

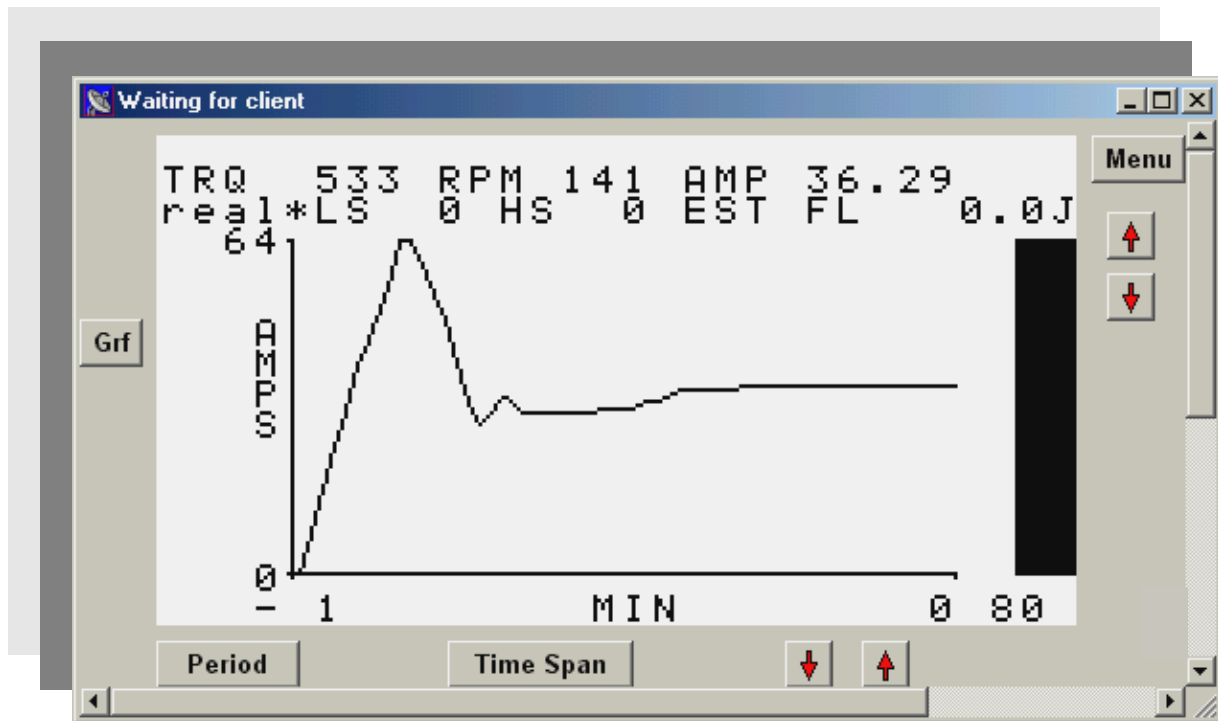
STELLAR TECH ENERGY SERVICES

#4, 6160 – 40TH STREET S.E. CALGARY, ALBERTA T2C 1Z3 (403) 279-8367

WELLMAX MANUAL

Data Logger & Controller

Electric Version
Hydraulic Version

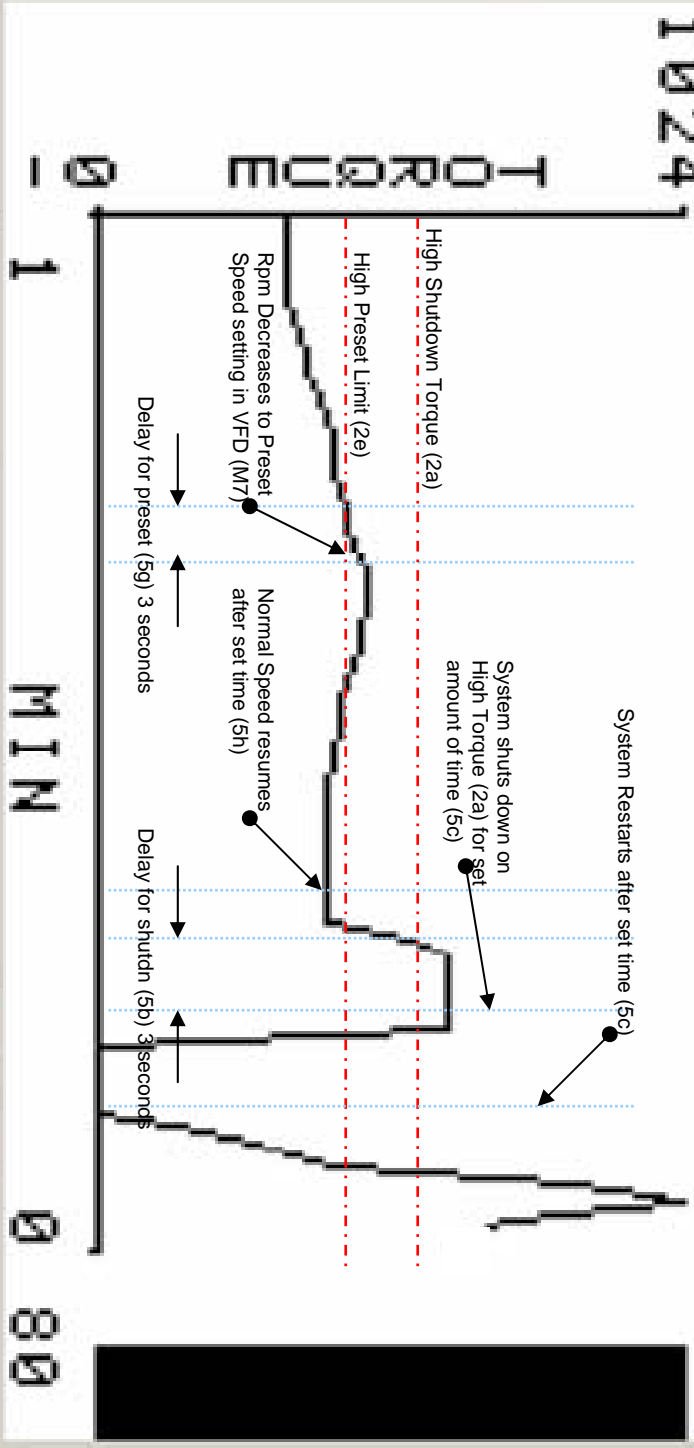


Specialized for Progressive
Cavity Pumping Systems



10th C Revision Sept 2005
STELLAR TECH ENERGY SERVICES INC.

HP 239 RPM 243 AMP 40.92
 TRQ *LS 635 RPHS 245 EST FL 0.0J
 1024



Get

Period

Time Span



Menu

WellMax Manual

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Manual Notes:

The following manual will distinguish between the Electric WellMax and the Hydraulic WellMax with the symbols below:

- † - Electric WellMax Version
- ‡ - Hydraulic WellMax Version

Important Notes:

During a *Downloading Process*, whether direct cable or modem connection, the WellMax screen may not respond or will be slow to respond when the WellMax buttons are pressed, this is due to the high demand of Microprocessor resources. Please REFRAIN from viewing data directly on the WellMax while downloading.

While downloading via modem using the WinWellMax Program the information displayed on the graph of the 'Current Conditions' page will not be updated until "download complete" is displayed on the 'Process' page.

Changing the time duration on the graph, by either pressing the 'Period' or 'Time Span' button will cause the screen to appear frozen although the WellMax is actually performing calculations needed to display the new time duration plot. Incrementing numbers will display on the screen.

Operation Notes:

Backspin Detect: Upon a 'power outage' this feature enables the Drive system (Motor Starter) to 'start' once the back spinning has come to a complete stop. The system then goes into a Special "**Wait For Run**" mode where the shutdown relay is closed but is waiting for the run signal before starting the Delay Limit Check count down.

If the Run Signal goes inactive (Operator turns off Start/Stop Switch), when it is running normal, then it will: Open Shutdown Relay; Wait for backspin to complete (five seconds); close the Shutdown Relay; go into **Wait For Run Mode**; when Run Signal goes active (Operator turns on Start/Stop switch) the Delay Limit Check count down commences. This bypasses the wasted down time of using a 'timer relay', which will force the 'Motor Starter' to remain stopped until the timer relay has counted down even if the back-spinning has been stopped for some time. Backspin Detect also prohibits the Drive system to start until the back spinning has completed, thus protecting the rods against high starting torque which may occur if the system tried starting while back spinning.

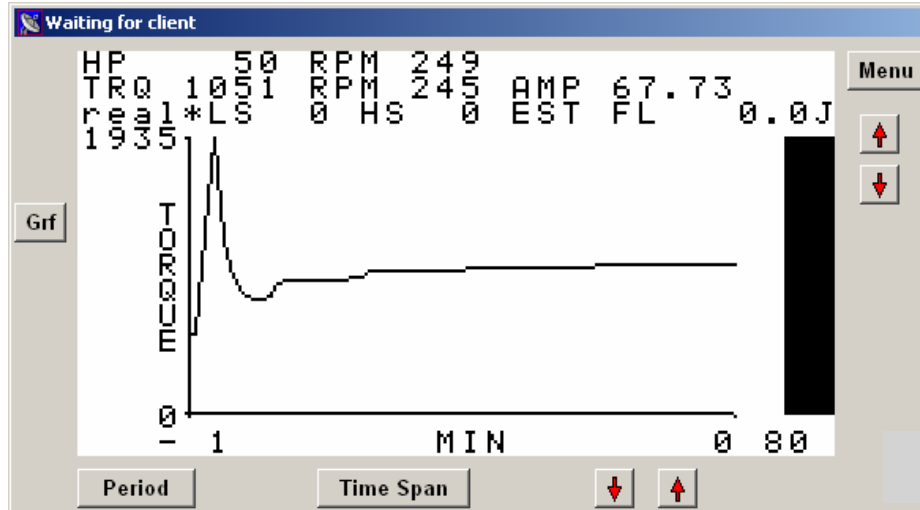
Belt Slip: Belt slip is ignored if the REF RPM ≤ 3 . RPM Sensor Fail is not enabled if Slip % is > 0 .

WellMax Manual

(†VFD / Motor Starter / Soft Starter / ‡Hydraulic)

Main Screen Description (Refer to Figure 1.0)

Figure 1.0



A description of each item proceeding from top to bottom is given below.

HP 50 (Horse Power drawn from a downhole pump)

The horse power is derived from the below formula:

$$HP = TRQ \times RPM \text{ (RPM – bottom row or top row if exists)} / 5252$$

This value will be displayed when the TRQ parameters are *Entered*. The reading on screen is updated every second.

RPM 249 (VFD RPM) †

(Optional) WellMax must be equipped with a RPM Sensor as well as receive an analog 0-10Vdc RPM signal from the VFD. This reading is derived from the analog 0-10Vdc RPM signal from the VFD. Also the parameters 7a Motor Sheave, 7b Drive Sheave, 7c Drive Gear Ratio, 8a Motor Hz, 8c Name Plate RPM, 9a Max Hz, and 9c Drive Spokes/Rev must be correctly set. The reading on screen is updated every 4 seconds.

TRQ 1051 (Rod Torque in ft/lbs)

Torque is measured in foot-pounds and will appear if the following parameters have been *Entered*: 7a Motor Sheave, 7b Drive Sheave, 7c Drive Gear Ratio, 8a Motor Hz, 8b Motor Volts, 8c Name Plate RPM, 9a Max Hz, 11b Max Sense Amps, and 11c Amps Offset. A question mark (?) will appear in place of the Torque value if not all the parameters have been *entered*. The readings on screen are updated every second.

RPM 245 (Polish Rod RPM)

RPM on a VFD system without the Backspin/Beltslip detection will appear if the following parameters have been *Entered*: 7a Motor Sheave, 7b Drive Sheave, 7c Drive Gear Ratio, 8a Motor Hz, 8c Name Plate RPM, and 9a Max Hz or systems with a RPM Sensor require the following parameters to be *Entered*: 9c Drive Spokes/Rev. The readings on screen are updated every 4 seconds on a VFD system with the Backspin/Beltslip detection or every one second otherwise.

AMP 67.73 (Motor Current) † / HPR (Hydraulic System Pressure) ‡

†Motor Amps are measured if the parameters 11b Max Sense Amps and 11c Amps Offset are entered. ‡Hydraulic System Pressure is measured if 11a Max Hyd Pres and 11b Hyd Pres Offset are set. The readings on screen are updated every second. This signal can be retrieved from one of two ways, First, VFD systems can output an analog signal being either a 0-10Vdc or 4-20mA signal, or Secondly, by using a current sensor (CT) with one of the motor leads threaded through sensor.

(Asterix)

The asterix will flash every time a sample is stored into memory. Located on the left of 'LS' on the third row. Example when 6a Sample Rate is set to 5 min the * will appear every 5 minutes.

LS 0 (Low Shutdown Counter)

Number of low torque shutdowns, which have occurred up to 99. No more than 99 low torque shutdowns will be counted. This value will continue to increment with every low shutdown until '1a Manual Reset' is pressed.

HS 0 (High Shutdown Counter)

Number of high torque shutdowns, which have occurred up to 99. No more than 99 high torque shutdowns will be counted. This value will continue to increment with every high shutdown until '1a Manual Reset' is pressed.

EST FL 0.0 J (Estimated Fluid Level)

The estimated fluid level in joints is measured from the surface. The following parameters must be entered: 4a Max Vert Joints (Joints to the pump), 4b Vert Joint Depth (Fluid Level 1), 4c Capture Torque (Fluid Level 1), 4e Vert Joint Depth (Fluid Level 2), and 4f Capture Torque (Fluid Level 2). This is updated every second.

EST Fluid Level Bar Graph (Right side of graph)

This is a graph of the fluid level in joints the well is pumping at, based on the amount of torque required to lift the fluid out of the hole. At the bottom is the vertical pump depth (4a) in joints. The **EST FL** at the top shows the estimated numeric value of the present fluid level. This value is based on the **4-Fluid Level Entries**, and is averaged over **4i-JNT Damp Time**.

NOTE: Sand, pump tightening, or gas influx into the well will affect the torque on the pump and thus affect the estimated fluid level reading.

Button / Dial Functions (Refer to Figure 2.0)

MENU Button

Pressing the **MENU** button switches between the graphical screen to the menu screen, which allows you to change parameters and 'Reset' Shutdowns and Preset Conditions. Press the **MENU** button again to return to the graphical screen. The WellMax will also return you to the graphical screen after 10 minutes of inactivity or upon power up.

GRAPH SEL Button (y-axis)

By pressing the **GRAPH SEL** button you can cycle through the different graphs. The possible graphs are **AMPS, RPM, TORQUE, JOINTS, PRESSURE** and **FLOW**. They can only be selected if sufficient parameters have been set in menus mentioned above. Pressure and Flow meters are optional and must be included with the system for their graphs to be present.

PERIOD Button (left on x-axis)

Pressing on the **PERIOD** button allows the user to change the duration of the time plotted. It will cycle between preset values each time you press it. The value is in reference to the present time and what is displayed in the center x-axis (DAY, HR-Hour, MIN-minute)

TIME SPAN Button (center on x-axis)

Pressing on the **TIME SPAN** button, the time unit in the center of the x-axis, allows the user to cycle between **DAY, HR** (Hour), and **MIN** (minute).

SPEED Adjust dial (VFD and Hydraulic Only)

The black dial is user settable which controls the Normal Operation speed of the polish rod. Turn dial counterclockwise for minimum speed or fully clockwise for maximum speed.

‡HI SPEED Adjust dial (Hydraulic Only)

The black dial is user settable to set the speed of the system during a High Torque Shutdown condition. To set this speed the user must force a High Shutdown condition by lowering parameter 2a High Shutdown Torque Limit below the current operating torque and then once the Red Shutdown light illuminates adjust the dial for desired speed during that condition. Turn dial counterclockwise for minimum speed or fully clockwise for maximum speed.

‡LO SPEED Adjust dial (Hydraulic Only)

The black dial is user settable to set the speed of the system during a Low Torque Shutdown condition. To set this speed the user must force a Low Shutdown condition by increasing parameter 2c Low Shutdown Torque Limit above the current operating torque and then once the Red Shutdown light illuminates adjust the dial for desired speed during that condition. Turn dial counterclockwise for minimum speed or fully clockwise for maximum speed.

Battery Direct/Battery Saver Switch (12 Volt Battery Systems-Gensets/Hydraulic)

Battery Saver mode powers down the WellMax to stop the battery from draining when the engine is not running and *automatically* powers on the WellMax when the engine starts. Battery Direct powers up the Wellmax whether the system is running or not as long as sufficient battery power is present.

Shutdown Enable/Shutdown Disable

Bypasses Shutdown control, this is used for setting up shutdown limits.

To access the parameter menu screen, press on the **MENU** button on the top right hand corner of the keypad.

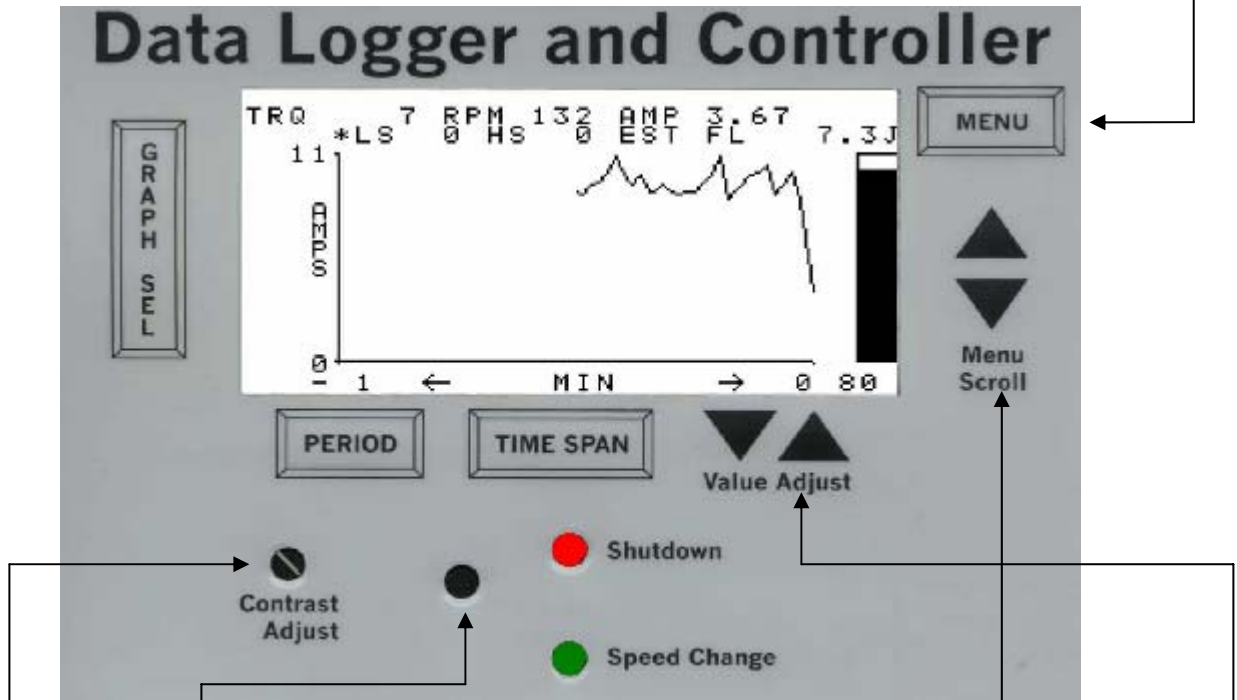


Figure 2.0

Temperature sensor Automatically adjusts screen brightness.

To implement or change parameter information in the menu, use the **Menu Scroll** buttons to move the cursor line to the appropriate parameter then use the **Value Adjust** buttons to change the parameter setting.

Adjust the **Contrast Adjust** screw to vary the brightness of the screen.

Menu Parameter Navigation

Use the **Menu Scroll** buttons to move the Cursor Line through the WellMax parameter settings. Use the **Value Adjust** buttons to change or activate the parameter that is underlined.

- 1) To select any parameter on the menu screen, press the **Menu Scroll** button until your parameter choice is underlined. If you hold down a **Menu Scroll** button, the program will quickly scroll through the choices, underlining each choice as it is selected.
- 2) Press a **Value Adjust** button to change the values for the parameter selected (underlined). If the user presses and holds the button, the values will increase or decrease rapidly through values or options available until you remove your finger.
- 3) When finished implementing or changing parameters, press the **MENU** button to return to the graphical screen.

Menu Parameter List Descriptions

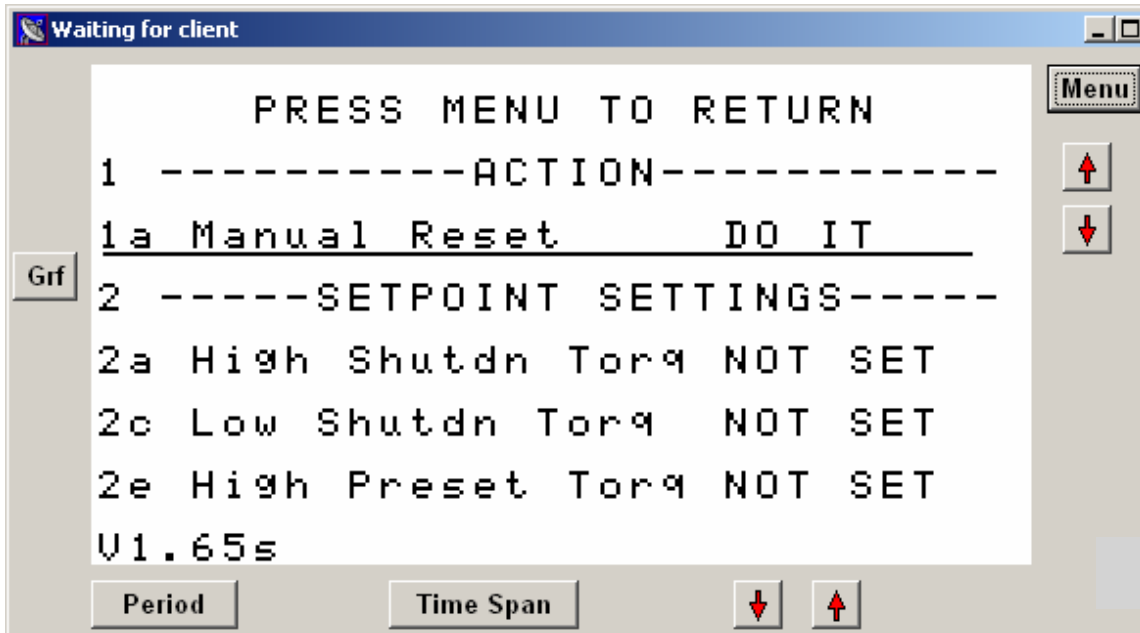


Figure 3.0

ACTION

1a - Manual Reset

This parameter will clear the LS (Low Shutdown) and HS (High Shutdown) counters and reset a shutdown or preset condition, which will in turn re-start the pump. With the Cursor Line underlining the **1a Manual Reset DO IT**, press one of **Value Adjust** buttons to activate the 'Reset'.

SETPOINT SETTINGS

2a - High Shutdn Torq

This value (i.e. VFDs +50% / Motor Starters +20% above the steady operating torque) is the high torque at which the unit will activate a set of dry contacts, which is used as a shutdown, and illuminate a RED light. Disable High Shutdown by setting to **NOT SET**. Entering a value in foot-pounds will enable the High Shutdown feature. The maximum value is 9999 foot-pounds and is incremented by 1. Typically set to catch high sand influx, rod torque protection, or low fluid levels (pump-off) etc.

2b - ‡ High Setpnt Hpres (Hpres = Hydraulic pressure of Hydraulic Motor)

This value is the high hydraulic pressure at which the unit will activate a set of dry contacts, which is used as a shutdown, and illuminate a RED light. Disable High Setpnt Hpres by setting to **NOT SET**. Entering a value will enable the High Shutdown feature. The maximum value is 9999 psi and is incremented by 1. Typically set to catch high sand influx, rod torque protection, or low fluid levels (pump-off) etc.

2c - Low Shutdn Torq

This value (i.e. VFDs -20% / Motor Starters -10% below the steady operating torque) is the low torque at which the unit will activate a set of dry contacts, which is used as a shutdown, and illuminate a RED light. Disable Low Shutdown by setting to **NOT SET**. Entering a value in foot-pounds will enable the Low Shutdown feature. The maximum value is 9999 foot-pounds and is incremented by 1. Typically set to shutdown system on tubing leaks or parted rods.

2d - ‡ Low Setpnt Hpres (Hpres = Hydraulic pressure of Hydraulic Motor)

This value is the low hydraulic pressure at which the unit will activate a set of dry contacts, which is used as a shutdown, and illuminate a RED light. Disable Low Setpnt Hpres by setting to **NOT SET**. Entering a value will enable the Low Shutdown feature. The maximum value is 9999 amps and is incremented by 1. Typically set to shutdown system on tubing leaks or parted rods.

2e - † High Preset Torq

This value (i.e. VFDs +20% / Motor Starters – N/A above the steady operating torque) is the high torque at which the unit will activate a set of dry contacts, which is used in setting a preset speed on a VFD, and illuminates a GREEN light. Disable High Preset by setting to **NOT SET**. Entering a value in foot-pounds will enable the High Preset feature. The maximum value is 9999 foot-pounds and is incremented by 1. Typically set to catch high sand influx, rod torque protection, and low fluid levels, etc. **If the current reading torque remains above the High Preset Torq setting the WellMax will cycle between Normal Operation speed and the High Preset Torq setting.**

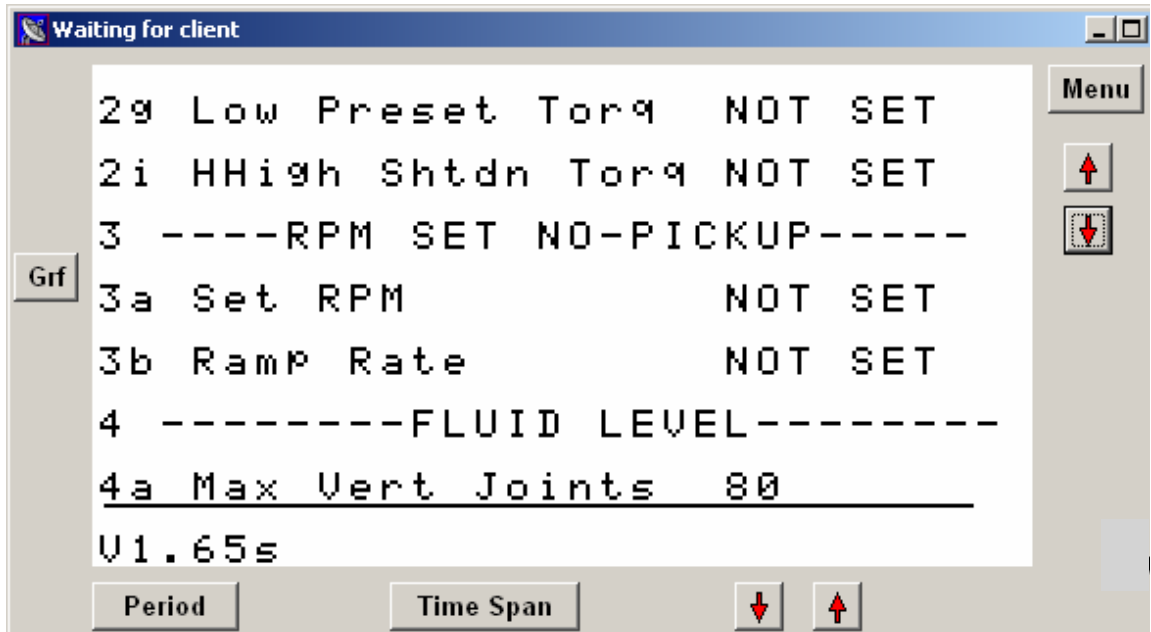


Figure 4.0

2g - † Low Preset Torq

This value (i.e. VFDs -10% / Motor Starters – N/A above the steady operating torque) is the low torque at which the unit will activate a set of dry contacts, which is used in setting a preset speed on a VFD, and illuminates a GREEN light. Disable Low Preset by setting to **NOT SET**. Entering a value in foot-pounds will enable the Low Preset feature. The maximum value is 9999 foot-pounds and is incremented by 1. Typically set to speed up polish rod upon high fluid levels. **Only one preset speed is utilized between High Preset Torq and Low Preset Torq.** If the present torque remains below the Low Preset Torq setting the WellMax will cycle between Normal Operation speed and the Low Preset Torq setting.

2i – † HHigh Shtdn Torq

This value (i.e. Rod Torque Limit as per calculation – Motor Starter application) is the high torque at which the unit will activate a set of dry contacts, which is used as a shutdown, and illuminate a RED light. Disable HHigh Shutdown by setting to **NOT SET**. Entering a value in foot-pounds will enable the High Shutdown feature. The maximum value is 9999 foot-pounds and is incremented by 1. This feature monitors torque upon Start-Up especially important for Motor Starter applications where the motor reaches full speed within 1 second. **Delay for shutdown is defaulted at 1 second. This feature utilizes the 5c Hi Shutdn Time and 5e Num of Hi Retry.**

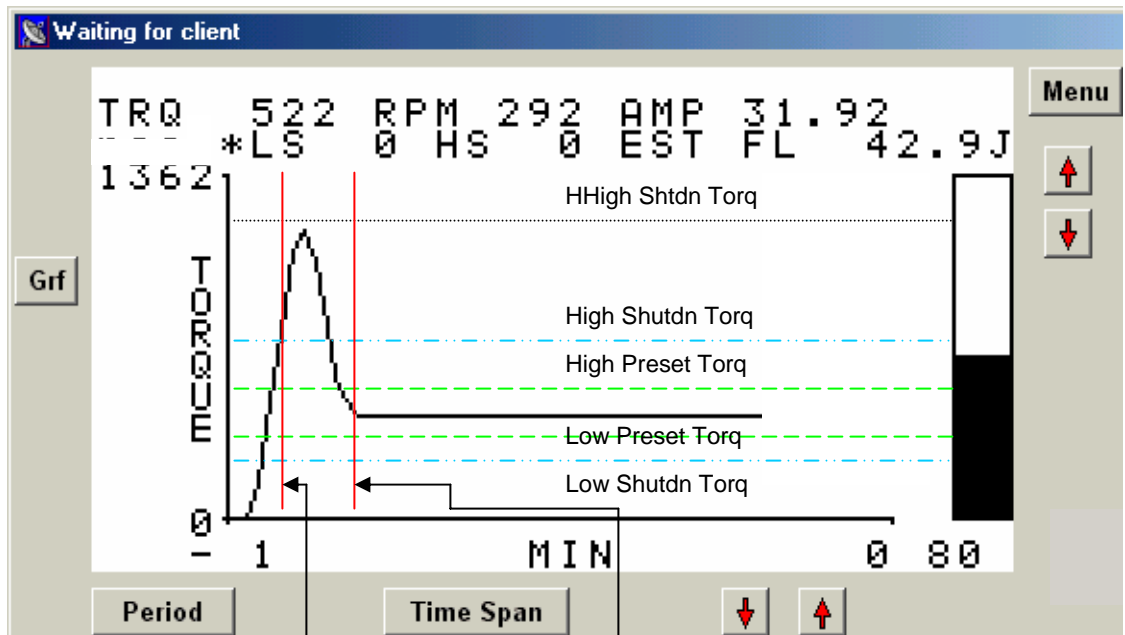


Figure 5.0

HH Delay Lim Chk
Typically set for 3 sec

Delay Limits Chk
Typically set for 5 minutes (or until fluid reaches surface)

Typical Percentages of the Normal Operating Torques

HH High Shtdn Torq (Motor Starter Application)	- Rod Torque Limit
High Shtdn Torq	- VFD +50% / Motor Starter +20%
High Preset Torq	- VFD +20% / Motor Starter N/A
Low Preset Torq	- VFD -10% / Motor Starter N/A
Low Shtdn Torq	- VFD -20% / Motor Starter -10%

RPM SET NO-PICKUP (No RPM sensor installed)

3a - Set RPM

This is the RPM of the polish rod. It can only be set if **11a Op Mode** is **VFD Sensor**. If **11a Op Mode** is **Line Start** or **Soft Start** then it will automatically be set to the calculated value (based on the sheaves, gear ratio and name plate RPM). It is ignored if **Op Mode** is **VFD Direct**.

NOTE: When running in VFD sensor mode, every time the speed is changed, on the pump, you will need to manually adjust this value in order for the WellMax to log RPM properly. VFD Sensor mode is used to compensate for torque above 60 Hz.

3b - Ramp Rate

This is the soft start time between the motor starting and reaching full RPM. It can only be set if **11a Op Mode** is set to **Soft Start** or **VFD sensor**.

FLUID LEVEL

4a - Max Vert Joints

Max Vert Joints is the number of vertical joints to the pump from surface. Default is 80 joints.

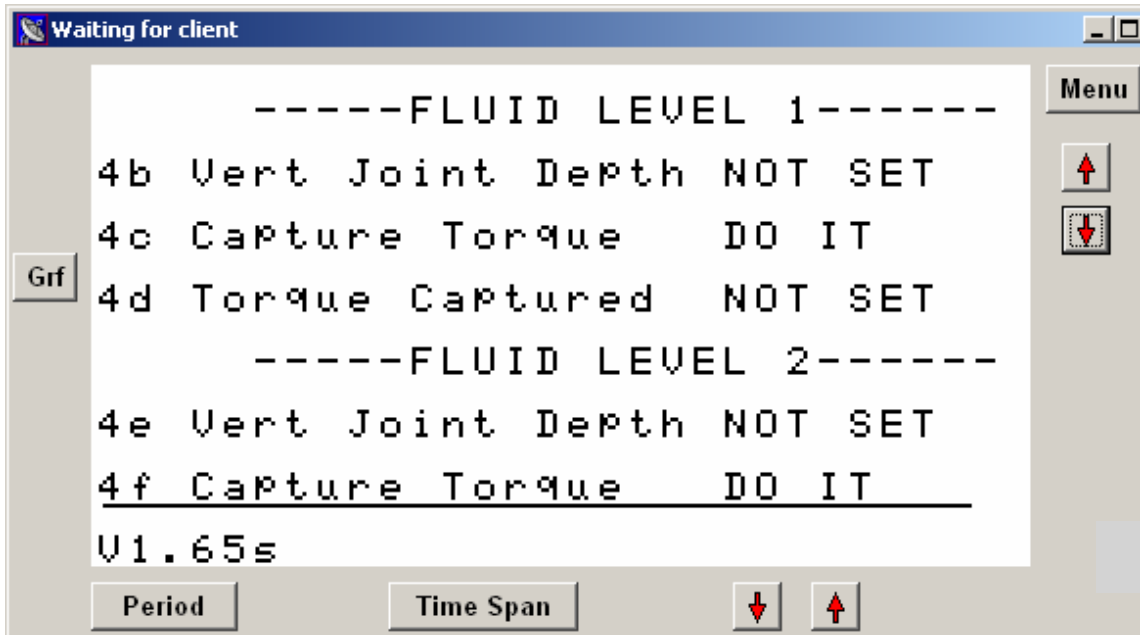


Figure 6.0

FLUID LEVEL 1

4b - Vert Joint Depth

This value should only be filled in when the well is running smoothly. Enter the fluid level (from a manual 'Fluid Shot') in joints at the vertical depth. This must be true vertical depth, not measured depth.

4c - Capture Torque

This captures the present operating torque, which is an average taken over the last minute. As above, the well should be running smoothly. Press one of the **Value Adjust** buttons while the Cursor Line is underlining the **4c Capture Torque** parameter. 4d – Torque Captured will automatically be updated.

4d - Torque Captured

The Torque Captured is either set by pressing **4c Capture Torque** above or is manually entered. This must be an accurate value for the amount of torque to pump down to the vertical depth in **4b Vert Joint Depth** above.

FLUID LEVEL 2

4e - Vert Joint Depth

This value should only be filled in when the well is running smoothly and after the Fluid Level 1 has been entered. Enter the fluid level (from a manual 'Fluid Shot') in joints at the vertical depth. This must be true vertical depth, not measured depth.

4f - Capture Torque

This captures the present torque, which is an average taken over the last minute. As above, the well should be running smoothly. Press one of the **Value Adjust** buttons while the Cursor Line is underlining the **4f Capture Torque** parameter. 4g – Torque Captured will automatically be updated.

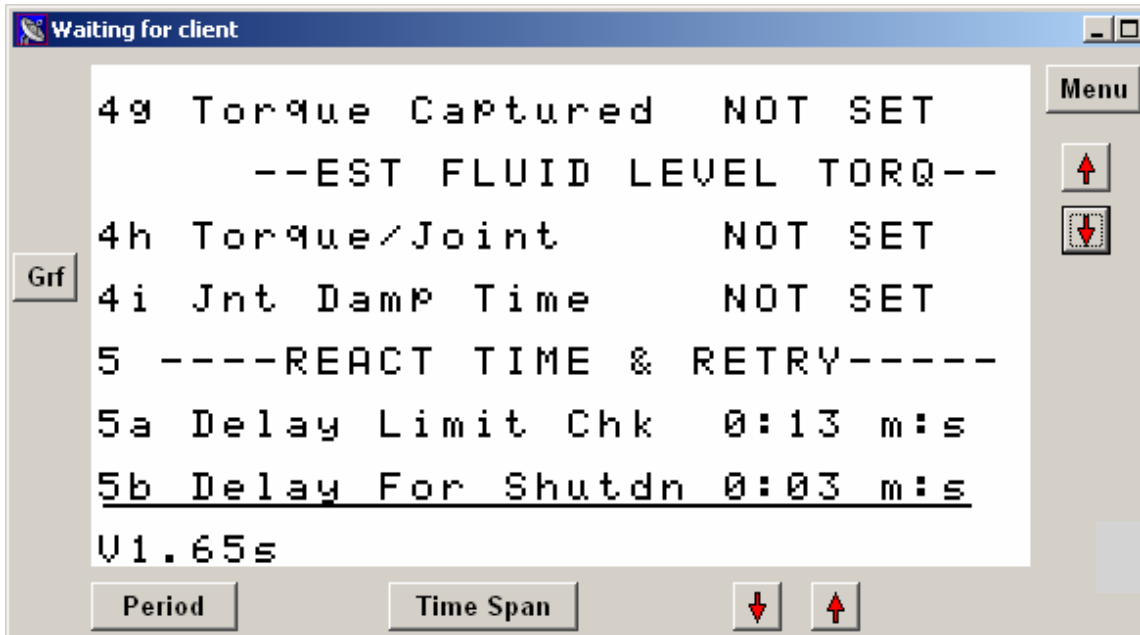


Figure 7.0

4g - Torque Captured

The Torque Captured is either set by pressing **4f Capture Torque** above or is manually entered. This must be an accurate value for the amount of torque to pump down to the vertical depth in **4e Vert Joint Depth** above.

4h - Torque/Joint

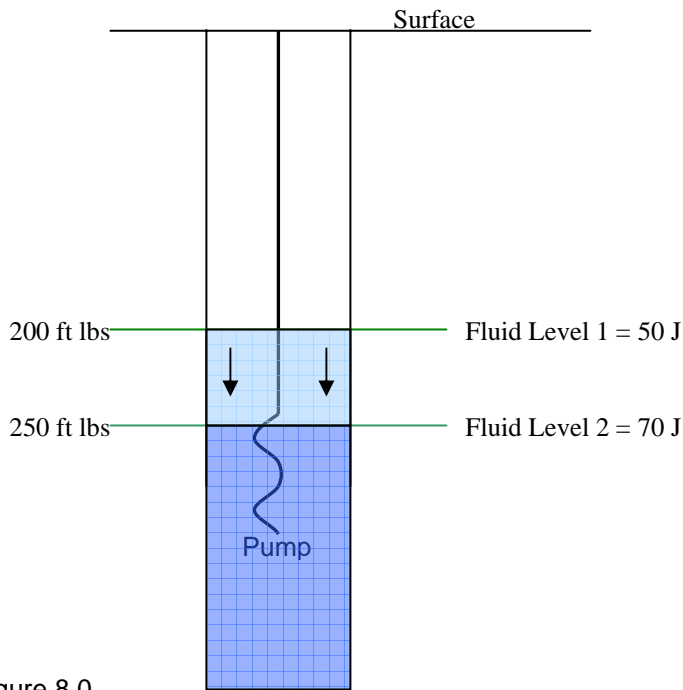
This is the calculated torque to pump down 1 joint. It is determined from the Fluid Level information (**4b-4g**) entered above.

4i - Jnt Damp Time

This value averages the calculated fluid depth, which may vary widely if the torque signal is noisy. This typically happens when using hydraulic pumps. Experimentation will be required to determine a value, which averages the variations but is still responsive enough to real events. Joint Damping will be disabled when set to **NOT SET**. (Default is 10 minutes)

Estimated fluid calculation is determined from a two-point calibration process. The WellMax bases its estimation from the torque and the amount of lift to surface. Torque is unique in that the lift is represented, but the downside is that other factors will also affect the calculated fluid level. Therefore, this feature functions best on clean wells.

Refer to Figure 8.0 below.



70 J – 50 J = 20 joints
 250 – 200 = 50 ft/lbs equals 2.5 ft lbs/joint

As the torque changes the estimated fluid level value will change appropriately. The fluid level value is averaged over a settable period of time.

Figure 8.0

REACT TIME & RETRY

5a - Delay Limit Chk

The time from **Start Up** over which WellMax will ignore High and Low Shutdowns or Preset conditions. This is typically set long enough for the pump to reach stable conditions, example the fluid reaching surface.

5b - Delay for Shutdn[†] / Delay for Setpnt[‡]

The amount of time the WellMax waits once the Shutdown/Setpoint limits are met or exceeded before it activates a shutdown condition.

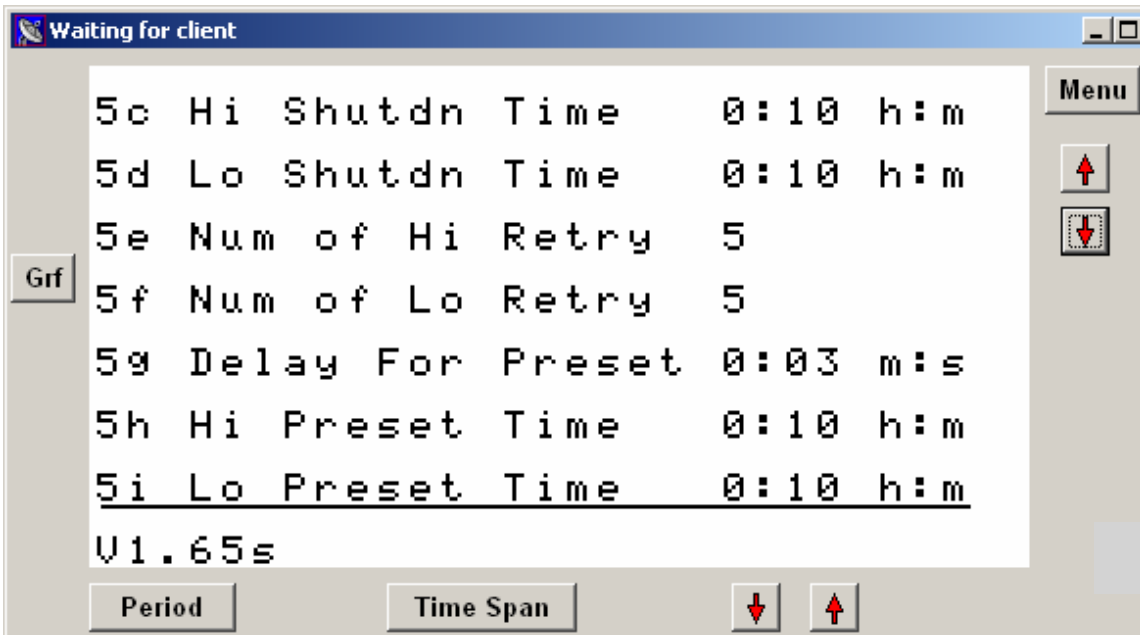


Figure 9.0

5c - Hi Shutdn Time[†] / Hi Setpnt Time[‡]

The amount of time the High Shutdown[†]/High Setpoint[‡] condition is active.

5d - Lo Shutdn Time[†] / Lo Setpnt Time[‡]

The amount of time the Low Shutdown[†]/Low Setpoint[‡] condition is active.

5e - Num of Hi Retry

The number of times the WellMax attempts to restart after a High Shutdown. After reaching this limit, WellMax shuts down and stays shut down until **1a Manual Reset** is performed. The number of high shutdowns is cleared after 3 minutes of smooth running. If set to **NOT SET** then it will continually restart.

5f - Num of Lo Retry

The number of times the WellMax attempts to restart after a Low Shutdown. After reaching this limit, WellMax shuts down and stays shut down until **1a Manual Reset** is performed. The number of low shutdowns is cleared after 3 minutes of smooth running. If set to **NOT SET** then it will continually restart.

5g - Delay for Preset[†]

The amount of time the WellMax waits once the Preset limits are met or exceeded before it activates a preset condition.

5h - Hi Preset Time[†]

The amount of time the High Preset condition is active.

5i - Lo Preset Time[†]

The amount of time the Low Preset condition is active.

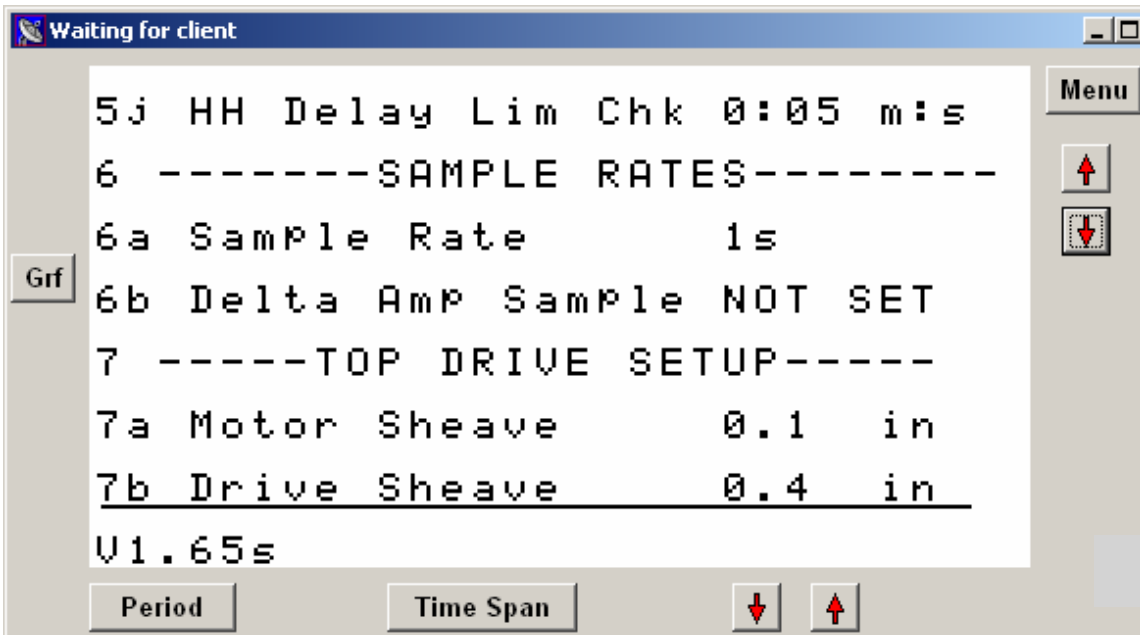


Figure 10.0

5j – HH Delay Lim Chk[†]

The time from **Start Up** over which WellMax will ignore the HHigh Shtdn Torq condition. This time is typically set before the “Delay Limit Chk” setting. Approximately 3 seconds for Motor Starter Applications.

SAMPLE RATES

6a - Sample Rate

The rate at which samples are plotted on the main screen and stored in the Flash memory.

This value can be set at **Not Set / 1s / 5s / 10s / 30s / 1m / 2.5m / 5m / 10m / 15m / 30m**

SAMPLE RATE (NO DELTA MODE)	DATA STORAGE CAPACITY
1 Second	4.84 Hours
5 Seconds	24.20 Hours
10 Seconds	48.40 Hours
30 seconds	6.05 Days
1 Minute	12 Days
2.5 Minutes	30 Days
5 Minutes	60 Days
10 Minutes	120 Days
15 Minutes	180 Days
30 Minutes	360 Days

6b - Delta Amp Sample[†] / Delta Hyd Pres[‡]

WellMax guarantees to sample and store data at the **Sample Rate** duration. It may record information more often if this is set. The Amps are monitored once every 1 second and compared to the last stored reading. If at any time from the last stored reading the amps change +/- **Delta Amp Sample** then a reading will be stored. Typically the **Sample Rate** will be set for a long period (5 minutes) and the **Delta Amp Sample** will be set to record significant changes at 1 second intervals.

TOP DRIVE SETUP

7a - Motor Sheave

The size of the Motor Sheave in inches.

7b - Drive Sheave

The size of the Drive Sheave in inches.

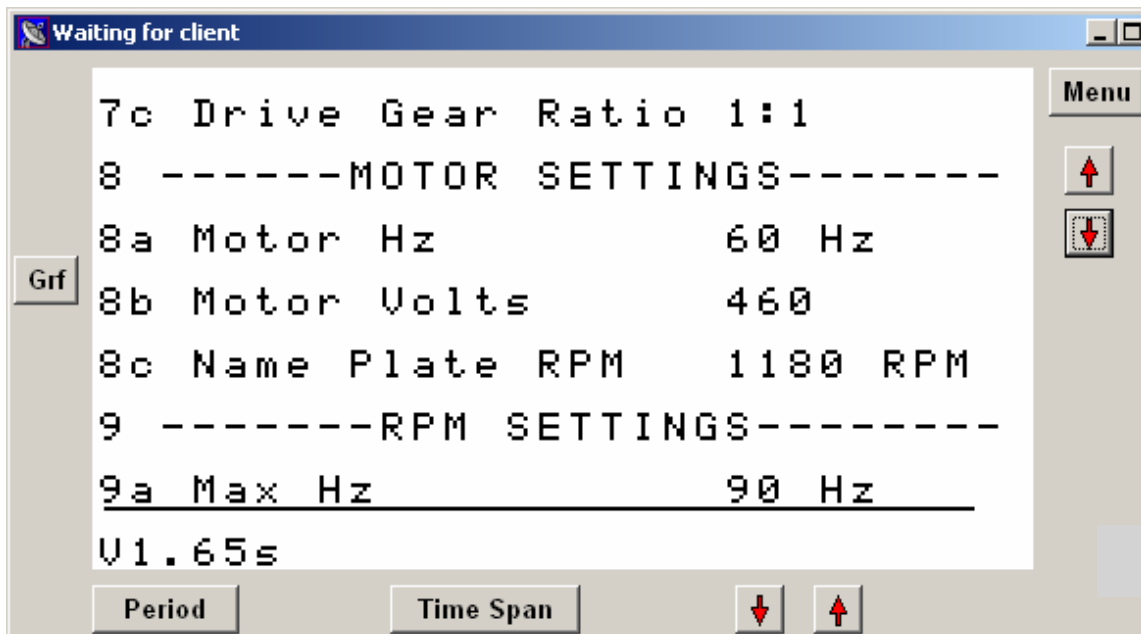


Figure 11.0

7c - Drive Gear Ratio

The drive gear ratio, example a right angle gear box

MOTOR SETTINGS

8a - Motor Hz[†] / Hyd Displacement[‡]

[†]The typical Motor frequency rating. [‡]The Hydraulic Displacement of hydraulic motor in cubic inches.

8b - Motor Volts[†]

The Motor Nameplate Voltage rating.

8c - Name Plate RPM[†]

The Motor Nameplate RPM rating.

RPM SETTINGS

9a - Max Hz[†]

Maximum Hz the VFD / Motor Starter can output.

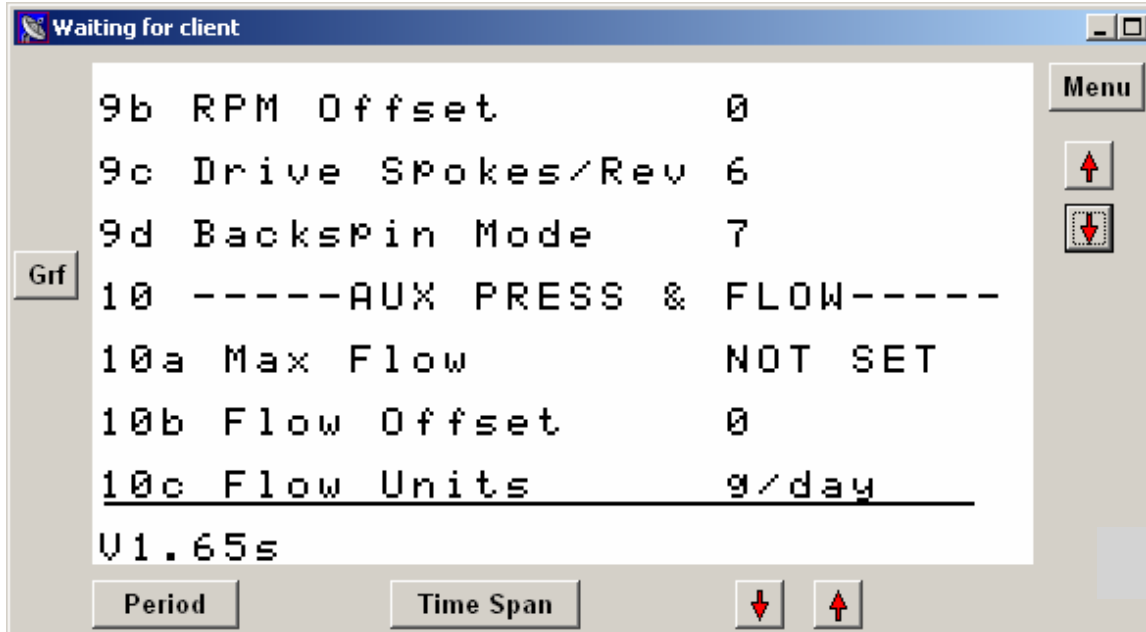


Figure 12.0

9b - RPM Offset[†]

This number represents the raw offset for RPM A to D converter. For example, a typical 1 volt offset will be 205, used typically for 4-20mA analog inputs. **Stellar Tech Service Engineer Use Only.**

9c - Drive Spokes/Rev[†] / 9a - Drive Spokes/Rev[‡]

The number of spokes the RPM sensor will count for one revolution. The RPM sensor is typically installed in a position to count the Drive Sheave spokes. If this is **Set** to 0 or **NOT SET** then the Hz VFD output must be used instead (typically a 0-10Vdc analog signal).

9d - Backspin Mode

This must be set to 7 in order for the 'Backspin' feature to be enabled. An Optional RPM Sensor must be installed. The Backspin feature is typically used for **Motor Starter** Applications.

Backspin Detect: Upon a 'power outage' this feature enables the Drive system (Motor Starter) to 'start' once the back spinning has come to a complete stop. This bypasses the wasted down time of using a 'timer relay', which will force the 'Motor Starter' to remain stopped until the timer relay has counted down even if the back-spinning has been stopped for some time. Backspin Detect also prohibits the Drive system to start until the back spinning has completed, thus protecting the rods against high starting torque which may occur if the system tried starting while back spinning. The WellMax displays 'WAIT FOR BACKSPIN' on the graph until the RPM is zero for 5 seconds, then it will start the system.

AUX PRESS & FLOW

10a - Max Flow (Optional)

Flow Meter must be installed. Set maximum value the flow meter will read.

10b - Flow Offset

This number represents the raw offset for flow A to D converter. For example, a typical 1 volt offset will be 205, used typically for 4-20mA analog inputs. **Stellar Tech Service Engineer Use Only.**

10c - Flow Units

The units that the flow is measured in: *g/day* (default), *bbl/day*, *m³/day*, *P-m³/d*, KPA, PSI.

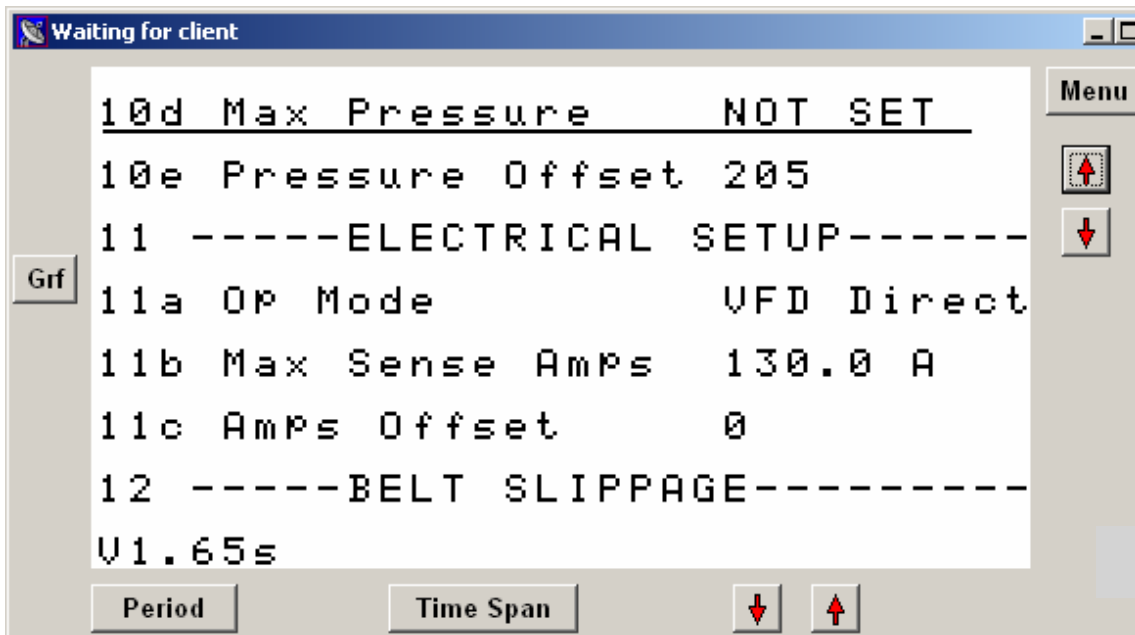


Figure 13.0

10d - Max Pressure (Optional)

Pressure Sensor must be installed. Set maximum value the Pressure sensor will read in psi.

10e - Pressure Offset

This number represents the raw offset for pressure A to D converter. For example, a typical 1 volt offset will be 205, used typically for 4-20mA analog inputs. **Stellar Tech Service Engineer Use Only.**

†ELECTRICAL SETUP / ‡HYDRAULIC SETUP

11a - Op Mode†

The Op Mode can be set to one of the following settings:

VFD Direct: Current and RPM Analog Inputs from VFD

VFD Sensor: Current Sensor and User entered RPM

Line Start: Current Sensor and Calculated RPM from Sheaves

Soft Start: Current Sensor or Amps input from Soft Start and Calculated RPM from Sheaves.

NOT SET: Must be set for specific application.

11a - Max Hyd Pres‡

The rated pressure that the Hydraulic Pressure Sensor will measure. Refer to Equipment specifications.

11b - Max Sense Amps†

The maximum Amps that the input will measure, whether the Amps input is a current sensor (200 Amps) or from the VFD (150% of Motor Name Plate Amps-PDL).

11c - Amps Offset† / 11b Hyd Pres Offset‡

This number represents the raw offset for Amps† (0 offset FOR 0-10Vdc inputs) / Hydraulic Pressure‡ (205 offset for 4-20mA inputs) A to D converter. For example, a typical 1 volt offset will be 205, used typically for 4-20mA analog inputs. **Stellar Tech Service Engineer Use Only.**

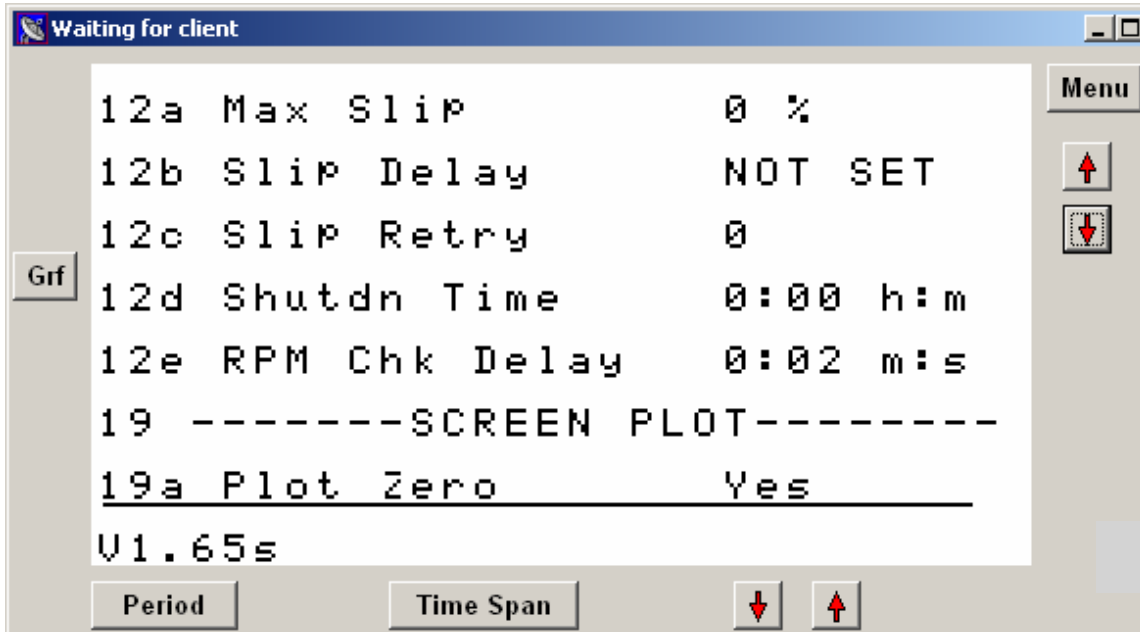


Figure 14.0

†BELT SLIPPAGE

12a – Max Slip (Belt Slippage)†

Maximum percentage allowed for belt slippage before shutting down. The percentage is derived from the actual polish rod RPM (RPM Sensor) and the calculated polish rod RPM (Motor Name Plate RPM/Sheave Ratio **3a – Set RPM** or VFD analog RPM signal).

Belt-slip Detect: The percentage of Belt-slip allowed and amount of delay time before shutdown occurs is set by User. Upon Power up there is a settable 'Delay Limit' time before the WellMax starts to monitor the Belt-slip, allowing the system to get to full speed.

12b - Slip Delay†

The amount of time from start up that the WellMax waits until monitoring the belt slip percentage.

12c – Slip Retry†

Number of times the system attempts to run after the initial Slipping Shutdown fault before shutting down completely on Slipping Shutdown Fault.

12d – Shutdn Time†

The time the WellMax waits before attempting to restart after a Slippage Shutdown Fault. The **12c Slip Retry** has to be set to a value above 0.

12e – RPM Chk Delay

The time from start where the WellMax will not monitor the RPM signal. If there is less than 5 RPM after this time has elapse the system will shutdown on a RPM Sensor Failure.

SCREEN PLOT

19a - Plot Zero

Forces the main data graph to always show 0 on the y-axis if set to YES.

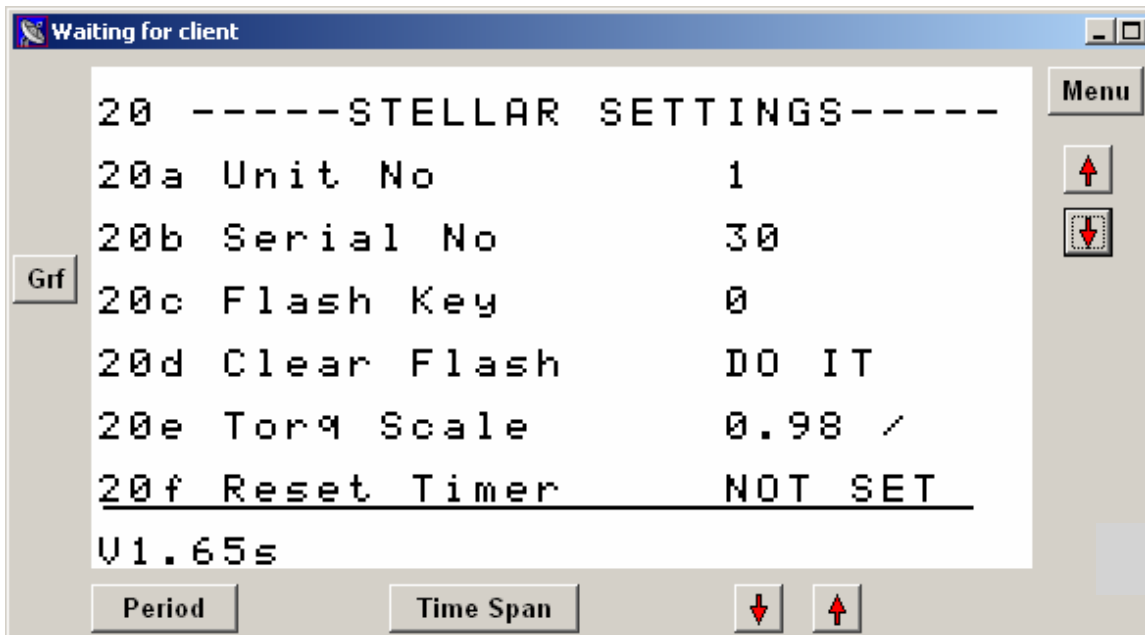


Figure 15.0

STELLAR SETTINGS

20a - Unit No

This is set to distinguish between different groups of pumps in one locale. It must be unique in a multi-drop configuration.

20b - Serial No

This number must be unique for the same company's wells. It is used to distinguish different wells when data is downloaded.

20c - Flash Key

This must be set to 29 if you want to clear the flash memory. This is protection against inadvertently clearing the flash. The **Flash Key** will be reset to 0 after a **20d Clear Flash** has been done.

20d - Clear Flash

Clears the historical data recorded in the Flash Memory. **20c Flash Key** must be set to 29. Underline the Clear Flash Do It then press either value adjust button.

20e - Torque Scale

This is used to adjust the torque reading due to the change in Power Factors (PF) and motor Efficiencies (EFF) of different motors. ($PF \times EFF = 0.80$). **Stellar Tech Service Engineer Use Only.**

20f - Reset Timer

Adjust this setting for a cycle timer for CDPD applications. A value of 0:0 disables the timer. The relay is energized for 30 seconds after the user settable time entered has expired. The timer is reset anytime any complete packet is received on either com port. Terminals are J6 – 7 through J6 – 9.

Faults

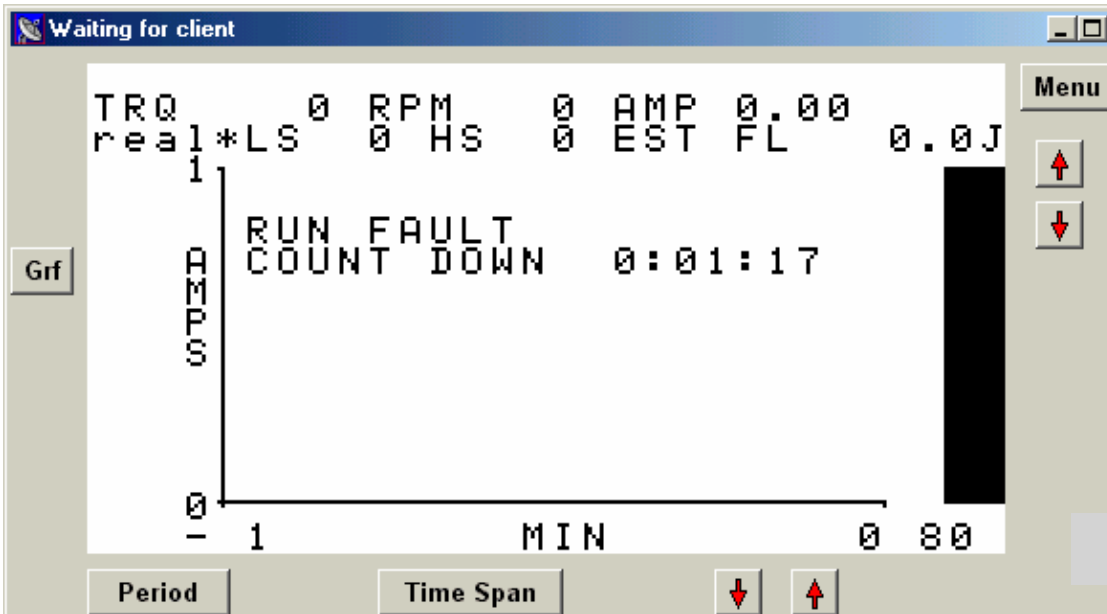


Figure 16.0

Fault: RUN FAULT
Possible Cause: Hand/Off/Auto switch is in the Off position, there is no 'Run Signal' present.
Action: Turn switch to Hand or Auto position, wait for backspin timer count down
 Check for loose wiring connections or broken Hand/Off/Auto switch.



Figure 17.0

Fault: RPM SENSOR FAIL (Motor Starter Applications)
Possible Cause: RPM Sensor Faulty, Sensor not detecting spokes, or not connected
Action: Upon receiving a 'Run Signal' the WellMax monitors the RPM for two seconds. If there is no RPM reading during the initial two seconds the WellMax shuts down the system, indicating a possible faulty RPM sensor or connection problem.
 Check RPM sensor is located within 1/4" (30 mm) from the drive sheave spokes.
 Check the RPM sensor is plugged in at the connectors.

Fault: **High High Shutdown** (message displayed and system has shut down)
Possible Cause: HHigh Shutdown Torque limits have been exceeded for more than 1 second.
Action: View data on graphing screen or download data to observe and understand reasoning of shutdown.
Pump Off – Check Well’s fluid level
Well sanded up – possible avalanche of sand
Pump tightened/Rotor Stuck
Increase HHigh Shutdown (2i/2j) ***Important DO NOT Exceed Rated Rod Torque Limit***
Increase HH Delay Limit Check (5j)

Fault: **High Torque Shutdown**
Possible Cause: High Shutdown Torque limit has been exceeded for more than the ‘Delay for shutdown’ time
Action: View data on graphing screen or download data to observe and understand reasoning of shutdown.
Pump Off – Check Well’s fluid level
Well sanded up – possible avalanche of sand
Pump tightened/Rotor Stuck/Waxing off-Chemical injection required
Increase High Shutdn Torq (2a/2b) ***Important DO NOT Exceed Rated Rod Torque Limit***
Increase Delay for Shtudn (5b)

Fault: **Low Torque Shutdown**
Possible Cause: Low Shutdown Torque limit has been exceeded for more than the ‘Delay for shutdown’ time
Action: View data on graphing screen or download data to observe and understand reasoning of shutdown.
Tubing Leak
Broken Rods/Parted Rods
Decrease Low Shutdn Torq (2c/2d)
Increase Delay for Shtudn (5b)

Fault: **High Torque Preset**
Possible Cause: High Preset Torque Limit has been exceed for more than the ‘Delay for shutdown’ time
Action: Well sanded up
Pump tightened/Waxing off-Chemical injection required/Low Fluid Level
Fluid level reaching a dangerously low level and requires the pump to slow down to rejuvenate the fluid supply.

Fault: **Low Torque Preset**
Possible Cause: Low Preset Torque Limit has been exceed for more than the ‘Delay for shutdown’ time
Action: Fluid level reaching a high level and requires the pump to speed up to lower fluid level.

Fault: The following faults occur but system remains running.
High High Shutdown
High Torque Shutdown
Low Torque Shutdown
Possible Cause: The Hand/Off/Auto switch is in the Hand position.
Action: Switch the Hand/Off/Auto switch to the Auto position. System should then shutdown.

Fault: The following faults occur but system does not change speed from normal operating speed.

**High Torque Preset
Low Torque Preset**

Possible Cause: The Hand/Off/Auto switch is in the Hand Position or Speed Change parameter is not set up in the VFD menu (M8).

Action: Switch the Hand/Off/Auto switch to the Auto position. System should then change speeds.
Using the VFD keypad view the parameter M8 and set up to appropriate speed % (% is referenced to the rated output motor speed).

Fault: **Slipping Shutdown**

Possible Cause: Belts on sheaves of drive head are slipping and have exceeded the Max Slip %

Action: Tighten Belts
Increase Max Slip % (12a)
Increase Slip Delay (12b) to approximately 20 seconds

Fault: **High Pressure/Presco**

Possible Cause: Presco circuit is open due to pressure switch tripping

Action: Reset Presco switch
Reset VFD – Press the Red STOP/RESET button or press the external Reset button on the WellMax if equipped
Check Presco switch wiring into terminal blocks
Presco switch is to be wired N.C. (When tripped the contacts Open)
If no Presco switch is present make sure a jumper wire is installed in Presco terminal blocks.

Fault: **VFD Fault**

Possible Cause: VFD system has tripped on a fault

Action: Refer to PDL VFD Keypad for fault code FXX, then check VFD Manual for description of fault (Consult a Stellar Tech Systems Service Rep for assistance 403-279-8367)
Reset VFD – Press the Red STOP/RESET button or press the external Reset button on the WellMax if equipped

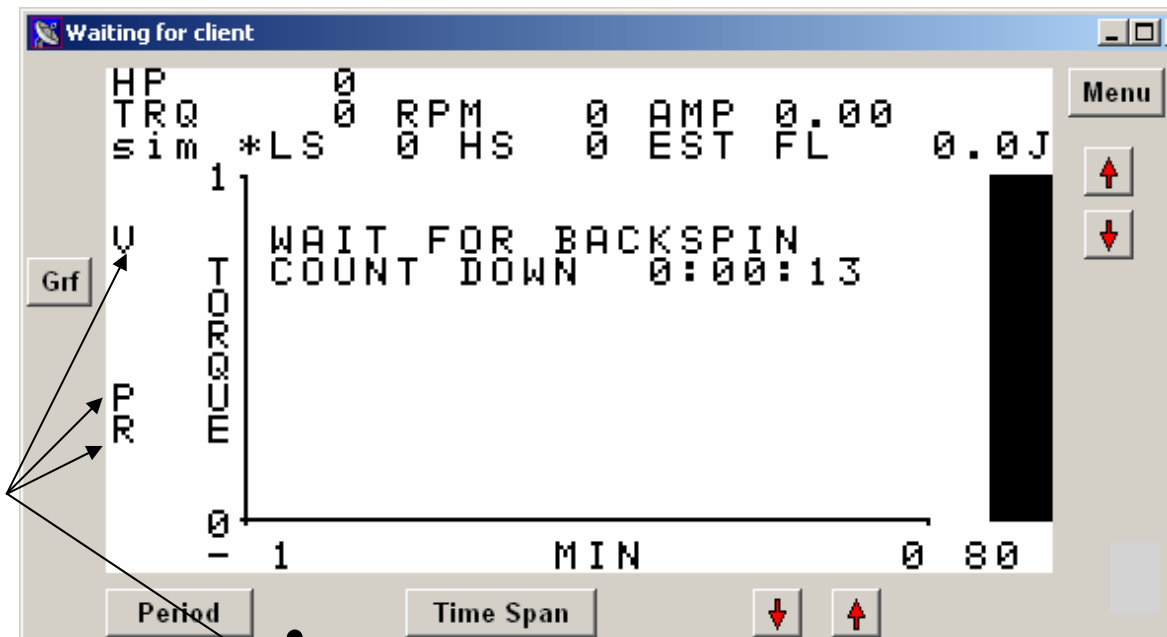


Figure 18.0

- V – Indicates VFD Fault
- P – Indicates High Pressure / Presco Fault
- R – Indicates No RUN signal to the VFD

‡HYDRAULIC MURPHY SWITCH FAULTS (Hydraulic Systems Only)

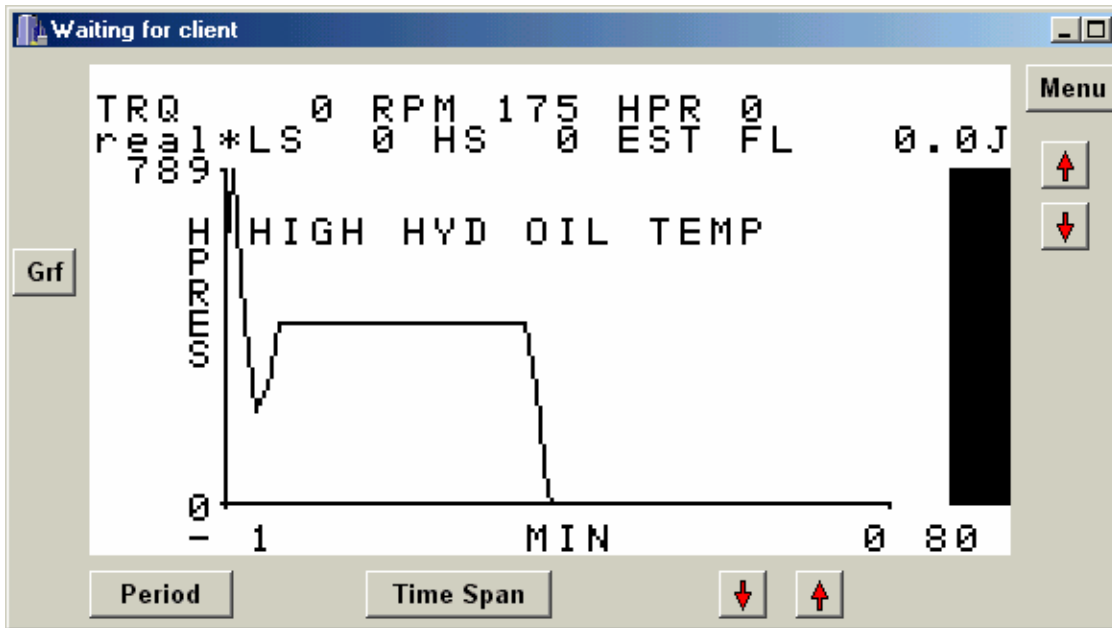


Figure 19.0

- HIGH HYD OIL TEMP** – High hydraulic oil temperature
- HIGH PRES (PRESCO)** – High pressure on flow line measured on the Presco Switch
- LOW HYDRAULIC OIL** – Low hydraulic oil in oil reservoir
- LOW OIL PRESSURE** – Engine Oil Pressure is Low
- HIGH ENGINE TEMP** – High Engine Temperature
- OVER TORQUE** – Rod Torque Limit is met or exceeded
- HIGH PRESSURE** – High Engine Pressure
- LOW ENGINE OIL** – Engine Oil needs replenishing
- OVER SPEED** – System has reached too high of speeds

Troubleshooting

!! WARNING !!

Some troubleshooting procedures require the system to be powered and its door to be opened to perform the test. There are multiple circuits that may be powered at any given time. Follow standard safety procedures to prevent any damage to the equipment or personal injuries.

WellMax Section

Problem:	Write Flash Error
Possible Cause:	Microcontroller or Flash Memory fault
Action:	Cycle WellMax power Off/On – This resets microcontroller If problem persists then replace WellMax PCB (Consult a Stellar Tech Systems Service Rep for assistance 403-279-8367)
Problem:	Searching For Log Start
Possible Cause:	Power Supply Faulty
Action:	Measure WellMax Input Power approx. +12Vdc on terminals J1-1 (GND) to J1-2 (+12Vdc) – Replace Power Supply if voltage is lower than +12Vdc Check analog inputs: J1-1 (GND) to J1-4 (voltage level between 0-10Vdc) J1-1 (GND) to J1-5 (voltage level between 0-10Vdc) *Check VFD outputs are programmed for 0-10Vdc.
Problem:	Frozen WellMax Screen (Buttons Do Not Respond)
Possible Cause:	Microcontroller hung up; Faulty microcontroller; Ribbon Cable from membrane damaged or unplugged
Action:	Check Ribbon cable is connected to the WellMax PCB Cycle WellMax Power Off/On – Resets microcontroller Remove WellMax and inspect the ribbon cable for visual damage (open traces due to scratches or cuts) If problem persists then replace WellMax PCB (Consult a Stellar Tech Systems Service Rep for assistance 403-279-8367)
Problem:	Incomplete Data after Downloading (Last Dump Date is not the current date)
Possible Cause:	Real Time Clock Battery low voltage
Action:	Measure voltage from J1-13 to U20 pin 3, should measure ≥ 3 Vdc, replace if voltage is low.
Problem:	0 New Records is indicated after a download process has been performed.
Possible Cause:	Damaged flash memory chip
Action:	NOTE: Record the parameter information before proceeding, since replacement of the memory chips will result in loss of data and parameter entry. Replace the 1 st memory chip labeled U7, located in the top right of the two columns of memory chips (component part 24LC256). Try re-downloading and if problem still persists then replace all the memory chips from U7 to U14. If the above has not repaired the issue the replace the microcontroller chip.

RPM Sensor Voltage Measurements

While Replacing the RPM Barrier Measure the following Resistance:

Power off WellMax

Unplug RPM Sensor

Remove wires from Barrier Out + and Out - (Black and White wires)

Measure resistance between White and Black wire (Cable from WellMax to RPM Connector)

Resistance should indicate an open circuit; If so Replace barrier

If cable is shorted then cable replacement may be necessary if short is physically not evident

After Barrier Replacement and LED on barrier (NOT RPM SENSOR) remains ON perform the following:

RPM Barrier Circuit (Voltage Checks)

GND = J1-13 on WellMax board

Barrier	RPM Sensor Unplugged	RPM Sensor Plugged
GND To In +	+ 30 Vdc	+26.19 Vdc
GND To In -	+ 0.038 Vdc	+2.677 Vdc
GND To Out +	+ 30 Vdc	+24.36 Vdc
GND To Out -	+ 0.038 Vdc	+2.679 Vdc

* The Barrier LED should only come on when there is a short circuit on the Out side of the barrier.

Problem: After a sheave change and entering the new sheave sizes in the WellMax, the system is shutting down at the incorrect torque levels.

Possible Cause: System is shutting down on the 2a High Amp Limit

Action: This problem exists with WellMax Versions BELOW 1.65s. All the torque limits must be adjusted after a sheave change in order to re-calculate the corresponding amp values. To do this place the line cursor on the torque limit and press the down value adjust button, then press the up value adjust button. Now the amps setting should be correct. Verify the amps and torque setting are still within spec of the equipment.

PDL VFD Section

Problem: VFD Starting then Stopping Continuously Without Tripping on Faults

Possible Causes: Temporarily Loss of Run signal and output to motor is stopped; Main Input Power Failure

Action: Check Main Power Input for correct phase voltage balance – fuse may be blown. To verify, advance to the screen XXX Vdc XXX Vac by pressing the + or – button. Start the drive, observing the XXX Vdc (A 460Vac system should read approximately 680Vdc on the dc bus). Once VFD starts the XXX Vdc may drop significantly – thus indicating a poor Main Power Supply. Check the Run signal for intermittent open circuit. Check the Hand/Off/Auto switch contact blocks are not broken or wires loose. Check for a steady +24Vdc on the VFD Terminal T13 while system is running.

Problem: VFD Shutdown on **F22 High Pressure**

Possible Cause: Presco circuit is open due to pressure switch tripping

Action: Reset Presco switch
Reset VFD – Press the Red STOP/RESET button or press the external Reset button on the WellMax if equipped
Check Presco switch wiring into terminal blocks
Presco switch is to be wired N.C. (When tripped the contacts Open)
If no Presco switch is present make sure a jumper wire is installed in Presco terminal blocks

Problem: VFD Shutdown on **F29 TQ Lim T/O** during Startup
Possible Cause: Incorrect motor rotation; Motor fan shroud dented into cooling fan; Incorrect Motor tuning; Pump tight and Rotor stuck
Action: Check for correct motor rotation – Reverse rotation could cause drive head brake to activate and stop system
Check motor shroud for dent causing the cooling fan to be stuck
If system is 100Hp or greater check X5c Damping – for light loads the system may be unstable - set X5c to 1%.
“Flush by” may be needed
If problem persists consult a Stellar Tech Systems Service Rep for assistance 403-279-8367

WELLMAX SPECIFICATIONS

Input Power Supply

12Vdc Terminal J1-1 Ground/ J1-2 +12Vdc or
 12Vac Terminal J1-1 and J1-2
 110-120Vac WellMax Stand Alone Cabinet (Separate from VFD Enclosure)

Digital Relays

Relay 1 (Shutdown) Terminal J6-4 to J6-5 (Normally Closed)
 Terminal J6-4 to J6-6 (Normally Open)
 Relay 2 (Preset) Terminal J6-1 to J6-2 (Normally Closed)
 Terminal J6-1 to J6-3 (Normally Open)
 Relay 3 (CDPD Reset) Terminal J6-7 to J6-8 (Normally Closed)
 Terminal J6-7 to J6-9 (Normally Open)

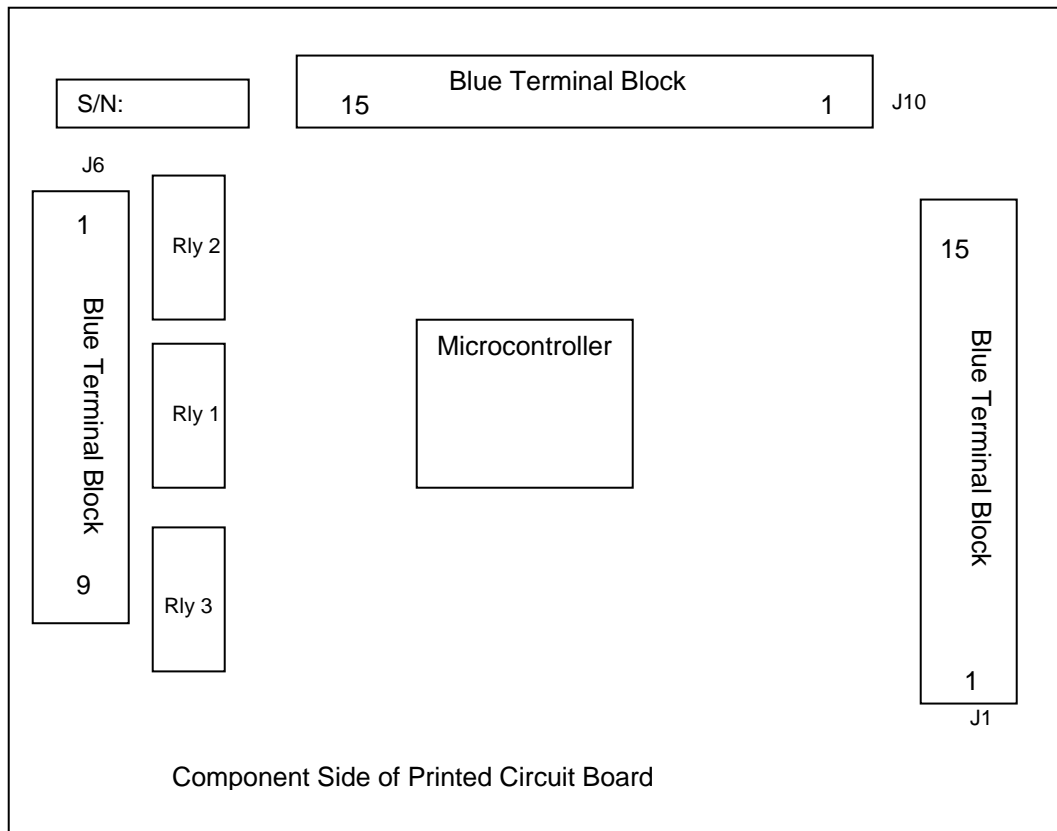
Digital Inputs

VFD Fault Terminal J10-7 Active low
 Run Signal Terminal J1-10 Active low
 Presco Fault Terminal J1-9 Active low

Analog Inputs

Analog Inputs	Signal	Description	Range
J1-4	0-10 Vdc	VFD RPM Signal	System dependant
J1-5	0-10 Vdc	VFD Amps Signal	System dependant
J1-5	0-1 Vdc	Lem Current Sensor	0-200 A
J1-6	1-5 Vdc	Flow Sensor	System dependant
J1-7	1-5 Vdc	Pressure Sensor	System dependant
J10-14	0-5 Vdc	RPM Sensor	4.2 KHz Max.

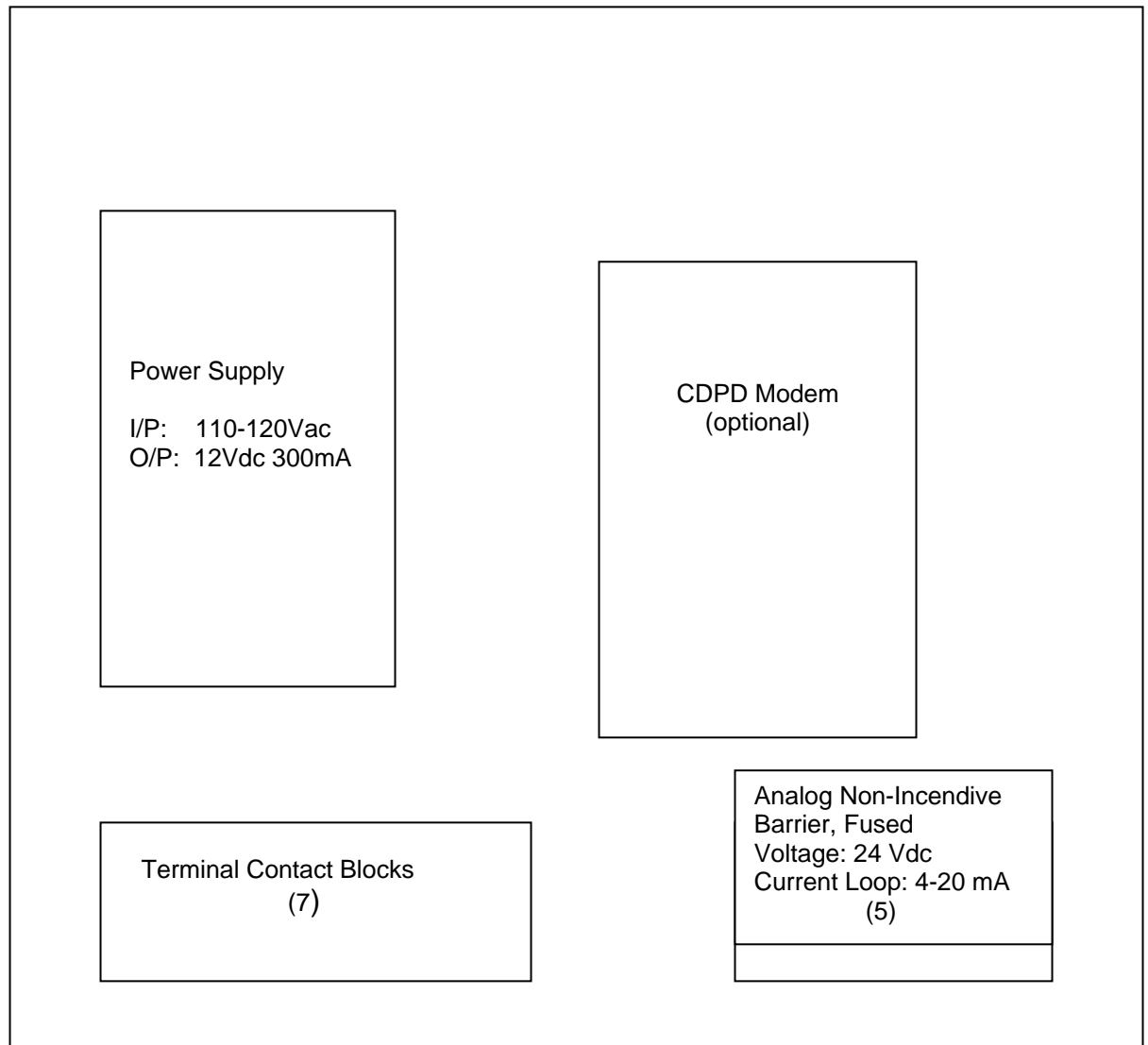
WellMax PCB Layout



WellMax Cabinet Components (Stand Alone – NOT VFD)

Dimensions: 12.00" x 10.00" x 6.00"

Panel Layout



The WellMax PCB is mounted on the backside of the door. The analog and digital connections are on the component side of the WellMax PCB (Refer to WellMax PCB Layout).

APPENDIX A:

VFD / Motor Starter / Soft Starter WELLMAX[†]

- 1 SETTINGS
 - 1a Manual Reset

- 2 SETPOINT SETTINGS
 - 2a High Shutdn Torq
 - 2c Low Shutdn Torq
 - 2e High Preset Torq
 - 2g Low Preset Torq
 - 2i HHigh Shtdn Torq

- 3 RPM SET NO-PICKUP
 - 3a Set RPM
 - 3b Ramp Rate

- 4 FLUID LEVEL
 - 4a Max Vert Joints

FLUID LEVEL 1

 - 4b Vert Joint Depth
 - 4c Capture Torque
 - 4d Torque Captured

FLUID LEVEL 2

 - 4e Vert Joint Depth
 - 4f Capture Torque
 - 4g Torque Captured

EST FLUID LEVEL TORQ

 - 4h Torque/Joint
 - 4i Jnt Damp Time

- 5 REACT TIME & RETRY
 - 5a Delay Limit Chk
 - 5b Delay For Shutdn
 - 5c Hi Shutdn Time
 - 5d Lo Shutdn Time
 - 5e Num of Hi Retry
 - 5f Num of Lo Retry
 - 5g Delay For Preset
 - 5h Hi Preset Time
 - 5i Lo Preset Time
 - 5j HH Delay Lim Chk

- 6 SAMPLE RATES
 - 6a Sample Rate
 - 6b Delta Amp Sample

- 7 TOP DRIVE SETUP
 - 7a Motor Sheave
 - 7b Drive Sheave
 - 7c Drive Gear Ratio

- 8 MOTOR SETTINGS
 - 8a Motor Hz
 - 8b Motor Volts
 - 8c Name Plate RPM

- 9 RPM SETTINGS
 - 9a Max Hz
 - 9b RPM Offset
 - 9c Drive Spokes/Rev
 - 9d Backspin Mode

- 10 AUX PRESS & FLOW
 - 10a Max Flow
 - 10b Flow Offset
 - 10c Flow Units
 - 10d Max Pressure
 - 10e Pressure Offset

- 11 ELECTRICAL SETUP
 - 11a Op Mode
 - 11b Max Sense Amps
 - 11c Amps Offset

- 12 BELT SLIPPAGE
 - 12a Max Slip
 - 12b Slip Delay
 - 12c Slip Retry
 - 12d Shutdn Time
 - 12e RPM Chk Delay

- 19 SCREEN PLOT
 - 19a Plot Zero

- 20 STELLAR SETTINGS
 - 20a Unit No
 - 20b Serial No
 - 20c Flash Key
 - 20d Clear Flash
 - 20e Torq Scale
 - 20f Reset Timer

APPENDIX B:

HYDRAULIC WELLMAX[‡]

- 1 SETTINGS
 - 1a Manual Reset
- 2 SETPOINT SETTINGS
 - 2a High Setpnt Torq
 - 2b High Setpnt HPres
 - 2c Low Setpnt Torq
 - 2d Low Setpnt HPres
- 3 RPM SET NO-PICKUP
 - 3a Set RPM
 - 3b Ramp Rate
- 4 FLUID LEVEL
 - 4a Max Vert Joints

FLUID LEVEL 1

 - 4b Vert Joint Depth
 - 4c Capture Torque
 - 4d Torque Captured

FLUID LEVEL 2

 - 4e Vert Joint Depth
 - 4f Capture Torque
 - 4g Torque Captured

EST FLUID LEVEL TORQ

 - 4h Torque/Joint
 - 4i Jnt Damp Time
- 5 REACT TIME & RETRY
 - 5a Delay Limit Chk
 - 5b Delay For Setpnt
 - 5c Hi Setpnt Time
 - 5d Lo Setpnt Time
 - 5e Num of Hi Retry
 - 5f Num of Lo Retry
- 6 SAMPLE RATES
 - 6a Sample Rate
 - 6b Delta Hyd Pres
- 7 TOP DRIVE SETUP
 - 7a Motor Sheave
 - 7b Drive Sheave
 - 7c Drive Gear Ratio
- 8 MOTOR SETTINGS
 - 8a Hyd Displacement
- 9 RPM SETTINGS
 - 9a Drive Spokes/Rev

- 10 AUX PRESS & FLOW
 - 10a Max Flow
 - 10b Flow Offset
 - 10c Flow Units
 - 10d Max Pressure
 - 10e Pressure Offset

- 11 HYDRAULIC SETUP
 - 11a Max Hyd Pres
 - 11b Hyd Pres Offset

- 19 SCREEN PLOT
 - 19a Plot Zero

- 20 STELLAR SETTINGS
 - 20a Unit No
 - 20b Serial No
 - 20c Flash Key
 - 20d Clear Flash
 - 20e Torq Scale

Revision History

1 st revision:	Dec. 9, 1999	
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3 rd revision:	May 20, 2000	
4 th revision:	July 27, 2001	
5 th revision:	August 8, 2001	
6 th revision:	April 3, 2002	
7 th revision:	May 14, 2002	
8 th revision	Nov 28, 2002	(added Faults and troubleshooting section) File: WellMax Manual 36-0002-01-08.doc Part No.: 36-0002-01-08
9 th revision	Apr 1, 2003	Addition of Horse Power VFD Slip Detect Specifications/WellMax Board Layout File: WellMax Manual 36-0002-01-09.doc Part No.: 36-0002-01-09
10 th revision	Aug 12, 2003	RPM Sensor Volt Measurements Troubleshooting- Sheave changes
	Sept 17, 2003	Digital Inputs: Run Signal and Presco File: WellMax Manual 36-0002-01-10.doc Part No.: 36-0002-01-10
10 th revision C	Jan 16, 2004	Troubleshooting - 0 New Records Downloaded
	Jan 20, 2005	Name Change to Stellar Tech Energy Services Inc.
	Sept 15, 2005	Added Better Business Bureau Logo



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