

# Extreme Equipment Sales & Rentals

## PowerDrive 4.6 Software Transition

### Revision 7.0



Date: May 15, 2024

Applicability: PowerDrive Orbit, G2, and NeoSteer

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### BACKGROUND INFORMATION

For several years, customers could choose between single-page and multi-page downlink functionality in Extreme RSS tools by choosing '3.2 Software' or '4.1 Software' during maintenance cycles. Configuration could only be done during maintenance and often limited the availability of specific versions per application.

Version 4.6 software enables users to have access to both single and multi-page functionality through standard downlinks that can be sent at the rigsite. This is done via the advent of an 'Engineering page' that allows the user to reconfigure a tool via downlink at the rigsite. Version 4.6 also includes several other improvements that have been vetted in applications around the world in versions 4.2 and higher.

Users must be aware of the software version (3.2,4.1, 4.6) and the specific configuration (single or multipage mode) to operate the tool without issues.

### COMMERCIAL INTRODUCTION

Starting in April 2024, Extreme will be stocking selected rental equipment at its staging locations in Katy, Midland, Bridgeport, and Casper as version 4.6. These tools will be configured to start in single page mode.

Schlumberger		PDCU-GA Tool Configuration Report	
Job Information			
Tool Firmware Version	46 b100.03		
ToolScope Framework Version	ToolScope 2020.0.2.2C		
ToolScope PDX6 Version	2020.0.460.11		
Tool Description			
Tool Clock	11967		

**Tool programming header showing "Tool firmware Version = 46 xxx" indicating that the tool has been programmed with 4.6**

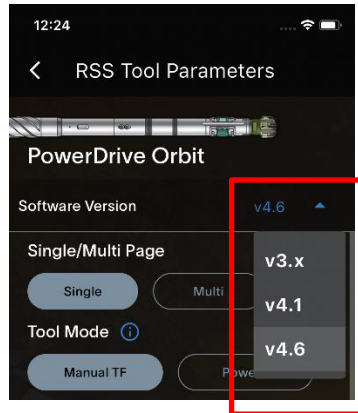
Tool Configuration Parameters				
Name	Value	Units	Report Name	Group
CollarSize	4.75		Collar Size	Tool Description
DlnkBitPeriod	18	s	Bit period of automated flow downlinks	Initial Steering Settings
DrillinnCvclde	180		Duration of drilling cvclde	Initial Steering Settings
FeatureEightSectorGamma	0		Eight sector gamma (0 = four sectors, 1 = eight sectors)	Feature List
FeatureHIA	1		Hold Inclination and Azimuth Mode	Feature List
FeatureSinglePageDLK	1		Enable single page or multipage downlink maps (0 = Multi, 1 = Single)	Feature List
SHK_AdapterRing	1		Shock Adaptor Ring fitted (0 = No, 1 = Yes)	Feature List

**Tool programming configuration report showing "FeatureSinglePageDLK = 1" indicating tool will start in Single Page (0)**

Customer-owned equipment can be ordered to PowerV, 3.2 (Single Page), 4.1 (multi-page), or 4.6 (configurable) by request. Customer owned equipment can also be ordered with specifically configured starting point – like single or multipage to eliminate downlinks.

## 4.6 BASIC FUNCTIONALITY OVERVIEW

Updated versions of the PowerDrive application (for iPhone and Android) support version 4.6 by drop down menu. This has been vetted during field testing in Extreme.



A tool programmed with 4.6 in single page mode will operate very much like a tool programmed with 3.2 software. The following differences will exist to the single page steering map (Page 0):

Downlink Command	4.6 Single Page	3.2 (Single Page)
2-24	Go to Page 7: Engineering Page	Downlink Bit Period to 18 seconds
2-25	Downlink Bit Period to 18 seconds	Downlink Bit Period to 36 seconds
2-26	Downlink Bit Period to 36 seconds	Not used

A tool programmed with 4.6 operating in multi-page mode will operate much like a tool programmed with 4.1 software.

4.6 includes the use of an Engineering page (page 7) to allow for reconfiguration of the tool via downlink. Downlinks to Page 7 are available from both single and multi-page modes. Once the tool is on Page 7, the next downlink accepted will reconfigure the tool.

Starting Point	Page 7 downlink	End state
Single Page Mode	2-26 – Engage/Disengage Single Downlink Page Mode	Multi-page mode – Similar setting to starting point in Single Page mode
Multi-page Mode	2-26 – Engage/Disengage Single Downlink Page Mode	Single page mode – Similar setting to starting point in Multi Page mode
Single or multi-page modes	Rejected Downlink	Starting Point
Single or multi-page modes	Any accepted downlink other than 2-26	Setting changed and back to starting point

If a tool in single page mode (Page 0) detects a downlink to Page 7, the next downlink will reconfigure the tool. If a 2-26 downlink is received after a downlink to Page 7, the tool will toggle between single page and multipage modes. The steering mode will not change. For example...

- If a tool is in single page mode in HIA, it will toggle to multipage mode on Page 3 (HIA) with the same targets and configuration as the tool had been in single page mode.
- If a tool is in single page manual mode with a particular setting, it toggles to multipage mode on Page 0 (manual mode) with the same settings it had in single page mode.

As with 4.1, if at any point during operations in 4.6 multi-page mode (including Page 7)...

- Downlink 1-0 always resets the tool to Page 0 - 0 degrees MTF – Steering ratio = 0% (manual, neutral mode in Magnetic Toolface)
- Downlink 2-31 always resets the tool to Page 0 – 0 degrees GTF – Steering ratio = 0% (manual, neutral mode in Gravity Toolface)

Do not use 2-18 from Page 7– Engage/Disengage Alternative All Axis unless consulting with Extreme. This functionality will be made available in the future.

Extreme configures all PowerDrive control units (regardless of firmware) to Extended protocol for real time communication. Babel Fish receives this data and makes it available to the MWD system to transmit uphole. All typical status words and values remain valid from 3.2 and 4.1 software versions. However, there are a few new data points that will be used with 4.6 software.

Data Point Name	Number of Bits	Scale	Offset	Description
PD3B3	3	1	0	Multi-Page Mode (0-7) (same as DLKPAGE in other protocol schemes)
RTSTAT2	12	1	0	Onboard diagnostics – See chart in appendix
RTSTAT3	6	1	0	Indicates firmware v.4.6 configuration (Page 7 features)
RTSTAT4	6	1	0	Azi mode single/blended/multi, DZM enabled/disabled, Drilling state

While in single page mode, PD3B3 (or DLKPAGE) will always be '7'. This is due to limited bits for this status word. Downlinks from single page to the Engineering page (Page 7) can only be confirmed by DLNK\_b or PDSTEER.

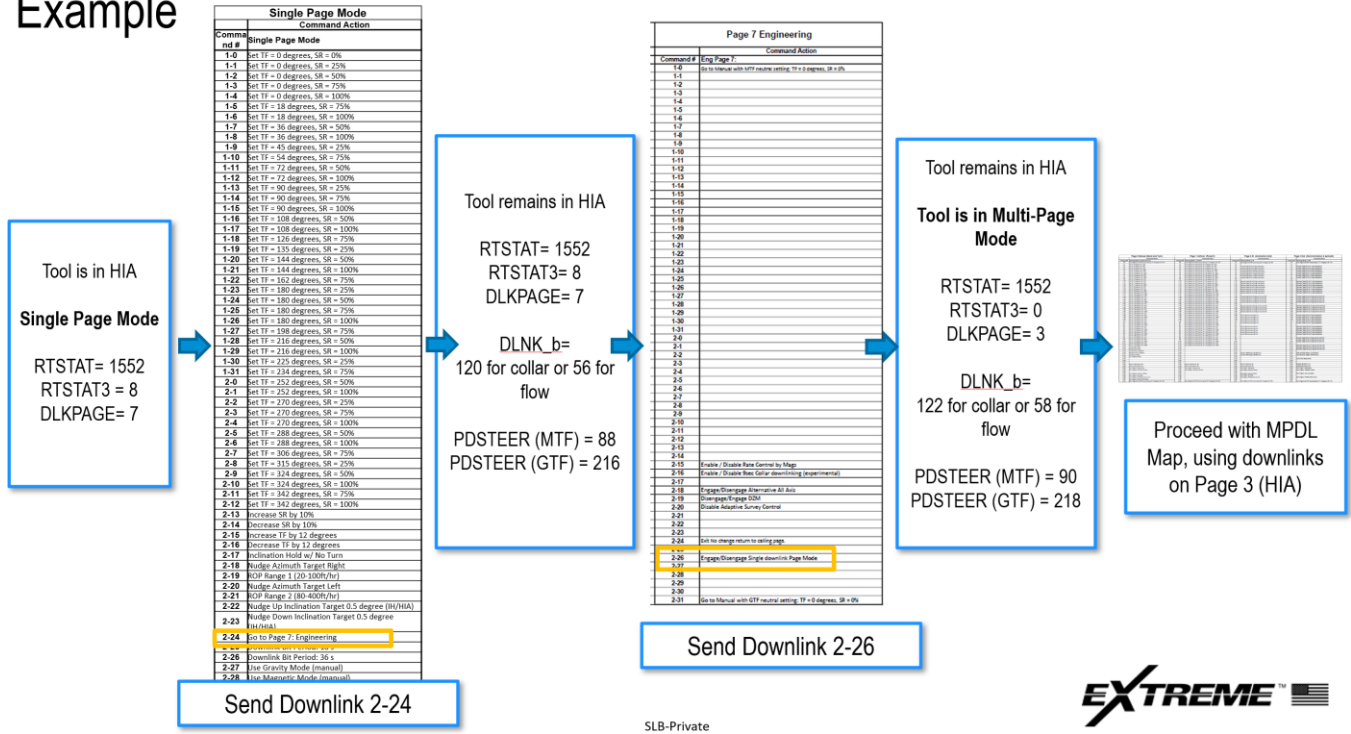
APPENDIX - 4.6 SUPPLEMENTAL DETAILS

Additional real-time onboard diagnostic information provided via RTSTAT2.

RTSTAT2 Value	Definition	Description	Recommended Action
0	No Errors	No Errors detected by the tool	Continued Operations
8	Invalid Static Survey	GTotal is out of range, or the control unit is not holding steady.	Recycle pumps to retake the static survey.
9	Survey Azimuth Diverging	Single and all axis azimuth are diverging while in HIA	Downlink to use all axis azimuth
10	Invalid Static Survey	Invalid Static Survey due to Gyro.	Recycle pumps to retake the static survey. Monitor RT values in case of gyro failure
200	Gyro Failure	Gyro offset detected effecting static survey and control unit roll rate	Monitor RT values in case of gyro failure in case
201	Gyro Failure	Gyro Measurement failure effecting survey and control unit role rate	Downlink to use to Gyro for Mission Critical and use Magnetometers
500	Downlink Noise	Noisy Steady State. Quality of pre downlink quiet period is not met.	Send the downlink again, this time hold the steady flow rate at the start and end of the downlink as per the EM-Manual Downlink program in HSPM
501	Downlink Level	High to low levels below good correlation energy levels	Send downlink again. This time increasing the difference between the high and low levels
502	Downlink Unknown	Unknown downlink command detected.	Downlink failed. Send downlink again
503	Downlink Noise	Noisy Steady State. Quality of post downlink quiet period is not met.	Send the downlink again. This time hold the steady state at the end of the downlink
504	Downlink Delay	Not enough steady flow wait time after pumps up or between downlinks. Tool cannot determine downlink.	Send the downlink again, this time hold the steady flow rate at the start and end of the downlink as per the EM-Manual Downlink program in HSPM
3324	Comms Timeout	Surface software has not received updated value in 11 minutes	
3581	Comms No Data	Surface software has not received any data	
3838	Comms Default	This is the initial value on surface for first 10 minutes until value or other comms errors	

Example of downlinking to multi-page mode from single page mode.

## Example



A complete listing of Page 7 downlinks. These reconfiguration possibilities and modes will be expanded over time as the technology progresses.

Page 7 Engineering	
Command #	Command Action
1-0	Go to Manual with MTF neutral setting: TF = 0 degrees, SR = 0%
1-1	
1-2	
1-3	
1-4	
1-5	Enable / Disable Rate Control by Mags
1-6	Enable / Disable 9sec Collar downlinking (experimental)
1-7	
1-8	Engage/Disengage Alternative All Axis
1-9	Disengage/Engage DZM
1-10	Disable Adaptive Survey Control
1-11	
1-12	
1-13	
1-14	
1-15	Exit No change return to calling page.
1-16	
1-17	Engage/Disengage Single downlink Page Mode
1-18	
1-19	
1-20	
1-21	
1-22	
1-23	
1-24	
1-25	
1-26	
1-27	
1-28	
1-29	
1-30	
1-31	Go to Manual with GTF neutral setting: TF = 0 degrees, SR = 0%

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New shock and vibration variables are available in 4.6. In extended protocol (all PowerDrive tools from Extreme are configured in extended protocol):

RT DPoint	Bit Size	Bit Location	Named bits	Scale	Offset	Unit	Working Range
PD6B1	6	5-0	LatShkPeak	5	25	Gs	25-345
PD6B2	6	5-0	LatVib	1	5	Grms	5-67
PD6B3	6	5-0	AxiShkPeak: 4-0	1	3	Gs	3-33
PD6B4	6	5-0	AxlVib: 4-0	1	3	Grms	3-33

**For use with extended protocol these scales/offsets will need to be applied**

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Additional nudges are available in 4.6 (reference the PD application). These nudge target inclination by 0.75 and 1.5 degrees.

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Adaptive neutral can be configured 'off' in 4.6 by request (shop configuration only). Adaptive neutral is intended to minimize mechanical wear on the assembly by rotating the control unit near collar speed during neutral cycles. The downside of this functionality is that recorded data may be 'noisy' and difficult to view if the Control Unit is chasing a very irregular collar RPM.

Customers that own tools can configure this from the shop by request. Rental tools will be configured per application where tradeoffs have been evaluated.