES:

- The first push of the VALUE knob activates the FIRST ACTION mode (BARO, ALT bug, or HDG bug) and displays a “pop-up” window indicating the current mode and value. Rotating the knob within 5 seconds changes the value of the FIRST ACTION mode. A second push of the VALUE knob within 5 seconds after rotating the knob closes the pop-up window.
- If, after the first push of the VALUE knob, the knob is *not* rotated, subsequent pushes of the VALUE knob cycle through BARO, HDG, and ALT, in that order.



If REQUIRE PUSH is set to NO:

- Rotating the VALUE knob changes the value of the FIRST ACTION mode (BARO, ALT bug, or HDG bug) and displays a pop-up window indicating the current mode and value. Pushing the VALUE knob again within 5 seconds of the last knob rotation closes the pop-up window.
- Pushing the VALUE knob without first rotating it cycles through the available adjustment values (BARO, ALT bug, or HDG bug, whichever were not chosen as FIRST ACTION) and displays a pop-up window indicating the current mode and value.

Disengage/Control Wheel Steering (CWS) Pushbutton

The primary function of the Disengage/CWS pushbutton is to disengage the Autopilot. While the AP Disengage/CWS button is held down, the servos are electrically disengaged and cannot control the aircraft. If configured in the EFIS > SETUP > AP > BUTTON CONFIG menu, the button can also serve as a control wheel steering mechanism, as described below.

HOLD TO ENGAGE

Setting HOLD TO ENGAGE to Y allows you to engage the Autopilot by holding the Disengage/CWS Button for more than 2 seconds. This allows for a convenient alternative to engaging the Autopilot via the menus and/or AP74 AP button. Default is N.

When this mode is active, anytime the autopilot is disengaged you can engage it by pressing and holding the Disengage/CWS Button for more than 2 seconds, then releasing. Note that after 2 seconds, the AP status indicator at lower left of the EFIS screen shows **AP:CWS-CWS**. This indicates that the servos are in Control Wheel Steering mode and are waiting for the button to be released before reengaging.



CONTROL WHEEL STEERING

When set to Y, the BUTTON CONFIG > CTRL WHEEL STEER > ENABLED option enables a secondary mode of the AP Disengage/CWS Button. This mode allows you to be flying under AP control, press *and hold* the Disengage/CWS Button while flying to a new heading and/or altitude, then release the button to reengage the Autopilot. The Autopilot reengages in the mode set by the MODE parameter, described below. Note that while holding down the button, the AP status indicator at lower left of the EFIS screen shows **AP:CWS-CWS**. This indicates that the servos are in Control Wheel Steering mode and are waiting for the button to be released before reengaging.

When the Control Wheel Steering ENABLED parameter is set to Y, the MODE parameter selects between two different ways of reengaging the Autopilot after the AP Disengage/CWS Button is released:

- Last Heading and/or Altitude (LAST HDG/ALT) - the AP is engaged and returns to the selected Heading and/or Altitude
- Hold Heading and/or Altitude (HOLD HDG/ALT) - the AP is engaged and changes the selected Heading and/or Altitude to match the current Heading and/or Altitude

Optional Preflight Checklist

If you desire an Autopilot preflight test, the following can be used as a baseline.

1. With AP power OFF, test the controls for proper operation of the control surfaces. The controls should feel normal; the servos should add little resistance.
2. With AP power ON, observe the EFIS. If any errors are detected in the AP, an AP:ERR:ERR message displays in the lower left corner of the EFIS display.
3. Repeat Step 1; the “feel” should be the same as with Power OFF.
4. Enter the EFIS > SETUP > AP > SERVO TEST menu and follow on-screen instructions. This verifies proper operation of the AP servos and AP Disengage/CWS button.

8. ALERTS

Alarm Indicators

Any time a built-in or preconfigured alarm set point is exceeded, you are alerted via both visible and audible (if connected) alarms.

When an alarm is triggered, the following things occur:

- The measurement's value and tick color are highlighted red
- The measurement's value and tick blink
- A red alarm bar appears at the bottom of the screen with a message identifying the out of range measurement
- Below the alarm bar, the alarm menu gives you options for what to do next. See the following subsections for more information
- If an external light is connected to the FlightDEK-D180 EMS main harness, the light turns on

The alarm menu appears below the red alarm bar. See the Alarm Silencing and Alarm Acknowledgement sections below for more information on this menu. Note, alarms may be silenced immediately; they may not be acknowledged during the first half second of the alarm.

In an alarm condition, the FlightDEK-D180 also alerts you audibly, provided the EMS Audio Alert output is connected to your intercom as described in the FlightDEK-D180 Installation Guide. If no audio device is connected, you will not hear an audible alarm.

DSAB

If your FlightDEK-D180 is networked to other Dynon products via DSAB, alarms sourced from those products will appear on your FlightDEK-D180 as well. Alert messages sourced from your FlightDEK-D180 are preceded



by the label “THIS.” Alert messages sourced from another Dynon product are preceded by the label “DSAB.” Pressing SILNCE or ACK on any unit in the system silences or confirms the alarm on all units in the system. Refer to the DSAB Alerts section below for detailed DSAB-specific alerts. Refer to the FlightDEK-D180 Installation Guide for more information on installing and configuring a DSAB system

AP74**HS34**

If installed, either the HS34 or AP74 (but not both) can be configured to output EMS, EFIS, and AOA alarm information with tones (such as with direct audio connections to the EMS and EFIS), or via spoken voice alerts. When configured for voice alerts, the HS34 reads out an alarm that occurs, such as “CHT 1 HIGH” or “LOW FUEL.” These voice alarms can be acknowledged and silenced just like the EMS tone.

SHOW PAGE

If the alarming measurement is not displayed on your current screen, or is available on a page which displays it better, a SHOW [PAGE] button is included in the alarm menu. [PAGE] is replaced with the name of the actual page that is displayed when you press the button. Press this button to display the page where the alarming measurement is best displayed. From there, you may press GO BACK to return to your original screen, leaving the alarm indications active, or press ACK to remove the alarm indications and return to your original screen.

ALARM SILENCING

To silence the audio alarm, press the SILNCE button.

ALARM ACKNOWLEDGEMENT

To acknowledge the alarm, press the ACK button. The ACK button has a number next to it indicating the number of currently posted alarms. If this number is higher than 1, after you press ACK the alarm text for the next posted alarm is displayed in the alarm bar. Pressing ACK does the following:

- Silences the audio alarm

- Removes the alarm bar and alarm menu (if no other alarms are stacked up), and brings up the previous menu.
- Stops the blinking of the relevant display
- Returns the display to the screen configuration displayed before the alarm occurred (if you pressed SHOW [PAGE])

The tic and numeric value remain highlighted red until the condition no longer exists. The alarm automatically rearms whenever the alarm condition is removed.

AP74**HS34**

When acknowledging a voice alert from the HS34 or AP74, the full text of the current alarm is read before it is silenced; no other queued alarms will be announced after that.

Multiple Alarms

Any time multiple alarms occur simultaneously, they are handled in the following way:

1. Each numeric value and gauge posts its alarm by being highlighted red, blinking, bringing up the alarm bar, and triggering the external light and audio alert.
2. Alarm messages in the alarm bar are stacked into memory and presented in the order in which they occurred, unless a higher priority alarm occurs. Removal of the Alarm Bar requires separate pilot acknowledgement of each alarm.
3. The ACK button displays a number indicating the number of stacked up alarms.
4. When the last alarm is acknowledged, the Alarm Bar and Alarm Menu are removed from the screen.
5. All alarmed parameters remain in their alarmed state until the alarm condition no longer exists.
6. Pressing SILNCE removes the audio alert for the displayed pending alarm.
7. Once the top alarm is acknowledged, the next alarm in the stack is shown, triggering the audio alarm again.



Latching and Self-clearing Alarms

Depending upon how your FlightDEK-D180 was set up, some of the sensors' alarms may be set to be latching, while others may be self-clearing. The distinction is described below. See the FlightDEK-D180 Installation Guide for more information on configuring this setting for each alarm.

LATCHING ALARMS

If an alarm occurs on a sensor configured to be latching, the alert displays on screen until the ACK button is pressed, even if the alarm condition goes away. This means if, for example, your oil pressure momentarily gets too high but returns to normal, the instrument continues to alarm on the condition until that alarm is acknowledged. Latching alarms let you to know if an alarm happened momentarily, when you might have otherwise missed it.

SELF-CLEARING ALARMS

If an alarm occurs on a sensor configured to be self-clearing, the alert displays on screen until either the ACK button is pressed *or* the alarm condition goes away. Consider the example where you have configured your fuel pressure alarm to be self-clearing. If your engine's fuel pressure momentarily rises too high but then returns to normal, the FlightDEK-D180 alarms for that brief instant, but stops as soon as the alarming condition has ceased; no acknowledgement is needed.

DSAB Alerts

DSAB When multiple Dynon Avionics instruments are networked together via DSAB, there are a few error messages designed to warn you of failures or reduced functionality.

NETWORK CONFIGURATION ERROR: This error can only occur within a short period of time after the system is turned on. This error indicates that a unit that was expected to be on the DSAB network was not found. For example, if –

in a system consisting of a FlightDEK-D180, EFIS-D100, and an HS34 – all three units are not present, this error appears. This error is displayed when any part of the system is not working, including backup EDCs or OATs.

If this error is unexpected, check all Dynon equipment for proper function, and cycle the power to all units. Additional information on the missing unit can be found on the network status page under SETUP > DSAB > STATUS. If a unit is purposefully removed from the system, refer to the FlightDEK-D180 Installation Guide for instructions on reconfiguring the network.

NETWORK CONNECTION LOST: This error means that all network communication has stopped. In this event, no instruments share data or settings until the cause of the communication problem is resolved and all units are power cycled. Individual units that are powered on and functioning continue to function using their internally-derived data.

<INSTRUMENT FUNCTION> CONNECTION LOST: This indicates that the network is still functioning, but a device in charge of providing a specific role on the network has stopped communicating. This means that other screens in the system can no longer display information related to that function. If you receive an “EMS LOST” message on an EFIS product, all EFIS-related pages still function, but all EMS pages are blank. This failure can warn about subsystem failures, such as an EDC or an OAT. In these cases, the device falls back to a local OAT or EDC, if it is available. The <INSTRUMENT FUNCTION> LOST message is preceded by “THIS:” or “DSAB:” on each connected display instrument. If the label is “THIS:” then the screen with this label is the source of the failure. If the message begins with “DSAB:” then the message indicates a failure on another device.

This message relates to the function on the network that goes missing, not the specific name of the unit that fails. A FlightDEK-D180 can be a provider of EFIS and/or EMS data, so the failure of a D180 would present as “EMS” and/or “EFIS” lost, depending on its function in the network.

HS34 If the HS34 is not communicating on DSAB properly, both the NAV and GPS lights are illuminated. During normal system operation both lights will never be illuminated simultaneously; dual illumination indicates a



communication failure. Additionally, if the DSAB network fails in flight “DSAB ERROR” will be annunciated via HS34’s the audio output.

9. EMS MONITORING FUNCTIONS

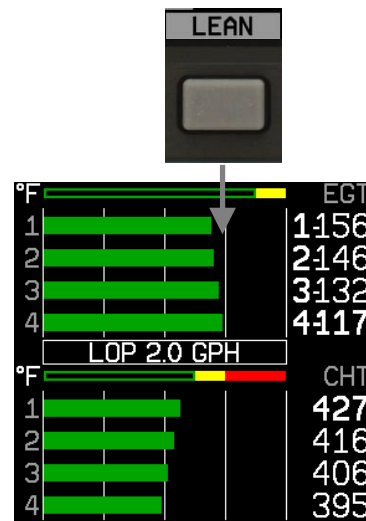
This section describes just a few of the advanced ways to use your FlightDEK-D180 to monitor the health and operation of your engine.

Engine Leaning and Power

The engine monitor provides multiple methods to assist you in setting the mixture of your engine for various functions. The first, and most basic, is to just watch the EGT display as the engine is richened or leaned. You can watch for the EGTs to peak and then richen or lean as desired from that point. The engine monitor also includes a leaning function to automate this process.

To activate leaning mode, enter the EMS menu and press the LEAN button. With this mode activated, the label “Lean Mode” is displayed underneath the EGT/CHT bars to clearly differentiate it from the normal operating mode. In split EGT/CHT mode, the label “LN” is displayed at the upper left of the EGT/CHT display. Additionally, the absolute EGT temperatures (indicated on the right side of the graph) are replaced with new data as each cylinder peaks.

As each cylinder peaks, the absolute temperature is replaced by a number indicating the cylinder peak sequence, followed by the difference from its peak temperature. Given this information, you may set your mixture more accurately to achieve a given EGT delta value on either the rich or lean side of peak EGT. After the last cylinder peaks during a leaning operation the difference in fuel flow between the first and last cylinder peaks is displayed. If the fuel flow decreases, it is shown as Lean of Peak. If fuel flow increases, it is shown as Rich of Peak.



In the above example, cylinder 1's EGT peaked first and cylinder 4's EGT peaked last. There was a total decrease of 2.0 GPH in fuel flow between the first and last cylinder peak, indicating lean-of-peak



To exit the Lean mode, reactivate the main menu and press the LEAN button; the EGT/CHT display then returns to its normal state.

For best results, lean carefully by making small adjustments and allowing some time for temperatures to stabilize before leaning further. In addition to the EGT temperatures, you can also watch the fuel flow rate and CHT temperatures. Carefully read and follow your engine manufacturer's leaning recommendations for best performance.

On some engines, when given the proper set of inputs, the EMS can also calculate percent power and lean-of-peak or rich-of-peak operation in real time. To do this, the EMS needs access to OAT, MAP, RPM, Altitude (from EFIS or GPS) and fuel flow, and needs to be monitoring an 8.5:1 compression ratio engine. This information is based on Lycoming and Continental power charts, is updated in real time, and is displayed near the manifold pressure gauge. The leaning information has three states, LOP, ROP, and PK (Peak). This information can be used to determine when it is safe to lean the engine, and if the current operating state is near peak or not. While this information is based on published charts, you should independently verify via manual leaning that this data matches your install and engine.

Detonation Characterization

Detonation is defined as the uncontrolled explosion of the fuel/air mixture. It occurs when the anti-knock rating of the fuel is lower than required by the pressure and temperature generated during engine operation. Using a fuel octane number less than that required, or over-leaning the engine can result in detonation and induce engine damage. Leaning too aggressively can leave little margin between normal combustion and detonation. Any defect like a bad spark plug, partially blocked fuel injector nozzle or intake manifold leak combined with a minimum margin can result in detonation and engine damage. One key characterization of detonation is lower EGT temperatures with corresponding higher cylinder head temperatures.



Pre-ignition Characteristics

Pre-ignition manifests itself as high EGT and high CHT temperatures resulting from premature ignition of fuel/air mixture in advance of normal ignition. This is usually caused by a hot spot in a combustion chamber. A hot spot is typically the spark plug electrode or exhaust valve. When pre-ignition occurs, ignition timing is lost and the upward movement of the piston is opposed by the high pressure generated by the early combustion.

Ignition Misfire

When a magneto fails or a plug gets fouled, one of the plugs in the cylinder stops firing. This causes the fuel to burn slower than it usually does, since only one plug ignites the mixture. This slow burn means some unburned fuel makes its way into the exhaust stack and burns there, causing high EGT values. This also means less energy is being put into the head, so the CHTs will also fall. If it occurs on one cylinder, suspect a fouled plug and try clearing it out. If it occurs on all cylinders at once, suspect a magneto and take appropriate action for your aircraft.

Shock Cooling

Significantly reducing power and dropping the nose simultaneously can cause shock cooling. This can cause the engine to cool rapidly and unevenly. When this happens, the rear of the engine is exposed to less cooling air than the front of the engine. Shock cooling is characterized by rapidly dropping and uneven CHT temperatures and may lead to cylinder cracking. You may configure shock cooling and span alarms; see the FlightDEK-D180 Installation Guide for more details.

Data Logging

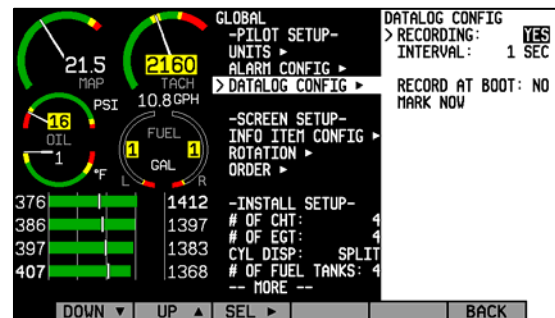
While many observations can be made via the various indicators on the EMS Main Page, some patterns are too subtle to be noticed during routine flight. Automatically recording (“logging”) engine monitor (EMS) and flight data (EFIS),



including positional data (if a GPS is connected) over longer periods of operation allows you to spot potential problems before they cause costly damage or result in a flight emergency. The FlightDEK-D180 provides two options for logging data. You may configure the FlightDEK-D180 to log data to its internal memory for later retrieval or you may record streaming data serial output to an external device (such as a laptop computer) in real-time from the EMS and EFIS serial ports. The former option has the advantage that it does not require an external device in the aircraft while recording. Additionally, the internal storage logs provide an indication of alarm events, while the real-time output does not. When data logging is activated, two logs are recorded - "all data" and "MIN/MAX". Both logs can be downloaded using the "Retrieve Logged Data" option of the Dynon Support Program. On certain Dynon Avionics EFIS and EMS units, a "SNAPSHOT" log is also recorded and can be downloaded. The snapshot log records the value of all parameters anytime an alert occurs.

INTERNAL LOGGING

To activate internal data logging, enter the EMS > SETUP > GLOBAL > DATALOG CONFIG menu or the EFIS > SETUP > DATALOG menu (different routes to the same menu) and set RECORDING to ON. Set the INTERVAL depending on how frequently you wish data to be stored. Data can be stored at intervals of 1, 3, 5, 10, 30, and 60 seconds. Leaving the RECORD AT BOOT option set to NO causes the RECORDING option to be reset to OFF every time power to the FlightDEK-D180 is cycled. Setting it to YES ensures that the FlightDEK-D180 begins logging data automatically at boot up. If you wish to mark the data log at any point, select the MARK NOW function and press SEL ►. This inserts a notation in the data log retrieved by your PC, allowing you to quickly find the place in your data when you marked the record. For information about retrieving data and reading the file produced, please see the help file included in the Dynon Product Support Program (version 5.0 and higher).





The FlightDEK-D180 has a limited amount non-volatile internal storage for the data log. With a 1-second recording interval, at least 30 minutes of *cumulative* data can be recorded; with a 10-second interval, at least 5 hours; with a 30-second interval, at least 15 hours, and with a 60-second interval, at least 30 hours. When the FlightDEK-D180 internal storage fills up, new records overwrite the oldest records. To delete the records in internal storage, select ERASE LOG, ERASE MIN/MAX LOG, or ERASE SNAPSHOT LOG (only available on certain units).

The data format and connection settings for the internally-recorded data are described in the Help Files of the Dynon Support Program.

EXTERNAL LOGGING

During normal operations, the FlightDEK-D180 constantly streams EFIS flight data via the EFIS DB25 serial output, and streams EMS engine data via the EMS DB37 serial output. To record and/or display data generated by the FlightDEK-D180 in real-time a laptop (or other serial port data collection device) must be connected to the serial port(s) of the FlightDEK-D180.

The data format and connection settings for the streamed data are described on page 11-2.

10. EMS OPERATION

This section contains common step-by-step procedures that are performed before, during, and after flight. You are encouraged to be familiar with all of these procedures prior to flying to ensure readiness as well as maximizing use of the capabilities of the instrument.

We recommend that you review and understand the Product Operation section on page 3-1 before reading this section.

ON/OFF

Turn ON: Press and hold button one.

Turn OFF: Exit all menus and press and hold button one.

You must hold button one down for approximately two seconds for either action. When power is connected, the unit does not completely turn off. It enters a low-power state, and keeps track of time as well as detects changes in the state of button one (the POWER button). It is acceptable to have the FlightDEK-D180 on during engine crank. It immediately powers on upon application of external power.

Display Brightness (DIM)

Adjust Display Brightness: EMS > DIM > BRITR/DRKR

Note: At boot, the FlightDEK-D180 display is always reset to maximum brightness. The screen cannot be dimmed to be completely black.

DSAB All screens in a DSAB network share a common dim level. Pressing BRITR or DARKR on one unit changes the brightness level on all screens if the change is possible. If you have any D100-series bright screen units in



the system, you must press BRITR on any bright screen unit to get the bright screen units to their final step of brightness.

HS34

The HS34 has a built-in light sensor which can be used to automatically dim all of the screens connected to a DSAB network. To turn this function on, press AUTODIM. When you enable auto-dim, the screen does not immediately change brightness. Instead, the system records the unit's current brightness level as the desired brightness. From that point on, all networked units react to changes in light intensity and maintain perceived brightness at the desired level. If auto-dim is enabled and the screen is too bright or dark, continue to use the BRITR or DARKR buttons as you would without auto-dim. The system records the new set level as the desired brightness, and auto-adjusts around the new set point.

Fuel Computer

The fuel computer can be programmed in EMS > SETUP > FUEL > ADD THRESHOLD to automatically detect the addition of fuel while the unit is turned off. When this is configured, the next time you turn the FlightDEK-D180 on, it asks you if you added fuel and gives you a shortcut to the add fuel menu. See the FlightDEK-D180 Installation Guide for more information on configuring the fuel sensors and fuel computer.

Add Fuel: EMS > FUEL > ADD > INC+/DEC- > SEL► > ACCEPT/CANCEL

Use this to add to or subtract fuel from the EMS Fuel Computer. Press INC+ to add fuel. Press DEC- to subtract fuel. Press SEL► to enter the value into the computer. Press ACCEPT to confirm the value. Press CANCEL if the value is not correct. Note that you can also access the FUEL menu from the Auxiliary page, if you have the fuel computer info item displayed on it.

Reset fuel level to pre-configured value: EMS > FUEL > PRESET

You may configure the PRESET value using the following path: EMS > SETUP > FUEL > PRESET VALUE > INC+/DEC- > BACK.

**Reset fuel level to full:** EMS > SETUP > FUEL > FULL

You may configure the FULL value using the following path: EMS > SETUP > FUEL > FULL VALUE > SEL► > INC+/DEC- > BACK.

Note: It is necessary to calibrate the EMS Fuel Computer with the sensors for fuel level to work correctly. See the FlightDEK-D180 Installation Guide for more details.

Engine Leaning

Enter Lean Mode: EMS > LEAN

This puts the EGT display into lean mode, changing the numerical values for each cylinder to the format “order peaked-temperature below peak.”

Exit Lean Mode: EMS > LEAN

This returns the EGT display to normal.

Clock Setup

Set Time: EMS > TIMES > CLOCK > SEL► > INC+/DEC- > BACK

This menu, and corresponding dialog box, allows you to set both your local time and Zulu time in 24-hour format. You may display times in either 12-hour or 24-hour format as described in the next section. Set the local and Zulu times independently. Highlight values using SEL►. Adjust highlighted values with INC+/DEC-. Each time a button is pressed, the value changes by one. Hold down INC+ or DEC- to adjust values rapidly. Seconds are reset to zero when minutes are adjusted. When connected to a GPS which is outputting time information, Zulu time is synchronized to the GPS and cannot be set on the FlightDEK-D180.



DSAB In a DSAB network, you can only set the Zulu time on the DSAB master, and only if it is not synchronized to GPS time. You can set the local time on all units individually.

Set 12/24 Display: EMS > SETUP > CLOCK > FORMAT

Press the 12/24 button to toggle between STNDRD (12 hour AM/PM format) and MILTRY (24 hour military format).

Timers

Reset trip timer to zero: EMS > TIMES > TRPRST

The Trip Timer is a Hobbs timer which you can reset. To reset, simply press the TRPRST button in the TIMES page menu.

Set recurring tank timer: EMS > TIMES > TIMER

The general purpose timer can be configured to be either an up timer or down timer. For the purposes of tank switch timing, set the timer to count down by pressing UP/DN until you see DOWN in the dialog box above the menu. Push the HOUR, MIN, and SEC button until the desired interval is shown in the dialog box. When ready, press START. When the timer expires, the alert menu displays the RESTRT button. Pressing this button restarts the down timer to the value you initially set it to.

DSAB Multiple Dynon products connected via a DSAB network share one timer. Starting, stopping, or configuring the timer on one instrument causes all other instruments to reflect the change.

Global Configuration Settings

Configure global settings: EMS > SETUP > GLOBAL



The Global page is divided into three sections: PILOT SETUP, SCREEN SETUP, INSTALL SETUP, and LOCAL SERIAL PORT. Pilot settings and screen settings are addressed in this guide. If you or your installer have completed the procedures outlined in the FlightDEK-D180 Installation Guide, you do not need to modify anything in the other sections.

Scroll between settings by using the UP ▲ / DOWN ▼ buttons. Chosen settings are highlighted. Toggle between parameter settings or display a menu of choices by pressing SEL ►. Press BACK to save.

Change displayed indicator units: EMS > SETUP > GLOBAL > UNITS ►

In the UNITS submenu, you may change the system-wide displayed units for a variety of parameters. See the following table for a list of available units.

DSAB In a DSAB network, unit preferences are shared between all connected instruments.

Parameter	Available units
Manifold Pressure	inHg, mbar
All other engine pressures	PSI, bar
Volume	Gallons, liters
Engine Temperature	Fahrenheit , Celsius
Distance	Nautical miles, statutory miles, kilometers
Speed	Knots, miles/hour, kilometers/hour
Altitude	Feet, meters
OAT temperature	Celsius, Fahrenheit
Barometric pressure	inHg, mbar

Change power on alarms status: EMS > SETUP > GLOBAL > ALARM CONFIG > PWR ON ALARMS

Set this parameter to “ON” to enable alarms before engine startup. When set to “OFF”, all alarms are suppressed whenever ALL of the following conditions exist:



- RPM less than 400
- Oil pressure less than 20 PSI
- First five minutes after master instrument power applied

All alarms are enabled when any of the above conditions are exceeded.

Note: The alarm light (if installed and configured) will flash whenever an alarm condition exists; it is not inhibited by setting PWR ON ALARMS to OFF.

Test light/audio alarm(s): EMS > SETUP > GLOBAL > ALARM CONFIG > TEST ALARM LIGHT/AUDIO

Note: You must select an alarm to test using the UP▲ / DOWN▼ buttons. Hold SEL▶ to test the selected alarm.

Info Item Configuration: EMS > SETUP > GLOBAL > INFO ITEM CONFIG▶

The INFO ITEM CONFIG submenu allows you to configure a variety of different sensors as simple analog bars, on/off contacts, or text items.

The first two info items are displayed on the EMS Main Page. Info item 1 is at the top right of the page, and info item 2 is at the lower right of the page. The other six info items are located on the Aux Page and are numbered 3 through 5 on the top row and 6 through 8 on the bottom row.

The Info Items Config submenu appears, allowing you to move up and down the list, selecting which parameter you would like displayed at each info item position. To change the function that a given item displays, press UP▲ or DOWN▼ until it is selected (the > symbol is to its left), and press SEL▶ to cycle through the available functions.





Repeat this for each info item you'd like displayed. One of the options available is NONE, which prevents that info item from displaying.

Any function that you have selected to be an info item has that fact reflected in its corresponding SENSORS configuration page. In its configuration page (EMS > SETUP > SENSORS > relevant sensor type), a label at the bottom of the menu indicates which info item(s) the parameter is set up to be displayed at.

HS34

The HS34 has 3 general purpose inputs and 4 contact inputs. The data obtained from these inputs can be configured and displayed on any EMS page in the system. In the event of a DSAB or HS34 failure, data obtained from the HS34 inputs will be marked as invalid on screen.

11. APPENDIX

This appendix contains information not covered in the main section of the manual. This section contains reference tools such as a detailed description of the serial data format output by the FlightDEK-D180, a specifications sheet, and a troubleshooting guide. This section also contains details regarding FlightDEK-D180 servicing.

Appendix A: Serial Data Output

The FlightDEK-D180 has two RS232 serial ports: one on the EFIS 25-pin connector and one on the EMS 37-pin connector. Each of these serial ports outputs data for its respective instrument function. Technical information on the installation and connection to these serial ports can be found in the FlightDEK-D180 Installation Guide. To log both EFIS and EMS data, you must connect both serial ports to a PC. This serial data can be logged using any standard serial terminal program such as HyperTerminal®. It can then be parsed into its respective columns by many spreadsheet programs including Microsoft Excel®. All numbers are output in decimal and are standard ASCII. To view the data using a terminal program, the following settings should be used for both serial ports:

Baud rate:	115200
Data:	8 bit
Parity:	none
Stop:	1 bit
Flow control:	none

The following sections detail the format used for both EFIS and EMS data output.



EMS SERIAL DATA OUTPUT

The format for the data sent out the EMS RS232 port follows. General purpose and contact inputs which are sourced from the HS34 are *not* output via the serial stream.

Parameter	ASCII Characters	Units	Example
Zulu Hour	2	Hours	12 (12 hrs)
Zulu Min	2	Minutes	12 (12 mins)
Zulu Sec	2	Seconds	12 (12 secs)
Fraction	2	1/64 of sec	12 (12/64 sec)
Manifold Pressure	4	inHg x 100	1215 (12.15inHg) (using 5/100 increments)
Oil Temp	3	° F	123 (123°F) or -12 (-12°F)
Oil Pressure	3	PSI	099 (99PSI)
Fuel pressure	3	PSI x 10	123 (12.3psi)
Volts	3	volts x 10	123 (12.3V)
Amps	3	amps	012 (12A) or -12 (-12A)
RPM	3	RPM/10	123 (1230 RPM)
Fuel Flow	3	GPH x 10	123 (12.3gph)
Gallons remaining	4	Gallons x 10	1234 (123.4g) or -123 (-12.3g)
Fuel_Level_1	3	Gallons x 10	123 (12.3g)
Fuel_Level_2	3	Gallons x 10	123 (12.3g)
GP_1	8	See table below	3 char label; 5 char data; see GP output table
GP_2	8	See table below	3 char label; 5 char data; see GP output table
GP_3	8	See table below	3 char label; 5 char data; see GP output table



Parameter	ASCII Characters	Units	Example
GP Thermocouple	4	°F	1234 (1234°F) or –123 (-123°F)
EGT_1	4	°F	1234 (1234°F) or –123 (-123°F)
EGT_2	4	°F	1234 (1234°F) or –123 (-123°F)
EGT_3	4	°F	1234 (1234°F) or –123 (-123°F)
EGT_4	4	°F	1234 (1234°F) or –123 (-123°F)
EGT_5	4	°F	1234 (1234°F) or –123 (-123°F)
EGT_6	4	°F	1234 (1234°F) or –123 (-123°F)
CHT_1	3	°F	123 (123°F) or –12 (-12°F)
CHT_2	3	°F	123 (123°F) or –12 (-12°F)
CHT_3	3	°F	123 (123°F) or –12 (-12°F)
CHT_4	3	° F	123 (123°F) or –12 (-12°F)
CHT_5	3	° F	123 (123°F) or –12 (-12°F)
CHT_6	3	° F	123 (123°F) or –12 (-12°F)
Contact_1	1	Boolean	‘0’ or ‘1’ indicating whether the contact is closed or open
Contact_2	1	Boolean	‘0’ or ‘1’ indicating whether the contact is closed or open
Product ID	2	ASCII hex	Internal-use product ID
Checksum	2	ASCII hex	The self-zeroing ascii-hex 2-byte checksum. The sum of the checksum with all preceding bytes produces 0x00.
CR	1		0x13
LF	1		0x10



GP output table

General purpose inputs have a unique format in the data output stream. As shown in the table above, they each have 8 characters. 3 are used as a label for the function; 5 are used for the data. As noted above, general purpose inputs sourced from the HS34 are not included in this table.

Description	Units	Label (3-Bytes)	Example (5-Bytes)
Unused		N/A	XXXXX ('X's are output as place holders)
OAT	°F	OAT	00123 (123 °F) or -0123 (-123 °F)
Carb Temp	°F	CRB	00123 (123 °F) or -0123 (-123 °F)
Coolant Temp	°F	CLT	00123 (123 °F) or -0123 (-123 °F)
Coolant Pressure	PSI	CLP	00123 (12.3 PSI)
Fuel Level 3	Gallons x 10	FL3	00123 (12.3 gal)
Fuel Level 4	Gallons x 10	FL4	00123 (12.3 gal)
CHT		CHT	
Aileron Trim	% of full deflection	TRA	0061 (61%)
Elevator Trim	% of full deflection	TRE	0061 (61%)
Rudder Trim	% of full deflection	TRR	0061 (61%)
Flap Position	°	FLP	00010 (10°)

As an example, the following is one line of EMS data:

```
0012224826351340262441240122631320562191191OAT00090TRE-0061FLP0001020481378139214
061421143514503583533633743843951103D2
```



EFIS SERIAL DATA OUTPUT

The format for the data sent out the EFIS RS232 port is:

Start Char	Width	Description	Notes
1	2	Hour	00 to 23, current Zulu time hour according to FlightDEK-D180's internal clock.
3	2	Minute	00 to 59, current Zulu time minute according to FlightDEK-D180's internal clock.
5	2	Second	00 to 59, current Zulu time second according to FlightDEK-D180's internal clock.
7	2	Fractions	00 to 63, counter for 1/64 second. Data output frequency.
9	1	Pitch Sign	'+' or '-' (positive means aircraft is pitched up).
10	3	Pitch	000 to 900, pitch up or down from level flight in 1/10 degrees (900 = 90°).
13	1	Roll Sign	'+' or '-' (positive means aircraft is banked right).
14	4	Roll	0000 to 1800, roll left or right from level flight in 1/10 degrees (1800 = 180°).
18	3	Yaw	000 to 359 in degrees (000 = North, 090 = East, 180 = South, 270 = West).
21	4	Airspeed	0000 to 9999, airspeed in units of 1/10 m/s (1555 = 155.5 m/s).
25	1	Altitude Sign	'+' or '-' (positive means altitude is above sea-level).
26	4	Altitude	0000 to 9999, altitude in units of meters; alternates between pressure and displayed altitude, depending on status bitmask, starting at character 42.
30	1	Turn Rate/VSI Sign	'+' or '-' (positive means aircraft is turning right). Alternates between turn rate and VSI sign, depending on status bitmask, starting at character 42.
31	3	Turn Rate or VSI	Alternates between turn rate and VSI, depending on status bitmask, starting at character 42. When turn rate, 000 to 999, 1/10 degrees/second rate of yaw change. When VSI, 000 to 999, 1/10 feet/second.
34	1	Lateral <i>g</i> 's Sign	'+' or '-' (positive means aircraft is experiencing leftward lateral acceleration).
35	2	Lateral <i>g</i> 's	00 to 99, lateral <i>g</i> 's in units of 1/100 <i>g</i> (99 = 0.99 <i>g</i> 's).



Start Char	Width	Description	Notes
37	1	Vertical g 's Sign	'+' or '-' (positive means aircraft is experiencing upward vertical acceleration).
38	2	Vertical g 's	00 to 99, vertical g 's in units of 1/10 g (99 = 9.9 g 's).
40	2	Angle of Attack	00 to 99, percentage of stall angle.
42	6	Status Bitmask	A 6-character ascii-hex field representing a 24-bit status bitmask. When the value of bit 0 (LSbit) is 0, the altitude field is displayed altitude, and turn rate is output in characters 30-33. When the value of bit 0 is 1 the altitude field is pressure altitude, and VSI is output in characters 30-33.
48	2	Internal use	Internal use – ignore
50	2	Checksum	The ascii-hex 2 byte sum of all 49 preceding bytes.
52	2	CR/LF	Carriage Return, Linefeed = 0x0D, 0x0A.

As an example, the following is what one line of serial data looks like:

```
00082119+058-00541301200+9141+011-01+15003EA0C701A4<CR><LF>
```

Appendix B: PC Support Program

Dynon offers a free PC Support Program which allows you to upload new firmware and checklists. The latest version of this program is available from our website at www.dynonavionics.com/downloads.

Appendix C: Troubleshooting

See the FlightDEK-D180 Installation Guide Appendix for a variety of troubleshooting tips and solutions. You may also reach us and other active users at our online support forums located at: www.dynonavionics.com/forum/.



Should you experience difficulty with your product that is not solved by reading the troubleshooting section or by posting on our forum, please call us at (425) 402-0433 or email us at support@dynonavionics.com. Be sure to have the FlightDEK-D180's firmware version number ready when you contact us. To locate your product's firmware version, refer to the Check firmware version section on page 5-11.

See the following list of alert messages displayed by the FlightDEK-D180. The list provides information about what they mean and what to do about them.

ALERT MESSAGES

The following table describes the error/warning messages that the FlightDEK-D180 could display. The meaning of the message is given here as well as information about what conditions clear the alert.

Alert Message	Meaning	End condition
POWER DOWN IN 30 SECS.	This alert appears when master switch power has been switched off but either the internal or the external emergency batteries are still connected. If no button is pressed within 30 seconds of when the alert appears, the unit turns off. The voltmeter also appears to show you the currently measured battery voltages prior to the unit turning off.	If any button is pressed, the alert disappears and the unit stays on. This causes the unit to continue full operation on battery power. The internal battery is rated for a minimum of 1.5 hours when fully charged. If no button is pressed within 30 seconds, the unit enters an extremely low-power mode.
INTERNAL BATTERY LOW	This alert is displayed when operating the unit solely off the internal backup battery and its voltage drops below 13V. Additionally, the voltmeter is displayed onscreen. When you see this alert, it is advisable that you turn the unit off by pressing and holding the leftmost button when no menus are displayed.	The alert is cleared when you press any button; however, it is advised that you do not ignore this alert, as it appears when the unit's internal battery has very little life left. This alert is also cleared upon the application of either the external backup battery or master switch power. At that point, the battery begins charging off the external power.



Alert Message	Meaning	End condition
HORIZON RECOVERING...	This alert is displayed anytime the unit is rotated at a rate faster than 150 degrees/second. Rotating the unit faster than this threshold overloads the sensors, leading to a potentially erroneous display. When this alert is displayed, the horizon indication turns grey and black to indicate that the artificial horizon is not currently a trusted source. This alert can only be triggered when airspeed is non-zero; using the FlightDEK-D180 on the bench will not trigger this alert.	Pressing the ACK button removes the text of the alert. However, the horizon indication remains grey/black until the unit has resumed normal operation. Once the unit detects relatively coordinated flight, it usually recovers within 5 seconds.
HOLD TO POWER DOWN	This alert appears when you have pressed the POWER button in Main Menu 1. If the button is held for 2 seconds, the unit turns off.	Releasing the POWER button causes the alert to disappear, allowing the unit to continue normal operation.
TEMPERATURE OUT OF SPEC	This alert appears when the ambient temperature sensed by the unit is below -30°C or above 50°C. The sensors in the unit have a certain temperature range within which they are specified to operate normally. If they operate outside this temperature range, the attitude result can be compromised. When the temperature is too high or low, the horizon indication turns to grey/black to indicate the potential unreliability of the sensors.	The text portion of the alert disappears when you press any of the buttons. However, the horizon will not display blue/brown until the unit senses temperature within its specified range. If ambient temperature is above 50°C, the unit always displays the horizon as grey/black. However, if ambient is below -30°C, it is possible that the unit can heat itself up enough to operate normally.
TIMER EXPIRED	This alert appears when you have a down timer enabled and it has reached 0. When this occurs, the up timer menu displays and the timer display flashes.	Pressing the ACK button removes the alert and stops the timer's flashing. However, you must press STOP in the Up Timer menu to stop the up timer. This allows you to see how much time has elapsed since the down timer has expired.



Alert Message	Meaning	End condition
OAT SENSOR NOT DETECTED	This alert appears when the FlightDEK-D180 has an OAT connected and then loses that connection for some reason. Either the EDC-D10A has become disconnected, or the OAT sensor itself has become disconnected from the EDC-D10A.	Double-check your wiring between the FlightDEK-D180 and the EDC-D10A as well as that of the OAT sensor.
REMOTE COMPASS NOT DETECTED	The FlightDEK-D180 is unable communicate with the EDC-D10A. If you have an OAT connected to your EDC-D10A, it will not be displayed either.	Ensure that you a) have an EDC-D10A installed and b) have verified that the wiring to the EDC-D10A is correct. Please see the FlightDEK-D180 Installation Guide for more information on verifying the installation of the EDC-D10A. This error also can appear if you have updated the firmware in your FlightDEK-D180 while the remote compass was <i>not</i> connected. If this is the case, try uploading the new firmware again with the EDC-D10A connected. Attempt the connection within the first few seconds of operation. Note that the FlightDEK-D180 does not have internal magnetic sensors and thus <i>requires</i> the EDC-D10A be connected.
TEMPERATURE UNSTABLE	When the unit is turned on after having been off for a long period, its internal temperature rises above ambient at a fast rate. This fast change in temperature can sometimes reduce the reliability of the output of the sensors. Therefore, this alert is displayed and the horizon indication is changed from blue/brown to grey/black.	The alert is cleared when you press any of the buttons. The screen remains grey and black until the temperature within the unit has stabilized. This temperature instability should last no longer than 2 minutes. For this reason, it is a good idea to turn the unit on before you run through any of the preflight procedures, so that it will be ready by the time you are ready to fly.



Alert Message	Meaning	End condition
INTERNAL ERROR SERVICE UNIT	This error can occur for a few reasons, including an aborted upload.	When this error appears, it may be possible to recover your unit in the field. The best way of ensuring this is to call Dynon Avionics immediately. However, there is a good possibility that the unit will have to be returned for service.



Appendix D: FlightDEK-D180 Specifications

Mechanical	Mounting:	6.95" wide x 4.90" tall x 4.51" deep (177 x 125 x 115 mm)
	Weight:	3 lb. (1.36 kg)
		3 lb. 6 oz. (1.6 kg) with internal battery
Operating Temperature		-22° to 122° F (-30° to 50° C)
Power	Voltage:	10 - 30 Vdc
	Power:	14 watts typical; 26 watts maximum
Connections	Wiring:	D-25 male, D-25 female, & D-37 male connectors
Screen	Type:	AMLCD, TFT (Thin Film Transistor)
	Backlight:	400 nits or 800 nits
	Size:	7.0" diagonal (178 mm)
	Resolution:	854 x 480 color pixels



Sensor Inputs

- 6 - EGT (Type K Thermocouple)
 - 6 - CHT (Type J Thermocouple)
 - 2 - Fuel Level (Resistive or Capacitance with 5 volt output)
 - 2 - RPM (P-lead or pickup)
 - 2 - Contacts
 - 1 - Manifold Pressure (voltage)
 - 1 - Oil Temperature (Resistive)
 - 1 - Oil Pressure (Resistive)
 - 1 - Fuel Pressure (Resistive)
 - 1 - Fuel Flow (Frequency)
 - 1 - Current (Shunt)
 - 1 - Voltage (from supply power)
 - 3 - General Purpose (Either resistive or voltage for OAT, Fuel Tanks 3&4, Coolant Temp, Coolant Press, Carburetor Temp, Flaps, Trim)
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Inputs/Outputs

- 1 - Alarm Light Contact
 - 2 - Audio Alarm
 - 1 - RS-232 bidirectional PC communication or external data input
 - 1 - RS-232 data input (GPS, SL30, etc.)
 - 3 - Dynon Smart Avionics Bus (DSAB)
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