ForeSite® EDGE (WellPilot) RPC HMI Manual



Contents

1.0 Introduction:	3
2.0 Navigation and Operation:	5
3.0 HMI Menu System:	7
VIEW DATA MENU STRUCTURE	8
4.0 System Setup:	9
SYSTEM SETUP MENU STRUCTURE	10
5.0 Quick Guided Setup:	11
QUICK GUIDED SETUP MENU STRUCTURE	11
6.0 VSD Setup:	21
6.1 VSD Min Fillage:	25
6.2 VSD Speed Trim Adjustment (STA):	26
7.0 Controller Diagnostics:	29
8.0 Pump Diagnostics:	30
8.1 Live Load Trend (Valve Troubleshoot):	31
8.2 Rod Rotator:	33
9.0 Dynagraph:	34
10.0 Communications:	36
11.0 Alarms:	43
12.0 Parameter Groups:	45
13.0 User Defined:	52
14.0 Commands:	54
15.0 Troubleshooting:	55
16.0 Specifications:	57

Revision	Description	Date
А	Initial Release	December 2020
В		May 2024
3.11.04	RPOC Firmware Version	Dec 2023
1.09.13	RPOC HMI Firmware Version	March 2024

1.0 Introduction:

Startup UP:

The HMI upon receiving power will undergo a startup sequence in which the base project file and its attributes will be loaded. During this process the "Weatherford" logo will appear followed by the main status screen, when the controller has completely initialized.



The HMI is intended to function in a similar manner to the EGD and thus the menu layout will be similar.



Status Screen:

The status screen is designed to provide the operator with basic information about the wells performance. Three different Status screens are available depending upon your setup choices. If you choose to use the surface pump fillage then the Surface Status Screen will be shown. If you choose to use pump fillage then the Downhole Status Screen will be displayed. If you choose to use the VSD function, then the VSD Status Screen will be displayed. This is an automatic selection of the Status Screen.







RPC Mode	VSD Mode
Well Status	VSD Type
Well Speed	VSD Start Up/Min SPM
POC Control Source	VSD Max SPM
Pump FIllage Setpoint and Calculated Pump Fillage	Motor Current
Current Load and Loads Last Stroke	Motor Speed

*Note: With the HMI the operator can now also see the Surface and Downhole Dynagraph plots.

2.0 Navigation and Operation:

Navigating or executing an operation change within the various screens for the HMI are performed by using the main control keys within the navigation pane at the bottom of each screen.



These keys can perform actions such as Starting or Stopping the operation of the pumping system or clearing any alarms that have been resolved and should to be cleared.



A numeric box is now available for entering longer number sequences. The "ENTER" key must be used to update values; while the "ESC" key is used to exit without making changes to the value.



Pre-selections remain available for selections such as "Rod TYPE" or "Position Sensor Type".

04/28/2017 10:59:29	Rod Tapers		Weatherford
Rod Type	Steel -	Pump Depth	5070
Rod Count	Nothing Steel	Total Rod Length	5070
Rod Diameter	Fiberglass Corod		
Rod Length	Custom Custom		
 Main Menu 	Clear P Alarms	ump Idle Stat On Time Scre	us en

04/28/2017 11:02:46	Quick Guided Setup	₩ Weatherford
SENSOR SETUR	5	
Load Input Source	Load Cell	
Preset Load Gain	Not Selected	
Load Input Gain	1500	
Position Input Source	Cont/Incl/Rota	
Set Top of Stroke	Pos Switch Cont/Incl/Rota Monitor Only	
Main Menu	Cont Pos W/DPS	tatus creen

3.0 HMI Menu System:



Main Menu- Is accessed from any screen by pressing the on the "Main Menu" key in the navigation pane at the bottom of any screen and is the root menu for all other menu's.

05/12/2024	12:03:52	Main Mer	าน	Weatherford
	View Data		Dynagraph	
	System Setup		Alarms	
	Quick Guided Setup		User Defined	
	Controller Diagnostic		Commands	
	Pump Diagnostic		Well Information	
	Main Clea Menu Alarm	r Pump Is On	Idle Status Time Screen	

View Data Menu-Allows operator to access to informational data related to the wells operating conditions.



VIEW DATA MENU STRUCTURE

3.0 View Data

3.1 Run Time Data

3.1.1 List Cycle Run Times

3.1.2 List Daily Run Times

3.2 I/O Status

3.2.1 Digital I/O

3.2.2 Analog I/O

3.2.3 RTD and Turbine

3.3 VSD Profile

- 3.3.1 VSD Run Time Status
- 3.3.2 RLC Run Time Status
- 3.3.3 STA Run Time Status
- 3.3.4 VSD Speed Control
- 3.3.5 Yaskawa VSD DI Status
- 3.3.6 VSD Run Status
- 3.3.7 VSD Run Program Status
- 3.3.8 Torque/Current Display
- 3.3.9 Export VSD Fault History to USB

3.4 Calculated Downhole Data

- 3.4.1 Downhole Stroke Length
- 3.4.2 Downhole Min Load
- 3.4.3 Downhole Max Load
- 3.4.4 Downhole Load Span
- 3.4.5 Pump Horsepower
- 3.4.6 Calculated Pump Fillage%
- 3.4.7 Pump Card Area Ratio
- 3.4.8 Pump-Off Stroke Count
- 3.4.9 POC Control Source

3.5 Logger Data

3.5.1 Advanced Logger3.5.2 Legacy Logger

3.6 Performance History

(12 days of: Strokes, Avg SPM, Avg Fill%, PIP (psi), Power kWh, and Regen kWh)

- 3.7 Stroke History
- 3.8 Load Summary
- 3.9 Accumulator Data

3.10 Tank and FCU Data

- 3.10.1 Tank Data
- 3.10.2 FCU Data

4.0 System Setup:

System Setup-Provides access to more detailed configurations not found in the "Quick Guided Setup" menu.



SYSTEM SETUP MENU STRUCTURE

4.0 System Setup

4.1 Time and Date

4.2 Surface Control Setup

- 4.2.1 Idle Time
- 4.2.2 Pump-Off Pos%
- 4.2.3 Pump-Off Load%
- 4.2.4 Pump-Off Strokes
- 4.2.5 Pump-Off Action
- 4.2.6 Stabilization Delay
- 4.2.7 POC Method
- 4.2.8 POS Sensor Type
- 4.2.9 Load Cell Size/Conn
- 4.2.10 Stroke Length
- 4.2.11 POC Control Source
- 4.2.12 Top of Stroke Setup

4.3 Downhole Setup

- 4.3.1 Downhole Well Parameters
- 4.3.2 Downhole Control Parameters
- 4.3.3 Downhole Calculation Parameters
- 4.3.4 PIP and Fluid Level
- 4.3.5 Rod Tapers
- 4.3.6 Rod Types
- 4.3.7 Rod Stress
- Downhole Method & Calc Status

4.4 Communication Setup

- 4.4.1 Port Assignments
- 4.4.2 8500/Modbus Host 1
- 4.4.3 8500/Modbus Host 2
- 4.4.4 8500/Modbus Host 3
- 4.4.5 Modbus Scanner
- 4.4.6 Network configuration

4.5 Inferred Production

4.6 Load Setup Menu

- 4.6.1 Load Violation Setup
- 4.6.2 Load Sensor Setup

4.7 I/O Setup

- 4.7.1 Digital Input
- 4.7.2 Analog Input
- 4.7.3 Analog Output
- 4.7.4 RTD Input
- 4.7.5 Digital Output
- 4.7.6 Analog Input Alarms
- 4.7.7 Analog Output Calibration
- 4.7.8 Rod Rotator

4.8 VSD Menu

- 4.8.1 Variable Speed Drive (VSD) Setup
- 4.8.2 VSD Advanced Setup
- 4.8.3 VSD Minimum Fillage Setup
- 4.8.4 Rod Load Control (RLC)
- 4.8.5 Speed Trim Adjustment (STA)

4.9 Additional Setup

- 4.9.1 Energy Management
- 4.9.2 Data Logger
- 4.9.3 Stop Location
- 4.9.4 Gas Engine Control
- 4.9.5 Accumulators
- 4.9.6 FCU Scanner
- 4.9.7 Tank Scanner
- 4.9.8 Injection
- 5.0 Software Timer

5.0 Quick Guided Setup:

Quick Guided Setup Menu- Is a basic menu that is primarily used when initially commissioning well.

The Quick Guided Setup Menu is also useful in terms of allowing access to settings that are need regular adjustment.

.0 Quick Guided Setup		
5.1 System Setup Page 1	5.6 VSD Control	
Press To Sync HMI Time to RTU	5.7.1 SPM Min	
5.1.1 Time	5.7.2 SPM Max	
5.1.2 Date	5.7.3 SPM Start-Up	
5.1.3 Idle Time	5.7.4 VSD Target Fillage	
5.1.4 Gauge Off Time	5.7.5 Min Fillage Action	
5.1.5 Pump-Up Delay	5.7.6 Min Fillage	
5.1.6 Power on Restart Delay	5.7.7 Min Fillage Strokes	
5.2 Sensor Setup	5.7.8 Surface Tol%	
5.2.1 Load Input Source	5.7.9 Downhole Tol%	
5.2.2 Preset Load Gain	5.7.10 Enable	
5.2.3 Load Input Gain	5.8 Rotaflex Control	
5.2.4 Position Input Source	5.8.1 Position Min Input	
5.2.5 Set Top of Stroke	5.8.2 Position Max Input	
5.2.6 Units	5.8.3 Pump on Settling Time	
5.3 Surface Control	5.8.4 Sensor Failure Action	
5.3.1 Pump-Off POS%	5.8.5 # Cycles to Average	
5.3.2 Pump-Off Load%	5.8.6 Manual Cycle Runtime 5.8.7 Weatherford Rotafley Model	
5.3.3 Pump-Off Strokes	5.8.8 STA Enable	
5.3.4 POC Method	5.8.9 Trim Speed Diff	
5.4 Pump Fillage Control	5.8.10 May Trans Speed	
5.4.1 VSD Target Fillage	5.8.11 STA Segment Setup	
5.4.2 Pump-Off Position Fillage	5.9 Well Setup	
	5.8.1 Pump Depth	
5.4.3 Pump-Off Strokes [Min Fillage Stroke]	5.8.2 Bore Dia	
5.4.4 Pump-Off Action [Min Fillage Action]	5.8.3 Fluid Depth	
5.4.5 Downhole Enable	5.8.4 Surface Stroke	
5.4.6 POC Control Source	5.8.5 Fluid Calc Method	
5.5 Load Violation Setup	5.8.6 Pump Efficiency	
	5.9 Rod Tapers	
	5.10 Pump Intake Pressure (PIP) Setup	
	5.11 8500/Modbus Slave	
	5.12 Modbus Scanner	
	5.13 Save and Restart	

QUICK GUIDED SETUP MENU STRUCTURE

12/01/2020 admin	04:53:02	Main Men	u	₩ Weatherford
	View Data		Dynagraph	
	System Setup		Alarms	
[Quick Guided Setup		User Defined	
	Controller Diagnostic		Commands	
	Pump Diagnostic		Well Information	
	Main Clea Menu Alarm	r Pump s On	idle Status Time Screen	

05/15/2024 04:22:54	Quick Gui	ded Setup	₩ Weatherford
SYSTEM SE	TUP		
Ρ	ress to Sync HMI Time to RTU	HMI Time	05/15/24 - 04:22:49
RPC Time	04:22:54	RPC Date	05/15/24 🔶
Idle Time	00:01:26	Pump-Up Delay	00:00:30
Gauge Off Time (Contract Hour)	00:00:00	Power On Restart Delay	00:00:00
Ma Me	ain Clear Pu enu Alarms C	imp Dn Idle Time	Status Screen
05/13/2024 07:19:22			*

05/13/2024 07:19:22	Quick Guided Setup	₩ Weatherford
SENSOR SETU	2	
Load Input Source	Load Cell	
Preset Load Gain	Not Selected	
Load Input Gain	2500.00lb/mV	
Position Input Source	Continuous/Inclinometer/Rot	taflex -
Set Top of Stroke	Manual	Units Imperial
◀ Main Menu	Clear Pump Idle Alarms On Time	Status Screen

- Load Input Source
 - Load cell Wired Load cell
 - Strain Gauge
 - Wireless Load cell
- Preset Load Gain Allows to choose the load cell gain. Selected load cell gain will be displayed under Load Input Gain.

Preset Load Gain	Not Selected
	Not Selected
	30K 1500lb/mV
	50K 2500lb/mV
	80K 4000lb/mV
	30K-I 2143lb/mV
	50K-I 3571lb/mV
	80K-I 5714lb/mV

- Choose 30K-I, 50K-I or 80K -I in case of load cell connected to RPOC through IS barriers.
- Position Input Source Continuous/Inclinometer/Rotaflex when using inclinometer position sensor or Speed Sentry Aux position kit output on Rotaflex.
- To operate VSD, position input source should be Continuos/Inclinometer/Rotaflex.

05/13/2024 07:20:15	Quick Guided Setup	₩ Weatherford
SURFACE CON	ſROL	
Pump-Off Pos %	70% POC Method	Quadrant -
Pump-Off Load %	30%	
Pump-Off Strokes	2	
◀ Main Menu	Clear Pump Idle Alarms On Time	Status Screen

- In case of Surface POC method, choose Quadrant when operating in VSD mode. Well will be controlled in Surface Quadrant pump fillage when downhole control fails.
- Pump Fillage Control page is dynamic and below is the screen layout when VSD Enable flag is disabled.

05/13/2024 07:32:45	Quick Guided Setup	Weatherford
PUMP FILLAGE	CONTROL	
Pump-Off Pos Fill	85% Downhole Enable	Enabled •
Pump-Off Strokes	2 Pump-Off Action	Idle Time
Downhole Method	Automatic POC Control Source	Pump Fillage ᠇
 Main Menu 	Clear Pump Idie Statu Alarms On Time Scree	is b

- Source of POC control Downhole or Surface
 - 0 = Surface
 - 1 = Pump Fillage (When DH is enabled)
- Downhole Method button allows user to choose the right pump fillage method.
- Choose "M1:Order" method for downhole cards that show gas interference and downhole friction.
 - Modified Orders Method for severe downhole friction, fluid acceleration and Rotaflex cards with load drop at bottom of stroke running in racetrack mode.
 - To enable Modified orders method.
 - Choose Downhole Method to M1: Order
 - Start: Top stroke
 - End: Qtr. Point



• Pump Fillage Control page changes to below layout when VSD enable flag is enabled by the drive model under VSD CONTROL page.

05/13/2024 07:30:23	Quick Guideo	d Setup	₩ Weatherford®
PUMP FILLAGE	CONTROL		
VSD Target Fillage	85%	Downhole Enable	Enabled •
Pump-Off Position Fillage [Min Fillage]	70%		
Pump-Off Strokes [Min Fillage Strokes]	2	Pump-Off Action [Min Fillage Action]	7
Downhole Method	M1:Order	OC Control Source	ump Fillage <u>·</u>
 Main Menu 	Clear Alarms On	Idle Status Time Screen	

- VSD Target fillage Well speed controlled between Min SPM and Max SPM based on the target fillage/
- Pump Off Position Fillage When fillage drops below pump off position for the pump off strokes, well can be stopped on idle time and started back by setting pump-off action to 4 = Idle time.
- Downhole Enable Allows to enable downhole calculation based on the downhole information entered (well depth and rod string information).
- POC Control Source -
 - Surface Fillage Control the well pump off from Surface Pump-Off Pos & Pump-Off Load in case of fixed speed or standard operation. Control well speed from surface fillage when VSD is enabled.
 - Pump Fillage Control the well pump off from Pump-Off Position Fillage in case of fixed speed or standard operation. Control well speed from VSD Target fillage when VSD is enabled.

05/13/2024 09:36:33	Quick Guided	Setup	₩ Weatherford [®]	
LOAD VIOL	ATION SETUP			
HIGH-HIGH				
Limit	0 lb Loa	d Last Stroke	22515 lb	
	Loa Cyc	d Since le Start	22722 lb	LOAD VIOLATION SETUP
Action 1	3 Loa	d Since /er-Up	23482 lb	
Action 2	7	C	ard Area	HIGH-HIGH LOAD LIMIT HIGH LOAD LIMIT LOW LOAD LIMIT
	Main Clear Pump Menu Alarms On	Idle Status Time Screen		MINIMUM LOAD SPAN MINIMUM AVERAGE LOAD

- High-High Load Limit Well shutdowns on Off/Reset when load value goes above the limit set under High-High Load limit page.
 - Load Last Stroke, Load Since Cycle Start and Load Since Power up shows the peak load captured.

- High Load Limit Well keeps running with RPOC fault lamp ON when value goes above the limit set under High Load Limit page.
- Low Load Limit Well keeps running with RPOC fault lamp ON when value goes below the limit set under High Load Limit page.
- Low-Low Load Limit Well shutdowns on Off/Reset when load value goes below the limit set under High-High Load limit page.
 - Load Last Stroke, Load Since Cycle Start and Load Since Power up shows the minimum load captured.
- Minimum Load Span Allows to detect malfunctioning downhole pump valves.
- Card Area Allows to detect delayed travelling valve closure and pump issues.



05/13/2024 09:49:52	Quick Guid	ed Setup	Weatherford [®]
VSD CONTROL			
SPM Min	2.00	Surface Tolerance	5 %
SPM Max	6.90	Downhole Tolerance	5 %
SPM Startup	4.30	Enable Disabled	•
VSD Target Fillage	85%	Min Fillage	70 %
Min Fillage Action	7	Min Fillage Strokes	2
Main Menu	Clear Pum Alarms On	Idle Status Time Screen	

VSD Enable (P1250)

- 0 = Disable
- 1 = WFT VSD
- 2 = WFT F7 VSD
- 3 = WFT RegenVSD (U1000)
- 4 = WFT AC7 RegenVSD
- 5 = Siemens G120
- 6 = ABB ACS880
- 7 = Schneider ATV930
- 8 = Nidec NE300 (Not supported)
- 9 = Toshiba AS3



05/13/2024 09:53:14	Quick (Guided Setup	₩ Weatherford
ROTOFLEX	CONTROL		
Position Min Input	-0.250 V	Sensor Failure Action	3=Off/Reset
Position Max Input	8.000∨	# Cycles to Average	6
Pump On Settling Time	120sec	Manual Cycle Runtime	00:00:00
Weatherfo	rd Rotaflex Model	1 = RF700 / 700-E	< -
STA Enable	Disable -		
Trim Speed Diff	0.5	STA Segmen Setup	t
Max Trans Speed	3		
	Aain Clear Ienu Alarms	Pump On Time	Status Screen

- Rotaflex Control Page is allows to setup the RPOC parameters for operating the unit safely, when installing the RPOC or RPOC integrated VSD with Weatherford Speed Sentry 4.0 and newer versions.
- Position Minimum Input: Set to -0.250 V
- Pump On Settling Time: 120 seconds from default 30 seconds for Beam units.
- Sensor Failure Action: Set to 3 = Off/Reset for load sensor signal failure due to wireless or wired cable issues.
- # Cycles to Averge: 0
- Manual Cycle Runtime: 00:00:00
- Weatherford Rotaflex Model Choosing the Model from the drop down list will limit the

12/01/2020 06:18:22 admin	Quick Guided Setup	Weatherford [®]
WELL SETUP		
Pump Depth	5070.00 ft Surface Stroke	125.50 in
Bore Diam	1.50 in Fluid Calc Method	Downhole -
Fluid Depth	4700.00 ft Pump Efficiency	80.0 %
Main Menu	Clear Pump Idle Sta Alarms On Time Scr	itus een

Fluid Stroke Calculation Method

- 0= Disabled
- 1 = Short Method (Used in surface control)
- 2 = Long Method (used in surface control)
- 3 = Downhole stroke (Should be set when downhole enabled)

05/13/2024 10:08:56	Quick Guided Setup	₩ Weatherford®	Rod Taper Setup
Rod Taper Setu	0	Troucioi foi u	Rod Taper 1 -
Rod Taper 1			Rod Taper 1
	1		Rod Taper 2
Rod Type	Steel Pump Depth	5070.00 ft	Rod Taper 3
			Rod Taper 4
Rod Count	68 Total Rod Length	5050.00 ft	Rod Taper 5
Rod Diameter	1 000 in		Rod Taper 6
Rod Diameter	1.000 "		Rod Taper 7
Rod Length	25.00 ft	Total Rod Tapers	Rod Taper 8
		Taporo	Rod Taper 9
Main Menu	Clear Pump Idle Statu Alarms On Time Screet	en	Rod Taper 10

• Total Rod Tapers screen shows the complete list of each rod tapers with count, diameter, length and total Rod Length of each taper.

05/13/2024 10:0	08:27	^{8:27} Total Rod Tapers				
Pump Depth	5070	.00 ft	To	otal Rod Length		5050.00 ft
Rod Taper	Rod Count	Rod Diameter	r	Rod Length		Total Rod Length
1	68	1.000)in	25.00	ft	1700.00 ft
2	68	0.875	in	25.00	ft	1700.00 ft
3	66	0.750)in	25.00	ft	1650.00 ft
4	0	0.000)in	0.00	ft	0.00 ft
5	0	0.000	in	0.00	ft	0.00 ft
	Main Menu	Clear Pur Alarms O	np n	Idle Time	Stat Scre	tus een

• Alert pop-up will show up when total rod length exceeds the pump depth. Verify each taper inputs with the well design downhole information.



- Tubing pressure and casing pressure transmitters analog points can be reference under Al selection.
 - Example: Tubing pressure is connected to RPOC AI1, set AI selection to AI1.
- If the location doesn't have a transmitter and has a murphy gauge, then set the AI selection to override and under Override value enter the manual gauge value read at field site.
- Fluid Load Factor is a manual input that represents the fluid load taken into PIP calculation considering downhole friction.

12/01/2020 17:44:49 admin	Quick Gui	Quick Guided Setup		
8500/MODBUS	SLAVE			
Address	1	Line Mode	RS232 -	
Data Format	8D 1S -	Port	Serial -	
Baud Rate	19.2k -	Radio ON Delay	0	
Protocol	8500 -	Radio OFF Delay	0	
Main Menu	Clear Pu Alarms C	imp Idle Sta Dn Time Scr	tus een	

12/01/2020 17:45:39 admin	Quick Gui	Quick Guided Setup	
MODBUS SCA	NNER		
Stop Bits	1 Stop Bit -	Line Mode	RS485 -
Data Format	8 Data Bit -	Radio ON Delay	2
Baud Rate	9600 -	Radio OFF Delay	2
Protocol	RTU -		
Main Menu	Clear Pu Alarms C	on Idle Sta Sta	tus een







05/14/2024	07:11:43	Sys	stem Se	etup		Weatherford
	Time and Dat	e		Loa	d Menu	
	Surface Contr	ol		I/O	Setup	
	Downhole Con	trol		VSE) Menu	
	Communicatio	ns		Additio	nal Setup	
	Inferred Produc	tion		Softwa	are Timer	
	Main Menu	Clear Alarms	Pump On	idie Time	Status Screen	



Min Pump Fillage Allowed – P1273 Ideal Fillage – P3014 Downhole

VSD DH Tolerance- P2900



VSD low fillage SPM - P2856

VSD Control Parameters					
Parameter No	Description				
30	Control Source; 0= Surface; 1 = Downhole				
3152	Downhole Enable; 0 = Disable (Surface Control); 1 = Enabled (Downhole Fillage Control)				
3014	VSD Target Fillage/Fillage Setpoint				
1256	VSD Min SPM				
1257	VSD Max SPM				
1252	VSD Surface Tolerance				
2900	VSD Downhole Tolerance				
1253	Immediate Speed Change				
1258	Speed Change				
1141	Initial step value slow down				
1142	Minimum step value slow down				
1263	VSD SPM Override Value				
1264	VSD SPM Override Flag				

Page 22 of 57

1174	Control Filter
1250	VSD Enable Flag (1 = WFT VSD)
149	Learn Mode
2990	Learn Mode Speed Output %

05/14/2024 07:15:57	VSD Cont	trol Setup	₩ Weatherford	05/14/2024 07:16:32	VSD Con	trol Setup	₩ Weatherford [®]
SPM Min	2.00	Override SPM	0.00	Immed Spd Change	0.50	Immediate Speed Change Slow Down	2.00
SPM Max	6.90	Override	Disabled -	Speed Change	0.20	Speed Change Slow Down	1.00
SPM Startup	4.30	Surface Tolerance	5 %	Control Filter	0.00		
Startup Strokes	2	Downhole Tolerance	e 5%				
VSD Target Fillage	85%			Enable	WFT VSD	•	Perform Learn Mode
Weatherford Rotafle:	x Model 1 = F	RF700 / 700-EX	• VSD Setup				
 Main Menu 	Clear Pur Alarms O	n Idle Sta n Time Scr	tus een	◀ Main Menu	Clear Pur Alarms O	nn idle Sta Time Scre	tus een

- (P3014) Ideal Pump Fillage Variable Frequency drive would speed up or slow down based upon Ideal Pump Fillage Setting and downhole tolerance.
- (P1256) VFD Minimum SPM This is the minimum SPM at which the pumping unit runs when the fillage drops below ideal pump fillage minus downhole tolerance.
- (P1257) VFD Maximum SPM This is the maximum SPM at which the pumping units runs when the pump fillage is more than ideal pump fillage plus downhole tolerance setpoint.
- (P1252) VSD Pump Off Position Tolerance This setting defines the VSD pumpoff tolerance range relative to the Surface Pump Off Position SetPoint.
- (P2900) VSD Downhole Tolerance This setting defines the VSD pumpoff tolerance range relative to the Ideal Pump Fillage SetPoint.
- (P1253) Immediate Speed Change This limit sets the allowed speed change on Initial Startup.
- Speed change increase from Min speed, when fillage crosses ideal pump fillage plus downhole tolerance setpoint.
- Speed change decrease from Max Speed, when fillage drops below ideal pump fillage minus downhole tolerance.
- (P1258) Speed change This limit sets the allowed speed change after Initial Speed Change.
- Initial Step Value down and Minimum Step value slow down allows the user to configure a "dual speed control" mode for the VSD, where separate Initial and Minimum Step values are used for slowing the pump.
- When dual mode is enabled, Initial Speed Change and VSD Speed Increment are used only for speeding up the pump. Setting Initial Step Value slow down to "0" disables dual mode.
- (P1141) Initial Step Value slow down This limit sets the allowed speed change when slowing down. Value can be >=0.0[SPM] but <=2.0[SPM].
- (P1142) Minimum step value slowdown This limit sets the minimum allowed speed change after Initial Step Value slow down. Value can be >0.0[SPM] but <=1.0[SPM]

- (P1263) SPM Over-ride Value When set to non-zero value and SPM over-ride flag is enabled, well speed is controlled from this SPM, irrespective of pump fillage value. Note: Min SPM>= SPM Override Value <= Max SPM
- (P1264) VSD SPM Override flag This is the SPM Override flag, when set to zero, VSD control operates normally. When set to 1, the VSD control output is defined by SPM Override value, VFD Minimum SPM and VFD Maximum SPM.
- (P1174) VSD Control Filter This parameter specifies how many strokes will be skipped in VSD mode before changing the speed based on fillage.
- (P1229) Weatherford Rotaflex Model selecting the Weatherford Rotaflex model will set and limit the Max SPM (1257) to the max cornering SPM when Speed Trim Adjustment/ STA (P1230) is not enabled.

If STA is enabled under P1230, then based on the model selected under P1229 will limit the max upstroke/downstroke and max transition speed to the selected pumping unit model limits.

Weatherford Rotaflex	STA Max Up/Max	Max Trans Speed SPM/
Model	Down SPM	Max SPM (Cornering)
RF700 / 700-EX	6.9	5
RF800/ 800-EX	6.24	4.5
RF950 / 950-EX	6.24	4.5
RF1100 / 1100-EX	5.96	4.3
RF1150 / 1150-EX	5.05	3.64
RF1155 / 1155-EX	5.20	3.75
RF1160 / 1160-EX	5.20	3.75

- (P149) Learn Mode RPOC will initiate learn mode automatically when P1250 is enabled for the first time. Learn mode should be performed on the unit only on below conditions –
 - Motor sheave changed.
 - Motor swapped.
 - Stroke length changed.
 - Mismatch between the setpoint and status values. Meaning RPOC tells to run at 4 and unit runs at 4.5

Note: Learn mode should not be performed when the VSD Min/Max setpoints on RPOC are changed, for every time a speed setpoint is changed on the controller.

When initiated a Learn Mode, RPOC Analog Output is set to 40% (10.4[mA]). For some wells, 40% forces the well to run beyond a safe speed and in this case, this AO % value can be changed in P2990.

6.1 VSD Min Fillage:

12/02/2020 18:19:31 admin	VSD Menu	₩ Weatherford [®]	05/14/2024 07:26:22	VSD Advanced Setup	₩ Weatherford
Variable Speed Drive	Rod Load Control		Min Fillage	70 % Action	7
Setup (VSD)	(RLC)		No. Strokes	2 Low Fill SPM	1.50
VSD Advanced Setup	Speed Trim Adjust (STA)				
VSD Minimum Fillage Setup					
Main Clea Menu Alarm	r Pump Idle Status Screen		M M	lain Clear Pump idie enu Alarms On Time	Status Screen

VSD Min Fillage (secondary Pump Fillage to stop/start)					
1273	Minimum Pump Fillage				
1274	Min Fillage stroke count				
1275	Min Fillage action = 4 (Idle time)				
20	Idle time				
2856	VSD Low/Min Fillage SPM; Works when 1275 = 7 (No Action)				

- (P1273) Minimum Pump Fillage Allowed This is the minimum pump fillage allowed. If the pump fillage is less than the set value, for the number of strokes specified in Minimum Fillage Stroke Count setpoint, controller will take the action set in Minimum Pump Fillage Alarm Action.
- (P1274) Minimum Fillage Stroke Count Stroke counts below minimum pump fillage allowed.
- (P1275) Minimum Pump Fillage Alarm Action This is the Alarm action taken if the minimum fillage level remains continuously below Minimum Pump fillage allowed for minimum pump fillage stroke counts.
- (P2856) VSD Low Fillage SPM VSD can be operated at this SPM when pump fillage drops below Minimum Pump fillage allowed for Minimum Pump fillage stroke counts and if Minimum Pump fillage Alarm action is set to 7 = No Action. Note: VSD Low fillage SPM can be set lower than VSD Min SPM. Minimum Pump fillage allowed should be set only lower than ideal pump fillage minus downhole tolerance.

6.2 VSD Speed Trim Adjustment (STA):



05/15/2024 01:51:04	Speed Trim Adjust (STA) Setup	Weatherford"	05/15/2024 02:39:46	Speed Trim Adjus	st (STA) Setup	Weatherford
STA Enable	Disable STA Segment Setup	wcauici ivi u	STA Enable	Enable	STA Segment Setup	induction for a
Trim Speed Diff	0.5		Trim Speed Diff	0.5		
Max Trans Speed	3		Max Trans Speed	5		
Weatherford Rotafle	ex Model 0 = No Model	•	Weatherford Rotafi	ex Model 1 = RF7	700 / 700-EX	•
			Peak Straight Away (Max Up/Down Spe	eed) 6.90	Max SPM (Cornering SPM)	5.00
Main Menu	Clear Pump Idie Status Alarms On Time Screen	▶	 Main Menu 	Clear Pump Alarms On	Idie Status Time Screen	

• VSD Status shows the polish rod position on each segment during the stroke.

00/10/2024 02:02:00	Fore Site Enter	EDGE RPC Well Name	W	leatherford [®]
WELL STATUS Current Run Time Set Point 2.87 Well S POC Control Source Target Fillage 85% F Pump Fillage PIP 282.49 psi Current Load Min Load Last Stroke Max Load Last Stroke	RUNNING 01:44:55 Speed 10.71 SPM DH Pump Fillage Pump-Off 70% 95.50% FL 321.00 ft 14910 lb 6280 lb 23487 lb 17207 lb	24064 19559 15054 10549 6044 0 31	Surface	94 126
VSD STATUS:RUN MOD VSD Type 1–V VSD Min SPM 2.00 VSD Max SPM 3.64 Startup SPM 3.63 Motor Current 0 Motor Speed 0 Mat	DE/NORMAL/STA:TOS VFT V3D 0 SPM 4 SPM 3 SPM A Hz hz ain Clear	7267- 4858- 2449- 40- 0 29 Pump dile		86 114

- (P1230) Speed Trim Adjustment (STA) Enabled To enable or disable Speed Trim Adjust operation, type in the number 0 = Disabled and 1= Enabled.
- (P1231) STA Trim Speed This is the Strokes per Minute that will be subtracted from the pump speed when the stroke enters the Bottom Stroke or Top of Stroke segment (SPM * 100)
- (P1240) Max Transition Speed in STA Mode This is the max speed during the transition segments. Unit = 0.1 SPM.
- (P1229) Weatherford Rotaflex Model selecting the Weatherford Rotaflex model will set and limit the Max SPM (1257) to the max cornering SPM when Speed Trim Adjustment/ STA (P1230) is not enabled.

If STA is enabled under P1230, then based on the model selected under P1229 will limit the max upstroke/downstroke and max transition speed to the selected pumping unit model limits.

Weatherford Rotaflex	STA Max Up/Max	Max Trans Speed SPM
Model	Down SPM	/Max SPM (Cornering)
RF700 / 700-EX	6.9	5
RF800/ 800-EX	6.24	4.5
RF950 / 950-EX	6.24	4.5
RF1100 / 1100-EX	5.96	4.3
RF1150 / 1150-EX	5.05	3.64
RF1155 / 1155-EX	5.20	3.75
RF1160 / 1160-EX	5.20	3.75

• If Max Transition Speed is entered above the Max SPM (Cornering SPM) for the Rotaflex unit model, then below pop-up message appears and limits the Max Transition Speed to Max Cornering SPM value.



05/15/2024 02:39:46	Speed Trim Adjust (STA) Setup	Weetherford	05/14/2024 10:08:32 Speed Trim Adjust (STA) Setup
STA Enable	Enable - STA Segment Setup	weathertoru	Up START TOP TOP 270 STOP TOP Down Stroke Stroke
Trim Speed Diff	0.5		5.00 STA Max Down SPM
Max Trans Speed	5		STA Max Up SPM 5.00
Weatherford Rotafle	ex Model 1 = RF700 / 700-EX	•	
Peak Straight Away (Max Up/Down Spe	ed) 6.90 Max SPM (Cornering SPM)	5.00	STOP BOT 30 BOTTOM 330 START BOT
Main Menu	Clear Pump Idle Status Alarms On Time Screen		Main Clear Pump Idle Status STA Menu Alarms On Time Screen Status

- (P1232) START BOT/BOS Segment Beginning Angle The Bottom of stroke must begin in the right-side hemisphere and end in the left side hemisphere. It can begin or end at 180 deg. If begin = end = 0. All angles must be <360. The TOS segment cannot overlap the Bottom of Stroke Segment
- (P1233) STOP BOT/BOS Segment Ending Angle The Bottom of stroke must begin in the right-side hemisphere and end in the left side hemisphere. It can begin or end at 180 deg. If begin = end = 0. All angles must be <360. The TOS segment cannot overlap the Bottom of Stroke Segment
- (P1234) START TOP/TOS Segment Beginning Angle The Top of Stroke must begin in the left side hemisphere and end in the right-side hemisphere. It can begin or end at 180 deg. If begin = end = 0 degrees, then the segment if disabled. All angles must be <360 deg. All angles must be <360. Begin = End = non-zero angle is not allowed. The TOS segment cannot overlap the BOS segment.
- (P1235) STOP TOP/TOS Segment Ending Angle The Top of Stroke must begin in the left side hemisphere and end in the right-side hemisphere. It can begin or end at 180 deg. If begin = end = 0 degrees, then the segment if disabled. All angles must be <360 deg. All angles must be <360. Begin = End = non-zero angle is not allowed. The TOS segment cannot overlap the BOS segment.
- (P1238) STA Max UP SPM This is the max speed that the unit will run in the up direction, must be less than or equal VFD Max SPM. Value is limited to Rotaflex model STA Max Up SPM when Rotaflex model enabled.
- (P1239) STA Max DOWN SPM This is the max speed that the unit will run in the down direction. Must be less than or equal VFD Max SPM. Value is limited to Rotaflex model STA Max Down SPM when Rotaflex model enabled.
- (P1241) Down Speed Differential If this is non-zero, the down speed will be set to the base speed plus/minus the differential direction on the downstroke when leaving the TOS Segment.
- (P1242) Down Speed Differential Direction 0 = Minus, 1 = Plus



7.0 Controller Diagnostics:

Controller Diagnostics-Allows access to diagnostic information such as: load sensor, position sensor, communication stats, HMI display settings, settings backup/restore, Firmware version viewing/upgrade, troubleshooting, display settings.

12/02/2020 admin	18:34:04	Main Menu	•	♥ Weatherford [®]	05/14/2024 1	0:14:38	[Diagnostic		₩ Weather1	iord
	View Data	D	ynagraph		Firmwa	are Version		Card Diagnostics		Export Audit Log to USB	
	System Setup		Alarms		Loa	ad Input		FCU Comm		Troubleshooting	
	Quick Guided Setup	Use	er Defined		Dia	gnosiics		Statistics			
[Controller Diagnostic	Co	ommands		Posi Dia	tion Input gnostics		System Restore		User Management	
	Pump Diagnostic	Well	Information		Comr Dia	nunication gnostics		Display Settings			
	Main Clear Menu Alarm	Pump Idle s On Time	Status Screen			Main Menu	Clear Alarms	Pump On	Idle Time	Status Screen	
7	.0 Controlle	er Diagnosti	C								
	7.1 Firmv	vare Version	(Firmu	are							

information and Firmware Upgrade)

- 7.2 Load Input Diagnostics
- 7.3 Position Input Diagnostics
- 7.4 Communication Diagnostics
- 7.5 Card Diagnostics
- 7.6 FCU Comm. Statistics
- **7.7 System Restore** (includes option to return to quick guided setup menu)
 - 7.6.1 System Backup to RPOC
 - 7.6.2 System Restore from RPOC
 - 7.6.3 System Backup to SD Card

7.6.4 System Restore from SD Card

7.7 Display Settings

- 7.7.1 HMI Brightness
- 7.7.2 IP Address
- 7.7.3 Display (HMI) Version
- 7.7.4 Display (HMI) Reset

7.8 Export Audit Log to USB

7.9 Troubleshooting

7.10 User Management (Note: This feature is available based on the HMI firmware)

8.0 Pump Diagnostics:

Pump Diagnostics-Currently used to display a trend of current system load and rod rotator configuration/ Historical Data.

8.0 Pump Diagnostics	
8.1 Live Load Trend (Valve	8.6 Rod/Tubing Rotator
Troubleshoot)	8.7 Belt Slippage
8.2 Rod/Turbing Rotator	8.8 Gearbox Torque
8.2.1 Setup	8.9 Card Area
8.2.2 Historical Data	
8.2.3 Current Data	
8.3 Structural Loading	
8.4 Pumping Unit Catalog	
8.5 Pump Fillage	



				Weatherford
Live Load Trend	J.,	Rod/Tubing	Rotator	
Structural Loading		Belt Slip	page	
Pumping Unit Catalog		Gearbox	Torque	
Pump Fillage		Card A	vrea	
Main Clear	Pump	idie	Status	1
Menu Alarms	On	Time	Screen	

8.1 Live Load Trend (Valve Troubleshoot):

Live Load can now be configured by the user for 1min, 5min, or 10min.



Figure 7: Valve Check Examples



Leaking Travelling Valve Example - **Stop the Pumping unit at Top Of stroke**. Load drops gradually over time.

Leaking Standing Valve Example – Stop **the pumping unit at Bottom of Stroke**. Load increases over time.



Live Load Export

Live Load graph can be exported from the HMI by inserting a USB drive and pressing Export to USB. The Live Load will be stored in PDF format.



8.2 Rod Rotator:

07/12/2017 05:47:18	Pump Diag	nostics	₩ Weatherford	07/12/2017 0	5:49:12	Rod Rotator		Weatherford
Live Lo	ad Trend	Rod/Tubing Rotator			Setup		Current Data	
				_	Historical Data			
Mair	Clear Pump Alarms On	Idle Status Time Screen	J		Main Cle Menu Ala	ear Pump rms On T	die Status Ime Screen	J

07/12/2017 04:54:42	Rod Rotator Setup			₩ Weatherford [®]	
Rotator Type	None		•		
Exp Strokes/Rot		0	Min Eff% A	Im Action	0
Input Source	None	•	Failure Ro	tations	0
Minimum Efficiency		0%	Failure Ala	rm Action	0
Eff% Alm Rotations		0			
Main Menu	Clear Alarms	Pum Or	np idle Time	Statu	Rod Rotator Setup

Set the rotator type (P5400) from the following list. Parameter 5401, expected strokes / rotation, will be set automatically. For the custom rod or tubing types enter the expected strokes/rotation manually.

Rotator Type	Strokes / Rotation			
Weatherford 13K/30	30 P5401			
Weatherford 30K/30	30 will be			
Weatherford 40K/80	40 set to the			
Weatherford 40K-	160 strokes/rotation			
SG/160				
T-164/28	28 associated with			
T-164 SG/43	43 the rotator			
T-252/24	24 type			
T-302/77	77			
T-302 SG/154	154			
Custom Rod	Set P5401 with the expected storkes/rotation			
Tubing	Set P5401 with the expected storkes/rotation			

9.0 Dynagraph:

Dynagraph Plot-Allows access to Dynagraph plots (Start-Up, Shutdown, Live, Single, Surface, and Downhole) and Event Buffer.

12/02/2020 18:49:13 admin	Main	Menu	₩ Weatherford [®]
Vier	w Data	Dynagraph	
Syste	m Setup	Alarms	
Quick G	uided Setup	User Defined	
Controlle	r Diagnostic	Commands	
Pump I	Diagnostic	Well Information	
Mair Men	n Clear Pun u Alarms Or	np Idie Status Time Screen	



DYNAGRAPH SCREEN STRUCTURE

9.0 Dynagraph				
9.1 Start-Up Card				
9.2 Shutdown Card				
9.3 Live Card				
9.4 Single Card				
9.5 Event Buffer				

• Event Buffer – RPOC stores 256 events under event buffer with 5 surface and Downhole cards for each event. Event refers to startup, pump off, RPOC and VSD faults.

05/15/2	05/15/2024 03:33:10 Event Buffer			V eat	therford [.]		
Event	Event Reason Timestamp		Cards	DH	Refresh		
1	Е	2048	START UP	05/15/24 - 00:49:52	5	Υ	Plot
252	Е	2050	MANUAL START	05/14/24 - 07:20:03	5	Y	Plot
251	Е	2050	MANUAL START	05/14/24 - 06:42:43	5	Υ	Plot
250	Е	2049	PUMP-OFF	05/14/24 - 06:39:46	5	Υ	Plot
249	Е	2048	START UP	05/14/24 - 06:38:38	5	Υ	Plot
248	Е	2049	PUMP-OFF	05/14/24 - 06:34:38	5	Υ	Plot
247	Е	2048	START UP	05/14/24 - 06:33:30	5	Υ	Plot
246	Е	2049	PUMP-OFF	05/14/24 - 06:29:29	5	Υ	Plot
		M	lain Clear Pun enu Alarms Or	np Idle Sta n Time Scre	tus een	Pa	ige 1

10.0 Communications:

01/05/201	8 03:32:26	Main Mer	าน	Weatherford [®]
	View Data		Dynagraph	
	System Setup		Alarms	
	Quick Guided Setup		User Defined	
	Controller Diagnostic		Commands	
	Pump Diagnostic			
	Main Clear Menu Alarm	r Is On	idie Status Time Screen	J

01/05/201	8 03:32:46	System Se	tup	₩ Weatherford
	Time and Date		Load Menu	
	Surface Control	I	I/O Setup	
	Downhole Contro	ol	VSD Menu	
	Communication	s	Additional Setup	
	Inferred Production	on		
	Main C Menu Al	Clear Pump larms On	idie Status Time Screen	

Serial Communication Setup

01/05/2018	^{3 03:40:32} Commu	nications Setup	Weatherford
	Port Assignments	Modbus Scanner	
	8500/Modbus Host 1	Network Configuratio	n
	8500/Modbus Host 2		
	8500/Modbus Host 3		
	Main Clear Menu Alarms	Pump On Time Status Screen]

01	/05/2018 03:44:09	Port Ass	ignments	W eatherford [®]
	8500/Modbus Host	1 Port 1 -	Modbus Scanner	Port 2 -
	8500/Modbus Host	² None -	Tank Gauge	None -
	8500/Modbus Host	³ None -	Flow Computer	None -
	 Main Menu 	Clear Pu Alarms C	mp Idle Sta Dn Time Scr	atus reen

01	/05/2018 03:44:09	Port Ass	signments	₩ Weatherford [®]
1	8500/Modbus Host 1	Port 1 -	Modbus Scanner	Port 2 -
	8500/Modbus Host 2	None -	Tank Gauge	None -
	8500/Modbus Host 3	None -	Flow Computer	None -
2	Main Menu	Clear Alarms	ump On Time Scr	een

01/05/201	^{8 03:47:59} Communica	tions Setup	► Neatherford [®]
	Port Assignments	Modbus Scanner	
	8500/Modbus Host 1	Network Configuration	
	8500/Modbus Host 2		
	8500/Modbus Host 3		
<	Main Clear Pu Menu Alarms C	np Idle Status Dn Time Screen	

^{01/05/2018 03:49:10} 8500/Modbus Host 1 Setup Weatherford							
RPC Address	:	2	Port Connection Serial -				
Baud Rate	19.2k	•	Pre-Key Delay 0				
Data Format	8D 1S	•	Post-Key Delay 0				
Protocol	8500	•	Max Transmit Time 30				
Line Mode	Line Mode RS232 - Host Port Selection Port 1 -						
Ma Me	ain Clear nu Alarms	Pu (Dn Idle Status Screen				
*Baud Rate,							
*Data Format							
*Line Mode	*Line Mode						
Match with Radio serial port properties							
* radio connecte	* radio connected to serial or Ethernet port						
* Port selection	if connected to s	ser	ial port				
Radio port conn	ection to RPOC l	bo	ard.				

By default on RPOC firmware,

- Port 1(top) is assigned for 8500/ Modbus Host communication. Port 1 jumpers are configured for RS232.
- Port 2(bottom) is assigned for Modbus Scanner Port for scanning the register values from different Yaskawa drives using RS485 (Port 2 Jumpers are configured for RS485)



- Port 1 can be configured for RS-485 by moving jumpers J9 and J10 to the top position. J11 is the terminating resistor for Port 1.
- Port 2 can be configured to RS-485 by moving jumpers J15, J16 and J17 to the top position. J17 is the terminating resistor for Port 2.

When a Master device is scanning two or more RPOC devices in a RS485 network, then Terminating resistor should be used on the last RPOC device on the network. Jumper J11 or J17 is moved up to include terminating resistor based on the port scanned.

For the 485 pins 2, 5 and 7 on the DB9 can be used as shown below,



- When the jumpers J9 and J10 are moved up on port 1, then pins 2 and 3 are jumped also, pins 7 and 8 are jumped as shown above in the diagram. So you can use pins 2(+),5(DCOM) and 7(-) on the DB9 for 485 port
- Port 1 to RS-232 is Jumpers J9 & J10 to the bottom position. Port 2 to RS-232 is Jumpers J15 & J16 to the bottom position.
- When the port is configured as RS 232 it is used for communicating with the host system (SCADA) and in this case jumper J11 and J17 are not used.

Pin #	Port 1 & Port 2 RS-485	Port 1 & Port 2 RS-232	
1	N/C*	N/C*	
2	RX+	RxD	
3	TX+	TxD	
4	N/C*	N/C*	
5	Ground	Ground	♥\�����/♥
6	N/C*	N/C*	
7	TX-	RTS	6 ' 8 "
8	RX-	CTS	
9	N/C*	N/C*	

 DTE and DCE are the two sides of an RS-232 interface. The DB9 pinouts for DTE and DCE are physically different. A modem is an example of a DCE device. A common DTE device is the serial port of a computer.

• RPOC – Port 1, Port 2 are DTE. MMI port is DCE

- Wiring a DTE device to a DCE device for communication is easy. The pins are a one-to-one connection, meaning all wires go from pin x to pin x. A **straight through cable** is commonly used for this application.
- For connecting the any serial modem (DCE) to the RPOC (DTE) com Port1 and Port 2 for host communication use a straight serial cable
- In contrast, wiring two DTE devices together requires crossing transmit and receive wires. This cable is known as a **null modem** or **crossover cable**.
- For connecting a laptop com port (DTE) to RPOC Port 1 and Port 2 (DTE) for any communication we should use a null modem along with a straight serial cable or a cross over cable. Also a null modem is used between two DCE.

Table below shows the cable to be used for serial communications

	RPOC				
	Port 1 (DTE) Port 2 (DTE) MMI (DCE)				
Laptop (DTE)	Null Modem or	Null Modem or	Straight through cable		
	cross over cable	cross over cable			
Serial Modem (DCE)	Straight through cable	Straight through cable	Null Modem or		
			cross over cable		



01/05/2018 07:54:55	Network Configuration Weatherford
Password	Enter 1255 to modify IP address, Netmask and Gateway
IP Address	169 · 254 · 0 · 1
Netmask	255 · 255 · 0 · 0
Gateway	169 · 254 · 0 · 254
	ain Clear Pump Idle Status enu Alarms On Time Screen

01/05/2018 07:58:43	8500/Modbus	Host 1 Setup	₩ Weatherford
RPC Address	2	Port Connection	Ethernet/T -
Baud Rate	19.2k -	Pre-Key Delay	0
Data Format	8D 1S -	Post-Key Delay	0
Protocol	8500 -	Max Transmit Time	30
Line Mode	RS232 -	Host Port Selection	Port 1 -
Ma Met	in Clear Pun nu Alarms Or	np Idle Stat	us en

For Ethernet communication the main properties to be checked for communication are

- Unit address
- Port connection
- Protocol
- Network configuration (Ethernet IP, Netmask and Gateway)

Note: RPOC will automatically pop up an alarm asking for Restart needed on below conditions

- Port assignments are changed
- Port connections are changed
- Protocol changed

ALARM	Active Alarms	V	/ eatherford [*]
Time	Name	State	Value
1/5/2018 1:57:19 PM	Restart Needed	Triggered	1

To perform software restart -





11.0 Alarms:



Alarms Menu- Main location for all alarms stored in controller.

ALARM		Active Alarms		Weatherfor
Time	7	Name	State	Value
3/28/2017 5:55:00 PM		Hi-Hi Load Limit	Triggered	8192
2				

05/15/2	2024 04:44:34	Alarm History				₩ Weatherfo	rd '
From : To :	05/08/24 - 04 05/15/24 - 04	:44:21 :44:21	Duration :	1 Week		Refresh	
	Time 🗸		Description		State	Value -	•
14 May	2024 06:43:32	Modbus C	om Interruption S	LF1 (ATV	Triggered	5	
13 May	2024 15:14:32	Pump On			Triggered	1	
13 May	2024 15:14:32	Pump On			Triggered	1	
13 May	2024 15:14:32	Pump On			Triggered	1	
13 May	2024 15:02:24	Pump On			Triggered	1	
13 May	2024 15:00:26	Idle Time			Triggered	1	
13 May	2024 10:38:15	Idle Time			Triggered	1	•
Back	kward		Troublesh Guid	ooting e		Forward	
	M	ain enu A	Clear Pum Alarms On	p Idle Time	Status Screen	Active Alarms) S

• Troubleshooting Guide will list the alarm message, description and troubleshooting steps.

	¹⁶ <u>)</u>		?	×
Alarm Mes The following section d RPC Alarms/E The following table lists	Sages escribes the RPC and VSD Error Messages the Host/RPC alarm mess	alarm/error messages. and Host Alarm Messages ages and the resolutions for those error messages:		
Message	Description	Resolution		
High load limit Note: This is a shutdown (SD) violation limit for all Weatherford RPCs.	The highest polished rod load reading has exceeded the high load limit setting in the controller on a single stroke (rod load has exceeded value in P211 (high load limit). A setting of <i>Q</i> disables this	Check P86 (maximum load since power-up) for actual load value that caused the fault. Check for stuck pump or other downhole problems to determine whether the load value in P211 should be adjusted. P211 defines a maximum allowed polished rod load. When this value is violated for a set number of consecutive strokes (P213 – high load violation strokes), the user-defined action is taken, and an alarm is sent to the user. This value is generally set at		

12.0 Parameter Groups:

Parameter Group	Range	Parameter Group	Range
A/D (Analog/Digital) Operations	450 – 458	Logger Freeze Buffer, Hourly	900 - 923
Accumulator 1 Setup	6510 – 6528	Logger Parameters	890 – 899
Accumulator 1 Status	0505 0540	Low Load Span, Well Off/On	
Accumulator 2 Setup	6535 - 6543	Limer Modbus Device Status	226 - 228
Accumulator 2 Status	6545 - 6563	Modbus Scapper 1	1300 - 1458
Accumulator 3 Sotup	6570 - 6578	Modbus Scanner 2	1500 - 1589
Accumulator 3 Status	6580 - 6598	Modbus Scanner Communication	1600 – 1689
Accumulator 5 Status	6605 – 6613	Properties	1190 – 1208
Accumulator 4 Setup	6615 – 6633	Modbus Scanner Database	1700 – 2299
Accumulator 4 Status	6640 – 6648	Modbus Scanners/Devices	1300 – 1458
AI1 Status & Setup	280 – 300	Motor Moisture Restart Protection	38 – 39
AI2 Status & Setup	310 – 329	Password Setup	500 – 501
AI3 Status & Setup	330 – 349	Peak Energy Hours Control	50 – 53
AI4 Status & Setup	700 – 719	POC Sensor Failure Action	200
AI5 Status & Setup	720 – 739	Position, Load Display Control	370 – 376
Al6 Status & Setup	740 – 759	Position Data, Actual	619
AI7 Status & Setup	760 – 779	Position Sensor, Setup	270 – 273
Al8 Status & Setup	780 – 799	Position Sensors, Data, & Control	128 – 135
AI as DI Actions	249 – 254	Position Switch Information	144 – 149
Al Channel 1 Status	160 – 168	Position Switch Setup	6 – 14
AI, DI Accumulators	193 – 199	Power Fail Multiplier	220 – 221
Air Balance Control	40 - 46	POC Load & Position Settings	20 – 26
AO Parameters		Pump Intake Pressure (PIP) –	
Auto Solf Tracking/Lood (Strain	1180 – 1189	Last 24 Hours	3700 – 3723
Gauge)	63 – 69	Last 60 Days	3724 – 3784
Auxiliary I/O Configuration	496 – 497	Radio Transmission Data	621 – 624
Card Collection	510 – 514	Reset to Defaults	472 – 473
Communications	601 – 653	Rod Load Control	1290 – 1294
Continuous Position Sensor Data	102 – 114		1470 – 1488
	270 – 273	Rod Rotator Setup	5400 – 5411
Control Failure	260 – 263	Rod Rotator Status	5415 – 5425
Control Override	27 – 33		5461 – 5522
Controller Configuration	492 – 494	Rod Stress	8101 – 8120
Controller Status, Fatal Error	389 – 397	Runtime Counter, Days, & Hours	398 – 399
Cycle Interval Filter Control	125 – 127	Runtime Segments	968 – 999
Cycle Runtime History	400 - 419	Scratch Pad	120 – 124
Daily Logger Freeze Buffer		Sensor Fail Action (Load or	
Daily Production	930 - 959	Position)	200 – 203
	3420 – 3539	Setup & Initialization Time ?	1 – 5
	670 – 699	Date	1 – 5

Parameter Group	Range	Parameter Group	Range
	3300 – 3419		15 – 19
Daily Runtime History	420 – 427		15
DI Actions	560 - 575	Software Timer	204 – 209
DI Status & Accumulators	180 – 199	Speed Trim Adjust	1230 – 1247
Display Rates	508 – 514		1154 – 1167
DO Action Ticks	590 – 599		1460 – 1469
DOs on Timer	580 – 587	Startup Control	54 – 56
Dynagraph Card Setup	614 – 618	Status	520 - 526
Error Bit Values & Descriptions	527 – 537	Stop Location	6670 - 6674
Error Bit Values & Descriptions, Accumulated	541 – 547		6682
Event Records Management	355 – 366	System Backup and Restore	465 – 470
Firmware, CMCS Compatibility	490 – 494	Tank 1 Setup	4020 - 4042
Firmware Version	478 – 479	Tank 1 Status	4043 - 4145
Firmware Version ID	549 – 556	Tank 2 Setup	4150 – 4172
Fluid Level – Last 24 Hours	5700 – 5723	Tank 2 Status	4173 – 4275
Fluid Level – Last 60 Days	5724 – 5784	Tank 3 Setup	4280 - 4302
Fluid Pump Stroke Calculation	800 - 810	Tank 3 Status	4303 - 4405
	841 – 849	Tank 4 Setup	4410 – 4432
Fluid Pump Stroke Displacement		Tank 4 Status	
Totals	811 – 840	Tank 5 Satur	4433 – 4535
	429 – 449	Tank 5 Setup	4540 – 4562
Gearbox Torque	2964	Tank 5 Status	4563 – 4665
	8200 - 8212	Tank 6 Selup	4670 – 4692
	8213 – 8224	Tank 6 Status	4693 – 4795
DIO1	578 – 579	Time & Date Setup	15 – 19
Host Alarms	1000 – 1016	Total Stroke Count – Last 24 Hours	5864 – 5892
Immediate Pump-Off	230 – 231	Total Stroke Count – Last 60 Days	5800 – 5831
Lamp Test/Software Reset	350 – 352	Traveling & Standing Valves	1020 – 1033
Load & Position Sensor Setup for POC	34 – 37	User Defined Display	870 – 881
Load Limits & Limit Violation Action	208 – 219	Variable Speed Control (VSD)	1250 – 1275
Load Parameters	70 – 114	VSD	1170 – 1179
Load Span, Low For Trash	115 – 117	Weekend Start Times & Mode Sequence	850 - 862
Load Span, Low Limit & Violation Action	222 – 225	Well Cycle (Stroke) Monitoring & Control	136 – 143
Logger Freeze Buffer, Daily	930 – 959	Worst Pump Control State	540

VSD Control Parameters		Load violation Shutdown limits		
Parameter		Parameter		
No	Description	No	Description	
	Control Source; 0= Surface;			
30	1 = Downhole	218	High High Load Limit	
	Downhole Enable; 0 = Disable			
	(Surface Control);			
3152	I – Ellabled (Downlible Fillage	219	High high Load action 1	
3014	VSD Target Fillage/Fillage Setnoint	660	High high Load action 2	
1256		211	High Load Limit	
1250		211	High Load action 1	
1257		214		
1252	VSD Surface Tolerance	661	High Load action 2	
2900	VSD Downhole Tolerance	210	Low Load Limit	
1253	Immediate Speed Change	216	Low load action 1	
1258	Speed Change	662	Low load action 2	
1141	Initial step value slow down	208	Low Low Load limit	
1142	Minimum step value slow down	209	Low Low load action 1	
1263	VSD SPM Override Value	663	Low Low load action 2	
1264	VSD SPM Override Flag	223	Low load span limit	
1174	Control Filter	225	Low Load span action 1	
		664	Low Load span action 2	
VSD Min I	Fillage (secondary Pump Fillage to stop/start)			
1273	Minimum Pump Fillage			
1274	Min Fillage stroke count		Inferred Fluid Production	
			Control Source; 0= Surface; 1 =	
1275	Min Fillage action = 4 (Idle time)	30	Downhole	
			Downhole Enable; 0 = Disable (Surface	
			Control);	
20	Idle time	3152	1 = Enabled (Downhole Fillage Control)	
	VSD Low/Min Fillage SPM: Works			
2856	when 1275 = 7 (No Action)	3002	Surface Stroke Length (in *100)	
			Production calculation Method (6=	
		805	Downhole)	
VSD STA (S	Speed Trim Adjustment) - Rotaflex			
	Operation	807	Pump bore diameter (in*100)	
4220	Speed Trim Adjustment (STA)	010		
1230		010	Pump Enciency (%*10)	
1231	STA Trim Speed			
1232	STA BOT Start Angle			
1233	STA BOT Stop Angle	PI	P(Pump Intake Pressure) Setup	
1234	STA TOP Start Angle		Tubing Pressure; Enter value when no	
1235	STA TOP Stop Angle	3171	Transmitter connected to RPC in P3172	
4000		2472	Tubing -Al(1-8); 0= No Transmitter, 1 =	
1238	STA Max Up Speed	31/2	AI1,8 = AI8	
1239	STA Max Down Speed	3173		

			Casing Pressure; Enter value when no
1240	STA Max Transition Speed		Transmitter connected in P3172
			Casing -AI(1-8);0= No Transmitter, 1 =
1241	STA Down Speed Difference	3174	AI1,8 = AI8
1242	Down Speed Differential Direction	3175	Pump Intake Pressure
		3176	Fluid Level
	Downhole Control Setup	3177	Toggle-Zero(0)/Negative(1)
3000	Pump depth	3178	Fluid Load Factor%
3001	Fluid depth		
3002	Surface stroke(in x 100)		
3003	Oil API gravity		
3004	Oil specific gravity		
3005	Water specific gravity		
3006	Water cut		
3007	D/H Damping factor		
	D/H Pump-off Position % (Fixed		
3014	Speed POC)		
3015	D/H strokes for pumpoff (Fixed Speed POC)		
3016	D/H strokes for failure		
3017	D/H fallback method		
3018	D/H strokes for recovery		
3019	D/H failure Action		
0010	Rod Taper Setup		
3020	Bod type 1 density		
3021	Rod type 1 density		
3022	Rod type 1 propagation		
3023	Bod type 1 service factor		
3024	Rod type 1 tensile strength		
3025	Bod type 2 density		
3026	Rod type 2 density		
3027	Bod type 2 propagation		
3027	Bod type 2 propagation		
3029	Bod type 2 tensile strength		
3030	Bod type 3 density		
3031	Rod type 3 elasticity		
3032	Bod type 3 propagation		
3033	Bod type 3 service factor		
3034	Bod type 3 tensile strength		
3035	Rod type 4 density		
3036	Rod type 4 elasticity		
3037	Rod type 4 propagation		
3038	Bod type 4 service factor		
3039	Rod type 4 tensile strength		
3040	Rod type 5 density		
20/11	Rod type 5 density		
140	nou type 5 clasticity		

	Pod Tapor Sotup		
3042	Rod type 5 propagation		
3043	Rod type 5 service factor		
3044	Rod type 5 tensile strength		
		0 = Nothing	, 1 = Steel, 2 = Fiberglass, 3 = Corod, 4 =
3045	Taper 1 rod type	Custom	
3046	Taper 1 rod count		
3047	Taper 1 rod diameter (inches)		
3048	Taper 1 rod length (feet)		
		0 = Nothing	, 1 = Steel, 2 = Fiberglass, 3 = Corod, 4 =
3050	Taper 2 rod type	Custom	
3051	Taper 2 rod count		
3052	Taper 2 rod diameter (inches)		
3053	Taper 2 rod length (feet)		
		0 = Nothing	, 1 = Steel, 2 = Fiberglass, 3 = Corod, 4 =
3055	Taper 3 rod type	Custom	
3056	Taper 3 rod count		
3057	Taper 3 rod diameter (inches)		
3058	Taper 3 rod length (feet)		
		0 = Nothing	, 1 = Steel, 2 = Fiberglass, 3 = Corod, 4 =
3060	Taper 4 rod type	Custom	
3061	Taper 4 rod count		
3062	Taper 4 rod diameter (inches)		
3063	Taper 4 rod length (feet)		
		0 = Nothing	, 1 = Steel, 2 = Fiberglass, 3 = Corod, 4 =
3065	Taper 5 rod type	Custom	
3066	Taper 5 rod count		
3067	Taper 5 rod diameter (inches)		
3068	Taper 5 rod length (feet)		

Strokes	Per Minute (SPM Values)		Well Status	Rod Stres	s Calculated Values
141	Last Stroke Well Speed	20	Idle time/Downtime	8101	Taper 1 Max Stress
	Filtered/Avg Well speed		· · · · · · · · · · · · · · · · · · ·		
142	over last 10 strokes	30	POC Control Source (Downhole)	8102	Taper 1 Min Stress
5900	Avg SPM Today	55	Time to IDLE at Startup	8103	Taper 1 Max Allowable
			Present Pump Off Time (Well In		
5901	Avg SPM Yesterday	419	Idle time status)	8104	Taper 1 Max Percentage
			Current Cycle Runtime/Pump run		
5800	Stroke Count Today	400	time [0]	8105	Taper 2 Max Stress
5801	Stroke count yesterday	421	Runtime yesterday (HH:MM:SS)	8106	Taper 2 Min Stress
		P526	8323 = Well is Running without		
	Load Values		any fault/alarm	8107	Taper 2 Max Allowable
70		P526	8192 = Well is in idle state. Will	0100	
/9	Min load last stroke		restart after idle time expires	8108	Taper 2 Max Percentage
80	Max load last stroke		Well In Fault State	8109	Taper 3 Max Stress
87	Span over last stroke	P1766	U1000/Regen VSD Fault	8110	Taper 3 Min Stress
274	MinLoad Today	P1780	A1000/AC7 VSD Fault	8111	Taper 3 Max Allowable
275	MinLoad Yesterday		Well In Fault State on not	8112	Taper 3 Max Percentage
276	MinLoad 2 days Back		Drive Fault/RPC Fault	8113	Taper 4 Max Stress
277	MaxLoad Today	register	P 1766/P526	8114	Taper 4 Min Stress
278	MaxLoad Yesterday	Fault	!=0/0	8115	Taper 4 Max Allowable
279	MaxLoad 2 Days Back	Fault	0/3	8116	Taper 4 Max Percentage
419	Present Pump off time	No fault	0/0	8117	Taper 5 Max Stress
	Today undisturbed		,		
430	cycles		Downhole Status	8118	Taper 5 Min Stress
	Yesterday undisturbed				
431	cycles	3001	fluid depth from surface	8119	Taper 5 Max Allowable
I	nferred Production	3014	D/H Pump-off Position %		
810	Pump Efficiency	3149	D/H fillage (% x 100)	8120	Taper 5 Max Percentage
	Current Inferred				
811	Production	3145	D/H stroke len.(in x 100)		
	Yesterday Inferred				
812	Production	3146	D/H Min load last stroke		GearBox Torque
	History	3147	D/H Max load last stroke	8213	Min torque-Upstroke
3300 -	Daily Runtime (120				
3419	Days)	3148	D/H load span last stroke	8214	Max torque-UpStroke
3420 -	Daily Production (120				
3539	Days)	3152	D/H enabled	8215	Min torque-DownStroke
3540 -	Cycle Runtime/Pump	2454	Duran fills as mosth ad 4	0210	Mau tanana Dauna Chualia
3659	Ruhtime (120)	3154	Pump fillage - method 1	8216	Max torque-DownStroke
3700 -	(24 Hours)	2155	Rump fillage method 2	0217	Max torque Stroke
3723	Dumn Intake Pressure	5133	Fullip Illage - Illetilou z	0217	
3784	(60 Davs)	3156	Pump fillage - method 3	8218	Min torque-Stroke
5700 -	(00 20,3)	5100		5210	
5723	Fluid Level (24 Hours)	3175	Pump Intake Pressure (PIP)	8219	Min torque-UpStroke%
5724 -		_		_	
5784	Fluid Level (60 Days)	3176	Fluid Level	8220	Max torque-UpStroke%

	History				
5801 -					
5831;					
5864 -					
5892	Stroke Count (60 Days)	8022	Polish Rod HorsePower	8221	Min torque-DownStroke%
5976 -					
5999	Stroke Count (24 Hours)	8100	Pump HorsePower	8222	Max torque-DownStroke%
5832 -	Average Pump Fillage				
5843	(Today - 11Days)		Card Area Status	8223	Min torque-Stroke%
5900 -	Average SPM (Today -				
5911	11Days)	1035	Min surf. area last cycle	8224	Max torque-Stroke%
5932 -	Power Consumed				
5943	(Today - 11Days)	1036	Max surf. area last cycle		
5964 -	Regen Power (Today -				
5975	11Days)	1037	Min surf. area since pwr up		
		1038	Max surf. area since pwr up		
		1040	d/h card area last stroke		
		1041	Min d/h area last cycle		
		1042	Max d/h area last cycle		
		1043	Min d/h area since pwr up		
		1044	Max d/h area since pwr up		

13.0 User Defined:

User Defined Menu- Allows the operator to configure 12 parameters to be viewed whenever the screen is opened.

03/28/2017 10:57:2	¹ User D	User Defined		
Parameter Number	Parameter Name	Read Value	Write Value	
6660	Element0	0		Write Value
77	Element1	26548		Write Value
1182	Element2	3950		Write Value
0	Element3			Write Value
0	Element4			Write Value
0	Element5			Write Value
•	Main Clear Pu Menu Alarms O	mp Idle In Time	Status Screen	

The user defined screen can also be used to access parameter system of controller. Access is obtained as shown the below example:

Example: Adjusting parameter 285 "AI-1 EGU Label"

<u>Step 1</u>-Enter the number of the parameter in the "Parameter Number" box, followed by "ENTER".

	04/28/20	17 10:19):59	User D	We	atherford	
	Parar Nun	neter 1ber	F	Parameter Name	Read Value	Write Value	
	28	33		Element0	1		Write Value
1			205	Element1	0		Write Value
	,	,	285	Element2	2		Write Value
1	2	3	÷	Element3	1000		Write Value
	H		ŀ	Element4	1		Write Value
4	Ľ	6		Element5	1000		Write Value
7	8	9	Esc	Clear	mp	Status	
	0	Er	iter	Alarms	Dn Time	Screen	

<u>Step 2</u>-Enter the number of the desired new value in the "Write Value" box, followed by "ENTER".

04/28/2017 10:23:3	² User De	efined	8		We	atherf	ord
Parameter Number	Parameter Name	Read '	Value	Write	Value		
285	Element0	2		3	3	Write Value	
284	Element1	(M/rita	
285	Element2	2		<i></i>	,	്യ	
287	Element3	10	1	2	3	+	
1184	Element4						
1187	Element5	10	4		6	_	
			7	8	9	Esc	
Main Clear Pump Menu Alarms On		P	•	0	En	iter	_

<u>Step 3</u>-Select the "Write Value" option to modify parameter.

04/28/2017 10:27:5	50 User D	User Defined		
Parameter Number	Parameter Name	Read Value	Write Value	
285	Element0	3	3	Write Value
284	Element1	0		Write Value
285	Element2	3		Write Value
287	Element3	1000		Write Value
1184	Element4	1		Write Value
1187	Element5	1000		Write Value
		n" an 107		
	Main Clear Pu Menu Alarms C	mp Idle Dn Time	Status Screen	

14.0 Commands:

Commands Menu-Contains 8 non-configurable controller commands, which are used often during normal operation of the controller.



COMMANDS SCREEN STRUCTURE

14.0 Commands	
14.1 Set TOS Manually	
14.2 Manual OFF Until Reset	
14.3 Zero Load Cell	
14.4 Force Save	
14.5 RPOC Software Reset	
14.6 Reset Load/Position Min/Max Values	
14.7 Perform Learn Mode	
14.8 Remove SD Card	

15.0 Troubleshooting:

	Issue	Reason	Solution
1	Yellow Caution Triangles On Main Status Screen	Communication between the HMI and the RPC board has not been has been lost or was never established.	-Ensure that RPC is operating on HMI F.W. 3.06.XX. and above. -Reset RPC back to factory defaults to ensure that default communication settings are being used



	Issue	Reason	Solution
2	Screen displaying "J- MOBILE"	HMI is missing RPC program and must be	-Contact Weatherford support
		loaded.	representative for program or further instructions.

	Issue	Reason	Solution
3	Controller Time and HMI Time Do Not Match	HMI time was never synchronized with controller time.	-Locate <u>Time and</u> <u>Date</u> menu within the <u>System Setup</u> menu and execute "Sync HMI Time" option.



	Issue	Reason	Solution
4	Blank Screen	Insufficient power is being supplied to HMI or Component Failure.	 Ensure that sufficient power is connected and has been tested/ verified. Contact Weatherford support representative for further instructions.

16.0 Specifications:

System Resources		
Display - Colors	7" TFT 16:9 LED - 16M	
Resolution	800x480, WVGA	
Brightness	500 Cd/m ² typ.	
Dimming	to 0%	
Touchscreen	True Glass Projected Capacitive, Multitouch	
CPU	ARM Cortex-A9 dual core 800 MHz	
Operating System	Linux RT	
Flash	4 GB	
RAM	1 GB	
Real Time Clock, RTC Back-up, Buzzer	Yes	
Interface		
Ethernet port	3 (port 0 - 10/100/1000, port 1 - 10/100, port 2 - 10/100)	
USB port	2 (Host V2.0, max. 500 mA)	
Ordeland	1 (RS-232, RS-485, RS-422, software configurable)	
Serial port	Max 3 serial ports using plug-in modules.	
SD card	Yes	
Expansion	2 slot for plug in modules	
Ratings		
Power supply	24 Vdc (10 to 32 Vdc)	
Current Consumption	0.7 A at 24 Vdc (max.)	
Input Protection	Electronic	
Battery	Rechargeable Lithium battery, not user-replaceable	
Environment Conditions		
	-20° to +60 °C (vertical installation)	
Operating Temp	Plug-in modules and USB devices may limit	
	max temperature to +50 °C	
Storage Temp	-20°C to +70°C	
Operating / Storage Humidity	5-85% RH. non condensing	
	IP66 (front), IP20 (rear)	
Protection Class	Type: 12 4X	
Dimensions and Weights	1100.121.00	
Facenlate LVH	187x147 mm (7 36x5 70*)	
Cutout AvB	176x136 mm (6.93x5.35*)	
Depth D+T	47+8 mm (1.85+0.31")	
Weight	15 Kg	
Approvals	1.0 Ng	
	Emission EN 61000 6 4 Immunity EN 61000 6 2	
CE	Emission EN 01000-0-4, immunity EN 01000-0-2	
	for installation in industrial environments	
UL	cULus: UL61010-1 / UL61010-2-201	
UL	cULus: Class 1 Div 2	
IECEX	Zone 2/22: Ex nA IIC T5 Gc, Ex tc IIIC T95°C Dc	
ATEA	Zone 2/22: II 3 G Ex nA IIC T5 Gc, II 3 D Ex tc IIIC T95°C Dc	
DNV-GL	Zone 2/22: II 3 G Ex nA IIC T5 Gc, II 3 D Ex tc IIIC T95°C Dc Yes	
DNV-GL LR	Zone 2/22: II 3 G Ex nA IIC T5 Gc, II 3 D Ex tc IIIC T95°C Dc Yes Yes	
DNV-GL LR EU RO MR	Zone 2/22: II 3 G Ex nA IIC T5 Gc, II 3 D Ex tc IIIC T95°C Dc Yes Yes Yes	

*Note: Operates on nominal 12Vdc. Also, tested at -40°C.



- 1 USB ports 1 and 2 2 Ethernet port 2 (10/100 Mb) 3 Ethernet port 1 (10/100 Mb)
- 4 Serial port
- 5 Ethernet port 0 (10/100/1000 Mb)

- a Enternet port of (16) root root may
 b Power supply
 7 SD Card slot
 8 2 Expansion slots for plugin modules



