DigiTrak FALCON F5®

Supplement B

Sub-k Rebar Transmitter

Full Scale Sensitive Pitch (FSSP)

Frequency Optimizer Update

and other recent updates

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Patents

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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.

What is This Document For?

Supplement B addresses the changes to the user interface that accompany the introduction of the Falcon F5 Sub-k Rebar transmitter and Full Scale Sensitive Pitch (FSSP). If you purchased your Falcon F5 guidance system without this capability, you can contact Customer Service for details on obtaining an update that includes these features. This supplement discusses the user interface changes that accompany these features.

Other Documents

Please visit the Falcon F5 manuals page at our website to download the:

- Falcon F5 Operator's Manual
- Falcon F5 Supplement A: iGPS

What's New

The latest Falcon F5® guidance systems include an updated frequency optimizer and other productivity-enhancing features.

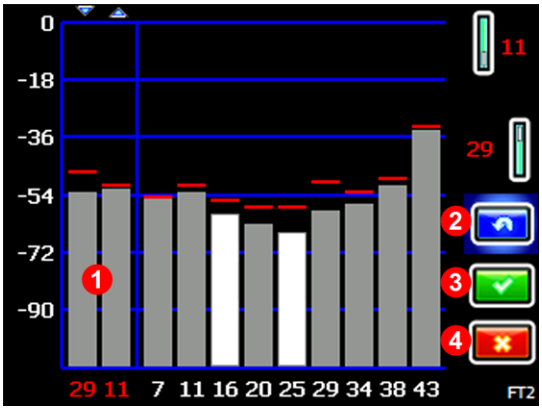
- The **Sub-k Rebar (FTR)** transmitter in its Down mode uses mid-power, ultra-low frequencies in the 0.33–0.75 kHz range for the depth/locate signal, plus frequencies at 4.5–18 kHz specifically for data, for best performance around passive interference like rebar. It also features a standard-power Up mode that functions like our original transmitter using just Bands 7–16 (4.5–18 kHz). The Sub-k Rebar transmitter is an excellent solution for tough interference conditions commonly found around rebar.
- **Full Scale Sensitive Pitch** provides extremely sensitive 0.1% pitch resolution throughout the entire range of ±99.9% slope for precision grade work.
- The frequency optimizer now always shows interference in the two currently selected bands as active graphs at the left of the FO screen. This also simplifies the **Transmitter Selection** menu by removing the now unneeded **View Frequency Optimization** icon.

To add these features to an earlier-model Falcon F5 receiver, contact Customer Service at 425.251.0559 or dci@digital-control.com.

Rebar transmitter users in Australia may require a modification to the receiver to accommodate regional frequency parameters. Please contact your local dealer for more information.

Frequency Optimizer (FO)

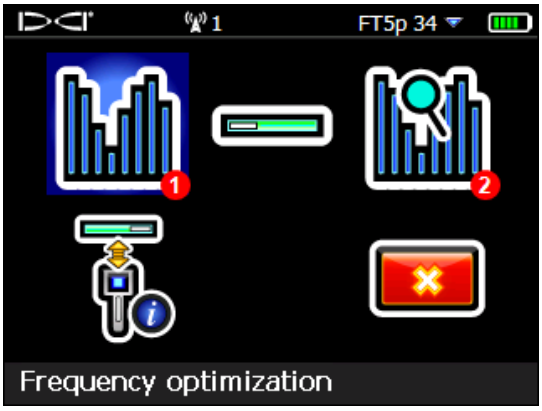
The frequency optimizer now shows active interference in the two currently optimized bands as live graphs at the left of the FO screen. If you walk the intended bore path with the transmitter off and these levels remain low, the current bands may be performing well enough that you may choose to not scan and pair new frequency bands.



1. Interference in the currently optimized bands
2. Start frequency optimizer
3. Accept selected bands
4. Exit

Frequency Optimizer

This removes the **View Frequency Optimization** option from the **Transmitter Selection** menu (#2 below).



1. Frequency optimization
2. View Frequency Optimization option is removed

Transmitter Selection Screen

Simply select **Frequency optimization** to view current levels of active interference in the current bands.

Selecting Sub-k Rebar

On a Sub-k Rebar (FTR) transmitter, the receiver uses six frequency bands specifically intended for use in areas of high passive interference:

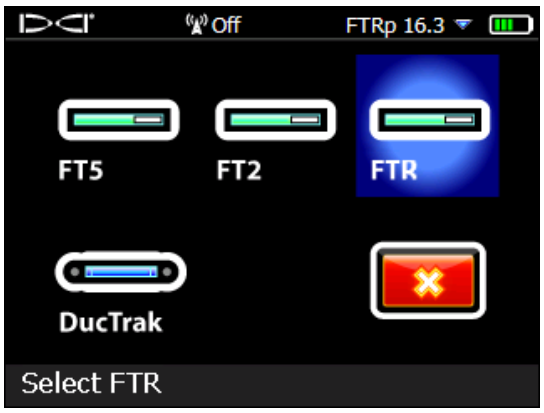
	Depth Bands			Data Bands		
Band Number	**0.3**	**0.5**	**0.7**	**7**	**11**	**16**
Range in kHz	0.33 – 0.40	0.40 –0.58	0.58 – 0.75	4.5 – 9.0	9.0 – 13.5	13.5 – 18

The Sub-k Up band provides standard-power depth/data capability with options for Bands 7, 11, and 16. The mid-power Down band uses these same frequencies for data, but assigns depth to new ultra-low bands 0.3, 0.5, and 0.7. By focusing performance in a narrower band of low frequencies, the Sub-k Rebar transmitter achieves exceptional results around sources of passive interference such as rebar.

With Sub-k, optimize and assign the Up and Down band in the same location, since they use the same band for data.

To select the Sub-k Rebar (FTR) transmitter:

1. From the Main menu, select **Transmitter selection**, **Transmitter selection**, then the new **FTR** Sub-k transmitter (for 19-, 15-, or 8-inch).



Transmitter Selection

2. At the Locate screen, toggle down to open the Main menu to optimize, pair, and calibrate the transmitter.

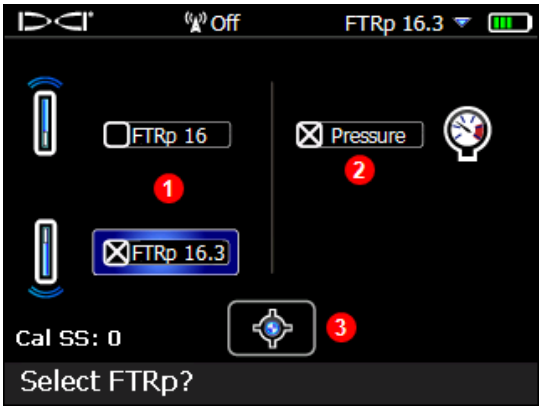
The Up and Down bands on a Sub-k Rebar transmitter have different performance characteristics, most notably, range. Using the 15-inch transmitter as an example, its depth/data range using the ultra-low frequencies available in the Down band is 15.2 m. However, when using the Up band and only its higher 4.5–18 kHz frequencies, its range is about 30% farther, or 19.8 m.

Switching Bands

Switch the transmitter between Up and Down bands pre- or mid-bore using any of the methods described in the Falcon F5 QSG or operator's manual.

On the receiver, hold-toggle right at the Locate screen to open the Band Selection Menu, where you can switch between the optimized Up and Down bands and turn on fluid pressure monitoring.

- The **Up** band is standard power with three bands encompassing a range of low frequencies.
- The **Down** band is mid-power with three ultra-low bands (0.3, 0.5, and 0.7) specifically for depth/locates, plus also uses the optimized Up band (7, 11, or 16) for data signal.



1. **Up or Down band**
2. **Pressure on/off**
3. **Locate mode**

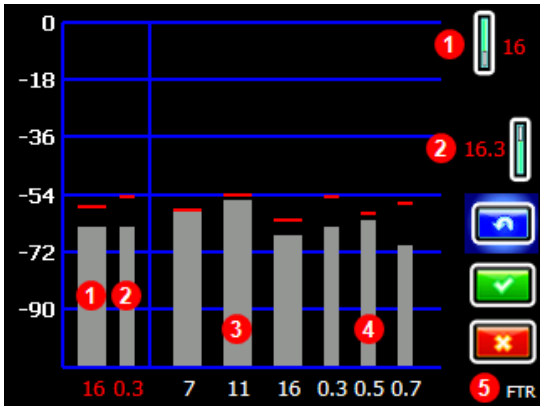
Band Selection Menu

Select **Pressure** to show fluid pressure transmitter data.

The FO graph does not show passive interference. The lowest band in the ultra-low frequency range (0.3) is always best for passive interference alone. However, if active interference in that band (shown on the FO graph) is exceptionally high, consider using 0.5 or 0.7.

Optimizing with Sub-k Rebar

The frequency optimizer (FO) has a slightly different look when you use a Sub-k Rebar transmitter. In addition to the currently optimized FO bars at the left, the remaining bars show the active interference (noise) in just six low-frequency bands.



1. Up mode band (one)
2. Down mode bands (two)
3. Interference in data bands 7–16
4. Interference in depth bands 0.3–0.7
5. Current transmitter

FO Screen for Rebar Transmitter

Here's how to optimize with a Sub-k transmitter:

1. From the Main menu, select **Transmitter Selection**, then **Frequency Optimization**.
2. With the transmitter off, walk the bore while observing interference levels in the two currently optimized bands (left side of screen). Interference will be greatest where two bars are highest, and recorded by the red Maximum marks.
3. At the point of greatest interference, select **Scan** to optimize frequencies in the three data and three depth bands. *If the current optimized bands are already performing as well as these newly optimized bands and you want to continue using them, select **Exit** and skip to the last step.*
4. Toggle to a wide band (7, 11, or 16) and click twice to select and assign as the Up band. The band number changes from red to green to indicate a new selection.
5. Toggle to a narrow depth band (0.3, 0.5, or 0.7) and click twice to select and assign as the Down band. This ultra-low frequency band is for depth/locate signal; data signal is sent on the Up band frequency. The two bands used in Down mode, such as 16 and 0.3, display together above as 16.3.
6. Insert batteries to power on the Sub-k transmitter, which will cause interference levels on the graph to spike and confirm that the transmitter is on. If the levels do not change, the transmitter is not powered on.
7. Select **OK** to assign the bands.
8. At the next screen, select **Transmitter pairing request** to pair with the transmitter.
9. At the transmitter pairing request screen, select whether to pair in standard pitch mode or Full Scale Sensitive Pitch (FSSP) mode (FSSP requires an FSSP-capable transmitter; see page 6).

The lowest band in the ultra-low frequency range (0.3) is always best for passive interference alone. However, if active interference in that band (shown on the FO graph) is high compared to the other bands, consider using 0.5 or 0.7.

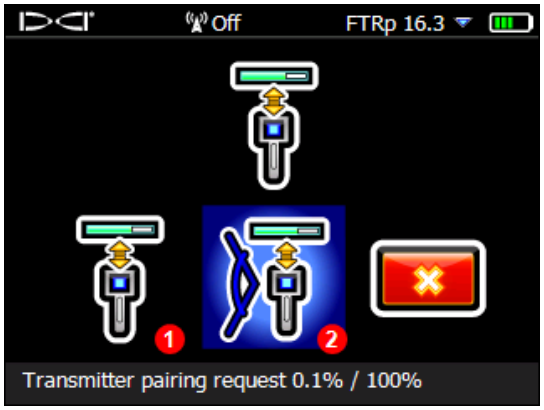
10. Pair the transmitter by aligning the IR ports (the divot on the transmitter and the small round port in the upper center portion of the receiver front) and clicking the trigger.
11. After pairing, the transmitter defaults to using the Down band. Calibrate with the transmitter in a housing in both the Up and Down bands, then perform an AGR test as described in the Falcon F5 operator's manual.

Full Scale Sensitive Pitch (FSSP)

FSSP mode requires an FSSP-capable transmitter. FSSP provides 0.1% pitch resolution throughout the entire range of ±99.9% slope for precision grade work.

FSSP is included on Falcon F5 19- and 15-inch fluid pressure transmitters with software v2.1.1.0 or higher. You can view a transmitter's software version by selecting **Transmitter selection** from the Main menu, then **Transmitter information**, then **Transmitter information request** while holding the IR port to the receiver as if you were pairing. If you select FSSP mode while pairing but it is not available on the transmitter, the transmitter will pair but only provide the standard pitch resolution.

After the transmitter pairing request screen, select **Transmitter pairing request 0.1%/100%** (#2 below).



1. **Standard pitch mode**
2. **FSSP mode**

Transmitter Pairing Request Screen

Standard transmitter pairing (#1 above) yields lower pitch resolution as the pitch increases:

±% Grade	± Degrees Grade	% Resolution
0 – 3%	0 – 1.7°	0.1%
3 – 9%	1.7 – 5.1°	0.2%
9 – 30%	5.1 – 16.7°	0.5%
30 – 50%	16.7 – 26.6°	2.0%
50 – 90%	26.6 – 42.0°	5.0%

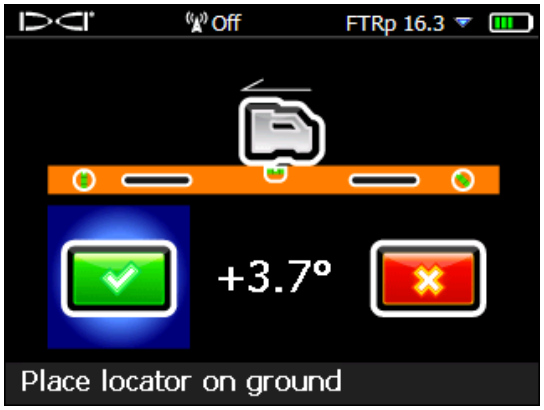
But in FSSP mode, the FTP transmitter retains and transmits 0.1% resolution at all times within ±99.9% slope.

While in FSSP mode, fluid pressure resolution decreases:

kPa	172	345	517	689	862	1034	1207	1379	1551	1724
Standard Resolution										
0 – 517	7 kPa									
517 – 1724				34 kPa						
FSSP Resolution										
0 – 345	34 kPa									
345 – 1034			69 kPa							
1034 – 1724							138 kPa			

Surface Grade

Surface grade assists in determining the pitch of the surface terrain being drilled, which is useful when it is necessary to maintain a consistent drilling depth. To show surface grade, open the Main menu and select **Diagnostics**  , then **Perform level check**  . Level check now includes the numeric value of the surface grade, in degrees or percent depending on your settings.

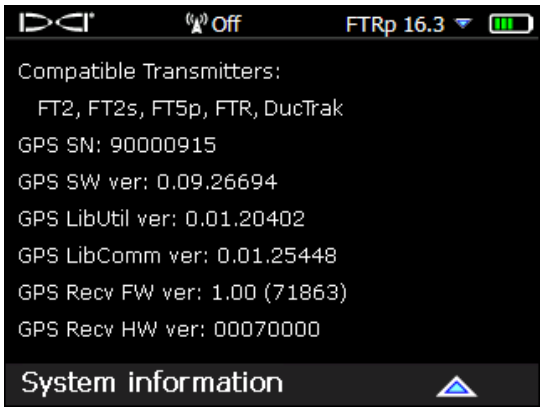


Diagnostic Level Check

To show proper surface grade on ground that causes the receiver to tilt to one side (roll), hold the receiver as close to 12:00 as possible.

Compatible Transmitters

From the Main menu select **System Information** and toggle down to the third page to read which transmitters are compatible with your Falcon F5 receiver. If an iGPS module is properly connected, this page displays its serial number and software versions as shown.



System Information Screen

As of mid-2017, Falcon F5 system has its own 8-inch transmitter, the FTR5s.

Transmitter Current Draw Warning

Transmitter over-current—drawing too much current from the batteries, which shortens battery life—may occur due to weak or used batteries or use of an incompatible drill housing. Excessive current is indicated by a lightning bolt over the transmitter battery strength icon on the Locate screen.

The Falcon transmitter only performs this current draw test for five minutes after powering on. The transmitter must be installed in the drill head for this test to be valid. Different drill heads and slot arrangements will affect current draw and battery life.

This feature does not work with 8-inch transmitters.

Changing Frequency Bands

For the three pre-bore and mid-bore methods of changing frequency bands discussed in the operator's manual, the FTR transmitter reacts differently than other transmitters when the band changes. Because the data band (7, 11, or 16) does not change, roll and pitch will not drop out briefly. Only the depth/locate signal (sent on bands 0.3, 0.5, or 0.7) will change, which may not be obvious on the remote display.

Updates to Manual

Beyond the features already discussed in this document, this section addresses numerous updates and improvements to the current Falcon F5 Operator's Manual, including helpful tips on using certain features. They are marked as New, Helpful, Clarification, or Deleted. Please read these topics to learn the latest information about your locating system.

Getting Started

New: Falcon technology is now better at combating passive interference using Sub-k Rebar transmitters. This transmitter allocates three new ultra-low bands between 0.33 and 0.75 kHz (330–750 Hz) specifically for depth/locate readings, plus Bands 7, 11, and 16 for data. Together these are an excellent combination for tough rebar conditions. The Sub-k Rebar transmitter is available in 19-, 15-, and 8-inch sizes.

New: Falcon F5 now also offers GPS capability when you add the convenient iGPS® module, available separately or bundled with your new Falcon F5. Combine with the free LWD Mobile app to see your bore plotted in real time on a map on your smart device and add a map view to the Log-While-Drilling (LWD) report on your PC. Read the Falcon F5 Supplement A, available on our website, for more information on iGPS.

Setup Summary

New: The frequency optimizer now shows interference in the currently selected bands at the left side of the optimization screen (see page 5). Before optimizing, use these readings to find the place along the intended bore path with the highest level of interference, then optimize there. If the existing bands are performing as well as the newly optimized bands, you can continue using them without having to pair and calibrate.

New: When pairing, the receiver now offers an option for Full Scale Sensitive Pitch (FSSP), discussed earlier in this Supplement. FSSP is available on all FTR and FT5p transmitters with software v2.1.1.0 or higher.

Receiver

Overview

Clarification: The IR port on the receiver is the small round port on the upper center of the receiver's front panel.

1. IR port

Falcon Receiver

New: To view which transmitters are compatible with your receiver, open the Main menu, toggle down and select **System Information**, and toggle down again to view a list. Your receiver may need an update to use our latest transmitters; please contact Customer Service for more information.

This screen also provides software and serial number information for a connected iGPS module.

DataLog

Left/Right Offset

Helpful: Offset can be turned on or off and the distance between selected rods can be changed at any point along the bore path.

Flags and Pins

Clarification: Flags and Pin position relative to the rod number being recorded must be based on the Locate Line (LL), not a Front or Rear Locate Point (FLP, RLP). The LWD recording will also note the X-Distance of the Flag or Pin from the starting point of the bore since the LL is not always directly above the drill head on steep-and-deep bores.

Calibration and AGR

View Calibration

Helpful: The **Transmitter Calibrations** page now also lists the Up and Down calibrations for Sub-k Rebar transmitters.

Transmitter Selection and Frequency Optimization

Frequency Optimization

Deleted: Because the FO screen now shows interference for the currently optimized bands at the left of the screen, the **View Frequency Optimization** feature and icon have been removed.

New: The frequency optimizer now shows interference in the currently optimized bands at the left side of the optimization screen (see page 5). Before optimizing, use these readings to find the place along the intended bore path with the highest level of interference, then optimize there.

New: Falcon 19- and 15-inch fluid pressure transmitters now include a Full Scale Sensitive Pitch (FSSP) mode (see page 6). This option appears at the end of the pairing sequence.

New: When using a Sub-k Rebar transmitter, additional frequency bands are available:

				Falcon F5 Wideband Transmitter								
	Falcon F5 Sub-k Rebar Transmitter											
Band Number	0.3	0.5	0.7	7	11	16	20	25	29	34	38	43
Range in kHz	.33 – .40	.40 – .58	.58 – .75	4.5 – 9.0	9.0 – 13.5	13.5 – 18	18 – 22.5	22.5 – 27	27 – 31.5	31.5 – 36	36 – 40.5	40.5 – 45

New: After optimizing a Sub-k Rebar transmitter, choose from bands 7–16 for the Up band depth and data signal. Then choose from bands 0.3–0.7 for the Sub-k Rebar Down band for depth/locate signal. In Down mode, the Sub-k also uses the Up band for data.

View Frequency Optimization

Deleted: This feature has been removed.

Diagnostics

New: The **Perform Level Check** feature now displays the numeric value of the surface grade. Knowing the surface grade is helpful for maintaining a consistent drilling depth. See Surface Grade on page 7.

Locating Screens

Depth Screen, Max Mode

Helpful: During deep bores or around extreme interference conditions, the locating ball and/or locate line (LL) may not center properly in the box. Try rotating the locator up at different angles to center the ball or LL and acquire depth and pitch. Continue trying different angles if needed when the receiver has entered Max Mode.

Transmitter

New: Falcon F5 now has 19-, 15-, and 8-inch transmitters in both original and Sub-k Rebar models. Refer to the Falcon F5 Transmitter Specification Sheet on our website for complete specs.

New: Falcon 19- and 15-inch fluid pressure transmitters now include a Full Scale Sensitive Pitch (FSSP) mode (see page 6).

Batteries and Power On/Off

New: Falcon F5 is now compatible with two 8-inch wideband transmitters: FTR5s (Sub-k Rebar) and FT2s (original). These require a single lithium 123 3V battery. Insert the positive end first. The battery should provide a maximum of 3.6 VDC and will last up to 12 hours.

Sleep Mode

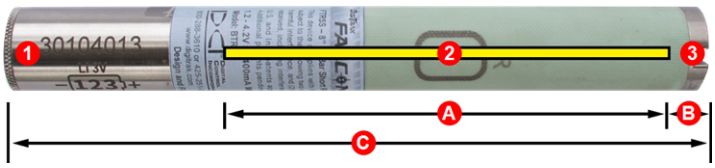
Clarification: A transmitter can be awoken from sleep mode with a roll as little as two clock positions, or 60 degrees. A half-turn (180°) is not necessary.

Attenuated Signal

Clarification: The receiver will not calibrate when the signal strength is flashing red, indicating the presence of extreme interference. When the **A** icon flashes red and the receiver is close enough to the transmitter to raise the signal strength to 1185, the receiver will not show a depth.

Transmitter Drill Head Requirements

New: For 8-inch transmitters:



1. **Battery cap**
2. **Slot position**
3. **Front end cap**

A. **Slot length**
B. **Distance**
C. **Transmitter length**

	A Minimum	B Maximum	C
8-inch wideband transmitter	10.2 cm	2.5 cm	20.3 cm

– End of Supplement –