MKV-A BOSS User's Manual

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1. Introduction

This document provides information on the use of the Honeywell BOSS program which is a software tool used in troubleshooting and checkout of aircraft installations of the Honeywell MKV-A Enhanced Ground Proximity Warning System (EGPWS).

1.1 Effectivity

This user's guide is effective for BOSS Version main\64, PN SWT69000940-554.

1.2 Reference Documents

PDS69000940-000	Product Specification for MKV-A EGPWS

2 Overview

The EGPWS provides an Ethernet port connection that can be used to access internal data from the EGPWS. In addition to internal data, other items such as unit configuration and flight history can also be viewed using a personal computer (PC).

A PC terminal emulator program called BOSS is used to access information in the EGPWS. BOSS runs on any PC with Windows XP or higher and communicates with the EGPWS by an Ethernet cable connection.

BOSS has two basic modes of operation, Terminal Mode and Data Display Mode. Terminal Mode is used to send EGPWS commands and receive data responses. Signals (data) can be seen in real-time using the Data Display Mode. Data Display Mode can be used to assist in the system checkout when using an appropriate command file.

3 Installing BOSS

BOSS is available for free of charge download from the following website:

http://www51.honeywell.com/aero/common/documents/egpws-documents/instalinfo-documents/diagrams-documents/Boss.zip

Honeywell recommends a Win7 PC running WinBOSS software (software provided by Honeywell). As it is a Windows PC, the guidance regarding virus/malware would be same as for any PC. The Boeing standard corporate IT guidance can be used, or airlines can follow their own internal IT policies on this matter. There are no known adverse interactions between WinBOSS and, for example, McAfee products, LANdesk, ePolicyOrchestrator, or Microsoft System Center. Additional information may appear in the Line Maintenance Manual.

Protecting the computer

The following techniques should be used to help protect your computer against potential security threats:

- **Install/Enable a Firewall.** A firewall protects the computer by preventing hackers or malicious software from gaining access to it.
- **Install Virus protection.** Antivirus software protects the computer against viruses, worms, and other security threats. Make sure the software is up to date and that the computer is scanned periodically.
- **Install Spyware and other malware protection.** Antispyware software protects the computer from spyware and other potentially unwanted software.
- **Keep Windows Up to date.** Windows can routinely check for updates for your computer and install them automatically.

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- **Install latest browser and enable browser security features.** Browsers contain security features to protect the computer.
- **Use a Standard User Account.** Prevents tampering with computer's security settings or changing other user accounts.
- **Use caution with email and web sites.** Only open emails, web sites, and download files from trusted sources.
- **Don't leave computer unsecured.** Lock the computer to prevent others from accessing the computer. Ensure that the computer will automatically lock when idle for too long.
- **Be cautious when using external storage devices.** USB memory devices can contain malware. Ensure they are safe before connecting them to the computer.

This process describes how to install the object media.

Prerequisites:

The below instructions assumes that the Test Station PC has the following:

a) Windows XP, 7, or 8 operating system

b) Winzip (9.0 or later)

c) Logged on the PC with an account with Administrator-level access rights. (This is needed to do the necessary install steps.)

If all prerequisites are met, then proceed with one of the following options:

Unzip all files from **Boss.zip** to the **C:\BOSS** directory using WinZip.

NOTE: The instructions below provide at least one method to perform the desired action. In some cases alternates methods may exist. Also in some cases the instructions are for Windows XP or Windows 7. In some cases names and selections vary slightly between these 2 Windows operating systems. It is expected that the installer will have enough knowledge of Windows to adapt to these difference to accomplish the general desired outcome.

In addition, the instructions are based on the files being placed in the C:\BOSS folder. If the files are in another directory, then it is expected that the installer will adjust accordingly for those changes.

It is recommended that you setup a BOSS shortcut on your PC's desktop. To accomplish this do the following:

1) Right Click on the Desktop.
2) Select "New\Shortcut".
3) On the next screen Browse to the **C:\BOSS\B32pc.exe**.
4) Click next and finish to create the shortcut

3.1 Ethernet Port Setup

On the PC, it is necessary to setup up the Ethernet ports used to communicate with the EGPWS system. The EGPWS uses a static IP address of 192.168.14.99. It is necessary to configure the PC Ethernet port to work with that IP address. It is recommended that a second Ethernet port be added to the PC to accomplish this if the standard one is being used for network access, but it is not required.

1) Click Start\Settings\Network connections.
2) Select the network connection which is going to be connected to the Debug port on the LRU.
3) Right Click and select properties.
4) In the "This connection uses the following items:"
5) Remove Check marks from all items except "Internet protocol (TCP/IP)"
6) Select Internet Protocol (TCP/IP) and press the "Properties" button.

7) Enter the static IP address
    a. Select "Use the following IP address:"
    b. IP address: 192.168.14.102
    c. Subnet mask: 255.255.255.0
    d. Default gateway: blank
8) Select OK
9) Select OK

3.2 Configure BOSS

There are some default values that should be set for BOSS to run correctly on a station.

1) Start BOSS via the shortcut.
2) Select Options\Port Setup…
3) Select Socket 2 for the Default channel for Term.
4) Select the Sockets 1-4 tab.
5) For Socket 1 enter an address of 192.168.14.99 and a port of 9013.
6) For Socket 2 enter an address of 192.168.14.99 and a port of 9014.
7) For Socket 3 enter an address of 192.168.14.99 and a port of 1012.
8) Select OK.

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3.3 Windows XP Firewall Configuration

BOSS is reliant on Ethernet communication on standard and non-standard ports. The Windows firewall tends to consider this activity as intrusion attempts and will interfere with them.

The following tools have issues with the Windows Firewall and need to be allowed access through the firewall.

In general when the program is run for the first time, windows may ask if the program is allowed or not. If this happens, then select all three boxes.

NOTE: Windows tracks the location of a program, so if a program (like BOSS) is run from multiple locations, then windows may block one of them but allow the other access. Therefore, it is important to make sure if multiple locations are expected to be used, that the program is executed from each of those locations.

Once the program has run the following instructions may be used to allow or modify the programs ability to pass through the firewall. The following steps may be a verification step rather than a modification.

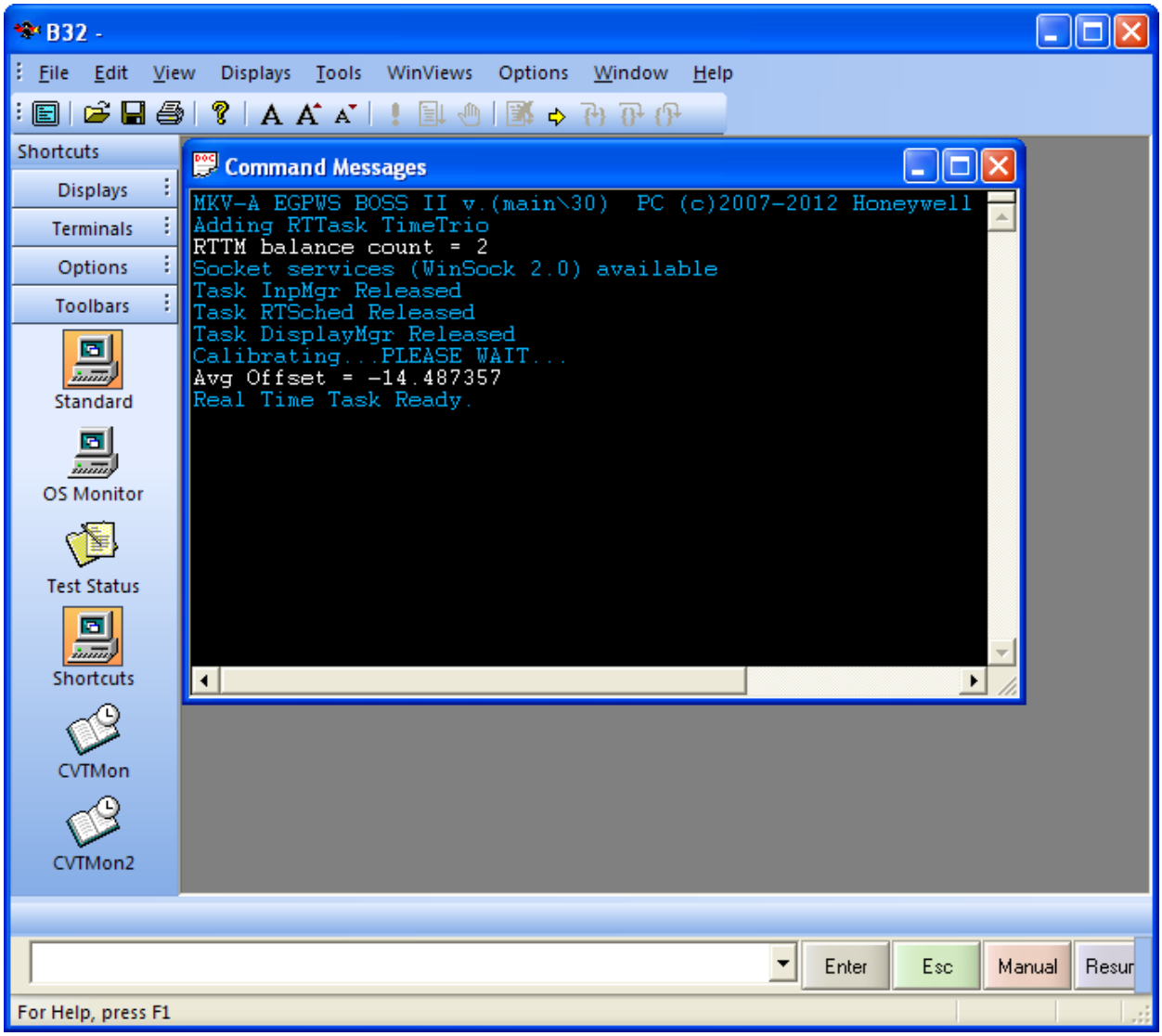
Before executing these instructions make sure to execute BOSS.

Execute the following instructions to configure Windows firewall.

1) Open the Control Panel->Security Center->Windows Firewall\Allowed Programs.
2) Enable BOSS access
    a. Find MKV-A EGPWS BOSS II
    b. Check all three boxes for any that appear in the list.
    c. Find b32pc.exe
    d. Check all three boxes for any that appear in the list.
    e. Press OK

4 Using BOSS

Start BOSS by clicking the shortcut created or by executing the executable **C:\BOSS\B32pc.exe** . It will come up with a screen similar to this:

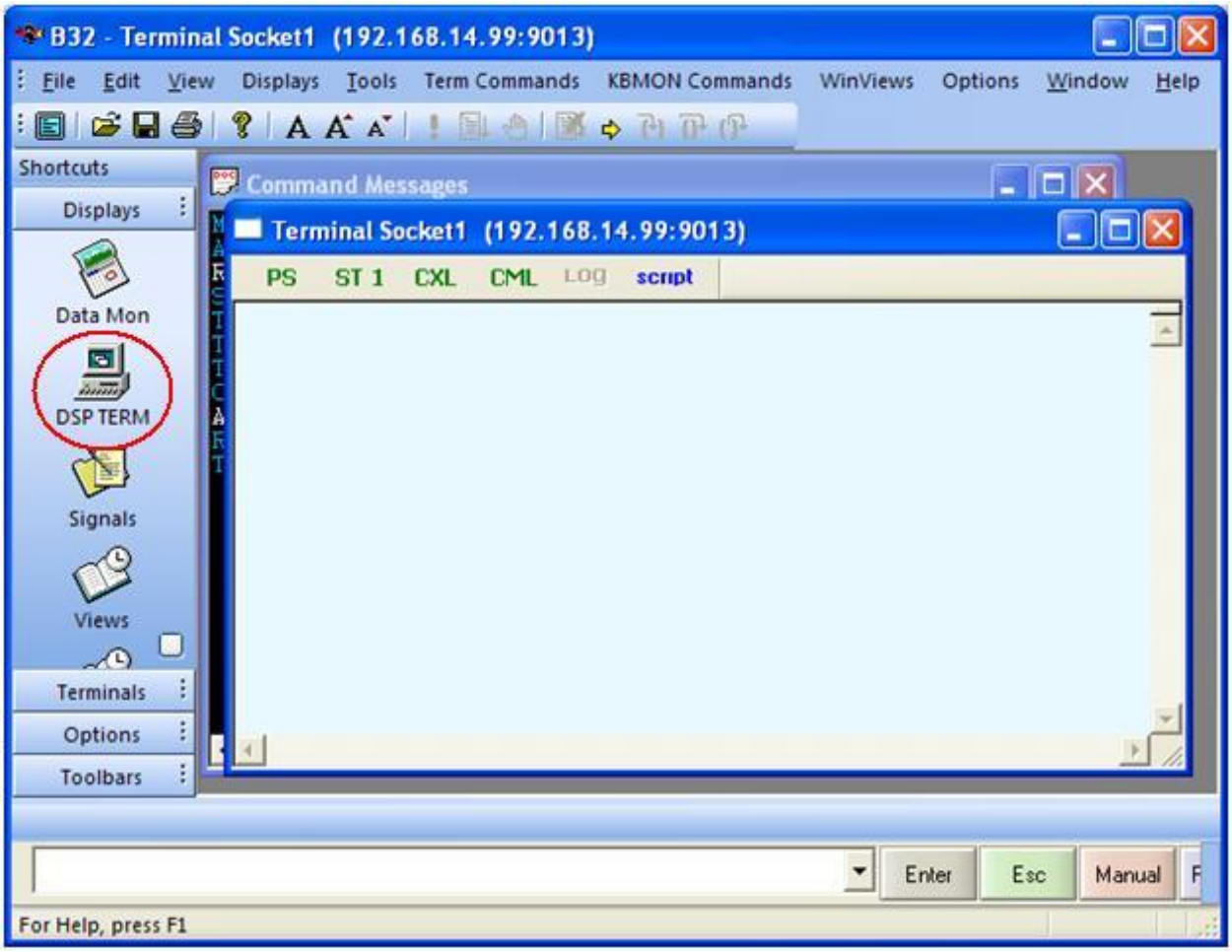


IMPORTANT NOTE: The MKV-A EGPWS will ***reset*** when the Etherent port cable is physically attached or removed from the LRU. This is intentional as per the requirements for the EGPWS system.

4.1 Terminal Mode

Terminal Mode is the primary mode of using BOSS to query the EGPWS signals. While in Terminal Mode, the user receives a command prompt ">" from the EGPWS whenever it is ready to receive a command. The user can enter a command by selecting it from the drop-down "Commands" menu or by typing it in after the prompt. This command will be sent to the EGPWS. The EGPWS will respond to the PC with the requested information.

The easiest way to launch Terminal Mode is to use the short cut toolbar on the left of the screen, Select Displays, and then DSP Term. This will bring up the terminal window as shown below:



This information can be viewed on the PC or recorded as a text file for later review.

While in Terminal Mode, it is also possible to send the EGPWS a list of signals from a command file or a list of commands from a script file. Command files contain a list of signal names that are sent to the EGPWS so that the values can be viewed. Similarly, script files contain a list of commands to be sent to the EGPWS for processing.

With the terminal window active, many of the common terminal commands are available on the terminal windows toolbar.

PS button: Generates a Present Status command (PS\n).
ST 1 button: Generates a self test command (ST 1\n).
CXL button: List the available CVT items (CXL\n).
CML button: Lists the selected CVT items (CML\n).
Script button: Load script, select script via dialog box.

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4.1.1 Present Status

Usually it is best to begin by checking Present Status; type **PS** and press Enter. An example is shown below for a MK V EGPWS. The following text will appear on the PC.

Note If the text overruns one screen height, the message "Press to Continue (Y/N)" will appear at the bottom of the screen. Press Y to continue scrolling down.

```
> PS
  EGPWC CONFIGURATION:
    PART NUMBER:                                69000942-001
    MOD STATUS:                                 0
    SERIAL NUMBER:                              MK5A-00251

    SOFTWARE VERSION:                           01.01
    TERRAIN DATABASE VERSION:                   469
    ENVELOPE MOD DATABASE VERSION:              B07
    BOOT CODE PART NUMBER:                      69001906-001

  CURRENT FAULTS:

    NO FAULTS

    ----------
    Terrain Awareness - Weather Radar 1 Off
    Terrain Awareness - Weather Radar 2 Off

  CURRENT CONFIGURATION:
    Aircraft Type                           = 30
    Audio Menu                              = 0
    Altitude Callout Menu                   = 0
    Optional Inputs Selected
    Dual ILS Selected

  RAW PROGRAM PIN STATES:
    Program Pin  1 (TP-10A) = 7 (TP-12A)
    Program Pin  2 (TP-10B) = 4 (MP-03D)
    Program Pin  3 (TP-10C) = 1 (Open)
    Program Pin  4 (MP-04D) = 1 (Open)
    Program Pin  5 (MP-04B) = 1 (Open)
    Program Pin  6 (MP-08A) = 1 (Open)
    Program Pin  7 (MP-14D) = 2 (Ground)
    Program Pin  8 (MP-05A) = 1 (Open)
    Program Pin  9 (MP-02C) = 5 (MP-07B)
    Program Pin 10 (MP-04A) = 1 (Open)
    Program Pin 11 (MP-04C) = 1 (Open)
    Program Pin 12 (TP-05B) = 1 (Open)
    Program Pin 13 (MP-05B) = 1 (Open)
    Program Pin 14 (TP-02C) = 1 (Open)
    Program Pin 15 (MP-15C) = 1 (Open)
    Program Pin 16 (MP-08B) = 1 (Open)
    Program Pin 17 (TP-06D) = 2 (Ground)
    Program Pin 18 (MP-15A) = 1 (Open)
    Program Pin 19 (MP-15B) = 1 (Open)
>
```


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4.1.2 Other Commands

Below is an alphabetical list of commonly used commands. To see a list of all commands, type **HELP** or **?**, then press Enter.

CXR <CVT Item> - output CVT Item's value

Example "CXR RawPitch1" will list current value of #1 Pitch source (in degrees)

Note: For a list of common CVT Items, see Section 5 of this document

CXL <CVT Item or partial name> - list matching CVT Items

Example "CXL GPS" will return all CVT Items with string GPS in their name

COV <CVT Item> <value> - overwrite CVT Item's value

Example "COV TerClr 750" will set computed terrain clearance to 750 feet

Note: When using the COV command, the COMPUTER STATUS LED on the EGPWS front panel will change from green to red to indicate a software value has been overwritten. The overwrite is temporary and will not be retained after power to the EGPWC is cycled (ON-OFF-ON).

COD <CVT Item or ALL> - clear overwrite of specific or all CVT Items

Example "COD TerClr" will return computed terrain clearance to normal processing

Note: When the COD ALL command is issued, the COMPUTER STATUS LED on the EGPWS front panel will return to its normal state.

FHE	- Flight history erase (will verify and reboot)
FHF	- Output flight fault history
FHG	- Output ground history
FHI	- Output INOP history
FHS	- Output status history
FHW	- Output Warning history
ST <1-6,L, or C>	- Perform SelfTest 1-6 (L=Long Level 1; C=Cancel)
VOI <word>	- Voice a word (if word unknown it will be spelled)

4.2 Script Files

Script files are files with *.SCR or *.BTS extension which contain a list of commands to be sent to the EGPWS. Script files can be created using a text editor. A sample script file is shown below. This file will set the EGPWS position to near Seattle, Washington, at an altitude of 12,000 feet, heading true north, with a groundspeed of 200 knots. The display range will be forced to 300 nautical miles:

```
COV PosUncert 0
COV TAWxRng1 300
COV TACAlt 12000
COV TALatude 47
COV TALngude –122
COV TATruHd 0
COV TATruTrk 0
delay 4000
COV TAGndSpd 200
```

The delay statement is not an EGPWS command and is not sent to the EGPWS. Instead, the "delay 4000" command causes BOSS to wait 4000 ms (4 seconds) before sending the next command.

The following commands are available to start a command script:

Include script.bts

Use script script.bts

4.3 Command Files

Ground testing of EGPWS typically uses BOSS in Data Display Mode to view and verify all EGPWS inputs. The EGPWS inputs are defined by Current Value Table (CVT) Items. While in Terminal Mode, it is possible to send the required list of CVT Items to the EGPWS for real-time display. This is called loading a Command file and must be done prior to using the real-time Data Display Mode.

Command files are text files with the *.CMD extension which contain a list of CVT Items to be sent to the EGPWS. Command files can be created using a text editor. Sample command files are typically found in an appendix to the applicable ground test procedure. Sample command files for ground and flight testing are found on the EGPWS website.

A brief sample Command File is shown below:

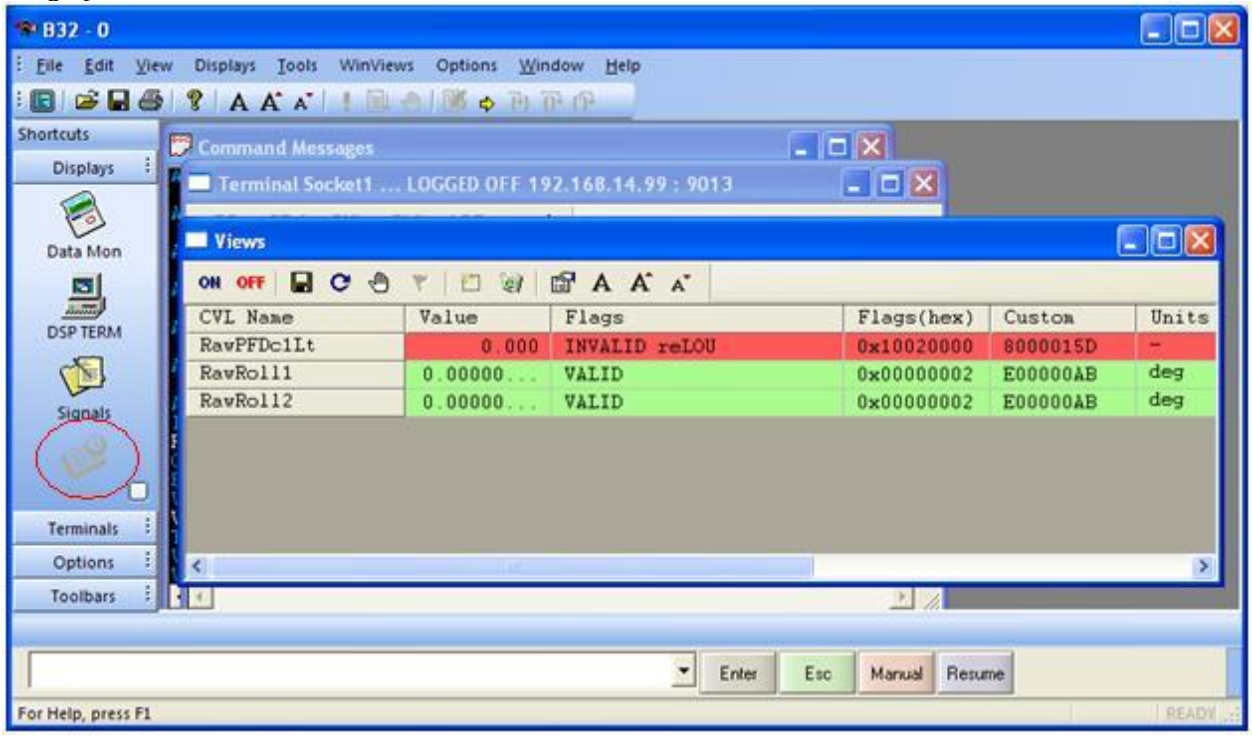
RawRA1
RawBAlt1
AGS1Val

The first string is the CVT Item (example RawRA1 is the raw radio altitude from the #1 source). After a space, the second string is optional (to make it compatible with previous versions of WinViews and BOSS) with contains a combination of the letters V, C, and/or F, and were used to signifying if the user wishes to examine the Value, Custom and/or Flag field of the preceding CVT Item. Now this field is ignored and all three values are provided.

4.4 Data Display Mode(Views)

Data Display Mode is a real-time display of selected signals (data) in the EGPWS. The available function keys are listed on the screen during Data Display Mode.

The Data Display Mode in BOSS is called a “views” window. To start a views window the easiest way is to select the “Views” toolbar button on the Shortcuts menu on the left hand side. When done it will bring up a window as shown below



The values shown are CVTs internal to the EGPWC and are constantly being updated based on information from the EGPWC. It includes information like the name, value, flags, custom value, and the

units of the CVT. Color coding is used to visually help understand what signals are valid (green) or invalid (red).

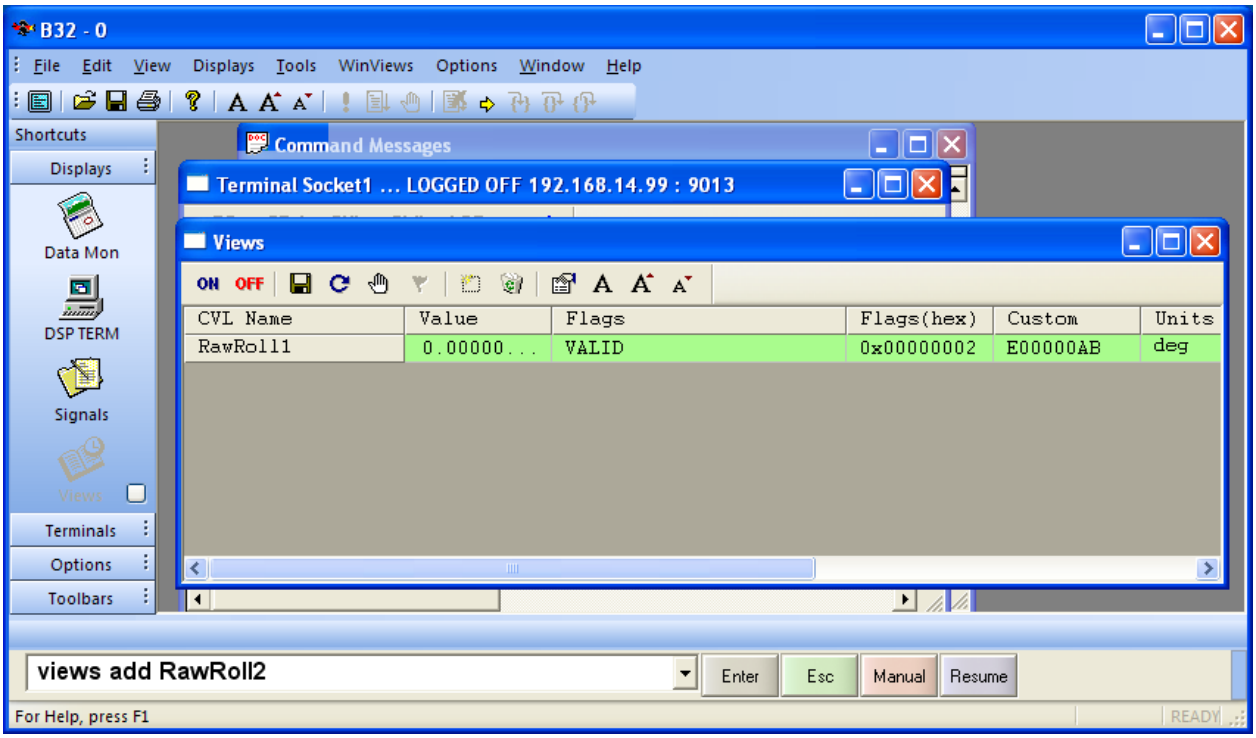
The toolbar on the Views Window provides access to much of the functionality provided by WinVIEWS. Toolbar help is provided to guide the user on what the various button will do.

The data viewed in Data Display Mode may be recorded for later analysis. A history file with a * .HST extension is used to log the data.

Listed below are some of the more useful ones.
"Disc" icon: Press to start recording data history.
"Hand" icon: Pause\Resume recording history.
Dotted Box: Add CVT to window individually or via a file containing a list of CVTs (a BOSS command file).
When the view is active the "WinVIEWS"\"Data Mode…" on the main menu provide additional functionality control related to data mode logging.

In addition CVT items can be added to the views window by typing the following in the text box at the bottom of the B32pc window:
Views add <cvt name>

See below for an example:



4.5 Recording History Files

History files contain a log of all the data passing through and all the messages generated by the software.

The full History File name can be specified by the operator, or just the base name can be given, in which case the software will generate a numbered file extension. These take the form of .H00, .H01, .H02, etc.

History files are nearly identical to the BOSS Data files in format. The difference is that the History file contains periodic sample of the BOSS II CVT with only changes saved. Additionally, the History file contains all the messages from the point the History file was opened until it was closed. The history task

scans the BOSS II CVT at a periodic rate specified by the configuration parameter "/hst=<millisecond scan period>" from the BTS.

A typical way to start a history file is to include a command in a script file. The following command is used to start a history file:

USE HIST <filename>

If no extension is specified, then .Hxx will be added to the file name where Hxx is the next number in sequemce. The normal externsion sequence is H00, followed by H01, H02, etc… If a file already exists with the .Hxx, then BOSS will select the next Hxx extension that does not already exist. If H99 is reached, then BOSS would cycle back to H00. If the file size exceeds ~1.4G, then the current history file will be closed and a new file started with the next available file extension. The file will be in the stored in BOSS's current working directory.

It is important to note that if an extension is specified and that file already exists, then the file will be erased and a new (empty) file created. Also, if an extension other than Hxx is specified, if BOSS reaches the file limit, it will erase the file and start recording again (losing all the previously recorded data).

The following command is used in the script or at the command prompt to stop recording history data to the history file

DEL HIST

Which data items are recorded in the history file can also be controlled with the following commands. By default everything is recorded in the history file. So the first command is to turn off everything being recorded as follows:

LOG * NONE

Then issue the following command for every data item that is desired to be recorded.

LOG <signal name> [VCF (default is 'VF')]

The 'V' indicates to record the value of the singal, 'C' for custom value, and 'F' for the flags fields of the signal. These fields can be used in combination so "VF" could be used to get both the value and the flags recorded.

4.5.1 Example

The following shows an example command or BTS file that creates a view, adds a few signals to the view, and creates a history file to log those signals to a log file. See section 5 for a list of signals. A script file is an ASCII text file and can be edited with any simple text editor like Windows Notepad or Wordpad.

```
//*************************************************************
// Set up the history file.
//*************************************************************
/NOSTATS                    // Turn off printing of statistics
```

```
USE HIST Test1                  // Start a history file named Test1.Hxx
LOG * NONE                      // Turn off logging of all signals
USE VIEWS                       // Start views interface

VIEWS SET RATE 1000             // Set View update rate to  1 second
VIEWS STOP                      // Stop updates while adding signals

views add RawBCAlt1             // Add required signals
views add RawPitch1 VF          // Value and flags
views add RawRoll1  V C         // Value and custom field
views add RawGAlt1


VIEWS START                     // Start the views running again

// log these signals to the history file

log RawBCAlt1
log RawPitch1
log RawRoll1
log RawGAlt1
```

Assuming the above file was named RecordAlt.bts, the following command would be used to execute the script file

INCLUDE RecordAlt.bts

When desired, the log file can be stopped by simply closing BOSS or issuing the following command.

DEL HIST

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5 CVT Items(by function)

The following is a list of the CVTs grouped by function.

5.1 Acceleration signals

CVT Item	Description (units)
RawLngAcc1	Raw body longitudinal acceleration from #1 IRS (g's)
RawLngAcc2	Raw body longitudinal acceleration from #2 IRS (g's)
RawNrmAcc1	Raw normal longitudinal acceleration from #1 IRS (g's)
RawNrmAcc2	Raw normal longitudinal acceleration from #2 IRS (g's)

5.2 Airspeed signals

CVT Item	Description (units)
RawCAS1	Raw computed airspeed from #1 source (knots)
RawCAS2	Raw computed airspeed from #2 source (knots)
RawTAS1	Raw true airspeed from #1 source (knots)
RawTAS2	Raw true airspeed from #2 source (knots)

5.3 Altitude signals

CVT Item	Description (units)
RawBAlt1	Raw barometric (uncorrected) altitude from #1 source (feet)
RawBAlt2	Raw barometric (uncorrected) altitude from #1 source (feet)
RawBCAlt1	Raw barometric corrected altitude from #1 source (feet)
RawBCAlt2	Raw barometric corrected altitude from #2 source (feet)

5.4 Altitude Rate signals

CVT Item	Description (units)
RawBaroRt1	Raw barometric altitude rate from #1 (feet/minute)
RawBaroRt2	Raw barometric altitude rate from #2 (feet/minute)

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5.5 Angle of Attack signals

CVT Item	Description (units)
AAOA1Val	Analog angle of attack #1 validity (1=valid)
AAOA2Val	Analog angle of attack #2 validity (1=valid)
RawAAOA1	Raw analog angle of attack from #1 source (degrees)
RawAAOA2	Raw analog angle of attack from #2 source (degrees)
RawAOA1	Raw digital angle of attack from #1 source (degrees)
RawAOA2	Raw digital angle of attack from #2 source (degrees)

5.6 Attitude signals

CVT Item	Description (units)
RawPitch1	Raw pitch angle from #1 source (degrees)
RawPitch2	Raw pitch angle from #2 source (degrees)
RawRoll1	Raw roll angle from #1 source (degrees)
RawRoll2	Raw roll angle from #2 source (degrees)

5.7 Audio signals

CVT Item	Description (units)
CalloutEnb	State of Mode 6 altitude callouts enable discrete input (1=active)
M6LwVolDsc	State of Mode 6 low volume discrete input (1=active)
AudInhDsc	State of Audio Inhibit discrete input (1=active)
MomAudSup	State of Momentary Audio Suppress discrete input (1=active)

5.8 Cockpit Switch signals

CVT Item	Description (units)
GSCan	State of momentary Glideslope Cancel discrete input (1=depressed).
GPWInop	State of GPWS INOP lamp (1=on)
LandFlDsc	State of the alternate action flap override discrete input (1=active)
StpAppEnb	State of steep approach enable input discrete #1 (1=activated)
StpAppSel	State of steep approach select input discrete #1 (1=activated)
TA_NotAvail	State of Terrain INOP lamp (1=inop)
TerrDis	State of the Terrain Inhibit discrete input (True=inhibited)
TerrSel1	State of the momentary Terrain Select switch #1 (3=activated, 2=non-activated)
TerrSel2	State of the momentary Terrain Select switch #2 (3=activated, 2=non-activated)
WSINOP	State of Windshear INOP lamp (1=inop)

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5.9 Course signals

CVT Item	Description (units)
RawSelCrs1	Raw digital selected course from #1 source (degrees)
RawSelCrs2	Raw digital selected course from #2 source (degrees)
RawSelCrs3	Raw digital selected course from #3 source (degrees)
RawSelCrs4	Raw digital selected course from #4 source (degrees)

5.10 Display signals

CVT Item	Description (units)
TAWxRng1	Weather radar range from #1 range controller (nautical miles)
TAWxRng2	Weather radar range from #2 range controller (nautical miles)
TerrDispLt	Indicates when terrain is being displayed on the Left Display (1=displayed)
TerrDispRt	Indicates when terrain is being displayed on the Right Display (1=displayed)
RawPFD1	Raw PFD word from #1 IOC source (no units)
RawPFD2	Raw PFD word from #2 IOC source (no units)

5.11 Flap Angle signals

CVT Item	Description (units)
FlapPos1	State of flap position #1 discrete input (1=active)
FlapPos2	State of flap position #2 discrete input (1=active)
FlapPos3	State of flap position #3 discrete input (1=active)
FlapPos4	State of flap position #4 discrete input (1=active)
LandFlDn	State of the landing flaps (1=down, 0=up)
LandFlDsc	State of the landing flaps (or flap override) discrete input (1=active)
LandFlFAng	Flap angle computed from digital or discrete flap position inputs (degrees)
RawFlpAng1	Raw digital flap angle from #1 source (degrees)
RawFlpAng2	Raw digital flap angle from #2 source (degrees)

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5.12 FMS signals

CVT Item	Description (units)
RawFGSpd1	Raw ground speed from #1 FMS source (knots)
RawFGSpd2	Raw ground speed from #2 FMS source (knots)
RawFLat1	Raw latitude from #1 FMS source (degrees)
RawFLat2	Raw latitude from #2 FMS source (degrees)
RawFLng1	Raw longitude from #1 FMS source (degrees)
RawFLng2	Raw longitude from #2 FMS source (degrees)
RawFMHd1	Raw magnetic heading from #1 FMS source (degrees)
RawFMHd2	Raw magnetic heading from #2 FMS source (degrees)
RawFMTk1	Raw magnetic track angle from #1 FMS source (degrees)
RawFMTk2	Raw magnetic track angle from #2 FMS source (degrees)
RawFMVar1	Raw magnetic variation angle from #1 FMS source (degrees)
RawFMVar2	Raw magnetic variation angle from #2 FMS source (degrees)
RawFTHd1	Raw true heading angle from #1 FMS source (degrees)
RawFTHd2	Raw true heading angle from #2 FMS source (degrees)
RawFTTk1	Raw true track angle from #1 FMS source (degrees)
RawFTTK2	Raw true track angle from #2 FMS source (degrees)
TANvMode1	FMS Nav mode (typically label 266) from #1 source – 0=Dead Reckoning, 1=Inertial, 2=VOR-DME, 3=GPS, 4=DME-DME, 5=VLF/Omega, 6=VLF/Omega/Inertial, 7=no nav source is selected, 8=nav mode not configured
TANvMode2	FMS Nav mode (typically label 266) from #2 source – 0=Dead Reckoning, 1=Inertial, 2=VOR-DME, 3=GPS, 4=DME-DME, 5=VLF/Omega, 6=VLF/Omega/Inertial, 7=no nav source is selected, 8=nav mode not configured

5.13 Gear signals

CVT Item	Description (units)
LandGrDn	State of the landing gear (1=down, 0=up)
LandGrDsc	State of the landing gear (or gear override) discrete input (1=active)

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5.14 Glideslope signals

CVT Item	Description (units)
AGS1Val	Analog glideslope deviation #1 validity (1=valid)
AGS2Val	Analog glideslope deviation #1 validity (1=valid)
GSFront	Mode 5 valid glideslope front course (1=active)
GSInh	State of glideslope inhibit discrete input (1=active)
ILSTuned1	State of ILS #1 tuned discrete input (1=active)
ILSTuned2	State of ILS #2 tuned discrete input (1=active)
RawAGS1	Raw analog glideslope deviation from #1 source
RawAGS1	Raw analog glideslope deviation from #2 source
RawGS1	Raw digital glideslope #1 source (DDM)
RawGS2	Raw digital glideslope #2 source (DDM)
RawGS3	Raw digital glideslope #3 source (DDM)
RawGS4	Raw digital glideslope #4 source (DDM)

5.15 GPS signals

CVT Item	Description (units)
RawGAlt1	Raw altitude from #1 GPS source (feet)
RawGAlt2	Raw altitude from #2 GPS source (feet)
RawGGSpd1	Raw ground speed from #1 GPS source (knots)
RawGGSpd2	Raw ground speed from #2 GPS source (knots)
RawGLat1	Raw latitude from #1 external GPS source (degrees)
RawGLat2	Raw latitude from #2 external GPS source (degrees)
RawGLng1	Raw longitude from #1 external GPS source (degrees)
RawGLng2	Raw longitude from #2 external GPS source (degrees)
RawHDOP1	Raw horizontal dilution of precision from #1 GPS source (no units)
RawHDOP2	Raw horizontal dilution of precision from #2 GPS source (no units)
RawHFOM1	Raw horizontal figure of merit from #1 GPS source (nautical miles or meters)
RawHFOM2	Raw horizontal figure of merit from #2 GPS source (nautical miles or meters)
RawHIL1	Raw horizontal integrity limit from #1 GPS Source (nautical miles)
RawHIL2	Raw horizontal integrity limit from #2 GPS Source (nautical miles)
RawVFOM1	Raw vertical figure of merit from #1 GPS source (feet or meters).
RawVFOM2	Raw vertical figure of merit from #2 GPS source (feet or meters).

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5.16 IRS/AHRS signals

CVT Item	Description (units)
RawIAlt1	Raw inertial altitude from #1 IRS source (feet)
RawIAlt2	Raw inertial altitude from #2 IRS source (feet)
RawIGSpd1	Raw ground speed from #1 IRS source (knots)
RawIGSpd2	Raw ground speed from #2 IRS source (knots)
RawILat1	Raw latitude from #1 IRS source (degrees)
RawILat2	Raw latitude from #2 IRS source (degrees)
RawILng1	Raw longitude from #1 IRS source (degrees)
RawILng2	Raw longitude from #2 IRS source (degrees)
RawIMHd1	Raw magnetic heading from #1 IRS or AHRS source (degrees)
RawIMHd2	Raw magnetic heading from #2 IRS or AHRS source (degrees)
RawIMTk1	Raw magnetic track angle from #1 IRS or AHRS source (degrees)
RawIMTk2	Raw magnetic track angle from #2 IRS or AHRS source (degrees)
RawITHd1	Raw true heading from #1 IRS source (degrees)
RawITHd2	Raw true heading from #2 IRS source (degrees)
RawITTK1	Raw true track angle from #1 IRS source (degrees)
RawITTK2	Raw true track angle from #2 IRS source (degrees)
RawIVS1	Raw inertial vertical speed (altitude rate) from #1 IRS source (feet per minute)
RawIVS2	Raw inertial vertical speed (altitude rate) from #2 IRS source (feet per minute)

5.17 Localizer signals

CVT Item	Description (units)
ALoc1Val	Analog localizer deviation validity (1=valid)
RawALoc	Raw analog localizer deviation (dots)
RawLoc1	Raw digital localizer deviation from #1 Nav source (DDM)
RawLoc2	Raw digital localizer deviation from #2 Nav source (DDM)
RawLoc3	Raw digital localizer deviation from #3 Nav source (DDM)
RawLoc4	Raw digital localizer deviation from #4 Nav source (DDM)

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5.18 Radio Altitude signals

CVT Item	Description (units)
ARA1Val	Analog radio altitude #1 valid (1=valid)
ARA2Val	Analog radio altitude #2 valid (1=valid)
DHDsc	State of decision height discrete input (1=Below DH)
RawARA1	Raw analog radio altitude from #1 source (feet)
RawARA2	Raw analog radio altitude from #2 source (feet)
RawDH1	Raw selected decision height from #1 digital source (feet)
RawDH2	Raw selected decision height from #2 digital source (feet)
RawRA1	Raw digital radio altitude from #1 RA source (feet)
RawRA2	Raw digital radio altitude from #2 RA source (feet)
RawRA3	Raw digital radio altitude from #3 RA source (feet)
UseDH	Indicates which of DH/MDA should be used for Mode 6 Minimums callouts (1=DH)

5.19 RAAS/SmartRunway/SmartLanding signals

CVT Item	Description (units)
ApproachSpd	Vref input that is compared to CAS in Excessive Approach Speed Monitor
ARwyID	ID of the Runway the aircraft is currently aligned with
DeepLimit	Distance remaining trigger for Long/Deep Landing callout
DremAirLim	Distance remaining trigger for InAir Distance Remaining callouts (feet)
LRwyEDist	Distance to Runway End
PosHiPrec	Position High Precision, must = 1 for RAAS/SR/SL to be operative
HtAbvField	Calculated height above field, used to trigger many callouts
LRwyCurGsA	Calculated approach angle to runway used in Excessive Approach Angle Monitor

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5.20 Terrain Awareness and GPWS signals

CVT Item	Description (units)
Approach	State of EGPWS Approach/Takeoff logic (1=approach mode, 0=takeoff mode)
CRwyApt	Airport designation of closest runway (ICAO code)
CRwyDist	Distance to closest runway (nautical miles)
CRwyElv	Elevation of closest runway (feet)
CRwyHdg	Heading of closest runway (degrees)
InAir	1 when aircraft is in air, 0 when aircraft is on ground
M1AltRte	Mode 1 altitude rate (feet/minute)
M3Alt	Mode 3 altitude (feet)
M4CAS	Mode 4 computed airspeed (knots)
M5GSDev	Mode 5 glideslope deviation (dots)
M5LocDev	Mode 5 localizer deviation (dots)
M5MagTrk	Mode 5 magnetic track (degrees)
M5RunHd	Mode 5 runway heading (degrees)
PosSrce	Source of latitude and longitude signals – 1=left GPS, 2=right GPS, 3=left FMC, 4=right FMC, 5=left IRS, 6=right IRS, 7=left IRS with left GPS correction, 8=left IRS with right GPS correction, 9=right IRS with left GPS correction, 10=right IRS with right GPS correction, 11 = Dead reckoning
PosUncert	Position uncertainty used in RNP (Terrain Not Available) calculation (nautical miles)
TACAlt	Terrain awareness corrected altitude – Geometric Altitude as computed from all altitude input sources including GPS altitude (feet)
TAGndSpd	Terrain awareness ground speed (knots)
TALatude	Terrain awareness and terrain clearance floor latitude, selected from multiple sources (degrees)
TAlertEnb	Terrain Alerting enable status (1=enabled)
TALngude	Terrain awareness and terrain clearance floor longitude, selected from multiple sources (degrees)
TATruHd	Terrain awareness true heading, selected from multiple sources (degrees)
TATruTrk	Terrain awareness true track angle, selected from multiple sources (degrees)
TerClr	Filtered Terrain clearance, i.e. radio altitude (feet)
VoiceModeID	Identifies the current EGPWS voice alert (e.g. M2PU is Mode 2 “Pull Up” alert)

5.21 Temperature signals

CVT Item	Description (units)
RawSAT1	Raw digital static air temperature from #1 source (degrees C)
RawSAT2	Raw digital static air temperature from #2 source (degrees C)

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