DIGITRAK FALCON F5

iGPS® Module

Supplement A

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Patents

Patent pending.

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Important Safety Instructions

Always operate your DigiTrak locating system properly to obtain accurate depth, pitch, roll, and locate points. If you have any questions about the operation of the system, please contact DCI Customer Service for assistance.

This document is a companion to your Falcon F5® guidance system operator's manual, which contains a more thorough list of warnings regarding the potential for serious injury and death, work slowdowns, property damage, and other hazards and warnings regarding the operation of horizontal drilling equipment. Please read and understand your system operator's manual completely before operating the equipment described in this manual.

The GPS receiver contained within DCI's iGPS module was designed, by a third-party manufacturer, to operate at up to sub-meter accuracy (according to the manufacturer's design specification, limited to North America, with WAAS correction). However, the accuracy of GNSS readings may in some cases be less than the design specification due to a variety of factors such as the weather, obstruction from trees, buildings and other impediments, interference from other signals or from solar activity, geographic location, inability to read from a sufficient number of satellites for proper triangulation and error correction, whether the datum of the GPS receiver matches up with the datum used by mapping tools such as Google Earth, other environmental conditions, and other factors. Accordingly, DCI does not warrant or guarantee, and disclaims liability for, the accuracy of GNSS data. It is also possible that satellite signals may be unavailable in some cases. DCI does not assume responsibility for the operation or failure of satellite-based positioning systems or the lack of availability of satellite-based positioning signals.

The iGPS module is designed to provide GNSS coordinates at up to sub-meter accuracy (in North America) for your DataLog and convenient White Lining of the bore site. It is *not* intended for use as a bore planner, for high-precision as-builts, or to guide the drill head during drilling. Accurate guidance of the drill head requires accurate tracking of the transmitter locate points as discussed in the Falcon F5 guidance system operator's manual.

Monitor GNSS signal quality carefully using the iGPS LEDs and do not use GNSS readings unless at least one of the three LED signal quality indicators is solid green (see GNSS Signal Quality on page 3).

Data logged, displayed, obtained, stored, and used by the Falcon F5, iGPS module, and LWD 3.04 is not guaranteed to be accurate or complete. Human review and judgment is required. The accuracy and completeness of data generated by HDD locating systems may be impacted by active or passive interference and other environmental conditions, failure to calibrate or use the device properly, as well as a variety of other factors.

The iGPS module is for use with DataLog files generated by a Falcon F5 receiver only. It is not compatible with classic F5 or its DataLog files. Users of classic F5 or Eclipse receivers should continue using LWD 2.12.

Acronyms

GNSS	Global Navigation Satellite System
GPS	Global Positioning System
iGPS	Integrated GPS
KML	Keyhole Markup Language (used for Google Earth maps)
SBAS	Satellite Based Augmentation System (increases GPS accuracy)
WAAS	Wide Area Augmentation System

Introduction

iGPS Module on Falcon F5

The DigiTrak iGPS module is the newest companion to DCI's flagship Falcon F5® guidance system. It is a lightweight and fully integrated GNSS receiver that provides positioning information directly to the DigiTrak Falcon F5 walkover receiver. It is purpose-built for HDD field applications where above-ground location data must be seamlessly integrated with underground locating data.

With iGPS, you can add GNSS coordinates to the entry, exit, and rods of any bore recorded with the DataLog® feature. And welcome to White Lining: walk your completed bore with iGPS, or trace the outline of a substation or utility crossing, and all these recorded paths transfer automatically onto a Google Earth map—without ever picking up a tape measure or pen.

Capturing an accurate representation of the bore location is a requirement for public utilities and private companies that install underground assets. The iGPS module powers up immediately upon attachment to the Falcon F5 receiver and adds GNSS data to every logged depth reading. The data is viewable in table format and can be exported as a KML file for overlay in Google Earth.

Attach or remove the iGPS module from your Falcon F5 receiver at any time; no need to shut down and restart. Your receiver knows when the iGPS is attached and will collect GNSS data automatically with up to sub-meter accuracy. The iGPS module is only compatible with specially-equipped Falcon F5-G receivers.

The GNSS data collected by the iGPS module appears in the data of a bore recorded using the DataLog feature, as well as on Google Earth maps. For detailed information on recording your bore with DataLog, read the operator's manual located on the flash drive that accompanied your LWD kit and also at www.DigiTrak.com/CustomerService/Downloads.

Click Support and then Software on our website for information on:

Cloud Manager	Store and manage DataLogs from all your receivers in one convenient place.
LWD Live	Watch your bore profile in real time on your Aurora® touchscreen display. Import a Vermeer BoreAssist file.
LWD Mobile	Use your smart device to view and save a real-time profile of your bore. Upload a Falcon F5 DataLog to your subscription cloud account for instant viewing and analysis company-wide.

Importing White Lines to a DataLog requires Log-While-Drilling (LWD) version 3.04 or later. Please contact DCI Customer Service if you need to update your LWD software.

Connecting iGPS

When installing the iGPS module on the Falcon F5 receiver, angle the module down and seat the front on the receiver first (1), then press down the back of the module (2). You will feel and hear a click as it snaps into place. To remove the module, lift the back first. Store the module safely in its carry case when not in use.

iGPS Module

1. **Install the front first**
2. **Press the back down second**

> If the connectors on the iGPS module or receiver are wet prior to installation, proper power-on may not occur. Gently dry the connectors before connecting the module, after which it will perform well even when exposed to rain.

GNSS Signal Quality

Reception of signals from GNSS satellites requires an open view of the sky. The more satellites the iGPS module can receive signals from, the more accurately it can determine its position. Signal strength and quality will be reduced if obstructed by trees, buildings, rugged terrain, or inclement weather.

There are four LED lights at the front of the iGPS module. The leftmost light, when it is blue, indicates the module is powered. If the blue changes to green, the iGPS is receiving corrections from an SBAS satellite that provides additional accuracy.

The next three green lights indicate signal quality. A flashing green light means satellite signals are still being acquired. As the iGPS acquires more satellite signals and increases in accuracy, the light will turn solid, and the next light to the right will flash, indicating the module is continuing to search for more satellite signals for increased accuracy. Three solid green lights indicates the best signal reception and highest accuracy. Using iGPS is still possible with fewer satellite signals, but response may be slower and accuracy will be reduced.

Signal quality is also reflected as green lights on the **Record Depth/Pitch** button on the DataLog recording options screen (see GNSS During DataLog on page 4).

> ⚠️ Monitor GNSS signal quality carefully using the iGPS LEDs and do not use GNSS readings unless at least one of the three LED signal quality indicators is solid green.

What is SBAS?

SBAS stands for Satellite Based Augmentation system. It supports wide-area or regional augmentation through the use of additional satellite-broadcast messages. An SBAS is commonly composed of multiple ground stations located at accurately-surveyed points. These stations take measurements of one or more of the GPS satellites, the satellite signals, or other environmental factors which may affect the signal received. Based on these measurements, they send information messages to one or more satellites for re-broadcast to end users to increase GPS signal accuracy.

GNSS During DataLog

When the iGPS module is attached while DataLog is enabled, it adds additional signal reception information to the **Record Depth/Pitch** button on the DataLog recording options screen:

1. **Record depth/pitch button showing best GNSS signal strength**

DataLog Recording Options Screen

The green lights on the **Record Depth/Pitch** button mimic the three right-most solid green lights on the iGPS module. A flashing green light on the module will not appear on the depth/pitch button.

	Zero green circles means **poor** accuracy.		Two green circles means **good** accuracy.
	One green circle means **moderate** accuracy.		Three green circles means **best** accuracy.
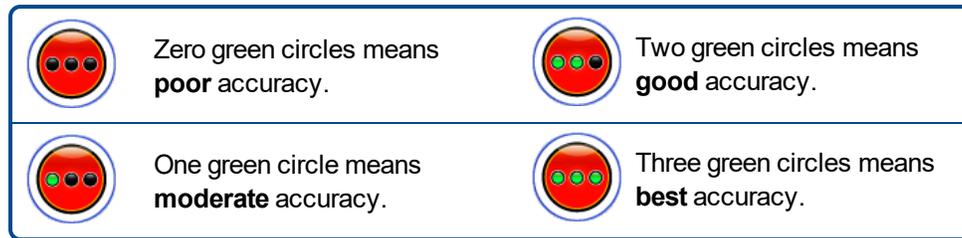
If the iGPS module is not connected or no GNSS data is available, this menu will use the standard

depth/pitch button with no GNSS strength information.

 If the iGPS module is connected and the record button is still solid red, or if the green lights on the record button do not match the three right-most solid green LEDs on the module, remove and reconnect the iGPS module.

Depending on your work environment, occasional cleaning may be required: power off the receiver, remove the iGPS, and clean the contacts on both it and the receiver with a cotton swab dipped in isopropyl alcohol. If necessary, first gently use an eraser to clean off the contacts. After the contacts dry, reattach the iGPS and ensure the iGPS LED count matches the receiver display.

How GNSS Affects DataLogging

Keep the following points in mind when capturing GNSS data with a DataLog.

- To accurately log GNSS data points, record LWD depth and data at the *Locate Line only*, not at a locate point.
- Recording a data point at the FLP will save the iGPS data, but since it is not above the head where the point will be graphed, iGPS latitude/longitude data will be hidden on the LWD report. You can individually unhide these points later in LWD.
  - Technical note: since the FLP data is recorded beyond the location of the drill head, the GNSS X-Distance on the report will indicate where the iGPS point was recorded in relation to the X-Distance position of the drill head.
- Recording data points as pitch-only or blank will not save any GNSS data for latitude/longitude.
- While Rod 0 is a pitch-only recording, it does log the Rod 0 iGPS point, so record it with the receiver positioned at the entry.

White Lining (WL)

Turning on WL and marking features at the drill site is just like removing the cap from a marker and drawing on a map, with the added bonus of being able to store White Lines and adding them to your Log-While-Drilling (LWD) report or overlaying any number of them on a map of your bore. It does not use DigiTrak transmitter data. To get started with WL, toggle up once (or down three times) in the Main menu and select **White Lining**.
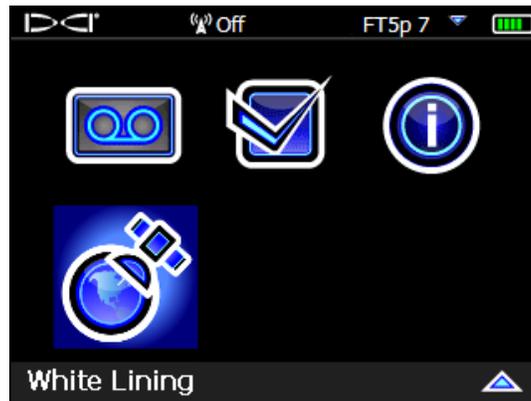
White Lining on Main Menu

White Lining Menu

The White Lining menu is very close in appearance and function to the DataLog menu.

1. **Set up White Line Job**
2. **Upload White Line to PC**
3. **Delete White Line Job**
4. **View or Delete White Line Flags**
5. **Exit**

White Lining Menu

Since White Line jobs are saved on the Falcon F5 receiver independent of DataLog jobs, it is important to make note of which WL is related to which DataLog job. The files are merged when you import (see page 9) a White Line into an existing DataLog job in LWD on a computer. Using White Lines requires LWD version 3.04 or later.

Set up White Line Job

Just like with DataLogs, select whether to **Append** to an existing White Line or **Create** a new one. When you create a new White Line, the receiver immediately creates a sequentially-numbered White Line job number (see caption #4 below).

When appending to a White Line, the previously logged path will not appear on the screen.
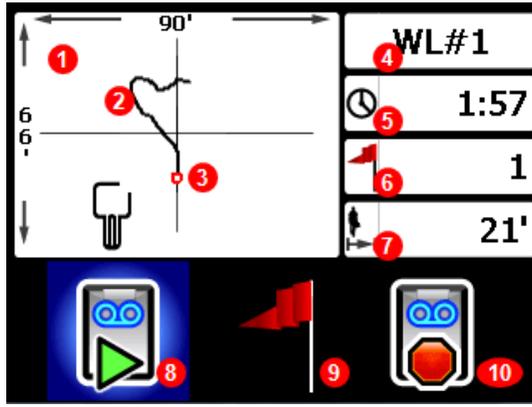
1. **Drawing window**
2. **Logged path**
3. **A set flag**
4. **Job number**
5. **Recording duration**
6. **Number of flags set**
7. **Direct line distance from start**
8. **Start or pause a White Line**
9. **Set a flag**
10. **Stop this White Line**

White Line Live Screen

Select **Start** on the White Line Live screen to start or resume recording and walk the receiver on the path you want to record. Click again to **Pause** the recording, which allows you to move to another part of the bore site without recording data. At any time while White Lining, set a **Flag** to mark a feature you can annotate later in Google Earth (see page 7). When you're done recording, select **Stop**. The next screen lets you **Close** the White Line or **Cancel** to return to this Live screen.

While creating a White Line, the path will draw in real time on the drawing window, which will automatically scale to show the entire path.

Setting a White Line Flag

Set a flag on a White Line to mark a point of interest, like the drill rig location, utilities, obstructions, or landmarks. Flags appear on the Live screen as a small red circle.

To set a White Line flag, toggle right in the Live screen (see previous section) and select ▮. The receiver displays the following flag information:

Flag Set Screen

1. **Flag number**
2. **Distance to previous flag**
3. **Cumulative distance of all flags**

The information on this screen is not editable. Select ✔ to set the flag or ✖ to cancel.

Distances are measured in a straight line from flag to flag, not along the actual White Line path.

Upload White Line to PC

Upload a white line to a PC in much the same way you upload a DataLog file:

1. In LWD 3.04, open the desired LWD job.

2. Click **Manage GNSS White Lines** .

3. Click **Import**.

4. On the receiver, select a White Line job from the list.

5. In LWD, click **Connect to Device** to upload the job.

6. Repeat for each White Line job. Multiple White Lines can be attached to one LWD file and selectively displayed later on Google Earth maps.

7. To exit the job list on the receiver, toggle up at the top of the list.

If your version of LWD does not have a Manage GNSS White Lines icon, contact DCI customer service for a software upgrade.
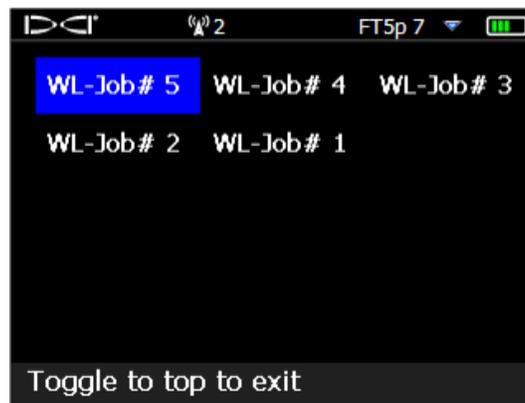

White Line Job List

LWD and WL (White Line) job numbers on the receiver are simply sequential; they do not correspond and are not connected to each other. Ensure you upload White Lines to the correct DataLog in LWD, or the White Line and bore will display in different geographic locations. To view a White Line without associating it to any drill data, import it into a new blank LWD job.

Delete White Line Job

From the Main menu select White Lining, **Delete**, and select whether to delete one White Line or all.
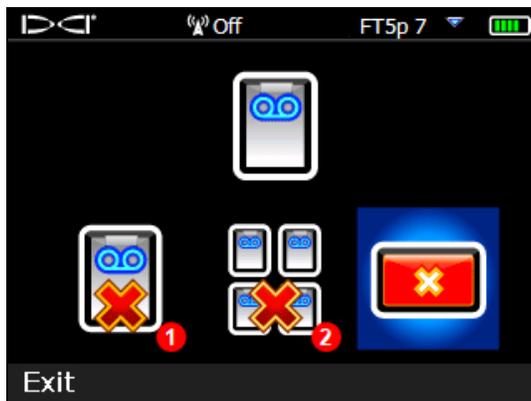
1. **Delete one White Line job**
2. **Delete all White Line jobs**

Delete White Lines Screen

For a single White Line Job, select it from the list.

At the next screen, toggle left and select **Yes** to delete.

View or Delete White Line Flags

From the Main menu select **White Lining**, **View White Line**, and select a White Line job from the list. The subsequent table has three columns:
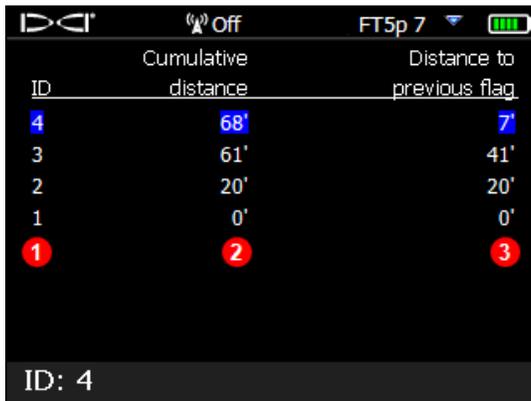
1. **Flag ID number**
2. **Cumulative distance**
3. **Distance to previous flag**

View White Lines Screen

ID is the flag number.

Cumulative distance is the total straight-line distance between all flags, starting from flag #1.

Distance to previous flag is the straight-line distance from the last flag.

To delete a flag, simply toggle to it, click to select, then select to confirm. Deleting a flag causes the remaining higher-number flags to be renumbered so there is not a gap in the sequence.

To exit the table of flags, toggle left or right.

If no flags were entered, this table will be blank.

If only one flag exists, the distance will be zero.

Viewing GNSS Data on Google Earth

When you open your DataLog in LWD 3.04 or later, you have the option of viewing the bore and/or White Line as a Google Earth map overlay. To view your bore on Google Earth, do the following:

1. Install Google Earth on your computer from https://www.google.com/earth/.

2. In LWD, open the desired job.

   Optional: If you haven't yet added an existing White Line to the bore, see Upload White Line to PC on page 9 to do so, then save the job.

3. Select **File** > **Export to KML…**.

4. Use the suggested file name or create your own, select your desired destination folder, and click **Save**. This creates a separate KML file containing GNSS rod-by-rod data and all White Lines imported into this job.

5. Locate and double-click the new .kml file to open in Google Earth.

The Google Earth interface has several options for moving around the map, changing views, and editing viewing preferences. Please refer to the Google Earth application Help for details.

The following table lists some common functions in Google Earth.

To	Do this
Move the map	Drag the map
Rotate the map	Ctrl+mouse wheel
Zoom in/out	Use the onscreen + and - buttons at the right of the screen, or the slider between them
Print the map	Click the Print icon
Save the map	Click the Save icon
Use street-level view	Drag the orange person icon above the zoom control to a point on the map; to exit, click the "Exit Street View" button at the top right of the screen
Change direction in street view	Drag the map
Move in street view	Click the map near the left or right edge

Google Earth provides minimal editing abilities that allow you to remove or hide a latitude/longitude point, but hiding or showing the GNSS point in LWD 3.04 prior to saving the KML file may produce better results.

Removing White Lines

To view the bore in Google Earth without White Lines or other elements, expand the Places menu at the left of the Google Earth screen:
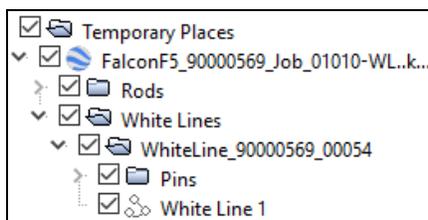
Select or clear boxes as desired to show or hide different elements on the map.

iGPS Information

When the iGPS module is attached to the Falcon F5, toggle down to the third page of the System Information screen for details about the module itself.

System Information Screen

Troubleshooting

If GNSS data does not appear, or if the receiver responds as though the iGPS module is not connected, try one of the following:

- Remove the iGPS module, wait five seconds, then re-install it.
- Remove the iGPS module, dry the contacts on both the module and receiver, and re-install it.
- Restart the receiver.

In most cases, restarting the receiver with the iGPS module connected will correct connectivity issues.

– End of Supplement –