Integrated Rig Instrumentation System

iRIS DRILLER’S INTERFACE

Quick Start Guide for JOIDES RESOLUTION

READ IN CONJUNCTION WITH THE FOLLOWING MANUALS:

- iRIS General User’s Quick Start Guide
- iRIS General User’s Manual
- iRIS Operations Superintendent Quick Start Guide
- iRIS Operations Superintendent Manual

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<tr>
<th>Version</th>
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</tbody>
</table>
# Table of Contents

iRIS – DRILLER's Interface, the TL;DR version ............................................................................................... 4

Drill Pipe Management ....................................................................................................................................... 4
  Pipe Tally Table Control ................................................................................................................................. 4
  Pipe Tally Editor ........................................................................................................................................ 6

Depth Control................................................................................................................................................ 6
  Coring Advancement................................................................................................................................. 7

SLIP Control.................................................................................................................................................. 8

Core On Deck (CoD) ......................................................................................................................................... 8

TRACER PUMP Control .............................................................................................................................. 8

Setup ............................................................................................................................................................. 9

Water Depths .......................................................................................................................................... 10

Loading/Saving Personal Configurations ................................................................................................ 10

Navigation Display ................................................................................................................................ 10

iRIS Driller’s Interface .............................................................................................................................. 12

DRILL 1 Tab .............................................................................................................................................. 13
  X-Axis range scaling. ............................................................................................................................ 13

DRILL 2 Tab .............................................................................................................................................. 14

KELLY Tab ................................................................................................................................................ 14

PIPE Tab................................................................................................................................................... 14

DEPTH Tab ............................................................................................................................................... 14
  Bit Depth Correction ........................................................................................................................... 16
  Penetration Reset .................................................................................................................................. 16

Using a Miscellaneous Drilling Component ............................................................................................ 16

About checkbox controls and confirmation indicators… ........................................................................ 17

WEIGHT (WT) Tab ................................................................................................................................... 17

Using Miscellaneous Drilling Component ............................................................................................... 17

BLOCK-COMP Tab ................................................................................................................................... 18

CORE SUM Tab ........................................................................................................................................ 19

PUMPS Tab .............................................................................................................................................. 19

WIRELINE Tab .......................................................................................................................................... 20

SITE FIX Tab ............................................................................................................................................. 20
iRIS – DRILLER’s Interface, the TL;DR version

The iRIS Driller’s interface communicates with the iRIS central processing system that is based on a NI cRIO processor in the subsea shop which collects drilling sensor data and input from the driller for depth and weight calculations. The program runs continuously and will automatically run when powered up.

Unlike the current RigWatch system on the JR, there is no master or remote computers to start, the iRIS program is the master computer in this system, and any computer (called clients) on the internal JR network that has the application installed, either the Driller’s Interface or the General User’s Interface for other users, can access the data streams broadcast by the cRIO. The interfaces allow the user to customize their own Rig Instrumentation Systems and collect individual data for their own analysis.

The Driller’s interface has two jobs, 1) display real-time sensor data and 2) receive the driller’s input for depth and weight calculation.

Input from the driller falls into two categories. The first is setup data that is entered before coring operations begin. This includes...

- Weights and length of BHA, knobbies, etc
- Water depth as measured from drill string sea floor tag
- Trigger weights for SLIP and ON BOTTOM indicators

The second type of data is dynamic and requires frequent updates/corrections from the driller. This includes...

- Drill pipe lengths as stands and singles. Also, the drillers must indicate which stand/singles currently make up the drill string.
- Kelly offset correct as calculated in the Drill 2 spreadsheet.
- Indicate what knobbies/subs are in use
- Set the static weight (or use the calculated weights) for WOB
- Indicate when they are ON BOTTOM (ACTIVE).

In addition, the driller can apply corrections to the block position and bit depths.

Drill Pipe Management

Pipe Tally Table Control

Drill pipe tally tables for both 5” and 5-1/2” pipe are provided on the interface tab marked PIPE. The values in either table can be loaded from a comma delimited spreadsheet or can be entered manually using the Load function. Note, the Insert function will automatically open the Pipe-Tally Edit window when you are at the end of table and you select a single from a stand not defined.
In **TRIP** mode, the current stand will advance when the pipe counter sensor is triggered. For this feature to work correctly you must have the correct pipe size table selected.

**NOTE:** If you miss or have a false double trigger the current stand can be corrected by double-clicking the correct row.

If the pipe counter is triggered and you are at the end of the table, the **Pipe-Tally Edit** window will automatically open so you can define the length of the next stand. When not in TRIP mode the pipe counter is ignored and the selected stand must be advanced manually be either full stands (select row) or by singles using the check boxes.
Pipe Tally Editor
This window is used to edit existing stands or for adding new stands to the pipe tally table.

Stands can be entered as just a full stand length by entering the length and clicking Enter As Stand button. The values for the singles will be calculated as the average length of the three singles.

Alternatively, you can enter the individual single length and click the Enter As Singles button. The stand length will be the sum of the singles.

Depth Control
Where did this core come from? Knowing the depth below sea floor of recovered core is critical to a scientific coring operation. Over the years the drilling team aboard the JR have perfected the process using the Drill2 spreadsheet. Currently iRIS still requires the use of this spreadsheet for calculating Kelly offsets.

Depth control starts with knowing bit depth below rig floor (MBRF). MBRF is measured from the top of the Dual Elevator Stool (DES = 0).

Total Drill String Length: This is the sum of all drill pipe in the string (from the 5” and 5.5” pipe tally tables) + BHA length + Cross-over subs. Also, any knobbies not used in the Kelly but as part of the drill string need to be included.

Kelly Down, Kelly Offset and the Cored Interval:
If the length of singles equaled the cored interval, then each connection would end up at the DES. But they do not because singles vary in length and can either longer or shorter than the cored interval. Also, the initial mud line core can result in the Kelly-drill string connection ending above (+) or below (-) the DES. This difference is the Kelly Offset. The Kelly Down is a position on the Kelly the drill will advance to (rotary coring) or shoot (piston coring) to advance the Cored Interval.

NOTE: changes in knobbies or adding a double will affect the Kelly Down value as well

On the interface, go to the KELLY tab and copy/paste the values into the controls as shown. The Kelly Offset will be calculated used to correct the Total Drill String length for the MBSF.

Bit depth as meters below sea floor (MBSF) is calculated as follows based on the MBRF when the sea floor was tagged.

\[ \text{MBRF}_{\text{sea floor}} = \text{MBRF} - (\text{Kelly to Keel Correction} - \text{Draft}) \]

\[ \text{MBSF} = \text{MBRF} - \text{MBRF}_{\text{sea floor}} \]

Coring Advancement

iRIS updates bit depth by tracking the relative movement of the draw works blocks (BLKH). For this to work, iRIS must capture the block position prior to coring (RCB/XCB) or shooting (APC) by setting the ACTIVE control to the START state. The ON BTM control must remain set to the START state until cutting the core interval is completed (RCB/XCB) or until the APC has shot and the pressure has bled down.

\[ \text{ADV}_{\text{ancement}} = (\text{MBRF} - \text{Kelly Offset}) + \text{BLKH}_{\text{current}} - \text{BLKH}_{\text{start}} \]

\[ \text{Rate Of Penetration} = \frac{\text{ADV}}{\text{time}} \]

While ACTIVE control is set to START, iRIS will continuously record coring parameters. These values can be seen on the CORE SUM tab of the iRIS interface.

When the ACTIVE control is set to STOP these values are frozen.

CAUTION! Setting ON BTM to ACTIVE will erase the values and begin the recording process (be careful!).

When the driller clicks the CORE ON DECK button these values are copied to the Core Entry window and will be used for entering a new core into the LIMS database.
SLIP Control
The SLIP state can operate in manual where the driller must set the value or automatic where the trigger weight values determine the state. (See Setup section).

When the SLIP state is IN, the ON BTM control is set to STOP and disabled.

Core On Deck (CoD)
On the CORE SUM tab of the interface the driller can set the current expedition, hole, and core type. Both must already be defined before they will show on these controls. Clicking the Refresh button will update values from the LIMS database.

The current core number can be set in the Next Core control. Both the core number and type can be changed in the Core Entry window before saving.

Values with the lighter background color must be filled in by the driller. Values entered from a previous entry will copied to the next entry. Values with the darker background are initially filled in by iRIS but can be edited by the driller before submitting the new core to LIMS.

TRACER PUMP Control
The Tracer pump rate is set by the technical staff in another application. Also, in the application the tracer pump can be configured to adjust its rate to the SPM rate of the pumps.

NOTE: Drillers should discuss with the IODP technical staff regarding the pumping mode.

The driller can start or stop the pump using the TRACER check box. The technical staff can also turn on the pump. The Confirm indicator will show the pump status regardless of who turned the pumps on (NOTE: Green is ON).
Setup

Prior to drilling operations on a hole, the following values must be entered. From the Driller’s Interface click the Setup button. This will open the Driller’s Setup Utility. In the window. There are multiple tabs for entering data used by iRIS for depth and weight calculations.

SLIP-ON BTM tab

The values entered in Slip w/TD (top drive in use) and Slip w/o TD are used for automatically setting the slip in and out states.

The On Btm Wt Trig can be ignored and will be removed in future versions. The ON BTM (Active) state must be set manually.

KNOBBIES-TD tab

Enter the weights for the drilling components lists. This is critical for determining WOB when using the calculated values for Static Weight.

BHA-MISC tab

Enter the weights and lengths for the components listed. These are components installed below the Kelly. “Misc” is a catch-all for anything not listed or for unique drill string setup.
Water Depths
Through another iRIS-integrated application, the technical staff will enter the PDR water depth. When they are done, two values will automatically show up on the LEN-DEPTH tab. PDR WATER DEPTH value is the corrected water depth from sea level and WATER DEPTH value is the corrected water depth from rig floor (DES). While tripping the Driller should copy the WATER DEPTH value into the TAG DEPTH control this will allow the BIT MBSF to show the distance to sea floor. Once you have tagged the sea floor and have the depth by drill pipe, update the WATER DEPTH control with the next value. BIT MBSF and PENETRATION will now show the correct values.

Tides tab (future development)

Loading/Saving Personal Configurations
In the setup window the driller can load a personal configuration file by clicking the Load From button. Current configuration can be saved to a personal configuration file clicking the Save To button.

NOTE: Personal configuration files are saved to the C:\IRIS\username folder

Navigation Display
On the SITE FIX tab, the ship’s position is displayed. This display is only available if the technical staff have the program SITE FIX running. The SITE FIX application collects and calculates the GPS fix for the moonpool location on the ship. After enough fix points have been collected, the values in the meanLAT and meanLON will be considered the holes final position. On the plot:

- The range values are in meters.
- The red circle is 4m diameter the as the moonpool.
- The last 30 fixes are plotted as a trail showing the ship’s recent movement history.
- The fix with the yellow circle is the current gps fix.
- Ship outline (not to scale) shows the ship’s heading

Values displayed on the left:

- LAT and LON: current GPS fix
- meanLAT and meanLON: current mean values of all GPS fixes displayed
- gaussLAT and gaussLON: current ship’s position as a gaussian curve fit. Takes more data but provides a better estimate for final hole location.
- HDG: current ship’s heading
- HDOP: The quality of the current fix
- RNG: Distance from the current fix to the mean values
- BRG: Direction from the current fix to the mean values
iRIS Driller’s Interface

The iRIS driller’s interface consists of three (3) sections:

The red section are the “tab” displays. There are 11 separate displays that can be selected by clicking the arrow or clicking on the control and selecting the display in the drop-down list. Details of each display discussed in the following sections.

The yellow section is the static data displays of drilling data. These are always visible.

The blue section is the driller’s input. The use of these controls is critical to having accurate depth and weight data, and for entering coring information.
DRILL 1 Tab

These first of two displays are used by the Driller during normal operations. It provides a graphical view of Weight-on-Bit (WOB), Top Drive Amps (TD AMP), Top Drive RPM (TD RPM), Stand Pipe Pressure (STNDP) and HEAVE.

The plots store the last 24 hrs of data but only display the last interval set by the SPAN value. To see older data, the user can scroll back using the red slider. Data plotting rate is set in the RATE control (100ms to 2 sec). Increasing the plotting rate will result in less data being shown, and a “jerkier” plot.

CAUTION! Clicking the Clear button will delete all data in all plots!

X-Axis range scaling.

There 4 options:

1. Auto scale (B)oth the left and right click on the B control.
2. Auto scale only the (R)ight and the user sets the left value, select R control.
3. Auto scale only the (L)eft and the user sets the right value, select L control.
4. Users sets both right and left values, deselect all.
Notes:

- Don’t see data in plot? Select B first.
- Auto scaling is based on all of the data in the buffer.
- To change a value just select the number and type in the new value.
- To export plot, right click plot and select either:
  - Export to clipboard
  - Export to Excel
  - Export to Image

**DRILL 2 Tab**

On this display, only Weight, Top Drive Amps, and RMP are displayed as analog indicators.

On the left is a decadal weight display at 10-KLBS, 100-KLBS and 1000-KLBS focus. The colored points show the active weight and the grey pointers the current static weight value. For controlling the weight on bit, the 100-KLBS gauge provides the best visual reference. All weights are dampened to remove the influence of ship’s heave. The averaging window is 5 seconds.

**KELLY Tab**

See Depth Control section. Note the BKLH height at Kelly Zero and the PCOMP stroke at Kelly Zero capture the BLKH and PCOMP values at the moment the ON BTM control is set to ACTIVE.

**PIPE Tab**

Drill pipe tally tables for both 5” and 5-1/2” pipe are provided on the interface tab marked PIPE. This utility recreates the functions in the DRILL2 Spreadsheet in use by the Drillers’ during operations. Use of this utility can be found in the Pipe Tally Table Control (Click to go to section).
Click to load data from a comma delimited spreadsheet.

Click save data to a comma delimited spreadsheet.

Double click to select the current stand just added to the drill string. (Red highlighted)

Use the TOP, MID and BTM check boxes to select singles in the next stand.

Single click on any row for Edit, Insert or Delete functions. (Blue highlighted)

When you select the third checkbox, then the current stand will advance and all check boxes will be cleared.

Will open the Pipe-Tally Edit window for the selected stand (Blue).

Insert a new stand after the selected stand (Blue).

This will open the Pipe-Tally Edit window.

Delete the selected stand (Blue).

Click to load data from a comma delimited spreadsheet.

Click save data to a comma delimited spreadsheet.

This will open the Pipe-Tally Edit window for the selected stand (Blue).
DEPTH Tab
This tab provides a summary of the values used in depth calculations.

This includes water depth values (see Water Depth section), pipe lengths (see Drill Pipe management section). Penetration and Bit Depth corrections and the ability to use and enter dynamic drilling components and their lengths on the fly.

Bit Depth Correction
A correction can be applied to the bit depth value by clicking the BIT MBSF Depth Correction button. In the dialog box that opens just enter the correct depth value. A correction offset will be calculated and displayed in the BIT DEPTH CORRECTION indicator. When a correction is applied a small indicator turn green on the BIT MBSF display.

Penetration Reset
Clicking the Reset Penetration button will cause the current value to be discarded and replaced by the current bit depth.

Using a Miscellaneous Drilling Component
This a catch-all for drilling components not included in the BHA list. Any value at any time can be entered and added or removed from the depth calculation by checking the check box.
About checkbox controls and confirmation indicators...

There are several reasons why the Driller’s interface and the cRIO can de-sync’d. For real-time indicators, just one cycle (100ms) and the indicator will update to the cRIO values.

This is not true for control inputs. To help detect this situation, these controls will display a small indicator just below the control marked “confirm”. If the checkbox is checked (true), the indicator should be green (true). If the checkbox is unchecked (false) then the confirm indicator should be grey (false). If not, you are de-sync’d. To fix this situation just cycle the input control. If they remain de-sync’d you may have a communication problem.

Check the that the cRIO is online and connected. The IODP Marine Computer Specialists (MCS) can assist.

WEIGHT (WT) Tab

This tab provides a summary of the values used in weight calculations.

This includes pipe, BHA, Traveling Block, Top Drive, Knobbies, Cross-Over Sub(s) and Miscellaneous Weight. This function gives the driller the ability to use and enter dynamic drilling components and their weights on the fly.

Using Miscellaneous Drilling Component

This a catch-all for drilling components not included in the BHA list. Any weight value at any time can be either added or removed from the depth calculation by checking the check box.
BLOCK-COMP Tab

This tab shows the real-time position of the Drawworks Traveling Block (BLK) and Passive Heave Compensator (PCOMP) stroke.

These values are measured and calculated from the radar distance sensor, or alternatively the laser range finder. Currently we are using the analog output which requires calibration when sensors are installed but **do not** need to be recalibrated after a cut and slip.

A correction can be applied to the block position data by clicking the BLK Correction button. In the dialog box that opens just enter the correct position value. A correction offset will be calculated and displayed in the CORRECTION BLK indicator. When a correction is applied a small indicator turn green on the BLK POS display.

Compensator drift is calculated by taking a running mean of the last 100 secs of stroke distance and displayed as a white line in the plot. In the future we hope to use this to correct for compensator errors in the block position while coring. Currently no correction is applied.
**CORE SUM Tab**

On this tab the current expedition is shown as defined in LIMS.

The **Site Hole** in displays the current defined holes. The **Core Type** list shows the possible core types. Selections made in these lists will be the default values when the Driller enters a new core into LIMS from the **Core Entry** window. See the Core On Deck section of this document for more information.

The data displayed to right is the Core Summary data. See the Core Advancement section of this document for more information.

**PUMPS Tab**

On this tab indicators for monitoring pump activity are displayed. For the Mud pumps, the Driller can display either pump 1 (MUD1), 2 (MUD2), or both (MUD1 & MUD2). For the cement pump, the Driller can select to display either pump 1 (CEM1) or pump 2 (CEM2).

Controls are provided to zero the pump counters.
CAUTION! If you are actively coring and zero a pump, it will affect the data collected in the core summary.

WIRELINE Tab
This tab displays the wireline information from the Schlumberger logging winch, VIT winch and Core Line winch. (Core Line depth shown in indicators on the right-hand side of display, at bottom.)

SITE FIX Tab
The iRIS GUI offers the User to view real-time GPS location during drilling/coring operations, and during transit periods. The SITE FIX display consists of two separate panels

a. GPS Information: This panel displays current Expedition and Hole information, UTC time, Latitude/Longitude, and ship’s heading
b. The compass shows the current heading of the JR

NOTE: FEATURES ON THE SITE FIX FUNCTIONAL PAGE ARE CURRENTLY IN “READ ONLY” MODE AND FUTURE FEATURES WILL BE ADDED.