application note

ILS Monitor Testing

The ILS software both controls a 2030 Avionics Signal Generator and displays relevant paragraphs of a Microsoft Word maintenance schedule.

Introduction

Major airports throughout the world are equipped with Instruments Landing Systems (ILS). These systems allow the airports to operate more safely in the presence of adverse weather conditions. The complete system includes signal monitors which provide alarms to alert engineering staff should any of the operating characteristics exceed predetermined limits. The National Air Traffic Services (NATS), part of the UK Civil Aviation Authority (CAA), have the responsibility for the maintenance of ILS systems at the majority of the UK's main airports. NATS have provided their maintenance engineers with IFR's 2030 Series Avionics Signal Generators as part of an evaluation program into their suitability as a prime instrument for ILS test and maintenance procedures.

IFR have written software which controls GPIB instruments and at the same time displays relevant paragraphs from a Microsoft Word maintenance schedule. NATS have bought this software to help them maintain their ILS monitor equipment. The software runs under Windows on a PC and controls the 2030 via a GPIB interface. This interface can be a National Instruments PCIIA card for standard PCs or a PCMCIA plug-in card for portables.

Dual Window User Interface

The ILS software initially presents the user with two windows. The bottom window provides the user with the monitor test control panel. Each button on the test control panel corresponds to a particular test setup. It is also linked to one of the paragraphs in the monitor equipment maintenance schedule. The software displays the relevant paragraph from the maintenance schedule in the top window while it performs each test.
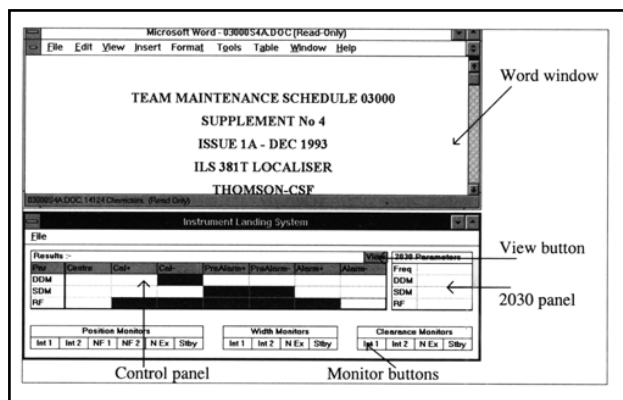

Figure 1 - The test control panel

The top window is in fact a Microsoft Word window and, unusually, it is under the control of the ILS software. The ILS software uses DDE calls to Microsoft Word to get it to display the appropriate paragraph from the maintenance schedule for whichever test is being executed. If any of these paragraphs includes tables or diagrams, then they would also be displayed. The user can refer to the paragraphs during the test for any supplementary information.

Selecting an Airport Runway

Before you can run the ILS test you have to select a site. You can do this by selecting option "Select Site..." from the File menu. When you do this another window opens listing all the available airport sites. You can select one and choose between localiser and glidepath. Once you have done this the selection window disappears and the ILS software window reappears, showing your selection across the window title.

Once a site has been selected the ILS software automatically selects the first available monitor. Normally this is Main Executive Position Monitor 1. This name is displayed just above the control panel. You can select a different monitor by clicking once on one of the monitor buttons at the bottom of the ILS software window. When a new monitor is selected the ILS software automatically sets up the 2030 signal generator to the correct DDM, SDM and RF levels.

Running the Tests

The maintenance schedule for the selected monitor can be run through in a repeatable and orderly manner by selecting option "Run" from the File menu and "All" from the cascaded menu. When this mode is selected the ILS software will first prompt the user to adjust the RF level to 2.0 volts. The actual 2030 setting required to achieve this level will be written back into the site runway file. The software will then run the individual tests in the order specified in the control panel configuration file.

Individual tests on the control panel can be run in any order by selecting option "Run" from the File menu and "Manual" from the cascaded menu. Again when this is selected the user is initially prompted to adjust the RF level to 2.0 volts. Thereafter he is free to select individual tests by double clicking on the appropriate box on the control panel.

As the ILS software starts on a new test, it sends commands to the Word window to make it display the relevant paragraph from the maintenance schedule. It then programs the 2030 to give the correct Frequency, DDM, SDM and RF levels. Finally it prompts the user to input readings obtained from the monitor under test.

Adjustments

There are occasions when it may be necessary to adjust the 2030 RF level. When such an occasion arises, the ILS software will display an adjustment window which has course and fine adjustment buttons. Alternatively, the user can switch the 2030 out of remote mode to manual and adjust the 2030 using its front panel and rotary dial. In these circumstances, the user should press button "Read 2031" on the Adjustment window to tell the software to read the current 2030 setup from the instrument, rather than rely on the value stored in the software.
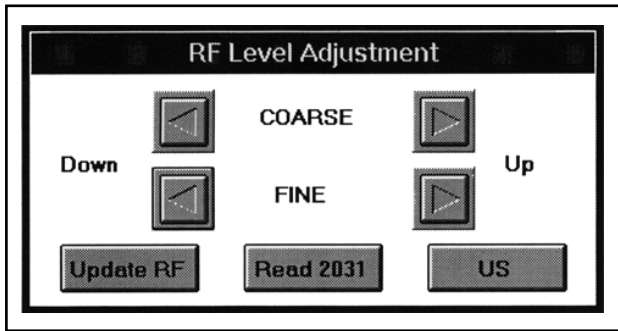
Figure 2 - The RF level adjustment box

Some tests (those which may need some adjustment of the monitor) require the user to input two values, one before making the adjustment and one afterwards. For these tests, the dialog box which is displayed to allow the user to input the value has two entry positions. The first (Initial Value) should be filled in prior to making any adjustment. The second should be filled in after making the adjustment. If no adjustment is required only the final entry should be filled in. If the value cannot be adjusted within the specified limits, pressing button "US" will stop the tests running and return you to the start of the ILS application.

Results File

The results of each test are appended to a results file. They are appended so that the file builds a history of monitor testing for various runways. The results file is in Microsoft Word table format and can be viewed from within the ILS software. You do this by clicking on the View button above the control panel. The user can search the file for the history of results for a particular runway. Alternatively it can be treated as any other Microsoft Word document, and so can be edited, printed, etc.

Figure 3 - The ILS results file

Editing the Control Panel

The control panel determines how the ILS monitor tests are run. It defines the paragraph in the maintenance schedule which is displayed when a test is selected. It defines the run order for "Run All" mode and the column order of results in the results file. It also defines how the IFR 2030 Signal Generator will be set up. The ILS software also provides an editor which allows the user to customise the

control panel and configuration data. The control panel can be modified in several ways. You can change row and column headers. You can change the run order or results column order. Finally you can edit the GPIB set up of the 2030.

Figure 4 - The control panel editor

The control panel editor is entered by selecting option "Edit" from the File menu and option "Control Panel" from the cascaded menu. When you do this the ILS software puts up the control panel editor window. Once in the control panel editor you can choose to edit the existing control panel or create a new panel by selecting option "New" from the Control Panel menu. When you select "New" you are prompted to enter the number of rows and number of columns for the new control panel. When you have made your selection the ILS software will create an empty control panel of the specified size.

Figure 5 - An empty control panel

You can give names to each of the rows and columns by double clicking on the entry in each and typing in a name to the prompt. Column widths can be altered be moving the cursor to the line separating column headers, clicking and dragging until the desired width is obtained. By double clicking on the test buttons you can bring up another window which allows you to change the cell properties associated with that test.

Field "MD paragraph" allows you to specify the paragraph in the maintenance document which is displayed as the test is performed. The paragraph is found using a string search for the string in the Microsoft Word box. "Run Order Position" controls the order in which the tests are performed. Entering value 'n' in this box makes this test the 'n'th test to be performed. Once the ILS software has run all the tests for a monitor it outputs the results to the results file in the order defined by "Results Column". The column headings in the results file also use this parameter.
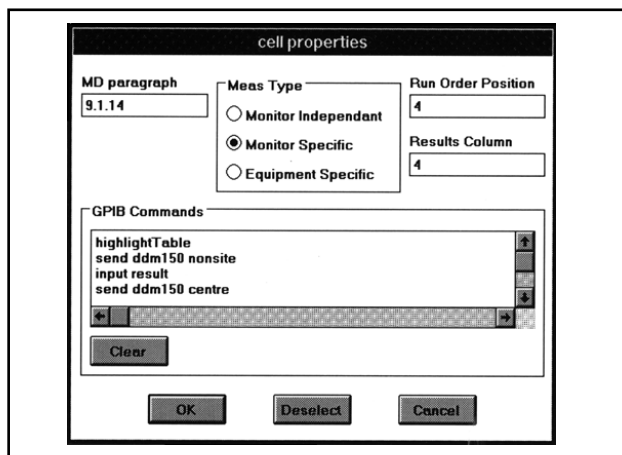
Figure 6 - The cell properties box

GPIB COMMANDS

Each test button has a 'script' attached to it which defines how the ILS software should execute that test. Some script commands set up the 2030 Signal Generator. Other commands display menus. The available commands are :-

If / else / elseif / endif

These commands are used to execute other commands conditionally, depending on the monitor type being tested. The "if" and "elseif" commands take one parameter, which can be "position", "width", "clearance", "integral", "nearfield", "nonexec", "standby", "singlefreq", "twofreq", "localiser" or "glidepath".

For example:

> if nearfield
> ...
> endif

Highlightable

This command highlights one of either Position, Width or Clearance from the table in the maintenance schedule.

Input

This command displays a dialog box and waits for one or more inputs. The parameter type defines the dialog box type. These can be "result" for a single result, or "results" for two results.

Manual adjust

This command displays an adjustment box which allows the user to adjust one of the 2030 Signal Generator values. Available parameters are:

ddm150	to adjust the DDM with 150 Hz dominant
ddm90	to adjust the DDM with 90 Hz dominant
rf	to adjust the RF
sdm	to adjust the SDM
freq	to adjust the frequency

Send

This sets up the 2030 Signal Generator. The parameters can take two forms. If the parameter takes the form of strings enclosed in square parentheses, these are taken to be raw GPIB strings and are sent to the 2030 (without the enclosing parentheses).

Otherwise parameters can be as listed below:

ddm150 <value>	to set the DDM to the specified value, 150 Hz dominant, eg "ddm150 43.2"
ddm150 centre	to set the DDM to the centre value for that monitor, 150 Hz dominant
ddm150 nonsite	to set the DDM to the value specified in the non site data, 150 Hz dominant
ddm150+ nonsite * 0.75	to set the DDM to the current value plus 75 % of the specified non site value, 150 Hz dominant
ddm150- nonsite * 0.75	to set the DDM to the current value minus 75 % of the specified non site value, 150 Hz dominant.
ddm90 ...	as ddm150 except 90 Hz dominant
sdm centre	to set the SDM to the centre value
sdm nonsite	to set the SDM to the non site value
sdm+ nonsite * 0.75	to set the SDM to the current value plus 75 % of the non site value
sdm- nonsite * 0.75	to set the SDM to the current value minus 75 % of the non site value.
freq	to set up the frequency
rf	to set up the RF level

Editing runway information

Not all runways have the same ILS monitors. You can edit each runway using the runway editor. This is entered by selecting option "Edit" from the File menu and "Runway" from the cascaded menu.

A new runway can be created by selecting option "New" from the Runway menu. Alternatively an existing runway could be edited by first selection option "Open..." from the Runway menu and choosing a runway from the list presented. If "New" is selected you will be prompted to input the Airport name and the runway heading. Once you have chosen either a new or an existing runway, you can select or deselect the available monitors, specify the RF frequency and set up default RF values.