

OPERATORS MANUAL

Service Rig DAS Manual

Rigsmart Syst	ems	
<u>10,000 lb</u> <u>25%</u> MAX LOAD = 40,000 lb	BLOCK HEIGHT 2.0' MAX 51.5' MIN 0.5'	
BY- PASS SELECT 25		
	25	



CAUTION

Failure to operate this equipment properly may result in damaged equipment, downtime or injury. For any questions or training, contact Rigsmart Systems before use.

Rigsmart Systems Best Practices

- **Washing** Please do not pressure-wash Rigsmart components. Direct application of highpressure water can break seals and lead to moisture damage.
- **Replacing Components** Remove batteries from spares, or components that have been replaced. Spares and replacement components will share the operating frequency of the unit they are replacing and can interfere with normal system operation if allowed to transmit.
- Swapping components between rigs Rigsmart components are not directly transferable between Rigsmart systems. An identical component from one rig cannot readily be used to replace one from another rig. All components are initialized for a system receiver. This allows adjacent installations while eliminating cross-talk between components.
- Welding Disconnect or power off the Rigsmart system before any welding takes place near the systems placed on the rig. Our components have built-in current protection, but welding can interfere with normal operation.
- Adding wireless devices Wireless routers, bridges and or controls for non-Rigsmart systems, can potentially cause interference with Rigsmart system communications. Please consult a technician before adding wireless devices to a rig.
- **Recalibration** Loss of power, ground thaws, slipping line and changing components can necessitate a recalibration. Consult this manual for system recalibration. If assistance is required, please contact Rigsmart Systems, at 1-780-438-9475.
- **System Malfunction** In the event of a system malfunction, record the status of the Rigsmart system, including all alarms and current readings, prior to powering off the system. This information will assist the Rigsmart technicians determine the nature of the problem and find a prompt solution.
- **Pneumatic Device Care** DO NOT blow Glycol or other methyl hydrates such as brake line antifreeze or tanner gas, through air lines that lead to Rigsmart pneumatic devices. Permanent damage may occur and safety critical devices may not operate correctly.



Contents

W	arranty	5
1	Description	6
2	Normal Operation	7
	 2.1 Start Up 2.2 Main Operation Screen 2.3 Tare 2.4 Sig 2.5 Info 2.6 Setup 	7 7 8 9 9 9
3	Operating Alarms	10
	3.1 Using Bypass	11
	3.2 Low Air Pressure	11
	3.3 Using the Raise Derrick Menu	11
	3.4 Using Ram Saver Mode	13
4	System Calibration	14
4	4.1 Block Height Calibration	14
4	4.2 Full Block Height Calibration – Encoder on Drawworks	14
	4.2.1 Enter Supervisor Mode	14
	4.2.2 Choose the Block Parts of Line	14
	4.2.5 Calibrate the Lowest Point	10
	4.2.5 Enter the Laver Change and Crown Calibration Points	20
	4.2.6 Return to the Main Operation Screen	22
4	4.3 Slip and Cut (First Layer Change Block Height Recalibration)	22
4	4.4 Simple Block Height	24
4	4.5 Load Calibration	26
	4.5.1 Set Span	26
	4.5.2 Set Zero	28
	4.5.3 Restore Factory Calibration	29
	4.5.4 POL (Parts of Line)	31
_	4.5.5 4-20mA weight Output	32
5		35
ļ	5.1 Crown and Floor Saver Limits	35
	5.1.1 Procedure Overview	38
I	5.1.2 Step by Step Instructions	30 ⊿2
ì	5.2 Pressure Limits	<u>-</u> ΔΛ
Ì	5.4 Wind Speed Limits	 45
`		40



6 Troubleshooting	1 7
6.1 Testing the Hardware Wireless Crown Saver, with a Software Crown Saver Installed4	7
6.2 Using the Supervisor Permission Code4	9
6.3 Diagnostics	2
6.3.1 Signals	2
6.3.2 Outputs	2
6.3.3 Device Diag	2
6.3.4 Viewer	3
6.3.5 Voltage	კ ი
6.3.7 RF Meter 5	с С
6.4 Battery Replacement	4
6.5 Antenna and Signal Issues	5
6.6 Measuring Block and Top Drive Heights	6
6.7 Common Error Messages Codes and Solutions	7
6.8 Alarm Code Master List	9
6.9 In the Event of System Power Loss	3
7 The DAS User Interface	34
7.1 Connecting to the System64	4
7.2 Dashboard	4
7.3 Devices	5
7.4 Creating Reports	8
7.4.1 The Reporting Page – Reports Tab6	8
7.4.2 The Reporting Page – Report Builder	9
8 Service 7	' 2
8.1 Regular System Maintenance	2
8.2 The Rigsmart Replacement Exchange System:	4
Replacement Agreement – please complete7	5



For sales, service or assistance: **1-780-438-9475**

You have invested in the industry's leading technology in rig safety equipment. Thank you for your business.

RIG SAFETY. MADE SIMPLE.

This manual covers the operation of the Rigsmart system. Each system is custom designed to the rig and customer. <u>Not all information contained in this manual may pertain to your specific system</u>. For any questions about system design, contact Rigsmart Systems.

Warranty

Rigsmart Systems warrants to the purchaser of each new Rigsmart System that any part thereof which proves to be defective in material or workmanship within one (1) year from date of delivery will be repaired or replaced at no charge if the system is returned to us in Edmonton, Alberta with all freight charges prepaid. If a performance problem should occur, contact our office in Edmonton, Alberta at 1-780-438-9475.

This warranty does not cover defects resulting from accident, alteration, improper use, or failure of the purchaser to follow normal operating procedures as outlined in this instruction manual.

PLEASE NOTE:

OPENING THE DISPLAY/RECIEVER PANEL VOIDS WARRANTY. THIS WARRANTY IS IN LIEU OF ANY WARRANTY OR MERCHANTABILITY AND OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ALL OF WHICH ARE HEREBY EXCLUDED.

Rigsmart Systems shall in no event be liable for any special, indirect, or consequential damages whatsoever and neither assumes nor authorizes any person to assume for it any other obligation or liability.



1 Description

Anti-Collision System

The Rigsmart Anti-Collision system uses a set of wireless sensors to determine the position and height of the rig's traveling blocks, top drive and bails. When the traveling blocks or top drive is in a position that could contact or damage the rig, the panel will sound an alarm and apply the brakes. The system may also integrate a wireless crown saver which is installed near the rig crown. This switch is triggered and brakes activated when the blocks lift an attached counterweight. The rig's main brakes may be activated either pneumatically or electrically based on the design of the system.

Drill Line Weight Indicator

The Drill Line Weight Indicator detects how much weight is suspended by the blocks, and remains accurate over time and through extreme temperatures. Through its design, it does not need to be removed during a slip-and-cut and does not need recalibration as long as the size of the drill line used remains the same. The weight indicator may include an analog dial gauge or a connection to a third party weight system.

Throttle Limiter Speed Control

The Rigsmart Throttle Limiter will automatically limit the speed of the traveling blocks in the upwards direction before a hard stopping limit is reached. It can be integrated pneumatically or electrically based on the design of the system.

Auxiliary Brake Speed Control

The Rigsmart Auxiliary Brake Controller will automatically engage the auxiliary brake, slowing the speed of the traveling blocks in the downwards direction before a hard stopping limit is reached. It can be integrated pneumatically or electrically based on the design of the system.

Other Devices

The Rigsmart system may include a number of other devices such as pressure sensors, emergency stops, flow meters, BOP ram transducers or other transducers.



2 Normal Operation

2.1 Start Up

When the Rigsmart system is powered on, a screen will appear asking for the user to accept control over the system. For safety purposes all outputs from the system are activated at this point, engaging the rig's brakes. When the user accepts control of the system, the rig's brakes are released and normal use can begin. This intermediary control between the system and the operator safeguards the rig in the event of an unexpected power loss/restore situation. To assume control over the system, press the SELECT button on the display panel.



2.2 Main Operation Screen

In normal operation the panel will display the currently measured load and block height information as shown below. The panel will display different screens based on what sensors are installed and activated.



Pressing the SELECT button will open the Secondary Operation Screen. On this screen, slip, tong and ram information is displayed.



SYSTEM INFO				
SLIP 1Psi OPEN	TONG LOAD Ø 15 OFF		RAM OPEN	
EXIL - LED (N∕OFF TARE S	IG	INFO	SETUP

After displaying the Secondary Operation Screen for 8 seconds, the panel will automatically return to the Main Operation Screen.

2.3 Tare

If the Rigsmart system is equipped with a Drill Line Weight Indicator, it will include a tare function. This enables the operator to 'zero out' the weight of the hook load. Once the tare function has been enabled, only the weight below the hook will be displayed as the actual weight on the Main Operation Screen.

SYSTEM INFO			
SLIP 1Psi OPEN	TONG LOAD Ø 11 OFF	RAM OPEN	
EXIT JACK L	EGS →	i INFO SETUP	

To Enable Tare Out:

- From the Main Operation Screen press the SELECT button to display the Secondary Operation Screen
- Use the up or down arrow button to select TARE. This automatically opens the Main Operation Screen and a 'T' will be displayed at the end of the bar graph.

To Disable Tare Out:

- From the Main Operation Screen press the SELECT button to display the Secondary Operation Screen.
- Use the up or down arrow button to select TARE. This automatically opens the Main Operation Screen, and the 'T' indicator will no longer be displayed.



2.4 Sig

The Signals Screen displays all of the signal strengths and data packets (RF) from the wireless transducers. In optimum conditions, all signals strengths should remain above 95% with a steady increase in RF packets. It is not unusual to see occasional, momentary drops in signal strength or slight delays in RF packets, but the readings should return to normal. If they do not, see the troubleshooting section of this manual.

SYSTEM INFO			
SLIP 105i OPEN	TONG LOAD Ø 16 OFF	RAM OPEN	
EXIST - LED (N∕OFF TARE SIG	i INFO SETUP	



2.5 Info

The Info Screen displays system information. This information may be required when calling technical support.

2.6 Setup

The Setup Menu contains all of the configurable options available on the system.



3 Operating Alarms

When the system encounters a problem (or a pre-set limit) an alarm message will flash on the display panel. For more important alarms, the panel will also beep continuously and if necessary, the rig brakes will also be applied. The message will flash and the beeping will continue until the detected problem is resolved. If however, the panel's Setup Menu is active when the system detects a problem, the alarm will instead be displayed in the status bar near the bottom of the screen and the panel will not beep.



If any of the components fail, or if a signal is lost for an extended period of time, a *system alarm* will sound to indicate that there is a problem. The system alarm will display in the same way as a regular operating alarm, but will be accompanied by a faster beeping sound. System alarms for top drive sensors will trigger the brake output as if the sensor had indicated that the top drive was in an unsafe position.

BAIL ANGLE
SYSTEM ALARM
64
TOP MENU
DIAGNOSTIC CALCULATIONS
BAIL ANGLE SYS NOT FUNCTIONING =64

For more information on alarms see the Troubleshooting section at the end of this manual.



3.1 Using Bypass

The panel's BYPASS button can be used if a component is malfunctioning or needs to be temporarily overridden. Pressing BYPASS will disable the alarms and outputs for 30 seconds and allow the blocks to be moved to a safe position. The display panel will count down the 30 second interval, and then resume normal operation.



It's very important to use the BYPASS button with caution. If rig activity is resumed before the bypass state is fully counted down, any potential collisions during the countdown will not be prevented by the system.

3.2 Low Air Pressure

The Rigsmart system may be equipped to pneumatically activate the rig's main brakes. This equipment requires a steady supply of rig air of no less than 100 PSI to operate correctly. If the system detects the rig air pressure drop below 70 PSI, an alarm will register on the panel; if there is not enough air in the system to activate the rig's brake, a collision may occur.



3.3 Using the Raise Derrick Menu



The Raise Derrick Mode is used to disable alarms associated with the crown saver counterweight. Normally, the rig brakes are applied when weight is taken off the counterweight, in order to avoid a collision between the top drive and the crown. In Raise Derrick Mode however, the counterweight alarm will not be triggered and the rig brakes will not be applied, in order to facilitate a rig-up or rig-down situation. The Raise Derrick option is only available when using the supervisor permission code.



Raise Derrick Mode

When the Rigsmart system is put into Raise Derrick Mode, all outputs are bypassed and the system will not prevent any potential collisions.



- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- From the Top Menu, use the arrow buttons to highlight OPERATIONS and press the SELECT button.
- While in Raise Derrick Mode (as indicated by the displayed message) the panel outputs will be disabled.

TOD MCNII		
->COMPONENTS HEIGHT RE-C OPERATIONS	SYSTEM AL DIAGNOSTI CALCULATI	IC IONS
MAIN LOAD= EXIT	1,500dN BLOC	X 4.5m_
TOP MENU COMPONENTS HEIGHT RE-C ->UPERHOUSE	SYSTEM AL DIAGNOSTI CALCULATI	IC IONS
MAIN LOAD= EXIT	1,500dN BLOC	X 4.5m_
TUP MENUXURAR		
TOP DRIVE	on CK	
TOP DRIVE ->REPUSEDUERAD RUN CASING MAIN LOAD= EXIT	on ICK 1,500dN BLO(BACK T(:K 4.5m_)P M⊒NU
TOP DRIVE	on CK 1,500dN BLOO BACK TO STIONS XRAISE DB	CK 4.5m OP MENU RRICK
TOP DRIVE ->REPISEDUERSU RUN CASING MAIN LOADE EXIT TOP MENU>OPERA OutPuts are di Exit menu to r	on 1,500dN BLOO BACK TO TIONSXRAISE D sabled. resume normal o	X 4.5m JP MENU RRICK



To re-enable the brake output and return to normal operation, use the arrow buttons to highlight EXIT and press SELECT. Press the ACCEPT button to confirm switching modes.

While in Raise Derrick Mode, all statuses for system sensors are unavailable.

3.4 Using Ram Saver Mode

If the Rigsmart system is equipped with BOP Ram Sensors, the system may allow the Ram Saver Mode. In normal operation, if the Ram Sensors detect that a BOP ram has been closed, an alarm will sound, but there will be no output or brake control. With the Rams Saver Mode turned on, the system will enable the brakes immediately upon detecting a BOP ram being closed.

Use the following instructions to turn the Ram Saver Mode on and off:

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- From the Top Menu, use the arrow buttons to highlight OPERATIONS and press the SELECT button.
- Use the arrow buttons to highlight RAM SAVER and press SELECT. Use the arrow buttons to select ON or OFF. Press the ACCEPT button twice to save the change.

HEIGHT RE-CAL OPERATIONS	SYSTEM DIAGNOSTIC CALCULATIONS
MAIN LOAD= 1,	500dN BLOCK 4.5m
TOP MENU	
COMPONENTS HEIGHT RE-CAL	SYSTEM DIAGNOSTIC CALCULATIONS
	500-10 PLOCK 4 5
EXIT	JOOGN BLOCK 4.3
TOP MENUXOPERATION	8
- ₩¤HĭISHW⊒¤ on RAISE DERRICK RUN CASING	
MAIN LOAD= 1, EXIT BAD	500dN BLOCK 4.5m

4 System Calibration

4.1 Block Height Calibration

In order for the panel to use and display the correct block height, the drill line payout transducer must be calibrated first. The system will be pre-calibrated during installation, but the displayed value may need to be adjusted occasionally. See the section below for instructions on how to do so.

If the block height has been previously calibrated but the displayed block height on the panel is no longer correct, the calibration can be restored using the Height Re-Cal Menu (see the 'Simple Block Height Re-Calibration' section for instructions).

If the bails or elevators are changed and the new equipment is of a different size, the anti-collision limits and system calibration will need to be changed to accommodate the new equipment.

4.2 Full Block Height Calibration – Encoder on Drawworks

If this is the first time a full block height calibration has been done, follow the steps below to calibrate the system.

- 1. Set POL (parts of line)
- 2. Set drawworks direction
- 3. Set the lowest point
- 4. Set the layer change points, all the way up the derrick
- 5. Set the crown calibration point

4.2.1 Enter Supervisor Mode

In order to access the calibration settings, you must first enter the supervisor permission code. Refer to the Troubleshooting section for instructions on how to do so.

4.2.2 Choose the Block Parts of Line

By default, the system is set to one part of line. If a different number of parts of line are being run through the block, this setting must be changed before calibrating the block height. If only 1 part of line is being used, skip ahead to the next section.



• After entering the supervisor permission code and being returned to the Top Menu, new options will be available. Use the arrow buttons to highlight the COMPONENTS option and press the SELECT button.

TOP MENU ->COMPONENTS HEIGHT RE-CAL OPERATIONS	SYSTEM DIAGNOSTIC CALCULATIONS	
MAIN LOAD= 1, EXIT	500dN BLOCK	4.5m

• This will open the Components Menu. Use the arrow buttons to highlight the CALIBRATE option and press SELECT.

TOP MENUXCOMPON LIMITS ->G:D032:1113 SETTINGS	ENABLE/DISABLE	
MAIN LOAD= EXIT	1,500dN BLOCK BRCK TOP MEN	4.5m_

• This will open the Calibration Menu. Use the arrow buttons to highlight the PAY-OUT option and press SELECT.

TOP MENU	DCOMPONENTSDC	ALIBRATE	
LOAD	TD ANGLE	ANGLE	
MAIN L EXI	OAD= 1,50 T BACK	Ødn <u>Block</u> Top	4.5m Menu

• This will open the Pay-Out (calibration) Menu. Use the arrow buttons to highlight SETTINGS and press SELECT.

TOP MENU>COMPO	DNENTS>CALIB	RATEXPAY-OUT
BLOCK POSITI	ON POINT 0	BLOCK POL 4
BLUCK HEIGHI I→SINNUMSIN	י . שש י	
READY - for	· PAY-OUT Ca	libration <u> </u>
EXIT	BACK	TOP MENU



• Use the arrow buttons to highlight MAIN POL and press SELECT.

TOP MENU>COMP	<u>ONENTS>CALIB</u>	RATEXPAY-OUT
PAY-OUT DIRE	ÇTION	
I DECIMHL PUIN.		
SVS TVPE du	rum chaft	
BLOC	K HEIGHT	4.5m
EXIT	BACK	TOP MENU

• Use the arrow buttons to change the value to match the number of parts of line being used.

TOP MENU>COM	IPONENTS>CALII	RATE XPAY-OUT
Press ACCEPT	to save chang	Jes.
<u>Press SELECT</u>	<u>to discard c</u>	nanges.
INENNENNENNE Sys type	drum shaft	
BLC	CK HEIGHT	4.5m
EXIT	BACK	TOP MENU

• When the desired number of parts of line is shown, press the ACCEPT button, then press ACCEPT again to confirm and save the setting.

TOP MENU>CO	MPONENTS>CALII	
SAVE	- ARE YOU	SURE?
NATUR FOL Sys type	drum shaft	
BL	OCK HEIGHT	4.5m
EXII	BHCK	IUP MENU
TOP MENU>CO	MPONENTS>CALII	
TOP MENU>CO	MPONENTS>CALII	RATEXPAY-OUT
TOP MENU>CO	MPONENTS>CALII SAUING drum shaft	SRATEXPAY-OUT
TOP MENU>CO	MPONENTS>CALII SAVING drum shaft OCK HEIGHT	87911=>PAY-OUT

4.2.3 Calibrate the Drawworks Direction

Because the Pay-Out Transducer can spin clockwise and counter clockwise, and can be installed on either side of the drawworks, the panel needs to set which spin direction is 'up'.



• While in the Pay-Out Calibration Settings Menu from the previous step, use the arrow buttons to highlight PAY-OUT DIRECTION and press the SELECT button.

TOP MENU>CO	MPONENTS>CAL	IBRATE>PAY-OUT
DECIMHL PU MOIN POI	UNIS 1	
SVS TYPE	drum shaft	
BL	OCK HEIGHT	4.5m
EXIT	BACK	TOP MENU

• Highlight the START option and press SELECT.

TOP MENU>COMPONENTS>CAL>PAY-OUT>NONREC			
Detect the Pay-out direction.			
PRESS START TO DETECT DIRECTION			
EXIT	BACK	TOP MENU	

• As indicated on the status bar, increase the block height by a short distance until the panel displays 'DIRECTION FOUND-PRESS STOP TO SAVE' on the status bar.

TOP MENU>COMPONENTS>CAL>PAY-OUT>		
Detect the Pay-out direction.		
START	-> <u>S1018</u>	CANCEL
INCREASE BLOCK	HEIGHT	
EXII	BHUK	TUP MENU
TOP MENU>COMP	PONENTS>CAL	PAY-OUT XOURE
Detect the Pa	ay-out direc	tion.
START	-> <u>81018</u>	CANCEL
DIRECTION FOUND-PRESS STOP TO SAVE		

• With STOP highlighted, press SELECT to store the detected direction.



TOP MENU/COMPONENTS/CAL/PAY-OUT/ MURIC			
Detect the Pay-out direction.			
START STOP -→@#1204=			
PAY-OUT DIRECTION SAVED			
	NENTS>CAL -out dire STOP DN SAVED		

• After detecting the spin direction, pay-out calibration can continue. Highlight BACK and press SELECT.

TOP MENU>COMPONENTS>CAL>PAY-OUT>10013100			
Detect the Pay-out direction.			
START STOP CANCEL			
PAY-OUT DIRECTION SAVED EXIT ->BACK TOP MENU			

• Again, highlight BACK and press SELECT.

TOP MENU>COM PAY-OUT DIR DECIMAL POI MAIN POL SYS TYPE	PONENTS>CAL ECTION NTS 1 drum shaft	IBRATEXPAY=OUN
EXIT	CK HEIGHT →BACK	4.5m TOP MENU

• This will open the Pay-Out Calibration Menu.

TOP MENU>COMPONENT	S>CALIBR	RATEXPAY-OUT
→ISTUDISTICES CONTROL P BLOCK HEIGHT	OINT 0 .0m	BLOCK POL 4 CAL POL 1
OTHER	R	RF COUNT 1
READY - for PAY	-OUT Cal	libration
EXIT BA	СК	TOP MENU



4.2.4 Calibrate the Lowest Point

- Move the block down, as close to the rig floor as possible.
- Measure the distance from the rig floor to the bottom of the elevator.
- Ensure that the BLOCK POSITION setting shows POINT 0.

TOP MENU>COMP	<u>ONENTS>CALIB</u>	RATEXPAY-OUT
	MUNIPOINTØ	BLOCK POL 4 CAL POL 1
OTHER		RF COUNT 1
READY - fo	r PAY-OUT Ca	libration
EXIT	BACK	TOP MENU

• Use the arrow buttons to highlight BLOCK HEIGHT and press the SELECT button.

TOP MENU>COMP	PONENTS>CALIB	RATEXPAY=000
BLOCK POSIT	TION POINT Ø	BLOCK POL 4 CAL POL 1
OTHER		RF COUNT 1
READY - fo	or PAY-OUT Ca	libration
EXIT	BACK	TOP MENU

• Use the arrow buttons to adjust the number to the measured height.

TOP MENU>COMF	PONENTS>CALI	BRATE XPAY-OUT
Press ACCEPT t	o save chang	9es.
<u>Press SELECT t</u>	<u>o discard ch</u>	han9es.
BLOCK HEIGHT	4.5m(-	CAL POL 1
SETTINGS		
OTHER		RF COUNT 7
READY - for	PAY-OUT Ca.	libration
EXIT	BACK	TOP MENU



 Press the ACCEPT button once the desired height is displayed. Press ACCEPT again to confirm and store the value.

TOP MENU>COMPC	<u>)NENTS>CALIE</u>	RATE XE	'AY-OUT
SAVE -	ARE YOU	SURE	?
BLOCK HEIGHT	4.5m(-	CAL	POL 1
OTHER		RF COU	INT 8
READY - for	PAY-OUT Cal	librati	on
EXIT	BACK	TOP M	ienu]

TOP MENU>COMPONENTS>CALIBRATE>PAY=OUT			
SAVING			
	4.5m(-	CAL	POL 1
OTHER		RF COL	<u>JNT 8</u>
READY - for	PAY-OUT Cal	ibrati	ion
EXIT	BACK	TOP	1enu i

 If the position was stored correctly 'SUCCESS – POINT 0 Cal STORED' will be displayed on the status bar and BLOCK POSITION will change from POINT 0 to POINT 1.

TOP MENU>COM	IPONENTS>CALI	BRATE XPAY-OUT
	TON POINT 1	BLOCK POL 4
	🖬 4.5m	ČAĽ POĽ 4
I SETTINGS		RE COUNT 0
SUCCESS -	POINT Ø STOR	
EXIT	BACK	TOP MENU

4.2.5 Enter the Layer Change and Crown Calibration Points

Further calibration points are taken at the start of each drawworks cable layer change, and at the maximum height (near the height of the crown saver). If there are no cable layer changes on the drawworks, only the crown position point needs to be set.

If the drawworks has cable layer changes, move the block to the start of the next cable layer change. If there are no layer changes, move the block to the crown position.

• Measure the block height from the rig floor to the bottom of the elevator.



• With BLOCK HEIGHT highlighted press the SELECT button.

TOP MENU>COM	IPONENTS>CALI	BRETTENPAY-OUT
BLOCK POSIT	ION POINT 1	BLOCK POL 4 CAL POL 4
OTHER		RF COUNT 2
SUCCESS -	POINT Ø STOR	ED
EXIT	BACK	TOP MENU

• Use the arrow buttons to change the number to match the measurement.

TOP MENU>CO	MPONENTS>CALI	BRATE XPAY-OUT
Press ACCEPT	to save char	iges.
<u>Press SELECT</u>	<u>to discard c</u>	hanges.
BLOCK HEIG	HT 8.7m4-	CAL POL 4
SETTINGS		
OTHER		<u>RF COUNT 7</u>
SUCCESS -	POINT 0 STOR	
EXIT	BACK	TOP MENU

• Press ACCEPT once the desired height is displayed. Press ACCEPT again to confirm and store the value.

TOP MENU>COMPONENTS>	CALIBRATEXPAY-OUT
save – Are	YOU SURE?
BLOCK HEIGHT 8.	nmt— CAL POL4
	RF COUNT 8
EXIT BACK	TOP MENU
TOP MENU>COMPONENTS>	
SAUING	
BEOCK HENGHIN	nmt+ CAL POL 4
OTHER	RE COUNT 8
EXIT BACK	TOP MENU

If the position was stored correctly 'SUCCESS – FULL Cal STORED point' will be displayed on the status bar and BLOCK POSITION will change to the next point.



TOP MENU>COMP(DNENTS>CALI)	BRATEXPAY-OUT
BLOCK POSITI	ON POINT 2	BLOCK POL 4
→ <u>BECCEKEEEECCEE</u>	8.7m	CAL POL 4
SETTINGS		RE COUNT 0
SUCCESS - FL	JLL Cal STO	RED Point
EXIT	BACK	TOP MENU

- (Repeat the above steps for each layer change while raising the block to the crown.)
- Continue to take measurements and enter points at each layer change until the position of the crown saver is reached.
- Once the layer changes are complete, measure the height of the block near the crown saver and enter the value in the manner that the layer change points were entered.

4.2.6 Return to the Main Operation Screen

Once the calibration is complete, return to the Main Operation Screen to verify that everything was entered correctly.

- Use the arrow buttons to highlight EXIT and press the SELECT button.
- Press the ACCEPT button to confirm the move to the Main Operation Screen.

4.3 Slip and Cut (First Layer Change Block Height Recalibration)

If a slip and cut operation has been done, or if the cable lay on the drum has changed in relation to the height of the block for any reason, a first layer change recalibration must be done.

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- After entering the supervisor permission code and being returned to the Top Menu, use the arrow buttons to highlight the HEIGHT RE-CAL option and press the SELECT button.
- This will open the Height Re-Cal Menu.



TOP MENU	
	QUQTEM
TUP MENU	
COMPONENTS	SYSTEM
│ → HENGHU REECH	DIAGNOSTIC
OPERATIONS	CALCULATIONS
MAIN LOAD=	1,500dN_BLOCK 4.5m
FXIT	
TOD MENILVERMAN	
NDECET TO LOT I	
	<u>Harren</u> j'jw
RESELIU HEIGH	11 4.5M
BLOICK HEIGHT	4.5m RF COUNT 5
READY - for P	AY-OUT Calibration
EUTT	TOD MENU

- Move the block to position the cable on the drawworks at the start of the first layer change.
- Measure the current height of the block from the rig floor to the bottom of the elevator.
- With RESET TO 1ST LAYER CHG highlighted, press the SELECT button.

TOP MENUXHEIGHT ->RESET TO 1ST LA RESET TO HEIGHT	ERCHG 5.3m 4.5m	
BLOCK HEIGHT READY - for PA EXIT B	4.5m RF COUNT -OUT Calibration CK TOP MENU	5

• Use the arrow buttons to enter the height measured above.

TOP MENUXHENGHT REFORM	
RESET TO IST LAYER CHG 5.2m(-	
Press ACCEPT to save changes.	
Press SELECT to discard changes.	
BLUCK HELCHENGER 45 M RF COUNT	7
READY - for PAY-OUT Calibration	
EXIT BACK TOP MENU	•

• Press ACCEPT when the correct value is displayed, then press ACCEPT again to confirm.



TOP MENUXHEIGHT RE-CAL RESET TO IST LOVER CHG 5 20/-	
SAVE - ARE YOU SURE?	
	8
READY - for PAY-OUT Calibration	Ĭ.
EAT BHON TO HENO	

TOP MENUXHEIG	IT RE-CAL		
	LAYER CHG	5.2m(-	
5	AUING		
	4.5m	RF COUNT	9
READY - for	PAY-OUT Ca	libration	
EXIT	BACK	TOP MENU	

- Use the arrow buttons to highlight EXIT and press SELECT.
- Press ACCEPT to confirm and return to the Main Operation Screen.

4.4 Simple Block Height

If no slip-and-cut operation has been done, and the cable lay on the drum has not changed in relation to the height of the block since the last time the block height has been recalibrated, the Simple Height Recalibration can be used instead of the First Layer Change Recalibration. This recalibration is used if the system was temporarily turned off, and the blocks were moved.

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- After entering the supervisor permission code and being returned to the Top Menu, use the arrow buttons to highlight HEIGHT RE-CAL and press the SELECT button.
- This will open the Height Re-Cal Menu.

TOP MENU ->COMPONENTS HEIGHT RE-CAL OPERATIONS	SYSTEM DIAGNOSTIC CALCULATIONS	
MAIN LOAD= 1: EXIT	500dN BLOCK	4.5m_
COMPONENTS →HI=DUGILUMISI=EUELM OPERATIONS	SYSTEM DIAGNOSTIC CALCULATIONS	
MAIN LOAD= 1: EXIT	500dN BLOCK	4.5m_



TOP MENUXHEIGH 	IT RE-CAL LAYER CHG SHT	5.3m 4.5m	
BLOCK HEIGHT	4.5m	RF COUNT	5
READY - for	PAY-OUT Ca	libration	
EXIT	BACK	TOP MENU	

- Move the block to a known or easy to measure height (such as 0.0m with the elevator touching the floor).
- Measure the current height of the block from the rig floor to the bottom of the elevator.
- Use the arrow buttons to highlight RESET TO HEIGHT and press SELECT.

TOP MENUXHEIGE RESET TO 1ST →RESET TO 1ST	HIRECHI Layer Chg Shu	5.3m 4.5m	
BLOCK HEIGHT	4.5m	RE COUNT	5
READY - for	PAY-OUT Ca	Libration	
EXIT	BACK	TOP MENU	

• Use the arrow buttons to enter the measured height.

TOP MENUXHELL	iHT RE-CAL		
RESET TO 1ST	LAYER CHG	5.3m	
RESET TO HEL	(d:))	4.6mi-	
Press ACCEPT t	o save chaı,	nges.	
IPress SELECT t	o discard (changes.	
BLOCK HEIGHT	4.5m	RF COUNT	7
READY - for	PAY-OUT C:	alibration	L
EXIT	BACK	TOP MENU	

• Press ACCEPT once the correct value is displayed, then again to confirm.

TOP MENUXHENG	HT RE-CAL		
RESET_TO_1ST	LAYER CHG	<u>5.3m</u>	
		4.6mi-	
saue -	· ARE YOU	SURE?	
BLOCK HEIGHT	4.5m	RF COUNT	8
READY - for	PAY-OUT Ca	libration	



TOP MENUXHISUG: RESET TO 1ST	IT RE-CAL LAYER CHG HII	5.3m 4.6m4-		
SAVING				
BLOCK HEIGHT READY - for	4.5m PAY-OUT Ca	RF COUNT alibration	9	
EXIT	BACK	TOP MENU		

 Highlight EXIT and press SELECT, then press ACCEPT to confirm and return to the Main Operation Screen.

4.5 Load Calibration

The Rigsmart Weight Indicator is pre-calibrated. As long as the same size and type of drill line is used, it does not need to be recalibrated (even if the line rider is taken off during a rig move). However, if the weight indicator readings are inaccurate, minor adjustments can be made to the calibration. The original factory calibration is hard coded into the panel and can be restored at any time.

4.5.1 Set Span

To calibrate the system to a particular, known weight, use the following steps:

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- In the Top Menu, use the arrow buttons to highlight COMPONENTS and press the SELECT button.

TOP MENU ->COMPONENTS OPERATIONS	SYSTEM DIAGNO: CALCULI	STIC ATIONS
MAIN LOAD= EXIT	1,500dN	CRWN= OKAY

• Use the arrow buttons to highlight CALIBRATE and press SELECT.





• Highlight LOAD and press SELECT.

TOP MENU>COMPO	INENTSXCAL I B	
->[[[[]]])]		
MAIN LOAD=	1,500dN	CRWN= OKAY _
EXIT	BACK	TOP MENU

- Highlight SET SPAN and press SELECT. Use the arrow buttons to change the value to the known weight on the hook.
- When the correct weight is displayed, press ACCEPT twice to save.

	ENTS>CALIBR 11,100dN 000dN	ameNload Main
FHCTORY CHL		MAIL POL 1
MAIN LOAD=	1,500dN	CRWN= OKAY
EXIT	BACK	TOP MENU]

TOP N	1ENU>COM SPAN	1PON	ENTS≻ 11,	CAL II 1004	RATE>	LOAD	MAIN
Press Press	ACCEPT SELECT	to to	save disca	chan9 rd cł	Jes. Nanges		
MAIN	↓ LOAD=		1,50	ØdN	CRM	N= Ok	(AY)
E	EXIT		BAC	К		TOP 1	1enu

TOP MENU>COM	I <u>PONENTS>CALIB</u>	RATEXLOAD MAIN
SELESPHN	11,100dNK-	
SAVE	- ARE YOU	SURE?
MAIN LOAD=	1,500dN	CRWN= OKAY _
EXIT	BACK	TOP MENU

TOP MENUXCOMPO SET SPAN	NENTSXCALIB 11,100dN i -	Ranexload Mai	k
S	AVING		
MAIN LOAD=	1,500dN	CRWN= OKAY	
EXIT	BACK	TOP MENU	Ī]



4.5.2 Set Zero

To calibrate the system to a weight of zero use the following steps:

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- When returned to the Top Menu, use the arrow buttons to highlight COMPONENTS and press the SELECT button.
- Use the arrow buttons to highlight CALIBRATE and press SELECT. Use the arrow buttons to select LOAD and press SELECT.

OPERATIONS	SYSTEM DIAGNOST CALCULAT	IC IONS
MAIN LOAD= EXIT	1,500dN	CRWN= OKAY
TOP MENUXCOMPON LIMITS 	enable/i	ISABLE
MAIN LOAD= EXIT	1,500dN BACK	CRWN= OKAY TOP MENU
	ENTSXCHLUBRE	113
MAIN LOAD=	1,500dN XEIGK	CRWN= OKAY

- Use the arrow buttons to highlight SET ZERO and press SELECT.
- Press ACCEPT twice to save.

TOP MENU≻COMPON SET SPAN -→SEUTZERU	ENTS>CALIBR 11,100dN 000dN	ATEXLOAD MAIN
FACTURY CAL		MAIL POL 1
MAIN LOAD=	1,500dN	CRWN= OKAY _
EXIT	BACK	TOP MENU

TOP MENU>COMPO SET SPAN	NENTSXCALIB 11,100dN	RATEXLOAD MAIN
Press ACCEPT to Press SELECT to	<pre>save change discard cha</pre>	es. anges.
MAIN LOAD= EXIT	1,500dN BACK	CRWN= OKAY TOP MENU

<u>TOP MENU>COMPO</u> SET SPAN	INENTS>CALIB	RATEXLOAD MAIN
S	AVING	
MAIN LOAD= EXIT	1,500dN BACK	CRWN= OKAY TOP MENU

<u>TOP MENU>COM</u> SET SPAN	IPONENTS>CALIB	RATEXLORD MAIN
SAVE	- ARE YOU	SURE?
MAIN LOAD=	1,500dN	CRWN= OKAY
EXIT	BACK	TOP MENU

4.5.3 Restore Factory Calibration

To calibrate the system to the original factory calibrations use the following steps:

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- In the Top Menu, use the arrow buttons to highlight COMPONENTS and press SELECT.
- Use the arrow buttons to highlight CALIBRATE and press SELECT.
- Highlight LOAD and press SELECT.

TOP MENU		
	SYSTEM	- T T-
OPERATIONS	CALCUL	ATIONS
MAIN LOAD=	1,500dN	CRWN= OKAY
EXIT		





- Use the arrow buttons to highlight FACTORY CAL and press SELECT.
- Press ACCEPT twice to save.

SET ZERU	000dN	
	MAIL POL	1
MAIN LOAD= 1,50	IOdn CRWN= OKAY	

TOP MENU>COM	PONENTSXCRIIB: 11,100dni	RATEXLOAD MAIN
Press ACCEPT · Press SELECT ·	to save chan9e to discard cha	es. anges.
MAIN LOAD= FXIT	1,500dN BACK	CRWN= OKAY

TOP MENU>COM	PONENTS>CAL IB	RATEXLOAD MAIN
SAUE	- ARE YOU	SURE?
MAIN LOAD=	1,500dN	CRWN= OKAY _
EXIT	BACK	TOP MENU



TOP MENU>COMPO)NENTS>CALIB 11,100dN 4 -	RATEXLOAD MAIN
S	AUING	
MAIN LOAD=	1,500dN BACK	CRWN= OKAY TOP MENU

4.5.4 POL (Parts of Line)

POL is used in weight calculation. The parts of line for the particular rig *must* be set in the panel before the correct weight will be displayed. Use the following steps to set the POL:

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- In the Top Menu, use the arrow buttons to highlight COMPONENTS and press the SELECT button.
- Highlight SETTINGS and press SELECT.
- Highlight LOAD and press SELECT.

TOR MENU ->COMPONENTS OPERATIONS	SYSTEM DIAGNOS CALCULA	TIC TIONS
MAIN LOAD= EXIT	1,500dN	CRWN= OKAY _
TOP MENUXICONISION LIMITS CALIBRATE ->SEMMONOS	i gzing Enablez:	DISABLE
MAIN LOAD= EXIT	1,500dN BACK	CRWN= OKAY TOP MENU
TOP MENU>COMPON	IENTSXSETTIN	rs

MAIN LOAD=	1,500dN	CRWN= OKAY
EXIT	BACK	TOP MENU



- Highlight MAIN POL and press SELECT.
- Use the arrow keys to change POL to the correct value.

TOP MENUSCOMPO	NENTS>SETTIN 6 WINCH	<mark>GSXLOAD MAIN</mark> main
MAIN LOAD=	1,500dN	CRWN= OKAY
EXIT	BACK	TOP MENU

• Press ACCEPT twice to save.

TOP MENU>COM	PONENTS>SETTIN 6 WINCH	NGSXLOAD MAIN main
Press ACCEPT Press SELECT	to save chan90 to discard ch	es. anges.
MAIN LOAD=	1,500dN	CRWN= OKAY
EXIT	BACK	TOP MENU

TOP MENU>COMP	<u>PONENTS>SETTI</u> 6 WINCH	<u>NGS>LOAD MAIN</u> main
SAUE	- ARE YOU	SURE?
MAIN LOAD=	1,500dN	CRWN= OKAY
EXIT	BACK	TOP MENU

4.5.5 4-20mA Weight Output

Some systems are equipped with an analog 4-20mA output signal to indicate weight. This signal may be used for a Rigsmart Dial Gauge or input to a PLC. Regardless of the device in use, before the signal will read correctly it must first be calibrated. To calibrate the 4-20mA output, complete the following steps:

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- In the Top Menu, use the arrow keys to highlight COMPONENTS and press the SELECT button.
- Use the arrow keys to highlight CALIBRATE and press SELECT, then highlight CNV4-20mA and press SELECT.



TOP MENU	SYSTEM
→COMPONENTS	DIAGNOSTIC
OPERATIONS	CALCULATIONS
MAIN LOAD= EXIT	1,500dN CRWN= OKAY
TOP MENUXBONEDINI LIMITS ->0::00:33:11= SETTINGS	ZWS ENABLE/DISABLE
MAIN LOAD=	1,500dN CRWN= OKAY
EXIT	BACK TOP MENU
TOP MENU>COMPONE LOAD PRESSURE ->[1]/USTERSME LEVEL	NTSXCEILUSSENIA PAYOUT TD ANGLE CRWN SAVR
MAIN LOAD=	1,500dN CRWN= OKAY
EXIT	BACK TOP MENU
TOP MENU>COMPONE	NTS>CALIBRATE XE 2000
SET ZERO	SET SPAN
->IOINO 000dN	LOAD 22,200dN
CURRENT 4.0mA	CURRENT 20.0mA
MAIN LOAD=	U * .UUU244mA 1,500dN CRWN= OKAY

- First, set the load and current low end (displayed beneath SET ZERO). Highlight LOAD and press SELECT. Change the value to 0dN and press ACCEPT twice to save. Similarly, change the CURRENT low end to 4.0mA.
- Now, set the load and current spans (displayed beneath SET SPAN). Highlight LOAD and press SELECT. Change the value displayed to the rated value for the load device used, and press ACCEPT twice to save. Similarly, change the maximum CURRENT to 20.0mA.

TOP MENU>COMPONE	NTS>CALIBRATE>4-20mA
SET_ZERO	SET SPAN
LUHU 0000N CURRENT 4 0mC	N LUHU 22,2000N) — Mainisisisisi
ADJUST OUTPUT:	0 * .000244mA
MAIN LOAD=	1,500dN
EXIT	BACK TOP MENU



• Because every analog device may output a slightly different signal, the ADJUST OUPUT function is used to fine tune the output. To change the ADJUST OUTPUT use the arrow keys to highlight and select it, then change the multiplying factor. The multiplying factor will increase or decrease the final analog output.

TOP MENU>COMPONEN	ITS>CALIBRATE	24-20mA
SET_ZERO	SET_SPAN_	a aaa w
LUHU UUUAN	СИРОСИТ 2	2,200dN
CURRENI 4.0MH	CURRENT	20.0MH
->fe) (0.006:000000000000000000000000000000000	9. * R	00244mA
MAIN LOAD= 1	,500dN CR	WN= OKAY
EXIT	BACK	TOP MENU



5 Limits

The Rigsmart system uses digitally stored limits to determine when the traveling blocks or top drive is in an unsafe position. Situations where the Rigsmart system would intervene include:

Crown Saver

- The Crown Saver prevents collisions between the travelling block and the rig crown.
- The Crown Saver is activated when the block travels above the Crown Saver Height Limit.

Floor Saver

- The Floor Saver prevents collisions between the elevator (or top drive) and the rig floor.
- The Floor Saver is activated when the block travels below the Floor Saver Height Limit.
- If the Auto-Adjusting Floor Saver Height feature is enabled, the floor saver height will automatically adjust when the bails are tilted. This allows the top drive to move closer to the floor than would otherwise be safe with the bails floated.

Load Limits

• The Maximum Load Limit prevents over-pulling the drawworks. An alarm will sound at 90% and 100% of the set limit.

Pressure Limits

• The Maximum Pressure Limit prevents over-pressuring of pipes and lines. An alarm will sound when this limit is reached.

Wind Limits

• The Maximum Wind Speed Limit sounds an alarm when environmental wind speeds rise above the limit.

IF THE BAILS OR ELEVATORS ARE CHANGED AND THE NEW EQUIPMENT IS OF A DIFFERENT SIZE, THE ANTI-COLLISION LIMITS AND SYTEM CALIBRATION WILL NEED TO BE ADJUSTED TO ACCOMODATE THE NEW EQUIPMENT.

5.1 Crown and Floor Saver Limits

The Pay-Out Crown & Floor Limits Menu allows specification of the crown saver and floor saver related settings.



CROWN SVR HT—The distance from the floor to the bottom of the elevator when the top of the travelling blocks are near the crown, with enough space to avoid collision if the brakes are applied.

This software crown saver is not the same as a hardware wireless crown saver (which may or may not be installed).

FLOOR SVR HT—The distance from the floor to the bottom of the elevators when the elevators are near the floor, but with enough space to avoid collision if the brakes were applied.

CROWN SAVER / FLOOR SAVER— This allows the enabling (ON) and disabling (OFF) of the block height crown saver and/or floor saver alarms.

WARNING: Disabling the crown or floor saver will remove any protection that the Rigsmart system provides against crown and/or floor collision. Disabling the crown or floor saver will also disable any speed control for the respective direction.

TD BTM FLOOR HT—The indicated block height with the bails fully tilted or removed and the bottom of the top drive (pipe handler) approaching the floor, with enough space to avoid collision if the brakes were applied. This height will generally be negative and lower than the floor saver height.

BAIL LENGTH—The length of the bails being used. This length is used when using the Auto-Adjust Floor Height feature. The distance may need to be adjusted to accommodate the bail pivot point and the height of the elevator and will usually be longer than the actual measured length of the bails.

ADJ FLOOR—Set this option to ON to enable the Auto-Adjust Floor Height feature. With this feature enabled, the floor height is automatically adjusted as the bails are tilted. This allows the top drive to move closer to the floor than would otherwise be safe with the bails floated.




See below for instructions on how to set limits that define the above situations.



5.1.1 Procedure Overview

For the software crown saver, floor saver, TD BTM FLOOR HT:

- 1. Set the crown saver (this should be just below the *hardware*, wireless crown saver):
 - a. Move the blocks up until they are touching the hardware crown saver, then move them back down slightly (the exact distance below is up to the rig manager's discretion).
 - b. Use the **SET HERE** function to define this limit.
- 2. Set the floor saver (this should be where the bottom of the elevators just meet the floor, with the bails floated):
 - a. Bring the blocks down to the floor.
 - b. Use the SET HERE function to define this limit.
 - c. If the rig is not equipped with a top drive and bails, bring the Kelly bar down to the floor, where a collision would occur.
- 3. Turn the crown and floor savers on.
- 4. Set the TD BTM FLOOR HT:
 - a. At the floor, link-tilt the bails all the way out.
 - b. Lower the pipe handler as far as possible.
 - c. Bring the top drive down to the floor, so the bottom of the pipe handler touches the floor.
 - d. Use the SET HERE function to define this limit.

NOTE: The TD BTM FLOOR HT value will be a negative number.

- 5. Turn the ADJ FLOOR option on (this will only work if the bail angle limits are already set).
- 6. Set the bail length:
 - a. By default, use the actual length of the bails.
 - b. Test the ADJ FLOOR feature (the bail length value may have to be set longer than the actual bails for this feature to work properly).

5.1.2 Step by Step Instructions

Follow the instructions below to set the Block Height Limits.



- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- From the Top Menu, use the arrow buttons to highlight the COMPONENTS option and press SELECT.

TOP MENU ->COMPONENTS HEIGHT RE-CAL OPERATIONS	SYSTEM DIAGNOSTIC CALCULATIONS	
MAIN LOAD= 1	500dN BLOCK	4.5m
EXIT		

• From the Components Menu, highlight the LIMITS option and press SELECT.

TOP MENUXCOMPON -MEIMOTS CALIBRATE SETTINGS	ENABLE	ZDISABLE	
MAIN LOAD=	1,500dN B	LOCK	4.5m
EXIT	BACK	TOP MEN	U

- Highlight the PAY-OUT option and press SELECT.
- Highlight the CROWN & FLOOR option and press SELECT.

TOP MENU>COMPONENTS>LIMINS			
→(¤(o)::):)	PAY-OUT TD ANGLE		
MAIN LOAD= EXIT	1,500dN BACK	BLOCK TOP	4.5m MENU

TOP MENU>COM	PONENTSXLIMI	8	
LOAD	TD ANGLE		
MAIN LOAD=	1,500dN	BLOCK	4.5m
EXIT	BACK	TOP	MENU



TOP	MENU>(:OMPONENTS>L1	(MITSXPAY-OUT	
z			ISION ED	
		SLOCK HEIGHT	4.5m	
	EXIT	BACK	TOP MENU	

TOP MENU>COMPONENTS>LIMITS>CRWN & FLR
-MORDING SUR HU 31.8m SET HERE
FLUUK SVR HI – U.UM SEI HERE
CRUWN SHVER ON FLUUR SHVER ON
IU BIM FLUUK HI - 9 SEI HERE
BHIL LENGTH 3.0M HUJ FLOUR Off
EATI BHUN TUP MENU

From the Crown and Floor Saver Limits Menu, the displayed limits can be changed in two ways. To change the limits *manually*:

• Highlight the limit to be changed and press SELECT.

TOP MENU>COMP	<u> DNENTS>LIMI</u>	TSXCRWN & FLR
CROWN SUR H	T <u> </u>	H-SET HERE
I FLOOR SVR_H	Г <u>0</u> ,0m	_ SET_HERE
CROWN SAVER	<u>o</u> n FLOO	R SAVERon
TD_BTM_FLOOI	R <u>H</u> T	9SET HERE
BAIL LENGTH	<u> 3.0m ADJ</u>	FLOOR off
BLO	CK HEIGHT	4.5m
EXIT	BACK	TOP MENU

• Use the arrow keys to change the displayed value to the desired limit.

TOP MENU>COMP	ONENTS>LIMITS	SORWN & FLR
ICROWN SUR H	T 31.7m4-	SET HERE
Press ACCEPT	to save chan9	les.
Press SELECT	<u>to discard ch</u>	nanges.
TD BTM FLOO	RHT9	SET HERE
BAIL LENGTH	3.0m ADJ F	LOOR off
BLO	CK HEIGHT	4.5m
EXIT	BACK	TOP MENU



• When the correct limit is displayed, press the ACCEPT button. Press ACCEPT again to confirm and save the new limit.

TOP MENU>COMPO CROWN SVR HT	NER 180 1000	TS≵CRWN & FL I-SET HERE	3
SAVE -	- ARE YO	U SURE?	
TD BTM FLOOR BAIL LENGTH	HT 3.0m ADJ	9 SETHE FLOOR of	RE f
	K HEIGHT BACK	4.5m TOP MENU	

TOP NERUSCONEONENESS CRWN & FLR CROWN SUR HT 31.7m(=SET HERE
SAVING
TD BTM FLOOR HT9 SET HERE BAIL LENGTH 3.0m ADJ FLOOR off
BLOCK HEIGHT 4.5m EXIT BACK TOP MENU

To set the limit *automatically:*

- Raise or lower the block to the position that will be used as the new limit.
- When the block is in position, use the arrow buttons to highlight SET HERE beside the corresponding limit on the display panel.

TOP MENU>COMPONENTS>LIMITS>CRWN & FLR
CROWN SVR HT 31.8m-Bet Here
FLOOR SVR_HT 0.0m_ SET_HERE
<u>CROWN SAVER on FLOOR SAVER</u> on
TD_BTM_FLOOR_HT9SET_HERE
BHIL LENGTH 3.0m HUJ FLOUR off
BLUCK HEIGHI 4.5m
EXII BHCK IUP MENU

• Press the SELECT button to set the limit to the current block height.

SETTING CROWN SAVER HEIGHT



CROWN SAVER HEIGHT SET

• Once setting the limits is complete, use the arrow buttons to highlight EXIT, press SELECT and then ACCEPT to confirm.

5.2 Load Limits

The Rigsmart Weight Indicator uses a pre-set limit to determine when to alarm. The Maximum Load Limit is usually set to the smallest maximum load limit of all the load bearing components (derrick structure, sub structure, drawworks, etc).

Use the following instructions to change this load limit:

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- In the Top Menu, use the arrow buttons to highlight COMPONENTS and press SELECT.

TOP MENU 	SYSTEM DIAGNOS CALCULA	STIC STIC STIONS
MAIN LOAD= EXIT	1,500dN	CRWN= OKAY

• From the Components Menu, highlight LIMITS and press SELECT.

CALIBRATE SETTINGS	CALIBRATE SETTINGS			
MAIN LOAD=	1,500dN	CRWN= OKAY		
EXIT	BACK	TOP MENU		



• Highlight LOAD and press SELECT.

	NENTSXENDIA	8
MAIN LOAD=	1,500dN	CRWN= OKAY
EXIT	BACK	TOP MENU
TOP MENU>COMPO	NENTS>LIMIT	SXLOAD
MAX LOAD MAIN	11,	100dN (

MAIN LOAD=	1,500dN	CRWN= OKAY _
EXIT	BACK	TOP MENU

- Use the arrows and SELECT button to select a MAX LOAD MAIN value. This is the value at which the MAX LOAD alarm will be triggered.
- After selecting the desired value, press the ACCEPT button to set the new limit, and again to confirm the changes.

TOP MENU>COL	MPONENTS>LIMI	TSX UI II
Max Load Mi		,100dN4-
Press ACCEPT	to save chan	ges.
Press SELECT	<u>to discard c</u>	nanges.
ΜΟΤΝ Ι ΟΟΠ=	1.500AN	CRIIN= OKOV
EXIT	BACK	TOP MENU
	<u>MPUNEN (S>LIMI</u>	
	- MRF ¥IW	
		JONE .
MAIN LOAD=	1,500dN	CRWN= OKAY
MAIN LOADE	1,500dN BACK	CRWN= OKAY TOP MENU
MAIN LOAD= EXIT	1,500dN BACK	CRWN= OKAY TOP MENU
MAIN LOADE	1,500dN BACK PONENTS>LIMI	TOP MENU
TOP MENUSCO MAX LOAD M	1,500dN BACK MPONENTS>LIMI	TOP MENU TSXLOAD
MAIN LOADE EXIT		CRWN= OKAY TOP MENU TSXLORD 1000IN4-
TOP MENU>COI MAX LOAD MI		TOP MENU
MAIN LOADE EXIT	1,500ch BACK PONENTS>LIMI ANI II SAUING	CRWN= OKAY TOP MENU TSXLOAD 1900IN4-



5.3 Pressure Limits

The Rigsmart Pressure Sensors use pre-set limits to determine when to alarm. When a pressure limit is reached, the panel will alarm but no output will be triggered (unless specifically requested by the customer).

Use the following steps to set the pressure limits:

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- From the Top Menu, use the arrow buttons to highlight the COMPONENTS option and press SELECT.

TOP MENU ->COMPONENTS HEIGHT RE-CAL OPERATIONS	SYSTEM DIAGNOSTIC CALCULATIONS	
MAIN LOAD= 1, EXIT	500dN BLOCK	4.5m_

• Highlight the LIMITS option and press SELECT.

TOP MENUXCOMPON 	ENABLE/DISABL	E
MAIN LOAD=	1,500dN BLOCK	4.5m
EXIT	BACK TOP ME	NU

- Highlight the PRESSURE option and press SELECT.
- Highlight and select the specific pressure sensor to be set. When selected, change the limit to the required maximum value. Press the ACCEPT button twice to save the change.

TOP MENU>COMP LOAD	ONENTSXEIND PAY-OUT TD ANGLE	<u>18</u> →	PRESSURE
	LEVEL		WIND
<u>MAIN LOAD=</u>	1,500dN	BLOCK	<u>4.5m</u>
EXIT	BACK	TOP	MENU



TOP MENU>COM →ERESSI 6 PRESS2 6 PRESS3 6	<u>PONENTS>LIM</u> 8,948kPa 8,948kPa 8,948kPa 8,948kPa	ITSX 985580 PRESS4 68, PRESS4 68,	94 8kPa 948kPa 948kPa
MAIN LOAD=	1,500d	N <u>BLOCK</u>	4.5m_
EXIT	BACK	Top Me	NU

5.4 Wind Speed Limits

The Rigsmart Wind Speed Sensor will display the current environmental wind speed. When a pre-set wind speed limit is reached, an alarm will sound but no output will be triggered (unless specifically requested by the customer).

Use the following steps to set the wind speed limits:

- Using the instructions in the Troubleshooting section, enter the supervisor permission code.
- From the Top Menu, use the arrow buttons to highlight the COMPONENTS option and press SELECT.

TOP MENU COMPONIENTS HEIGHT RE-CAL OPERATIONS	SYSTEM DIAGNOSTIC CALCULATIONS	
MAIN LOAD= 1: EXIT	500dN BLOCK	4.5m_

• From the Components Menu, highlight the LIMITS option and press SELECT.

TOP MENUXCOMPON	ENTS	
	ENABLE/	DISABLE
SETTINGS		
MOTH LOOD-	1 EQQUE DE	
LININ LOND-		
EXII	внск	IUP MENU



• Highlight the WIND option and press SELECT.

T <u>op Menu>comp</u> Load	ONENTSX IND PAY-OUT TR ONGLE	RESSURE
	LEVEL	<u>→(2002))</u>
MAIN LOAD= EXIT	1,500dN BACK	BLOCK 4.5m TOP MENU

• Use the arrow buttons to highlight and select MAX WIND. When selected, change the limit to the required maximum value. Press ACCEPT twice to save the change.

TOP	MENU>COMPONE	ENTS>LIMI	IS XPRES	SURE
		95kmh		
MA	AIN LOAD=	1,500dN	BLOCK	4.5m_
	EXIT	BACK	TOP	MENU



6 Troubleshooting

It is important to note that after the Rigsmart system sets an alarm or detects a significant disruption, the panel may display a corresponding message even after the conditions have been returned to normal. This commonly occurs during rig-up operations, or after the rig air supply has been shut off. Pressing the BYPASS button on the panel will advance these screen messages and return the system to normal operation.

6.1 Testing the Hardware Wireless Crown Saver, with a Software Crown Saver Installed

Usually the hardware wireless crown saver is set higher in the derrick then the software crown saver. To test the hardware crown saver the software crown saver must temporarily be disabled. If the software crown saver is not temporarily disabled, then the brakes will be applied before hitting the hardware crown saver. To temporarily disable the software crown saver complete the following steps:

• After entering the supervisor permission code, use the arrow keys to highlight the COMPONETNTS option in the Top Menu and press SELECT.

TOP MENU 	SYSTEM DIAGNOSTIC CALCULATIONS	
MAIN LOAD= 1: EXIT	500dN BLOCK	4.5m_

• This will open the Components Menu. Use the arrow buttons to highlight the LIMITS option and press SELECT.

TOP MENUXCOMPON		
→LIMITS	ENABLE/DISABL	E
<u>CALIBRATE</u>		
SETTINGS		
<u>MHIN LUHD</u> =	1,500dN_BLOCK	<u>4.5m</u>
EXIT	<u>BACK TOP ME</u>	NU



• Highlight the PAY-OUT option and press SELECT.

TOP MENU>CI	MPONENTSXLIMITS
LOAD	->I <u>ST-WEDOLONI</u> TD ANGLE
MAIN LOA EXIT)= 1,500dN BLOCK 4.5m BACK TOP MENU

• Highlight the CROWN & FLOOR option and press SELECT.

TOP MENU>COMPONENTS>LIMITS>PAY=OUN		
BLOCK HEIGHT 4.5m		
EXIT	BACK	TOP MENU

• This will open the Crown & Floor Saver Limits Menu.

TOP MENU>COMPC	NENTS>LIMI	TSXCRWN & FLR
CROWN SUR HT	31.8m	<u>SET HERE</u>
FLOOR SVR HT	0.0m	SET_HERE
<u>법정비원위법(SEMERS</u>)	<u>.on</u> FLUUK	SHVER
I IU BIM FLUUR	HI9 7 Gm ODII	SEI HEKE
DHIL LENGIH		
EXIT	ROCK	TOP MENU
	DHCK	

- Select the option for CROWN SAVER and change the value to OFF.
- Test the crown saver.
- Repeat the steps listed above and turn the software crown saver back ON.





6.2 Using the Supervisor Permission Code

The supervisor permission code is used to make changes to the system. The code is given to the rig manager or supervisor when the system is installed. If this code has been lost, Rigsmart Systems can provide the code to the rig manager over the phone.

• From the Main Operation Screen press the SELECT button.



• Use the up and down arrows on the panel to highlight the SETUP option and press SELECT.

SYSTEM INFO			
BLOCK ANG	BAIL ANG	ELEV POS	
n n∘	n n°	TRTP	
0.0	0.0		
EXIT	TARE SIC	3 INFO- →<u>B</u>enule	

If no buttons are pressed for 8 seconds while viewing the Secondary Operation Screen, redirection to the Main Operation Screen will automatically occur. Press SELECT again to return to the Secondary Operation Screen.

• From the Top Menu, use the up and down arrows to highlight SYSTEM and press SELECT.



TOP MENU	->SYSILED DIAGNOSTIC CALCULATIONS	
MAIN LOAD= EXIT	1,500dN BLOCK	4.5m_

• Use the up and down arrow buttons to highlight PERMISSION and press SELECT.

TOP MENUXSWSTER ->ABOUT LCD CONTRAS	N PERMISS T	ION	
MAIN LOAD=	1,500dN BL	OCK 4.	.5m_
EXII	Brek	TOP MENU	

TOP MENU>SYSTEM		
ABOUT		1
LCD CONTRAS	Т	
MOTN 00D=	1.500AN BLOCK	4 5m
EVIT	BOCK TOP	
	DHOV IOL	

• On the PERMISSION screen, with the word PERMISSION highlighted, press the SELECT button.

TOP MENU>SYSTE	MOPERMIS	S1002	
Enter Permission code:			
MAIN LOAD= EXIT	1,500d BACK	N BLOCK TOP M	4.5m_ ⊒NU

TOP MENU>SYSTEM>			
Enter Permission code:			
<u> 2 2 2 0 0 5550(0)2 </u> 0 2 14-			
MAIN LOAD= 1,500dN BLOCK	4.5m_		
EXIT BACK TOP MEN	U		

• Use the up and down arrows to change the value to the predetermined supervisor permission code. This number is set with the rig manager during installation.

TOP MENU>SYS	STEMØRERMISS	3 (012)	
During OCCEDI	+		
Press SELECT	to discard	changes.	
MAIN LOAD=	1,500dN	BLOCK	4.5m
EXIT	BACK	TOP ME	NU

• When the desired value is reached, press the ACCEPT button once to accept the change, then again to confirm and save the selection.

TOP MENU>SYSTEM>PERMISSION				
Save - Are you sure?				
MAIN LOAD= 1,500dN BLOCK 4.5m EXIT BACK TOP MENU				
TOP MENU>SYSTEM>PERMISSION				
SAVING				
izerndisiston idzist-				
MAIN LOAD= 1,500dN BLOCK 4.5m_				

• After entering the correct permission code, the Top Menu will open. New options will be available in many menus.

TOP NENU ->CONPONENTS HEIGHT RE-CAL OPERATIONS	SYSTEM DIAGNOSTIC CALCULATIONS	
MAIN LOAD= 1: EXIT	500dN BLOCK	4.5m

• If an incorrect permission code is entered, simply use the up and down arrows to highlight PERMISSION and repeat the previous steps to retry.

If the permission code is unavailable, please contact Rigsmart Service at 1-780-438-9475.

6.3 Diagnostics

If there is a problem with the Rigsmart system, it might be necessary to access important system information for troubleshooting purposes. A 'Diagnostic Menu' is available via the supervisor permission code. All of the information under this menu is read only; no damage can be done to the system by viewing it.

To enter the Diagnostics Menu:

- Enter the supervisor permission code as outlined in the Troubleshooting section of this manual.
- From the Top Menu, use the arrow buttons to highlight DIAGNOSTICS and press the SELECT button.

TOP MENU COMPONENTS HEIGHT RE-C OPERATIONS	SYSTEM CAL ->ND(FIGNOS CALCULA	TIONS	
MAIN LOAD= EXIT	1,500dN BL	OCK	4.5m_
TOP MENUXDIAGNO			
	VIEWER VOLTAGE FIRMWARE	RF	METER

1,500dN BLOCK

4.5m

6.3.1 Signals

The Signals Screen shows the signal strength of all enabled wireless devices.

MAIN LOAD=

6.3.2 Outputs

The Outputs Screen shows the current output status of either the Alarm Hub or Panel wire.

6.3.3 Device Diag

The Device Diag Screen shows very detailed information about specific devices. Each device shows different information specific to its function.



6.3.4 Viewer

The Viewer Screen displays load calibration info and device IDs.

6.3.5 Voltage

The Voltage Menu displays the current voltage entering the panel.

6.3.6 Firmware

The Firmware Menu displays information about the panel's loaded firmware.

6.3.7 RF Meter

The RF Meter Screen shows the quality of the wireless signals being received. This is different than the Signals Screen, which shows the signal strengths.



6.4 Battery Replacement

The Rigsmart Display Panel will indicate when a component battery is low. **Batteries indicated as** being low on power should be replaced immediately with the help of a Rigsmart service technician: (780) 438-9475. The serial number of the system will be required and can be found on the display panel or the transmitter itself. Once the technical problem has been verified as being due to a dead battery, follow the steps below to replace it.

Tools and Equipment for Battery Replacement:

The battery replacement kit contains:

- (1) 3.6 Volt Lithium Ion D-cell battery
- (1) 1/8 Inch Allen key

NOTE: The transmitter should be removed from the rig before battery replacement occurs. However, replacement can still be done with the transmitter on the rig. If it is raining or snowing, remove the transmitter and perform the battery replacement indoors or under cover.

To Replace the Battery:

- 1. Remove the screws from the battery compartment lid and remove the lid.
- 2. Remove the battery from the holder.
- 3. Insert the new battery according to the battery orientation diagram on the base of the battery clip.
- 4. Ensure that the o-ring is greased and has not been damaged, as this will affect the seal.
- 5. Secure the lid with the screws.



Front View with Lid On



Front View with Lid Off



Front View with Battery Out



6.5 Antenna and Signal Issues

All of the wireless sensors on the Rigsmart system are received by the panel through a common antenna. If there is a problem with the antenna, the wireless sensors may not work correctly. Also, if there is outside wireless interference in the local environment, there may be a reduction in signal strength and quality.

For the best possible communication, the Rigsmart antenna should have a clear line-of-sight to each wireless transducer, which should be no more than 100m away. In practice this may be challenging to obtain; the best compromise for line-of-sight to every wireless transducer should be made.

The Rigsmart antenna can be fitted with an extension cable so that it can be placed further away from the panel. Every effort should be made to reduce the number of extension cables and connector fittings used; each extension and connector fitting will reduce the signal strength.

	SIGNAL STRENGTH	RF
LOAD MAIN CROWN SVR1 BAIL ANG PAY-OUT	60% 10% FHIL FAIL	15 7 0
EXIT		TOP MENU

If any particular sensor is experiencing a loss of signal, there are a few quick troubleshooting steps that can easily be completed before contacting technical support:

- 1. The most common issue is a dead battery. If the battery in a sensor is dead, it cannot transmit and will have no signal. Replace the battery and recheck the signal.
- 2. Move the sensor closer to the antenna. Check to see if the signal has returned.
- 3. Check to ensure there are no breaks, pinches or cuts in the antenna cable, as this may cause damage to the wire inside.
- 4. If all transducers are experiencing a signal failure, there may be an issue with the antenna it is the common point for all the devices.
 - a. Move the antenna around and check to see if the signal has returned.
 - b. Often, moving the antenna inside the derrick structure will improve signals from a top drive.
 - c. Change the orientation of the antenna; if it is placed vertically, change it so it is mounted horizontally.
 - d. Replace the antenna completely.



6.6 Measuring Block and Top Drive Heights

When calibrating block height or setting anti-collision limits, it is very important to measure heights correctly. It should be noted that the 'Block Height' is not actually the height of the traveling blocks, rather the height of the lowest point of the top drive or the top of the Kelly bar. This is common to most height calculation systems. The drill floor is always used as the reference point of measurements. When using a top drive, measure from the floor to the bottom of the elevators. If there is no top drive, measure from the floor to the top of the Kelly bar. The important factor is that measurement reference points remain constant through the calibration and limit-setting process.





6.7 Common Error Messages Codes and Solutions

During the course of operation, alarms may be displayed on the panel screen. The following list contains all alarms, with their reference numbers and brief descriptions. Refer to this list for troubleshooting purposes.

Alarm Text	Number	Description		
** BY-PASS ** XX SEC REMAIN	0	This message indicates that the BYPASS button has been pressed, which will disable all alarms for 30 seconds. During this 30 seconds, this message will flash to indicate how much time is left.		
MAIN LOAD ABOVE PRESET	3	This alarm indicates that the measured load is above the entered load limit. If this alarm is being triggered at too low or too high a load value, the limit may need to be adjusted.		
CROWN SAVER 1 ALARM	4	This alarm indicates that the Crown Saver Counterweight is lifted and the block is approaching the crown of the rig.		
BLOCK HEIGHT ABOVE MAXIMUM	8	This alarm indicates that the measured block height is above the entered preset crown saver height. If this alarm is being triggered when the block is not near the crown the block height may need recalibration, or the crown saver height value may need to be changed.		
BLOCK HEIGHT BELOW MINIMUM	9	This alarm indicates that the measured block height is below the entered preset minimum (floor) height. If this alarm is being triggered when the block is not near the floor, the minimum height value or block height may need recalibration.		
Em SHUTDOWN 1 *** STOP ***	12	This alarm indicates that the Emergency Shutdown button has been pressed.		
CROWN SAVER 1 ABOVE THRESHOLD	14	This alarm indicates that the weight on the Crown Saver Switch is too high or that it has been damaged. Check for extra weight on the crown saver counterweight or obvious physical damage.		
TOP DRIVE BLOCK EXTENDED	19	This alarm indicates that the top drive is extended away from the derrick while there is a danger of it contacting the monkey board. If this alarm is being triggered while the top drive is not extended, it may be necessary to zero the block angle or adjust the set limits. See the Calibration or Limits section for more information.		
TOP DRIVE BAILS TILTED 20		This alarm indicates that the bails are tilted while there is a danger of them contacting the monkey board. If this alarm is being triggered while the bails are not tilted, it may be necessary to zero the bail angle or adjust the set limits. See the Calibration or Limits section for more information.		
ELEVATOR POS ALARM	21	This alarm indicates that the bails are tilted while the elevator is not in trip nor drill position. If this alarm is being triggered while the elevator is in trip or drill position, it may be necessary to adjust the positioning of the sensor in relation to the RFID targets.		
TOP DRIVE BLK & BAILS EXT	25	This alarm indicates that both the bails and block are at least partially extended while there is a danger of the bails contacting the monkey board. If this alarm is being triggered while the bails are not tilted, it may be necessary to zero the bail angle or adjust the set limits. See the Calibration or Limits section for more information.		
TOP DRIVE BAILS TILTED	26	This alarm indicates that the bails are tilted while there is a danger of them contacting the torque track. If this alarm is being triggered while the bails are not tilted, it may be necessary to zero the bail angle or adjust the set limits. See the Calibration or Limits section for more information.		
LOAD 90% OF MAXIMUM LOAD	29	This alarm indicates that the measured load is approaching the entered load limit. If this alarm is being triggered at too low or too high a load value, the limit may need to be adjusted.		
ALARM HUB MALFUNCTION	43	This alarm indicates that the panel cannot communicate with the attached Alarm Hub. This can happen if the cable between the panel and the Alarm Hub is disconnected or damaged.		



MAIN LOAD SYSTEM ALARM	45	This alarm indicates that the panel is not receiving a signal from the Load Sensor. Either the sensor has stopped functioning due to a dead battery, damage, or failure, or the signal strength from the switch is too low. Try repositioning the antenna for a more direct line-of-sight with the sensor.
CROWN SAVER 1 SYSTEM ALARM	47	This alarm indicates that the panel is not receiving a signal from the Crown Saver Switch. Either the switch has stopped functioning due to a dead battery, damage, or failure, or the signal strength from the switch is too low. Try repositioning the antenna for a more direct line-of-sight with the switch.
RFID TAG READER SYSTEM ALARM	51	This alarm indicates that the Elevator Position Transmitter cannot communicate with the RFID Tag Reader. This can happen if the cable between the Tag Reader and Transmitter is disconnected or damaged.
LINE PAY-OUT SYSTEM ALARM	54	This alarm indicates that the panel is not receiving a signal from the Pay-Out Sensor. Either the sensor has stopped functioning due to lost power, damage, or failure, or the signal strength from the sensor is too low. Try repositioning the antenna for a more direct line-of-sight with the sensor.
Em SHUTDOWN 1 SYSTEM ALARM	59	This alarm indicates that the panel is not receiving a signal from the Emergency Shutdown sensor. Either the sensor has stopped functioning due to a dead battery, damage, or failure, or the signal strength from the sensor is too low. Try repositioning the antenna for a more direct line-of-sight with the sensor.
BLOCK ANGLE SYSTEM ALARM	63	This alarm indicates that the panel is not receiving a signal from the Block Angle Sensor. Either the sensor has stopped functioning due to a dead battery, damage, or failure, or the signal strength from the sensor is too low. Try repositioning the antenna for a more direct line-of-sight with the sensor.
BAIL ANGLE SYSTEM ALARM	64	This alarm indicates that the panel is not receiving a signal from the Bail Angle Sensor. Either the sensor has stopped functioning due to a dead battery, damage, or failure, or the signal strength from the sensor is too low. Try repositioning the antenna for a more direct line-of-sight with the sensor.
ELEVATOR POS SYSTEM ALARM	65	This alarm indicates that the panel is not receiving a signal from the Elevator Position Sensor. Either the sensor has stopped functioning due to a loss of power, damage, or failure, or the signal strength from the sensor is too low. Try repositioning the antenna for a more direct line-of-sight with the sensor.
LOW BRAKE PRESSURE DETECTED	69	This alarm indicates that the rig air pressure into the Main Air Kill has dropped below 70psi. This may have been done intentionally to bypass the Rigsmart system, or it may be due to an air pressure leak or malfunction. To resolve this, increase the rig air pressure going into the Main Air Kill.
MAIN LOAD LOW BATTERY	72	This alarm indicates that the battery in the Load Sensor is low. Please contact our service department for a replacement.
CROWN SAVER 1 LOW BATTERY	74	This alarm indicates that the battery in the Crown Saver Switch is low. Please contact our service department for a replacement.
Em SHUTDOWN LOW BATTERY	84	This alarm indicates that the battery in the Emergency Shutdown Sensor is low. Please contact our service department for a replacement.
BLOCK ANGLE LOW BATTERY	87	This alarm indicates that the battery in the Top Drive Extend Angle Sensor is low. Please contact our service department for a replacement.
BAIL ANGLE LOW BATTERY	237	This alarm indicates that the battery in the Bail Tilt Angle Sensor is low. Please contact our service department for a replacement.



6.8 Alarm Code Master List

No.	Alarm Text 1	Alarm Text 2	Menu Alarm Text	
1	STRING WEIGHT	TOO HIGH	STRING WEIGHT TOO HIGH	
2	LOAD OVER	PIPE STRENGTH	MAIN LOAD OVER PIPE STRENGTH	
3	MAIN LOAD	ABOVE PRESET	MAIN LOAD ABOVE PRESET	
4	CROWN SAVER 1	ALARM	CROWN SAVER 1 ALARM	
7	THROT OVERRIDE	PEDAL PRESSED	THROT OVERRIDE PEDAL PRESSED	
8	BLOCK HEIGHT	ABOVE MAXIMUM	BLOCK HEIGHT ABOVE PRESET MAXIMUM	
9	BLOCK HEIGHT	BELOW MINIMUM	BLOCK HEIGHT BELOW PRESET MINIMUM	
10	H2S 1	ABOVE LIMIT	H2S 1 LEVELS ABOVE MAXIMUM LIMIT	
11	LEL 1	ABOVE LIMIT	LEL 1 LEVELS ABOVE MAXIMUM LIMIT	
12	Em SHUTDOWN 1	*** STOP ***	Em SHUTDOWN 1 ***STOP***	
13	PRESSURE 1	ABOVE PRESET	PRESSURE 1 ABOVE PRESET MAXIMUM	
14	CROWN SAVER 1	ABOVE THRESHOLD	CROWN SAVER 1 ABOVE THRESHOLD	
15	ROLL	ABOVE PRESET	ROLL OVER PRESET MAXIMUM	
16	IRON DERRICKMAN	EXTENDED	IRON DERRICKMAN EXTENDED	
17	MAIN ANGLE	ABOVE PRESET	MAIN ANGLE ABOVE PRESET MAXIMUM	
18	MAIN ANGLE	BELOW PRESET	MAIN ANGLE BELOW PRESET MINIMUM	
19	TOP DRIVE	BLOCK EXTENDED	TOP DRIVE BLOCK EXTENDED	
20	TOP DRIVE	BAILS TILTED	TOP DRIVE BAILS TILTED	
21	ELEVATOR POS	ALARM	TOP DRIVE ELEVATOR POSITION ALARM	
22	WIND SPEED	ABOVE PRESET	WIND SPEED ABOVE PRESET MAXIMUM	
23	RAM1		RAM1 IS CLOSED	
24	RAM1 SIDE A		RAM1 SIDE A IS CLOSED	
25	TOP DRIVE	BLK & BAILS EXT	TOP DRIVE BLOCK & BAILS EXTENDED	
26		BAILS TILTED	TOP DRIVE BAILS THI TED	
27			RAISING DERRICK - OUTPUT DISABLED	
28	MAIN 90% OF	PIPE STRENGTH	MAIN LOAD AT 90% OF PIPE STRENGTH	
29	MAIN 90% OF	PRESET	MAIN LOAD AT 90% OF MAXIMUM LOAD	
30	** BY-PASS **	SEC REMAIN	** BY-PASS PRESSED **	
31	BLOCK SPEED	OVER LIMIT	BLOCK SPEED OVER MAXIMUM LIMIT	
32	BLOCK SPEED	OVER LIMIT	BLOCK SPEED OVER MAXIMUM LIMIT	
39	SERIAL ADC IN	MALFUNCTION	SERIAL ADC INPUT MALEUNCTION	
40	THROT CONTROL	MALFUNCTION	THROTTLE CONTROL MALFUNCTION	
41	BRAKE CONTROL	MALFUNCTION	BRAKE CONTROL MALFUNCTION	
42	SERIAL LIMIT TX	MALFUNCTION		
43	ALARM HUB	MALEUNCTION		
44	STROBE HUB	MALEUNCTION	STROBE HUB MAI FUNCTION	
45	MAIN LOAD	SYSTEM ALARM	MAIN LOAD NOT FUNCTIONING	
46	MAIN ANGLE	SYSTEM ALARM	MAIN ANGLE NOT FUNCTIONING	
47	CROWN SAVER 1	SYSTEM ALARM	CROWN SAVER 1 NOT FUNCTIONING	
48		SYSTEM ALARM		
40				
50				
50				
51				
52				
53	RAIVE SIDE A	STSTEIN ALAKIN	KAIVIT SIDE A SENSOK NUT FUNCTIONING	

No.	Alarm Text 1	Alarm Text 2	Menu Alarm Text	
54	LINE PAY-OUT	SYSTEM ALARM	LINE PAY-OUT SYSTEM NOT FUNCTIONING	
55	THROT LIMITER	SYSTEM ALARM	THROTTLE LIMITER NOT FUNCTIONING	
56	THROT OVERRIDE	SYSTEM ALARM	THROTTLE OVERRIDE NOT FUNCTIONING	
57	H2S 1	SYSTEM ALARM	H2S 1 SYSTEM NOT FUNCTIONING	
58	LEL 1	SYSTEM ALARM	LEL 1 SYSTEM NOT FUNCTIONING	
59	Em SHUTDOWN 1	SYSTEM ALARM	Em SHUTDOWN 1 SYS NOT FUNCTIONING	
60	PRESSURE 1	SYSTEM ALARM	PRESSURE 1 NOT FUNCTIONING	
61	PUMP SPEED	SYSTEM ALARM	ROTARY SPEED SYS NOT FUNCTIONING	
62	4-20mA CONVRTER	SYSTEM ALARM	4 to 20mA CONVERTER NOT FUNCTIONING	
63	BLOCK ANGLE	SYSTEM ALARM	BLOCK ANGLE SYS NOT FUNCTIONING	
64	BAIL ANGLE	SYSTEM ALARM	BAIL ANGLE SYS NOT FUNCTIONING	
65	ELEVATOR POS	SYSTEM ALARM	ELEVATOR POS SYS NOT FUNCTIONING	
66	FLOW SENSOR 1	SYSTEM ALARM	FLOW SENSOR 1 NOT FUNCTIONING	
67	LCD DIAL	SYSTEM ALARM	LCD DIAL SYSTEM ALARM	
68	DISPLAY	OVERFLOW	DISPLAY OVERFLOW ALARM	
69	LOW BRAKE	PRESSURE	LOW BRAKE PRESSURE DETECTED	
70	CHECKSUM	ERROR:	MEMORY ERROR - CHECKSUM ALARM	
72	MAIN LOAD	LOW BATTERY	MAIN LOAD LOW BATTERY	
73	MAIN ANGLE	LOW BATTERY	MAIN ANGLE LOW BATTERY	
74	CROWN SAVER 1	LOW BATTERY	CROWN SAVER 1 LOW BATTERY	
75	JIB ANGLE	LOW BATTERY	JIB ANGLE LOW BATTERY	
76	PANEL RELAY	DETECT SHORT	PANEL RELAY DETECT SHORT CIRCUIT	
77	MAIN LD REPEATR	LOW BATTERY	MAIN LOAD REPEATER LOW BATTERY	
78	LEVELING	LOW BATTERY	LEVELING SENSOR LOW BATTERY	
79	WIND SPEED	LOW BATTERY	WIND SPEED LOW BATTERY	
80	RAM1 SIDE A	LOW BATTERY	RAM1 SIDE A SENSOR LOW BATTERY	
81	H2S 1	LOW BATTERY	H2S 1 SENSOR LOW BATTERY	
82	LEL 1	LOW BATTERY	LEL 1 SENSOR LOW BATTERY	
84	Em SHUTDOWN 1	LOW BATTERY	Em SHUTDOWN 1 LOW BATTERY	
85	MODBUS SLAVE	MODE SELECTED	MODBUS SLAVE MODE SELECTED	
86	PRESSURE 1	LOW BATTERY	PRESSURE 1 LOW BATTERY	
87	BLOCK ANGLE	LOW BATTERY	TD BLOCK ANGL LOW BATTERY	
88	FLOW SENSOR 1	LOW BATTERY	FLOW SENSOR 1 LOW BATTERY	
89	LINE PAY-OUT	LOW BATTERY	PAY-OUT TRANSDUCER LOW BATTERY	
153	AUX1 LOAD	ABOVE PRESET	AUX1 LOAD ABOVE PRESET	
154	CROWN SAVER 2	ALARM	CROWN SAVER 2 ALARM	
160	H2S 2	ABOVE LIMIT	H2S 2 LEVELS ABOVE MAXIMUM LIMIT	
161	LEL 2	ABOVE LIMIT	LEL 2 LEVELS ABOVE MAXIMUM LIMIT	
162	Em SHUTDOWN 2	*** STOP ***	Em SHUTDOWN 2 ***STOP***	
163	PRESSURE 2	ABOVE PRESET	PRESSURE 2 ABOVE PRESET MAXIMUM	
164	CROWN SAVER 2	ABOVE THRESHOLD	CROWN SAVER 2 ABOVE THRESHOLD	
165	PITCH	ABOVE PRESET	PITCH OVER PRESET MAXIMUM	
167	AUX1 ANGLE	ABOVE PRESET	AUX1 ANGLE ABOVE PRESET MAXIMUM	
168	AUX1 ANGLE	BELOW PRESET	AUX1 ANGLE BELOW PRESET MINIMUM	
173	RAM2	CLOSED	RAM2 IS CLOSED	
174	RAM1 SIDE B	CLOSED	RAM1 SIDE B IS CLOSED	
178	AUX1 90% OF	PIPE STRENGTH	AUX1 LOAD AT 90% OF PIPE STRENGTH	
179	AUX1 90% OF	PRESET	AUX1 LOAD AT 90% OF MAXIMUM LOAD	

No.	Alarm Text 1	Alarm Text 2	Menu Alarm Text	
195	AUX1 LOAD	SYSTEM ALARM	AUX1 LOAD NOT FUNCTIONING	
196	AUX1 ANGLE	SYSTEM ALARM	AUX1 ANGLE NOT FUNCTIONING	
197	CROWN SAVER 2	SYSTEM ALARM	CROWN SAVER 2 NOT FUNCTIONING	
203	RAM1 SIDE B	SYSTEM ALARM	RAM1 SIDE B SENSOR NOT FUNCTIONING	
207	H2S 2	SYSTEM ALARM	H2S 2 SYSTEM NOT FUNCTIONING	
208	LEL 2	SYSTEM ALARM	LEL 2 SYSTEM NOT FUNCTIONING	
209	Em SHUTDOWN 2	SYSTEM ALARM	Em SHUTDOWN 2 SYS NOT FUNCTIONING	
210	PRESSURE 2	SYSTEM ALARM	PRESSURE 2 NOT FUNCTIONING	
216	FLOW SENSOR 2	SYSTEM ALARM	FLOW SENSOR 2 NOT FUNCTIONING	
222	AUX1 LOAD	LOW BATTERY	AUX1 LOAD LOW BATTERY =	
223	AUX1 ANGLE	LOW BATTERY	AUX1 ANGLE LOW BATTERY =	
224	CROWN SAVER 2	LOW BATTERY	CROWN SAVER 2 LOW BATTERY	
230	RAM1 SIDE B	LOW BATTERY	RAM1 SIDE B SENSOR LOW BATTERY	
231	H2S 2	LOW BATTERY	H2S 2 SENSOR LOW BATTERY	
232	LEL 2	LOW BATTERY	LEL 2 SENSOR LOW BATTERY	
234	Em SHUTDOWN 2	LOW BATTERY	Em SHUTDOWN 2 LOW BATTERY	
236	PRESSURE 2	LOW BATTERY	PRESSURE 2 LOW BATTERY	
237	BAIL ANGLE	LOW BATTERY	TD BAIL ANGLE LOW BATTERY	
238	FLOW SENSOR 2	LOW BATTERY	FLOW SENSOR 2 LOW BATTERY	
253	AUX2 LOAD	ABOVE PRESET	AUX2 LOAD ABOVE PRESET	
254	CROWN SAVER 3	ALARM	CROWN SAVER 3 ALARM	
260	H2S 3	ABOVE LIMIT	H2S 3 LEVELS ABOVE MAXIMUM LIMIT	
261	LEL 3	ABOVE LIMIT	LEL 3 LEVELS ABOVE MAXIMUM LIMIT	
262	Em SHUTDOWN 3	*** STOP ***	Em SHUTDOWN 3 ***STOP***	
263	PRESSURE 3	ABOVE PRESET	PRESSURE 3 ABOVE PRESET MAXIMUM	
264	CROWN SAVER 3	ABOVE THRESHOLD	CROWN SAVER 3 ABOVE THRESHOLD	
265	PITCH & ROLL	ABOVE PRESET	PITCH AND ROLL OVER PRESET MAXIMUM	
267	AUX2 ANGLE	ABOVE PRESET	AUX2 ANGLE ABOVE PRESET MAXIMUM	
268	AUX2 ANGLE	BELOW PRESET	AUX2 ANGLE BELOW PRESET MINIMUM	
273	RAM3	CLOSED	RAM3 IS CLOSED	
274	RAM2 SIDE A	CLOSED	RAM2 SIDE A IS CLOSED	
278	AUX2 90% OF	PIPE STRENGTH	AUX2 LOAD AT 90% OF PIPE STRENGTH	
279	AUX2 90% OF	PRESET	AUX2 LOAD AT 90% OF MAXIMUM LOAD	
295	AUX2 LOAD	SYSTEM ALARM	AUX2 LOAD NOT FUNCTIONING	
296	AUX2 ANGLE	SYSTEM ALARM	AUX2 ANGLE NOT FUNCTIONING	
297	CROWN SAVER 3	SYSTEM ALARM	CROWN SAVER 3 NOT FUNCTIONING	
303	RAM2 SIDE A	SYSTEM ALARM	RAM2 SIDE A SENSOR NOT FUNCTIONING	
307	H2S 3	SYSTEM ALARM	H2S 3 SYSTEM NOT FUNCTIONING	
308	LEL 3	SYSTEM ALARM	LEL 3 SYSTEM NOT FUNCTIONING	
309	Em SHUTDOWN 3	SYSTEM ALARM	Em SHUTDOWN 3 SYS NOT FUNCTIONING	
310	PRESSURE 3	SYSTEM ALARM	PRESSURE 3 NOT FUNCTIONING	
316	FLOW SENSOR 3	SYSTEM ALARM	FLOW SENSOR 3 NOT FUNCTIONING	
322				
323	AUX2 ANGLE			
324	CROWN SAVER 3			
330				
331	H2S 3			
332	LEL 3	LOW BALLERY	LEL 3 SENSOR LOW BATTERY	

No.	Alarm Text 1	Alarm Text 2	Menu Alarm Text
334	Em SHUTDOWN 3	LOW BATTERY	Em SHUTDOWN 3 LOW BATTERY
336	PRESSURE 3	LOW BATTERY	PRESSURE 3 LOW BATTERY
337	ELEV POSITION	LOW BATTERY	ELEV POSITION LOW BATTERY
338	FLOW SENSOR 3	LOW BATTERY	FLOW SENSOR 3 LOW BATTERY
360	H2S 4	ABOVE LIMIT	H2S 4 LEVELS ABOVE MAXIMUM LIMIT
361	LEL 4	ABOVE LIMIT	LEL 4 LEVELS ABOVE MAXIMUM LIMIT
362	Em SHUTDOWN 4	*** STOP ***	Em SHUTDOWN 4 ***STOP***
363	PRESSURE 4	ABOVE PRESET	PRESSURE 4 ABOVE PRESET MAXIMUM
374	RAM2 SIDE B	CLOSED	RAM2 SIDE B IS CLOSED
403	RAM2 SIDE B	SYSTEM ALARM	RAM2 SIDE B SENSOR NOT FUNCTIONING
407	H2S 4	SYSTEM ALARM	H2S 4 SYSTEM NOT FUNCTIONING
408	LEL 4	SYSTEM ALARM	LEL 4 SYSTEM NOT FUNCTIONING
409	Em SHUTDOWN 4	SYSTEM ALARM	Em SHUTDOWN 4 SYS NOT FUNCTIONING
410	PRESSURE 4	SYSTEM ALARM	PRESSURE 4 NOT FUNCTIONING
430	RAM2 SIDE B	LOW BATTERY	RAM2 SIDE B SENSOR LOW BATTERY
431	H2S 4	LOW BATTERY	H2S 4 SENSOR LOW BATTERY
432	LEL 4	LOW BATTERY	LEL 4 SENSOR LOW BATTERY
434	Em SHUTDOWN 4	LOW BATTERY	Em SHUTDOWN 4 LOW BATTERY
436	PRESSURE 4	LOW BATTERY	PRESSURE 4 LOW BATTERY
463	PRESSURE 5	ABOVE PRESET	PRESSURE 5 ABOVE PRESET MAXIMUM
474	RAM3 SIDE A	CLOSED	RAM3 SIDE A IS CLOSED
503	RAM3 SIDE A	SYSTEM ALARM	RAM3 SIDE A SENSOR NOT FUNCTIONING
510	PRESSURE 5	SYSTEM ALARM	PRESSURE 5 NOT FUNCTIONING
530	RAM3 SIDE A	LOW BATTERY	RAM3 SIDE A SENSOR LOW BATTERY
536	PRESSURE 5	LOW BATTERY	PRESSURE 5 LOW BATTERY
563	PRESSURE 6	ABOVE PRESET	PRESSURE 6 ABOVE PRESET MAXIMUM
574	RAM3 SIDE B	CLOSED	RAM3 SIDE B IS CLOSED
603	RAM3 SIDE B	SYSTEM ALARM	RAM3 SIDE B SENSOR NOT FUNCTIONING
610	PRESSURE 6	SYSTEM ALARM	PRESSURE 6 NOT FUNCTIONING
630	RAM3 SIDE B	LOW BATTERY	RAM3 SIDE B SENSOR LOW BATTERY
636	PRESSURE 6	LOW BATTERY	PRESSURE 6 LOW BATTERY



6.9 In the Event of System Power Loss

In the event of a rig black out while the Rigsmart System is in use (either while drilling, rig-up, rig-down, or any other time), complete the following steps to avoid potential accidents. By default, if power is lost to the Rigsmart System, the main brakes will engage. The brakes will not be released until power is restored to the Rigsmart system.



WARNING Potential for Accident The Rigsmart system may unexpectedly release the brakes if the following steps are not completed correctly.

- 1. Stop operations.
- 2. Chain brake the main brakes.

(This ensures that the rig's blocks will not move while the power issue is being resolved).

3. Turn off the MAIN POWER to the Rigsmart system at the Power Disconnect.

(Turning off the main power to the Rigsmart system ensures that if the power

unexpectedly restores, the Rigsmart system will still be off and the main brakes will still be applied).

- 4. Troubleshoot and repair the power issues on the rig.
- 5. After stable power has been restored to the rig, ensure that the main brakes are still chained

down. Turn on the main power to the Rigsmart system at the Power Disconnect.

(Depending on the alarm condition the Rigsmart system was in before the power loss, the system may release the brakes when power is restored. This is why the rig's main brakes **MUST** be chained down first).

- 6. Once the operator has assumed control of the rig again, the Rigsmart system needs to be recalibrated.
 - a. Complete a 'First Layer Change' height recalibration.
 - b. If the block height is supplied by a 4-20mA connection to a PLC, a height calibration must be done.
- 7. Continue operations.



7 The DAS User Interface

Note: The system can be accessed from any device that can access a wireless network such as a computer, tablet, or cell phone.

7.1 Connecting to the System

- 1. Connect to the wireless network: ______ and password: ______
- 2. Open a web browser and enter the following IP address:_____
- 3. To sign in, enter the username: _____and password: _____

Templete	
rstech	
Password	
☑ Remember me	
Sign in	
© 2019	

7.2 Dashboard

Upon successful sign in, the Dashboard will appear. This is the main operating display, showing the system components and their current statues in real time.

RIG SMART 🔲 Dashboard 🗇 Devices 🔟 Reporting 💥 Tools					
Block Height Height	Stip f Pre	rressure SSUTO	Tong Rotation Current Count (1)		
2.5	1		0		
ft	psi				
Load Weight	Ram 1A Status	Ram 18 Status	Tong Torque Tong Torque (j)		
0	Open	Open	0		
lb -			lb-ft		

Each component can be clicked to view its parameters in the Devices screen.



Ram 1A Status	Block Height	Block Height
Closed	Height 2.5 ft	Height 2.5 ft
	Configuration 😁	Configuration +
	Calibration +	Activate True
	Limit 🋶	Enable
	Diagnostic *>	Irue
	Alarm +	79
		Calibration \mapsto
		Limit ↔
Click on the expand icons (double-he	aded arrow) to expand the flyout	Diagnostic 😁
component are listed here and can be	e adjusted by clicking on each.	Alarm 😁

Once a value is clicked, a user input box will appear near the top of the screen. Enter a new value in the text field, or click the up / down arrows (or checkboxes) to adjust the current value. NOTE: It is not necessary to press the 'Enter' key to confirm a value change.

RIG SMART	🔟 Dashboard 🖨 Devices 🔟 Reporting 💥 Tools		
	Block Height : ID	79	(the second seco
Block Height Height 2.5 ft Configuration Activate True Enable True ID 79 Calibration Limit Diagnostic Alarm	click current value	enter new value	(or use arrows to adjust incrementally)

7.3 Devices

The Devices screen shows all components associated with the system, including ones that are not displayed on the Dashboard. From this screen, settings related to all the components can be checked



at once. Click the expand icons (double-headed arrow) next to any menu item to expand that particular menu for all components.

el 1 Load Tong Torg	que Ram 1A Ram 1B Slip P	ressure Tong Rotation IME	Block Height						
					V Fi	lter			
Panel 1	Block Height	Load	Slip Pressure	Ram 1A	Ram 1B	Tong Torque	IMD	Tong Rotation	
Configuration	Height	Weight	Slips Status	Status	Status	Weight	Configuration	Current Count	
Alarm	Configuration	Configuration	Pressure Pressure	Configuration	Configuration	U lb Tong Torque	Diagnostic 💮	Configuration	
requency	Calibration	Calibration	1 psi	Calibration	Calibration	0 lb-ft	Alarm +++	Calibration	
nfo	Limit	Limit	Calibration	Diagnostic 😔	Diagnostic	Collibration		Diagnostic +-+	
	Diagnostic	Diagnostic 😁	Limit	Alarm ↔	Alarm \mapsto	Limit		Alarm +++	
	Alarm	Alarm	Diagnostic ++			Diagnostic			
			Alarm ++			Alarm			
	/								
G SMART	Dashboard 🖨 🕻 Ram 1A Ram 1B Stip Pre	Devices 🔟 Report	ting 💥 Tools Block Helght						10:45 AM
G SMART	Dashboard 🖨 🕻 Ram 1A Ram 18 Stip Pre	Devices 🖽 Report	iing 💸 Tools Block Height		V	Filter			10:45 AM
G SMART	Dashboard 🖨 C Ram16 Ram18 Stip Ire Block Height	Devices Ltd Report	ting 🎗 Tools Block Height Slip Pressure	Ram 1A	₩ Ram 18	Filter Tong Torque	IMD	Tong Rotation	10:45 AM
G SMART	Dashboard 🖨 D Ram18 Slip Inc Block Height Height 2.5 ft	Devices Lid Report	ting X Tools Block Height Slip Pressure Slips Status Open	Ram 1A Status Open	Ram 18 Status Open	Filter Tong Torque Weight O Ib	IMD Configuration	Tong Rotation	10:45 AM
G SMART	Dashboard Dashboard Can 16 Ran 18 Stip fre Block Height Height 2.5 ft Configuration	Devices Let Report sture forg Rotation (MO Load Weight 0 lb Configuration	ting 🎘 Tools Block Height Slip Pressure Slips Status Open Pressure	Ram 1A Status Open Configuration ==	Ram 18 Status Open Configuration	Filter Tong Torque Weight O Ib - Tong Torque	IMD Configuration Activate False	Configuration	10:45 AM
G SMART	Dashboard Dispresent Ban 16 Stip Pre Block Height Height 2.5 ft Configuration == Activate	Devices Lat Report	ting 🎘 Tools Block Height Slip Pressure Slips Status Open Pressure 1 psi	Ram 1A Status Open Configuration = Activate	Ram 18 Status Open Configuration Activate	Filter Tong Torque Uib Tong Torque O Ib-ft	IMD Configuration Activate False Enable	Tong Rotation Current Count Configuration == Activate	10:45 AM
G SMART	Dashboard C C Ram 10 Ram 10 Stip tree Block Height Height 2.5 ft Configuration Activate True	Devices Lat Report	Ing X Tools Block Height Slip Pressure Slips Status Open Pressure 1 psi Configuration	Ram 1A Status Open Configuration Activate True	Ram 18 Status Open Configuration Activate True	Filter Tong Torque Weight O Ib- Tong Torque O Ib-ft Configuration	IMD Configuration Activate False Enable False	Tong Rotation Current Count O Configuration Activate False	10:45 AM
G SMART	Dashboard C C Cam 10 Ram 10 Stip /re Block Height Height 2.5 ft Configuration Activate True Enable True	Devices Lat Report	ting X Tools: flick Heart Slips Status Open Pressure 1 psi Configuration ++ Activete True	Ram 1A Status Open Configuration Activate True Enable True	Ram 18 Status Open Confugation Activate True Enable True	Filter Tong Torque Weight O Ib Tong Torque O Ib-ft Configuration Activate False	IMD Configuration Activate False Enable False Output 1 Voltage Norm Cold	Current Count Courter Count Configuration False Enable False	10:45 AM
G SMART	Dashboard C C Ram IA Ram IB Sirp Pre Block Height Height 2.5 ft Configuration == Activate True Enable True ID	Devices Lett Report	Silp Pressure Silp Status Open Pressure 1 psi Configuration Activate True Enable	Ram 1A Status Open Configuration Activate True Ensble True ID	Ram 18 Status Open Configuration = Activate True Enable True D	Filter Tong Torque Weight O Ib Tong Torque O Ib-t Configuration Activate False Enable	IMD Configuration Activite False False Output Voltage Output Voltage	Current Count O Configuration Activate False Ensite False ID	10:45 AM
G SMART Cong long long Cong long Con	Dashboard C C Ram 12 Ram 13 Stop Pre Block Height 2.5 ft Configuration == Activate True Enable True ID 79	Vergint Condition Condition	ing X Tools Block Height Slip Status Open Pressure 1 psi Configuration Activate True Enable True	Ram 1A Status Open Configuration Activate True Enable True ID 77	Ram 18 Status Open Configuration Configuration Configuration True Enable True Enable True ID 78	Filter Tong Torque Viejnt O Ib Tong Torque O Ib-ft Configuration Activate False Enstel False	IIID Configuration Activite False False Output 1 Voltage Norm Cold Output 2 Voltage Norm Cold	Tong Rotation → Current Count 0 Configuration Activate False False False False 0 255 Configuration	10:45 AM
G SMART I tool fong torque Panel 1 figuration Factory Settings Se m Factory Settings Se m Factory Settings Se m Factory Settings Se m Factory Settings Se	Dashboard C C Ram 10 Ram 18 Ship Pre Block Height 2.5 ft Configuration Activate True Enable True Do 79 Calibration	Devices Lett Report store Tong Rotation (M0 Load Weight 0 Ib Configuration	ing X Tools Block Height Slip Status Open Pressure 1 pai Configuration Activate True Enable True Enable True Enable True	Ram 1A Status Open Configuration = Activate True Enable True 10 77 Calibration =	Ram 18 Status Open Configuration Configuration True Enable True Enable True Configuration True Configuration	Filter Filter Veight 0 Ib Tong Torque 0 Ib Configuration Activate False Enable False Enable False 1 ID 255	IMD Configuration Activate False False Output 1 Voitage Norm Cold Output 2 Voitage Norm Cold Output 2 Voitage Norm Cold Output 2 Voitage	Tong Rotation → Current Count 0 Configuration → Activate False False 0 255 Calibration Activate	10:45 AM
G SMART Constant of the second	Dashboard C C Ram 10 Ram 18 Ship Pre Block Height 2.5 ft Configuration True Enable True Enable True Do 79 Calibration **	Devices Lett Report store Tong Rotation (M0 Load Weight 0 Ib Configuration	ing X Tools Block Height Slip Status Open Pressure 1 psi Configuration Activate True Enable True Enable True Configuration	Ram 1A Status Open Configuration Activate True Enable True 10 77 Calibration Diagnostic	Ram 18 Status Open Configuration = Activate True Enable True Calibration = Calibration =	Filter Filter Veight O Ib O Ib Configuration Activate False Enable False Enable ID 255 Calibration	IIII Configuration Activate False False Output Yoltage Norm Cold Output Yoltage Norm Cold Output Yoltage	Tong Rotation Current Count O Configuration Palse Ensite False Calibration Calibration Diagnostic	10:45 AM
G SMART G S	Dashboard C C Ram 10 Ram 18 Ship Pre Block Height 2.5 ft Configuration True Enable True Enable True Diaprostic Calibration Calibration Calibration Calibration C C C C C C C C C C C C C C C C C C C	Devices Lett Report store Tong Rotation (M0 Load Weight 0 Ib Configuration + Activate True Enable True Enable True Enable True Limit + Limit +	ing X Tools Bird Happi Slip Pressure Slip Status Open Pressure 1 pai Configuration Activate True Enable True Enable True Enable True	Ram 1A Status Open Configuration Activate True ID 77 Calibration Diagnostic Alarm	Ram 18 Status Open Configuration Configuration Enable True Enable True ID Opignostic Diagnostic Alarm	Filter Filter Filter Veight 0 Ib Tong Torque 0 Ib-ft Configuration Activate False Enable False Enable ID 25 2 Calibration Limit	IMD Configuration Activite False False Output Yoltage Norm Cold Output Yoltage Norm Hot	Tong Rotation Current Count O Configuration Palse Enable False O Calibration Diagnostic Alarm	10:45 AM
G SMART	Dashboard C C	Devices Lat Report store from Instantion (MD Load Weight 0 Ib Configuration + Activate True Enable True ID 71 Calibration + Limit + Diagnostic + Alarm ++	ing X Tools Bind Happit Slip Pressure Slip Status Open Pressure 1 psi Configuration Activate True Enable True Enable True Enable True Enable True Enable True Enable True	Ram 1A Status Open Configuration Activate True ID 77 Calibration Diagnostic Alarm	Ram 18 Status Open Configuration Configurati	Filter Filter Veight Olb Configuration Activate False Enable False Enable Solution Calibration Calibration Calibration Limit	IMD Configuration Configuration Configuration Configuration Configuration Configuration False Couput Voltage Norm Cold Output Voltage Norm Kot Output Voltage Norm Output Voltage Norm Norm Output Voltage Norm Norm Output Voltage Norm Norm Output Voltage Norm N	Tong Rotation Current Count O Configuration Activate False Enable False Do Zos Diagnostic Alarm	10:45 AM
G SMART	Dashboard C C Ram 10 Ram 10 Step tree Block Height Height 2.5 ft Configuration === Activate True Enable True Calibration === Calibration === Diagnostic === Aarm ====	Load IMD Verget Tong trateform IMD Load Verget IMD Configuration Activate True Enable True Do Diagnostic Alarm	ing X Tools: Ricck Height Slip Pressure Slips Status Open Pressure 1 psi Configuration == Activate True Enable True Enable True Enable Diagnostic ==	Ram 1A Status Open Configuration = Activate True Enable True Enable True ID 77 Calibration = IQ 77 Calibration = IQ Alarm =	Ram 18 Status Open Configuration Calibration True Enable True Io 78 2 Calibration Pagnostic Pagnostic	Filter Filter Filter Weight O Ib Tong Torque O Ib-ft Configuration Activate False Easte False ID 255 Calibration C	IMD Configuration Activate False False Couput Voltage Norm Cold Output Voltage Norm Cold Output Voltage Norm Hot Output Voltage Norm Cold Output Svoltage Norm Kot Output Svoltage Output Svoltage Output Svoltage	Tong Rotation Current Count O Configuration Activate False ID 255 Calibration Diagnostic Alarm	10:45 AM
C SMART Constant C	Dashboard C III Cam 1a Ram 1a Stip yee Block Height Height 2.5 ft Configuration 4= Activate True Enable True ID 79 Calibration 4= Diagnostic 4= Aarm 4=	Load Load Weight 0 0 lb Configuration Activate True Enable True ID 71 Calibration ID Dia Alarm	ting X Tools: Flick Heart Slips Status Open Pressure 1 psi Configuration ← Activate True Enable True Enable True Enable True Diagnostic ← Alarm ←	Ram 1A Status Open Configuration Activate True Enable T7 Calibration ID 77 Calibration ID 77 Calibration ID 77 Calibration ID Alarm	Ram 18 Status Open Configuration Configuration Activate True Enable True ID 78 Calibration Calibration Dagnostic Alarm	Filter Tong Torque Weight O Ib Tong Torque O Ib-t Configuration Activate False Enable False Enable Configuration Configuration Limit Diagnostic Alarm	IMD Configuration Activate False False Configuration Activate False Gorput Voltage Norm Cold Output Voltage Norm Cold Output Voltage Norm Cold Output Voltage Norm Cold Output Svoltage Norm Cold	Corrent Count O Configuration False Emble False Calibration Calibration Adarm	10:45 AM

Configuration for all components expanded

Values and attributes can also be individually adjusted from this screen. Once a value is clicked, a user input box will appear near the top of the screen.



^	Load : ID			71		÷	
					ΥF	ilter	
Panel 1	Block Height	Load	Slip Pressure	Ram 1A	Ram 1B	Tong Torque	
Configuration ++	Height 2.5 ft	Weight O Ib	SHps Status Open	Status Open	Status Open	Weight O Ib	Configu
Factory Reset Panel False	Configuration 🛁	Configuration 🛶	Pressure	Configuration \cdots	Configuration 🕞	Tong Torque	False
Store Factory Settings False	Activate True	Activate True	Configuration	Activate True	Activate True	Configuration +	Enable False
Restore Factory Settings False	Enable True	Enable True	Activate True	Enable True	Enable True	Activate False	Output Norm
Alarm	1D 79	1D 71	Enable True	ID 77	ID 78	Enable False	Output Norm
Frequency	Calibration 🖂	Calibration 🚥	ID 75	Calibration \cdots	Calibration \cdots	ID 255	Output Norm
Into ↔	Limit ↔	Limit 🛶	Calibration \mapsto	Diagnostic 🏎	Diagnostic 🛶	Calibration +++	Output Norm
	Diagnostic \cdots	Diagnostic \cdots	Limit 🛶	Alarm \cdots	Alarm	Limit +-+	Output

Enter a new value in the text field, or click the up / down arrows (or checkboxes) to adjust the current value. *NOTE: It is not necessary to press the 'Enter' key to confirm a value change.*

The filter feature is useful for customizing the display to show certain components alone. Click the blue button labeled 'filter' near the top of the screen.

					V	⁷ Filter			
k anywhere in the		Ram 1A			Ram 1B	Tong	Torque	IMD	
er banner button		Sta	itus nen	Status	n	Weight 0.lb	1	Configuration	
		Co	nfiguration	⊷ Config	guration	→ Tong Torq	ue	Activate False	
elect which items to dis	play	Ac Tr	tivate ue	Activa True	te	Configura	tion ↔	Enable False	
		En	able	Enable	e	Activate		Output 1 Voltage	
Planel 1)Torque Ram 116 Ram 110 Stip Pr Block Height	ressure Trong Rotation (RAD)	Block Height	Ram 1A	त्तु । Ram 18	îlter Tong Torque	IMD	Tong Rotation	
Continuation	Height	Weight	Slips Status	Status	Status	Weight	Configuration	Current Count	
Ender Broke Broke	2.5 ft	0 lb	Open	Open	Open	0 lb	Advan	0	
False	Configuration 🙌	Configuration 😁	Pressure	Configuration	Configuration 🙌	Tong Torque	False	Configuration \cdots	
Store Factory Settin False	gs Activate True	Activate True	Configuration	Activate True	Activate True	Configuration	Enable False	Activate False	
Restore Factory Set False	ings Enable True	Enable True	Activate True	Enable	Enable	Activate False	Output 1 Voltage Norm Cold	Enable False	
	orn/	1000	The second secon	100	(mail)			110	

Click the filter button again to hide it once the display has been adjusted to the desired configuration.



7.4 Creating Reports

The Reporting page of the Data Acquisition system (DAS) is used to create real-time reports, making data visualization quick, easy and effective.

Use the following procedure to create a custom report for any device (or multiple devices) in the system.

7.4.1 The Reporting Page – Reports Tab

The Reporting Page consists of two tabs: *Reports* and *Report Builder*. The Reports tab allows the user to access any report saved in the system, and select a time range of data. The following image illustrates the Reports tab and its components.



Report Start Time – select the start time of data displayed on the report (month/day/year/time of day)
 Report End Time – select the end time of data displayed on the report (month/day/year/time of day)
 Report List – a dropdown menu, showing all available reports created by the Report Builder
 Chart Button – click this button to chart the currently selected report, for the selected start and end times



7.4.2 The Reporting Page – Report Builder

The Report Builder is used to customize the data for charting. The following image illustrates the Reports Builder and its components. Follow the illustrated procedure below to create a custom report.

1 First, give the new report a name by typing it in the 'Name' text field.



2 Next, click the 'Add Axis' button to reveal a dropdown menu with more options. First select a device to record data from. Then select a single data attribute of that device, and finally select a time interval. The time interval will average the data points over the selected period of time for each point on the chart.

RIG SMART ID Dashboard 🖨 Devices 🖬 Reporting 💥 Tools	RIG SMART Dashboard C Devices Lat Reporting X Tools	RIG SMART III Dashboard 📾 Devices 🖼 Reporting 💸 loois
Reports Report Builder	Reports Report Builder	Reports Report Builder
Report Editor	Report Editor	Report Editor
Name: Custom Report 1	Name: Custom Report 1	Name: Custom Report 1
O Arld Asis 📝 Fdit O Remove	O Add Asis 🔀 Edit O Remove	🗘 Add Axis 📝 Edit 🗢 Remove
Device: Select a Device *	Device: I coul *	Device: Lond *
Attribute: Panel 1	Attribute: Select an Attribute *	Attribute: Weight *
Interval: Load	Interval Activate	Interval: Select an Interval *
C) Add Filter Slip Hearune CF Fail C Rescore Nam 10 Ison 10 Isong logge, M05 Isong Rotation	O Add Talwer Coller plan O factories POL 70pr A/D Zero A/D Zero A/D Zero A/D Zero A/D Zero Main Zero Main Zero	O Add File No Interval 20 € Edit O Remove 5 sect 15 sect 10 sect 1 min 5 min

3 To further customize the data selected, filters can be added to each axis. This will narrow the data down to only certain specified values or ranges of value. For example, a filter can be selected to show only values 'above zero' or 'equal to 100'. To create a filter, simply click the 'Add Filter' button, select an option from the 'Select an Operator' list, and type a value in the 'Value' text field.

moni mostiosto es	revices an reporting of tools				1.50 P	IN 199	-
Report Builder							
rport Editor			Current Report: Custom Rep	ort 1			
ane. Cust	m Report 1		O Add	 Dekte 	Existing Reports *		Ľ
O Add Axis	(C Edit	😔 Remove		Save:			
O Add Filter	💕 Edit	😑 Remove	LAND CONST. 10 WARNE				
Select an Operator +	Value	8					
equals							
less than							
less than or equal to							
greater than							



4 Several axis can be added to any report. Once an axis is complete, click the 'Add Axis' button to create more to add to the report. As the data for the report is selected, it appears in the 'Current Report' window on the right side. Once all the desired data is selected, click the 'Save' button.

Report Editor				Current Report: Custom Repo	ort 1	
Name:	Custom Report 1			• Ada	C Delete	Existing Reports *
O Add Axis	🗹 talı		C Remove		8 Save	
• Add Filter	🚺 Fdt		· Renne			
equals *		sol	R			

5 After saving, the new report will be available to chart. Navigate back to the 'Reports' page and click the 'Reports' button. A dropdown menu will appear, displaying all the reports available. Select the desired report and click the 'Chart' button.

Block Height Custom Report 1		
Custom Report 1	Block Height	
	Custom Report 1	

Shown below is a sample report with its components labeled. The following section describes these components and their functions.



Attribute Charted – shows the attribute being displayed as the line color indicated

Zoom – click to use the zoom bar to view larger or smaller sections of data, as shown in the images below

1

2



3



PDF Export – click to create a PDF of the current report. A tab will appear at the bottom of the screen, indicating that the report PDF has been generated. Click on this tab to open the PDF in a separate browser window, where the options to download and/or print are available.





8 Service

8.1 Regular System Maintenance

For the Rigsmart system to operate correctly there are a number of regular system maintenance items that should be tended to on a regular basis. Consistent testing of the system should be worked into the rig's regular schedule to ensure that it is continuously protecting the rig. This maintenance list is a guide only; if the customer's safety program recommends more frequent safety checks, the greater of the two should be observed. For example, if the customer's safety policy is to check the crown saver every tour, the Rigsmart crown saver should be checked at the same time.

				Frequen	су	
Maintenance Item	Description	Every Day	Weekly	Monthly	On Rig Move	As Required
General						
Load Calibration	Any device used to indicate weight should be returned to Rigsmart Systems annually to ensure proper calibration and functionality.					X (annually)
Visual inspection of equipment	Visual inspection of components, transducers and brackets. Checking for obvious damage.				х	
Wash equipment	If equipment becomes heavily soiled with drilling fluids or mud they should be sprayed off. Make sure all covers are securely closed and lids are tight. Use only a light spray with soap and water. Do not pressure wash with high pressure sprays. No harsh chemicals or diesel fuel should be used.					х
Function Crown Saver	The hardware and software Crown Savers should be tested every day to ensure functionality.	х				
Limit Testing	Test each of the Anti-Collision Limits. Make sure the brakes activate correctly and the limits are placed in the correct positions.		х			
Emergency Shutdown	If equipped, test the Emergency Shutdown to ensure it functions correctly.	х				


		Frequency				
Maintenance Item	Description	Every Day	Weekly	Monthly	On Rig Move	As Required
General						
Elevator Position	If equipped, rotate the top drive pipe handler to ensure the Elevator Position Sensor is working correctly and all micro-dots are being sensed.				х	
Check Safety Cables	Ensure all safety cables on overhead equipment are connected and tight.				Х	
Electrical						
Antenna Connection	Apply a moderate amount of dielectric grease to create a watertight seal on the antenna connection and any extension cables or bulkheads. Make sure each connection is tight.				х	
Check Electrical Cables	Check cables for damage, kinks or pinch points.				Х	
Replace Batteries	If a transducer's battery has died or the panel displays a 'low battery' warning message, replace the battery in the corresponding component. After replacing the battery, ensure that the lid is greased and closed tightly.					x
Electrical Connections	All electrical cables NOT on the component stand should be opened and a moderate amount of dielectric grease should be applied to create a water tight seal. Make sure to tighten connections when connecting and reconnecting. NOTE: This should NOT be done while drilling, as the brakes will be applied if a connection is broken.				X	
Pneumatic						
Check Hoses	Check hoses for damage, kinks or pinch points.				х	
Air Pressure	The supply pressure tank should be checked to ensure there is a constant supply of at least 90PSI.		х			



		Frequency				
Maintenance Item	Description	Every Day	Weekly	Monthly	On Rig Move	As Required
General						
Pneumatic Filters	All of Rigsmart's pneumatic boxes have air filters in them; these filters should be checked and cleaned.		х			

8.2 The Rigsmart Replacement Exchange System:

- 1. A customer calls with a valid Rigsmart component serial number. (XXX-XXXX.), and specifies which components need to be replaced. (Example: Panel, Crown Saver, Bail Angle, Elevator Rotation System...etc.).
- 2. A replacement agreement is then faxed to the customer. The customer is responsible for signing and returning the agreement to Rigsmart Systems. No product will leave Rigsmart Systems until this agreement is signed.
- 3. The replacement parts are spooled up and tested.
- 4. Parts are then shipped to the customer. If the system is still within the warranty period, no charges will be applied at this time, unless importing to a country with a value added tax (VAT). If the part's warranty period is expired, the customer is responsible for the cost of freight. A purchase order number will be required.
- 5. Upon receiving the new parts, the customer can then reuse the same box to package and ship the faulty or damaged components back to Rigsmart Systems.

Service Contact Information

E-mail:	service@rigsmart.com
Telephone:	+1 780 438 9475
Facsimile:	+1 780 438 9477
Address:	4908 97 Street NW
	Edmonton, Alberta
	Canada T6E 5S1

4904 – 97th Street Edmonton, Alberta T6E 5S1 Canada Telephone: (780) 438-9475 Facsimile: (780) 438-9477

Replacement Agreement – please complete

Between Rigsmart Systems and

Company:	Contact Name:
Address:	Phone:
City:	Fax:

Serial Number: n/a	Service Order #:
Component(s):	Replacement Value: \$

On behalf of (COMPANY)______ I hereby request in writing, replacement system component(s) for Rigsmart System (RS#______. I agree to return the non-functioning component(s) to Rigsmart Systems at the above address within 15 business days of receipt. In the event I fail to return the non-functioning component(s) to Rigsmart Systems within 15 business days – and do not notify Rigsmart Systems, I hereby authorize Rigsmart Systems to charge my account or credit card on file for the cost of the equipment as detailed on this agreement.

I understand this replacement is being provided as a service. Any subsequent costs charged for this replacement due to loss are non-refundable. I also understand that there may be additional fees to repair the component(s) being replaced. If this is a replacement for a known repair please provide a purchase order number in the space below

COMPLETION AND RETURN OF THIS AGREEMENT, AND ACCEPTANCE OF REPLACEMENT EQUIPMENT CONSTITUTES ACCEPTANCE OF THESE TERMS AND CONDITIONS. AS AN AUTHORIZED EMPLOYEE OF YOUR COMPANY, BY SIGNING THIS DOCUMENT IT BECOMES A BINDING CONTRACT.

*Authorized Signature:	
*Name:	Service Tech:
Title:	Title:
*Date:	Date:
*Purchase Order Number:	Crane/Rig Description

Fax copy of signed agreement to 1-780-438-9477

*These fields are mandatory. If a Purchase Order Number is not available, please print name in field

Note: No equipment shall be shipped until a completed copy is received by Rigsmart Systems



NOTES:

 ······