

Remko K37 Engine Control Panel Operations Manual

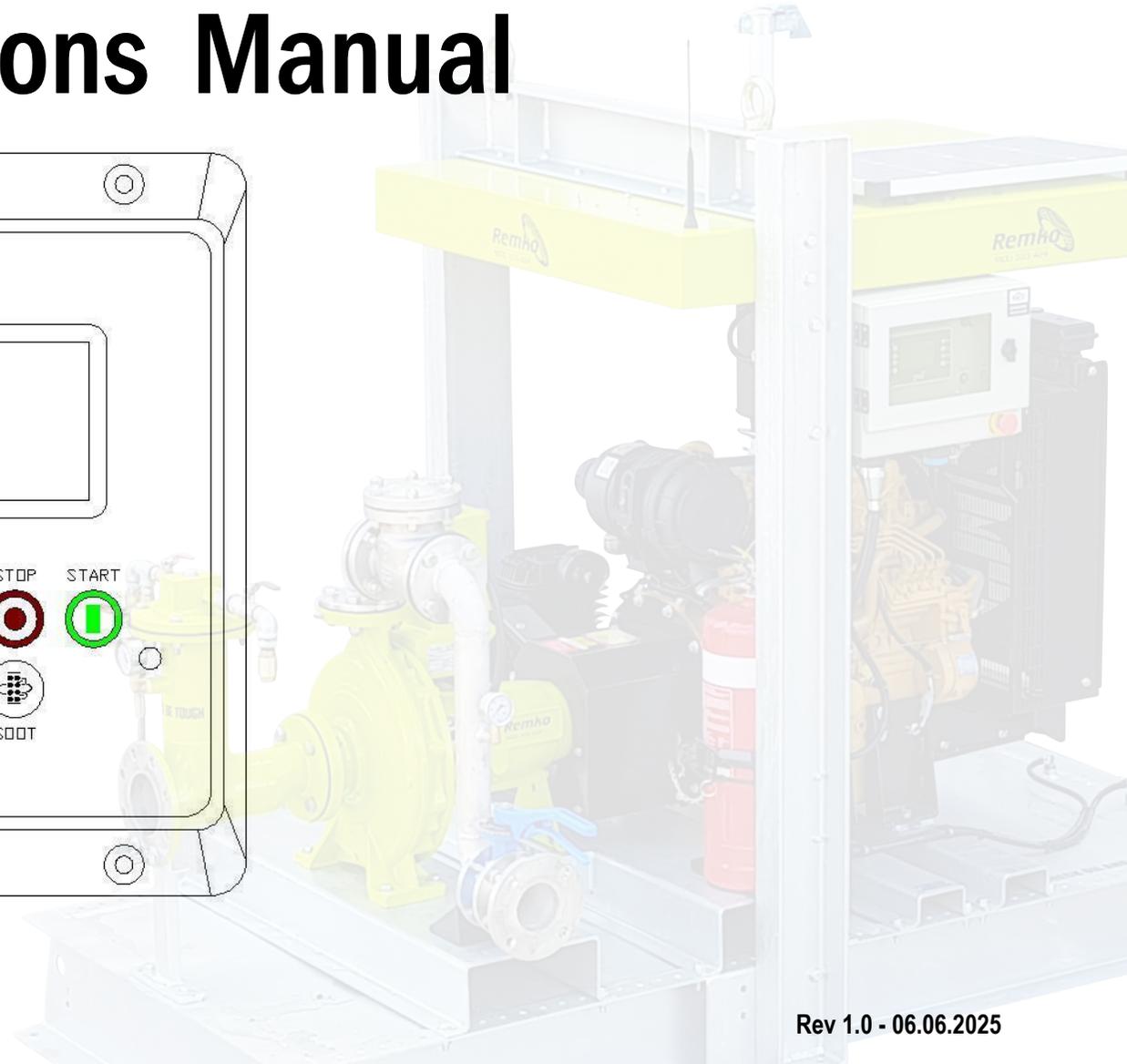
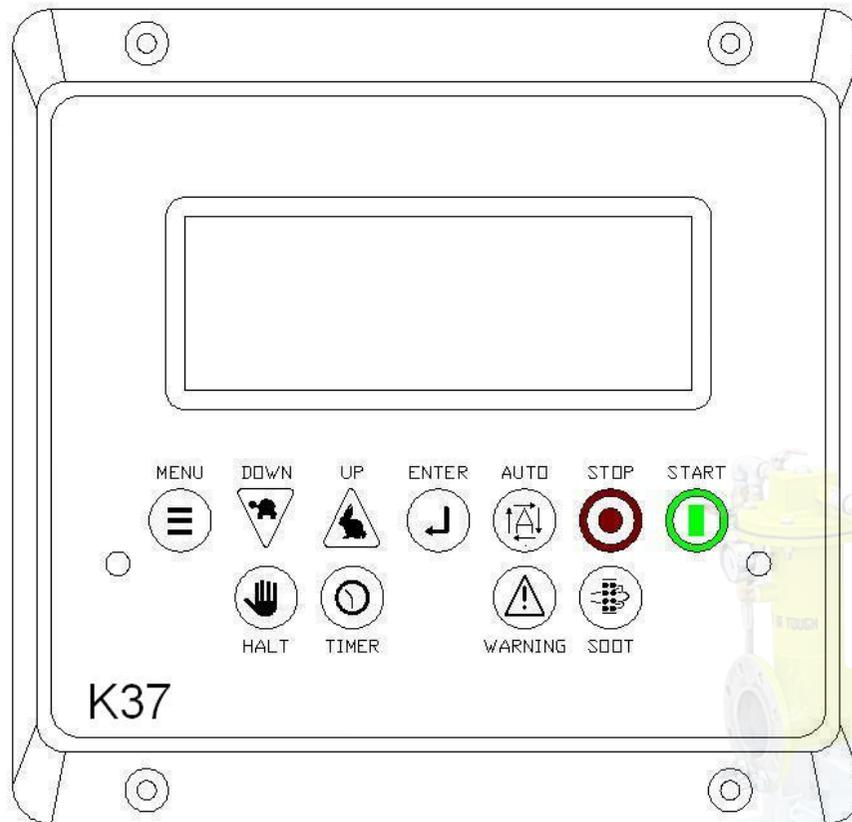


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WARNING

Prior to Installation and/or Servicing.

- Remove all electrical power from controller and engine
- Ensure machine is safely secured during installation
- Check and follow all safety warnings and read all instruction manuals carefully
- Only use the controller for its intended purpose.

Prior to Engine Ignition

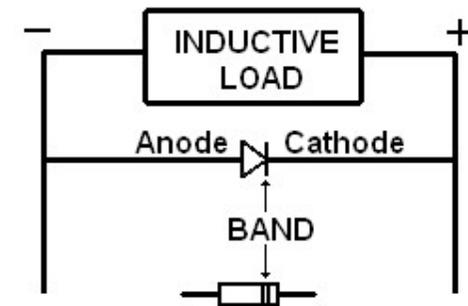
- Ensure that persons, engine and moving parts are free from obstruction.
- The user is responsible for ensuring the engine and controller are operated safely.

Any parameter or settings changes must be carried out by persons with expert knowledge. Failure to do so may result in serious damage to equipment, persons and may also void warranty.

Fly-back Diode Installation

All Inductive Loads (e.g. Starter Solenoids, Fuel Stop Solenoids, Clutch Solenoids, General Relays etc) must be fitted with a fly-back diode such as the widely available 1N4005. The diode used must be of sufficient size in order to prevent damage from reverse voltage spikes. A fly-back diode is sometimes also referred to as a snubber diode, free-wheeling diode, suppressor diode, catch diode, or clamping diode.

The diode is fitted onto the source of the inductive load, normally in the engine wiring loom.



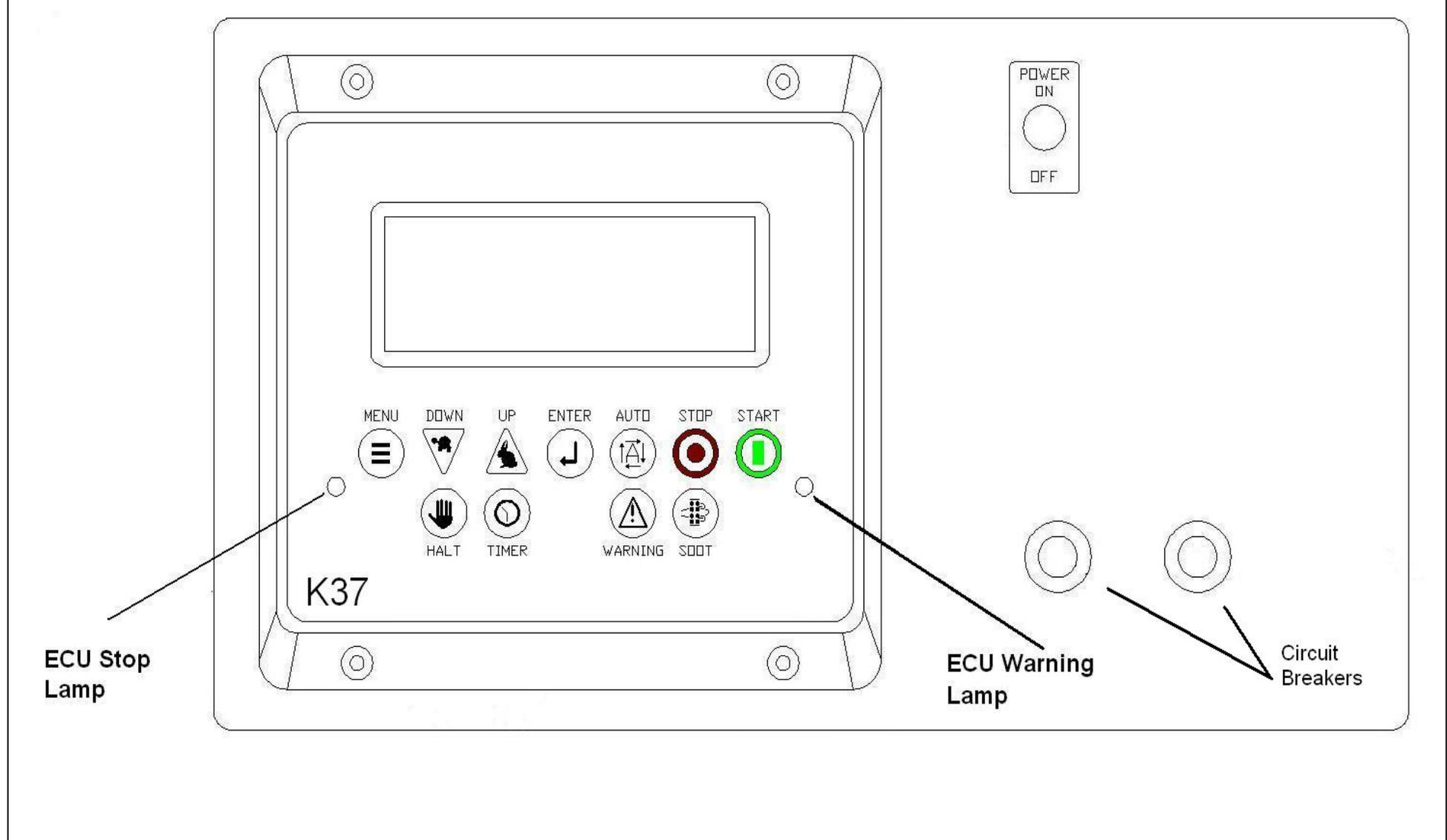
General Description

The K37 is a full function control panel to auto start and monitor both diesel engines and driven equipment such as pumps. With its graphical display and intuitive menu system, the K37 can be used in a broad range of operating applications from basic manual start to fully automated “throttle with respect to pressure “ systems. Telemetry ready options include basic GSM text messaging, Combination Modem, GPS, Satellite system for full web interface and MODBUS RTU for SCADA/PLC systems.

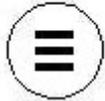
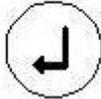
Features include:

- Multi-voltage 12 or 24VDC power input, low power operation and sleep modes.
- Operates with both J1939 Electronic ECU and Mechanical Engines using applicable wiring harness.
- Engine Throttle control via Torque/Speed Control (TSC1) for J1939 electronic engines or Mechanical engine Speed Control via a Linear Actuator .
- J1939 CAN data providing Active Codes, Stored Codes and Engine Configuration.
- Engine Fault History logging and display.
- Large Graphical display showing engine and pump information. A Icon status panel for specific real time information including telemetry status information.
- 11 x interface buttons for clear and easy control.
- Real Time Clock for 7 Day Timer function and adjustable 100 Hour Run Timer.
- Various analogue inputs for Fuel Level, Pump Temperature etc.
- Multiple Start / Stop methods, Single Dual Floats, Pressure, Suction and Level, GSM, MODBUS
- 4-20mA Primary 2 or 3 input for sensing for Flow or Pump Pressure with user definable low and high alarm set points , bypass and slush timers.
- 4-20mA Pump Suction Pressure inputs with adjustable engine shutdown set point, built in bypass and slush timers.
- 4-20mA secondary Pump Discharge Pressure with adjustable engine shutdown set point, built-in bypass and slush timers.
- 4-20mA Level Input for start / stop and target level functions.
- Vibration and Remote Speed 4-20mA inputs
- Remote Start/Stop ability using external switching device e.g. Water Float
- Programmed Relay outputs used to control ECU power/fuel stop solenoid, crank, glow , engine running and common alarm functions/
- Dedicated Flow Switch input with adjustable Bypass Timer, and Shutdown Types
- Up to 5 spare user definable digital inputs.
- 2 x Communication ports 1 x RS232 (GSM Modem, MODBUS and PC GUI interface) , 1 x RS485 MODBUS interface.
- Default profiles for mechanical and electronic engine parameters as well as on board back up for user specific parameters.
- Multi language—English and Chinese
- User programmable passwords.
- On board I/O diagnostic features to assist in sensor setup and operation.

Control Panel Layout



Keypad Description

Button	Description	Button	Description
<p>MENU</p> 	<p>The MENU button allows access to the menu structure. Pressing once while on the main screen enters the menu. Further presses cycle back through the various menus.</p>	<p>UP</p> 	<p>The UP button allows for scrolling through menu items and the increasing of various values. When the screen is in the main screen the engine speed is decreased when the throttle is enabled. This is signified on the keypad by the Rabbit Symbol.</p>
<p>ENTER</p> 	<p>At the default screen, pressing ENTER will cycle through the more engine and pump data and graphical gauge screens. When in the menu structure, pressing this button will enter a sub menu. This button is also used to confirm changes.</p>	<p>DOWN</p> 	<p>The DOWN button allows for scrolling through menu items and the decreasing of various values. When the screen is in the main screen the engine speed is decreased when the throttle is enabled. This is signified on the keypad by the Turtle Symbol.</p>
<p>AUTO</p> 	<p>The AUTO button will place the K37 into Automatic mode. The Status line will change from READY to AUTO. If a remote start condition exists the engine will go in the start sequence.</p>	<p>HALT</p> 	<p>Will shutdown the engine when the 7 Day Timer or Set Stop Timer is active. Pressing HALT again will start the engine again continuing the current 7 Day Timer or Set Stop Timer running cycle.</p>
<p>STOP</p> 	<p>The STOP button will stop the engine. The Engine Cooldown Timer will commence if throttling is enabled. Pressing STOP a 2nd time will bypass the cool down timer and stop immediately. It was also cause the controller to return to Manual Mode.</p>	<p>TIMER</p> 	<p>Enters the Set Timer menu where the 100hour run time, delay between starts and 7 day timers schedules are configured.</p>
<p>START</p> 	<p>The START button when in manual mode will initiate the engine start sequence. Once the engine has started the protections are in place for the engine and given sensors BUT throttling (if enabled) is done by the user using the UP and DOWN arrows.</p>	<p>WARNING</p> 	<p>Will Display any current ECU warnings that may be present. Pressing this button will also return the screen to the default screen. If the warning is still present the warning symbol will be present in the ICON bar.</p>
		<p>SOOT</p> 	<p>Button for Tier 4 emission engines. (Future Implementation) Pressing this button can cancel or force a diesel particulate regeneration sequence.</p>

Graphical LCD Layout

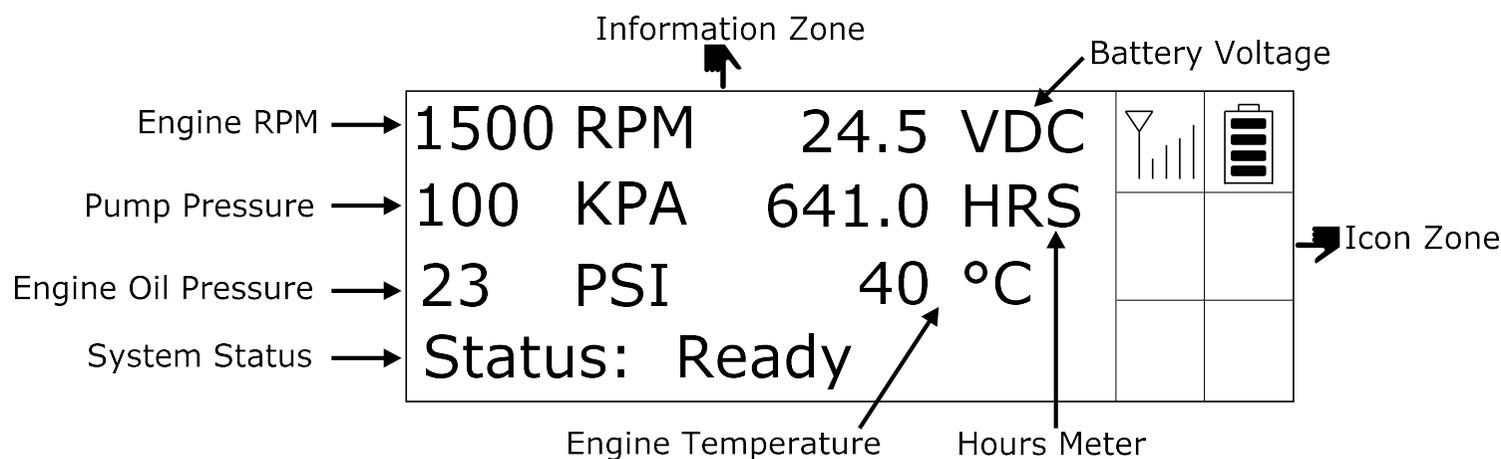
Main Screen

The main screen is divided into **Information** and **ICON** zones.

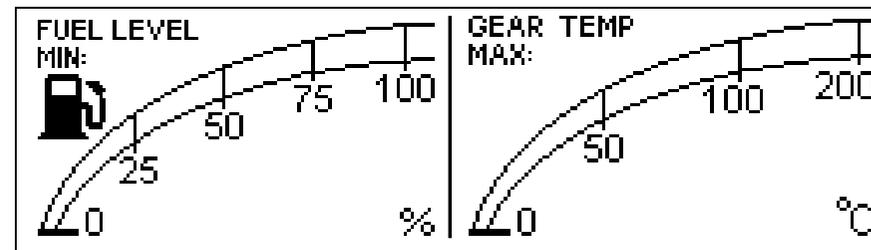
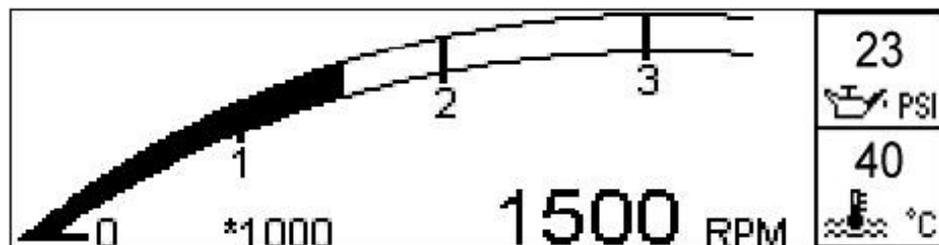
The **Information zone** shows the engine and sensors data (when active) and shows the current state of the controller.

The **ICON zone** shows if the GSM or MODBUS is active, battery, warning, pump and throttle status.

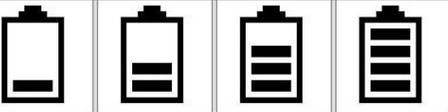
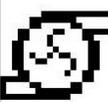
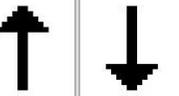
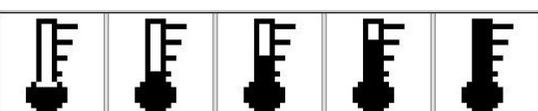
Pressing ENTER here will cycle through active items on the third line and then the gauge screens as the examples shown below.



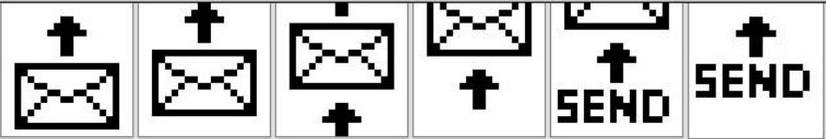
Gauge Screens



Graphical LCD ICON ZONE

 <p>Battery Status indication Low to High</p>  <p>After 10mins of engine operation if the battery does not appear to be charging. The charge fail ICON will be blinking.</p>	 <p>Flashing Padlock ICON when engine and pump are running within the Lockout Delay Period set in Engine Parameters.</p>
 <p>GSM modem or MODBUS GSM is enabled. ? - Denotes no connectivity to modem. Blinking means the controller is attempting to connect to the modem—this may happen for a 2min period. X - Denotes no connectivity to network carrier. Animated ICON—General Bars show the current signal strength.</p>	 <p>MODBUS communication port is enabled and the service is ready for communications.</p>
 <p>Animated ICON when MODBUS combination MODEM is enabled. Icon denotes that the MODBUS modem is communicating via Satellite. NO GSM is available at the time of transmission.</p>	 <p>Engine DATA is Derived from CAN J1939 BUS. Please note, if MODBUS and CAN are enabled together these symbols will appear in the one box.</p>
 <p>CAN J1939 ECU Warning symbol when an Active Warning code is present. Pressing the Warning button will reveal the code message active in the ECU.</p>	 <p>Animated Pump ICON when engine and pump are running.</p>
 <p>Arrows appear when engine is running and the throttle is engaged via the toggle switch or automatic operation. The RPM follows the arrow direction.</p>	 <p>Animated Temperature ICON when engine is running in Auto and the Warm up Timer is active. E.g. Status : Warm up 50</p>
 <p>Animated Hour Glass ICON when engine is running in Auto or Manual and the 100Hour run Timer has been enabled. The Stop time can be viewed by Pressing ENTER and the 3rd line will show the time left. e.g. Stop In : 01:02:45</p>	 <p>Animated Pump ICON when in Auto and Line Fill timer is active. The line fill timer is also shown in the Status Line E.g. Status : Line Fill 58</p>

Graphical LCD ICON ZONE

<p>The Maintenance Timer for the Engine has elapsed indicating a service is due. It will disappear when the timer is RESET or disabled.</p>	<p>The flow switch icon only appears when Flow Switch Input is triggered and slush period occurs.</p>
<p>The Maintenance Timer for the Pump has elapsed indicating a service is due. It will disappear when the timer is RESET or disabled.</p>	
<p>The Maintenance Timer for the Engine and Pump have elapsed indicating a service is due on both elements.</p>	
 <p>Animated ICON when the GSM Text messaging system is enabled and messages are being sent to the users set in User Settings →GSM.</p>	
<p>Appears when a GSM Text messaging system is enabled and a message is being received. Only messages from registered users will be processed and acted on by the controller.</p>	
<p>7 Day timer is Enabled and will appear when the panel is placed in AUTO mode. i.e. Status : Auto</p>	
<p>The Overload ICON only appears when the J1939 Engine Load value is greater than 90%. If the Load exceeds 95% ICON will begin to blink.</p>	

Main Menu Options

The K37 can be configured by accessing the menu items shown on the following LCD screen. Press  at any time to view the menu options.

Menu
>> 1. Set Timers
2. General Settings
3. User Settings

Menu
>> 4. View Diag Codes
5. System Info
6. Fault History

Menu
>> 7. Engine Config
8. LCD Contrast

Use   to choose the desired option.

Then press 

1. Set Timers	Set Stop Timer Up to 100 Hour engine run timer which can be used in Manual or Auto Mode.
	Delay Between Starts While in Auto, a timer that only allows a start after a preset time to avoid a cyclic start/stop incidence. This can be used in conjunction with the Set Stop Timer.
	7 Day Timer When in Auto, a scheduled user defined start/stop sequence can be entered everyday
	Set Date and Time Sets the controller Real Time Clock.
2. General Settings	Non password protected settings that the user alter—non critical settings.
3. User Settings	Password Protected Settings for authorised users only.
4. View Diag. Codes	Display CAN J1939 ECU Warning and Stop messages Currently active or previously active codes.
5. System Info	Display Serial Number, Build Date, Firmware Version , J1939 ECU Information, Board Temp and last shutdown messaging.
6. Fault History	View previous controller generated fault shutdown history or send via RS232 to a Personal Computer.
7. Engine Config.	CAN J1939 ECU Engine Configuration information—Read Only for Speed and Torque Settings.
8. LCD Contrast	Sets the Contrast of the LCD Display

1. Set Timers

The Set Timers menu covers three (3) different timers that can be activated by the user.

1.1 Set Stop Timer

The Stop Timer is configurable up to 100 hours when running in Auto or Manual. If this timer is set to e.g. 5hours 30mins after the engine is running the timer begins to count down. Once the timer has elapsed the engine will go into a normal shutdown with the resulting message being "Stop Timer". This is a useful feature such that the user can start the engine in manual and it will only run for a preset time unless no other stop condition exists.

When in Auto, e.g. starting on a float, it can also limit the run time unless the stop float is initiated. Which ever occurs first. The Timer can be adjusted before the engine starts and will count down on every start when enabled. It can also be adjusted while the engine is running and will begin the count down from the new time entered.

The stop timer can be viewed on the third line by pressing the ENTER button only while the engine is running.

During this time the animated hour glass icon will be present in the ICON ZONE.

Aborting or cancelling the timer can be done at any time by disabling the Timer function.

1500 RPM	24.5 VDC		
100 KPA	641.0 HRS		
Stop in -	04:07:10		
Status:	Ready		

- Menu
- >> 1. Set Timers
 - 2. General Settings
 - 3. User Settings

- Set Timer
- >> 1. Set Stop Timer
 - 2. Delay Btw Starts
 - 3. Set 7 Day Timer

1.2. Delay Btw Starts (Delay Between Starts)

The Delay between starts timer is used to ensure a **minimum off period** before the next start. When in **AUTO only**, if the timer is enabled and set to 1 hour, after a normal shutdown occurs the engine will not be able to be started even if a start condition is present within 5mins of the shutdown. This can help reduce the amount of cycle starts with in a given period e.g. 24hours. The Start In timer can be viewed on the third line of the LCD by pressing ENTER.

The "Start in" timer shows when the next allowable start can occur, if a start condition exists at the end of the countdown then the engine will start immediately. If no start condition exists at the end of the count down then it will remain in AUTO waiting for a start.

Aborting or cancelling the timer can be done at any time by disabling the function.

0 RPM	24.5 VDC		
	641.0 HRS		
Start In:	00:01:44		
Status:	Auto		

- Set Timer
- >> 1. Set Stop Timer
 - 2. Delay Btw Starts
 - 3. Set 7 Day Timer

Application Hint:

The Set Stop Timer and Delay Between Start timers can be used together when in Auto. If an application requires that the engine runs for 5 hours then stops for 6 hours and this is to be repeatedly all day every day. Setting the two timers for the required time and having the remote start input always active, can achieve this outcome. The remote start input can be activated or deactivated to start and stop this procedure. Usually the Set Start Type is set to Momentary in User Settings.

1.3 Set 7 Day Timer

The controller has an internal battery backed up clock which allows the user to set the controller to start and stop the engine based on time. The in built 7 day timer has two modes which you can choose an Everyday Scheduler or 7 Day Scheduler. When the mode has been chosen option 3 which change accordingly. Once entering the scheduler the item to be edited will be blinking. Simply use the Up and Down arrows to change the parameter to the desired value then press ENTER to jump to the next parameter to edit which will be blinking. The times are in 24hour mode i.e. 13:00 = 1:00pm

```

Set Schedule Timer
>> 1. Function Enable
    2. Mode
    3. Everyday Scheduler
    
```

```

Set Schedule Timer
>> 1. Function Enable
    2. Mode
    3. 7 Day Scheduler
    
```

Everyday Scheduler

The every day scheduler allows the user to set up to 6 starts and stops per day which will be the same for every day of the week. The times are in 15 minute intervals and once you enter a start time the stop time will automatically be a minimum of 15mins in front awaiting your response to enter the desired time.

E.g. If the operator wants the engine to run only twice a day from 11:00am to 5:00pm, then 8:00pm to 11:00pm everyday, 2 starts and stops is entered and this is done every day of the week.

The **Overnight** function can be set to YES if the engine needs to start at 11:00pm and stop at 3:00am the following morning .At the end of the last Start Stop a +1 will appear e.g. 2 23:00 to 03:00+1

```

Everyday Scheduler
Start /Stop per Day: 2          Overnight: No
Start   Stop                Start   Stop
1: 11:00 to 17:00           2: 20:00 to 23:00

Enter = Save                Up/Dn = Change
    
```

7 Day Scheduler

The seven day scheduler allows the user to set, up to 6 starts and stops per day, where each day can be individually programmed or not at all. For example Monday can be programmed for 2 starts, Wednesday can be programmed for 3 starts and Friday can be programmed for 1 start but with an overnight run. As per the Everyday Scheduler, the times are in 15 minute intervals and once you enter a start time the stop time will automatically be a minimum of 15mins in front awaiting your response to enter the desired time.

On entering the 7 day Scheduler the first item to be edited is "Day of Week" and will be blinking. Simply use the Up and Down arrows to scroll though each day of the week. Once you press ENTER at the Day of Week the next parameter to edited for that day will be the Start/Stop per Day which will be blinking and then change the value as required. Press ENTER the step through each parameter modifying the value as required.

At the Main RPM screen when the controller is set to Auto timer ICON will be set in the ICON zone and pressing ENTER will reveal the Next Start on the third line of the display. When the engine has started the third line will reveal the Next Stop time. E.g. **Next Start : 10:00 FRI** or when running **Next Stop : 12:30 FRI**

The Status line will show the current time and day when Next Start or Stop time is shown. E.g. **Status: 11:59 FRI**

Please Note: When using the 7 Day Timer please make sure the that in User Settings : Set Start Type is set to Momentary

```

7 Day Scheduler
Day of Week : MONDAY
Start/Stop per Day : 2          Overnight: No
Start   Stop                Start   Stop
1. 06:00 to 10:00           2. 14:00 to 17:00

Enter = Save                Up/Dn = Change
    
```

```

7 Day Scheduler
Day of Week : WEDNESDAY
Start/Stop per Day : 3          Overnight: No
Start   Stop                Start   Stop
1. 04:30 to 06:00           2. 10:15 to 13:45
3. 19:00 to 22:00

Enter = Save                Up/Dn = Change
    
```

```

7 Day Scheduler
Day of Week : FRIDAY
Start/Stop per Day : 1          Overnight: YES
Start   Stop                Start   Stop
1. 22:00 to 04:00+1

Enter = Save                Up/Dn = Change
    
```

1.4. Set Date and Time (RTC Settings)

The RTC (Real Time Clock) needs to be set for the 7 Day Timer function.
Enter into each menu item to set the Year, Month, Day, Day or Week, and time (in 24 hour mode.)

Example: In 1. Set Year the section in red below will be blinking.

```

RTC Settings
1. Set Year
Year  2000
Enter = Save  Up/Dn = Change
    
```

Using the  and  arrows change the year press 

Repeat the process for the Month, Day, Day of Week.

```

RTC Settings
>> 1. Set Year
    2. Set Month
    3. Set Day
    
```

```

RTC Settings
>> 4. Set Day of Week
    5. Set Time
    
```

To set the Time enter 5. Set Time

```

RTC Settings
5. Set Time
12:34
Enter = Save  Up/Dn = Change
    
```

The hours will be blinking use the  and  to change the hours and press 

The minutes will be blinking use the  and  to change the minutes and press  to save.

1.5. Purge Timers

The Purge Timer function is an additional feature to the Set Timer menu. This works in conjunction with the Alternate Speed function of Digital Input 3. Both must be setup to work correctly.

The Purge Timers is a virtual digital Input based on a continuous timed cycle event causing the Alternate Speed function to trigger based on an Interval and Purge time.

The Purge Timer and Digital Input 3 must be setup.

When running in **AUTO** mode only and "Enabled" the Engine will run at the nominated Engine Run Speed (found in the Engine Parameters) for the 2. **Interval Time**. e.g. 60mins. Once the 60mins has elapsed the Purge Time will virtual trigger the Alternate Speed function for the 3. **Purge Time**. e.g 20secs. and continue this cycle.

E.g. 60minutes Interval at 1800RPM , then 20seconds at the Alternate Speed (Digital Input 3) for 20secs, then back to 1800RPM for another 60mins - Repeated.

This can be altered during operation but will not come into effect until the next purge cycle or the engine is stopped and re-started.

Purge Timer Parameters

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Purge Timer	Disabled	Enabled Disabled	-	Enable or Disabled function. Must Enable and set Digital Input 3 to Alternate Speed
2	Interval Time	mins60:00secs	0 to 120mins	10secs	Time to Run at Engine Run Speed
3	Purge Time	Mins02:00secs	0 to 2mins	1sec	Time to Run at Alternate Speed set in digital input 3.

Example: Settings for Digital Input 3 to work with the Purge Timer

Item	Parameter	Default Value	Range	User Setting
1	Input Enable	Disabled	Enabled Disabled	Enabled
2	Input Type	Normally Closed	Normally Open Normally Closed	Normally Open
3	Bypass Time	mins0:20secs	00:00 to 20:00	mins0:20secs
4	Slush Time	3secs	0 to 60secs	mins0:03secs
5	Shutdown Type	Shutdown Latched	See Manual	Alternate Speed
6	Input Label	Aux Input 3	User Set	Not required
7	Alternate Speed	1200RPM	800 to 4000RPM	900RPM

Please note: the Hardwired Digital input 3 is still usable to instigate an Alternate Speed.

The Interval timer is not displayed in operation and will not show a countdown. However, when the Purge time is active and the engine is called to the Alternate Speed the Status Line will show the message Purge Timer with a count down timer.

Set Timer 1. Set Stop Timer 2. Delay Btw Starts 3. Set 7 Day Timer
Set Timer 4. Set Date and Time >> 5. Purge Timers
Purge Timers >> 1. Purge Timer 2. Interval Time 3. Purge Time

0900 RPM	14.1 VDC	MOD	
78 PSI	641.6 HRS	CAN	
Status: Purge Timers 55	88 'C		

2. General Settings

General settings is a non password protected area that allows a small subset of parameters to be changed. Please refer to Engine Parameter and Throttle parameters for the full list of setting if required. Target Pressure or Flow is dependant as to which Primary Sensor is to be used when the throttle type is set to go Variable. The menu will automatically change to suit which sensor is selected. These parameters can be changed while the engine is running but throttling will be paused during this operation.

Menu

1. Set Timers
- >> 2. General Settings
3. User Settings

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Engine Run Speed	1800RPM	600 to 4000 RPM	25RPM	Desired Speed of Engine at Load when in Auto and throttle type is GOTO FIXED RPM.
2	Line Fill Speed	1200RPM	800 to 2000RPM	25RPM	After the warm up timer has elapsed the engine (when in auto) will throttle to this speed according to the adjustable Line Fill Time set to fill irrigation lines.
3	Line Fill Time	mins2:00secs	0 to mins20:00secs	10sec	After the warm up timer has elapsed the engine (when in auto) will throttle to Line Fill Speed according to the adjustable time set to fill irrigation lines.
4	MaxRPM @ Variable	1800RPM	900 to 4000RPM	25RPM	Indicates how high the engine RPM will throttle to if target value is not being achieved, when throttling with respect to pressure or flow.
5	MinRPM @ Variable	1000RPM	900 to 4000RPM	25RPM	Indicates how low the engine RPM will throttle to if Pump Pressure/flow is over target value, when throttling with respect to pressure or flow.
6	Target Pressure or Flow	500KPA 10L/S	0 to Sensor Range	10KPA 5L/S	The target Pressure or flow rate to be achieved, when GO Variable is selected as the Throttle Type.
7	Pressure Dead band Flow Dead band	20KPA 20L/S	10 to 200KPA 10 to 100L/S	10KPA 5L/S	When the engine speed is changing the throttle will cease to alter once the actual pressure or flow is within +/- the dead zone value of the target Pressure or Flow.

3. User Settings

The User Settings Menu is password protected and should only be accessed by qualified and authorized users.

The password is a string of 4 numbers. Upon entering this menu, the first number shown in red below will be blinking. Use the Up and Down arrows to change the individual numbers and press ENTER to progress to the next number.

Once the password entry is complete you will be able to enter individual user settings items described in detail in the following sections.

Enter Password
00 00 00 00

Menu
1. Set Timers
2. General Settings
>> 3. User Settings

These settings will define how the system will operate and care must be taken when changing settings as incorrect values may cause undesirable results. In the following sections each parameter is listed and a functional description is given. Please read these descriptions before making any changes to the settings.

Editing User Settings from the Keypad

To make changes to the settings please do the following.

The example below is changing the Engine RUN Speed in Engine Parameters.

User Settings
 1. Profile
 >> 2. Engine
 3. Throttle

When in **User Settings** use the  and  buttons to move >> to **2. Engine** then press 

Engine Parameters
 >> 1. Engine Run Speed
 2. Speed Source
 3. Flywheel Teeth

Use the  and  buttons to move >> and choose **1. Engine Run Speed** then press 

Engine Parameters
 1. Engine Run Speed
 1800 RPM
 Enter=Save Up/Dn=Change

The engine speed variable shown will now be blinking.

Use  the  and button to change the number to the desired value, then press 

It will show **Setting Confirmed** and an audible beep should be heard.

Please note:

When working within any part of the menu system, if any button has not been pressed for 60 seconds the screen will automatically return to the main RPM screen.

Once you have entered the password you can repeatedly enter the User Settings, however If the controller has entered sleep mode or is powered down you will be required to enter the password again to enter User Settings.

3.1 Profile Settings

- Profile Setting
 >> 1. Load Profile
 2. Save Profile

A profile forms the basis of an engine and pump parameter setup. The panel has default settings or profiles for an electronic or mechanical engine with or without throttling capability.

Default profiles are standard setups which covers the most basic engine parameters but may still require some key settings to be changed such as speed source and flywheel teeth or pulses/rev. Generally additional sensors such as fuel level and pump pressure are turned off to allow an engine to run.

Active profile. When users make changes to the settings these directly affect current operation and are usually engine/pump and site specific. Once you are happy with the active setup you can save this to an Onboard Backup as a baseline for the commissioned engine and pump or generator.

Onboard Backup. The on board backup has no effect on the active operation but is useful to save a working profile in case a user makes temporary changes. The on board back up can be retrieved at any time and copied to the Active settings .

Menu	Option	Description
1. Load Profile	1.Default ECU	Basic setup for CAN J1939 ECU Engines with Throttling Enabled for Go To Fixed Speed operation when in Auto.
	2. Default MECH	Basic setup for Mechanical engines with no throttling. Speed Source is set to Alternator and tachometer calibration is a default setting.
	3. Default MECH + GOV	Basic setup for Mechanical Engines with Throttling Enabled for Go To Fixed Speed operation when in Auto. Basic Actuator setup has been provided.
	4. Onboard Backup	Load from a previously backed up active profile stored on the controller.
	5. RS232	Loads the settings or profile from a personal computer which has a program. The Connection is with a cable connected to the RS232 ports of the controller and personal computer.
2. Save Profile	1. On Backup	Known working settings can be saved to the on board backup as a safety net in case temporary changes are made
	2. TO RS232	Saves the settings or profile to a personal computer which has a settings program. The Connection is with a cable connected to the RS232 ports of the controller and personal computer.

3.2 Engine Parameters

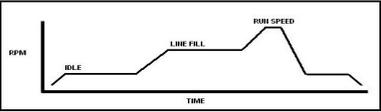
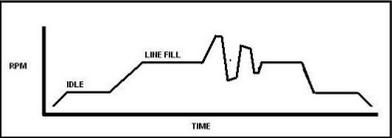
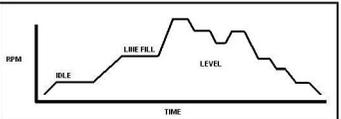
Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Engine Run Speed	1800RPM	600 to 4000 RPM	25RPM	Desired Speed of Engine at Load when in Auto and throttle type is GOTO FIXED RPM.
2	Speed Source	Alternator	J1939, ALT, MPU.	-	RPM Speed source from J1939 ECU, Alternator, Magnetic Pickup (NO FILTER)
3	Flywheel Teeth	120 Teeth	60 to 190 Teeth	1 tooth	Number of Teeth on the Flywheel when MPU is selected as the speed source for a Mechanical Engine.
4	Pulses Per REV	10.50	2.00 to 25.00	0.02	Number of Pulses from an Alternator for 1 revolution when the Alternator is the speed source on a Mechanical Engine.
5	Underspeed	650RPM	550 to 2000RPM	25RPM	Engine Overload, slow speed protection with a Slush Delay of 5 secs.
6	Overspeed	1950RPM	1000 to 4000 RPM	25RPM	Engine/Pump high speed protection with a slush delay of 5 secs.
7	Start Speed (Crank Disconnect)	600RPM	400 to 2000RPM	25RPM	On a start of the engine when the engine speed rises above this value a crank disconnect will occur.
8	Lockout Delay	30secs	20 to 60secs	1sec	Digital and Analogue sensor shutdown bypass timer upon engine start up.
9	Crank Time	10secs	5 to 20secs	1sec	The maximum time the engine will crank on a start attempt.
10	Crank Rest Time (and Shutdown :Stabilization time)	10secs	5 to 60secs	1sec	Allows the engine to rest for a specific time after an unsuccessful start attempt before a crank retry. This value also acts as the Shut down stabilize time at an engine stop. Increasing this value keeps the ignition off for longer.
11	Crank Attempts	3	3 to 10	1sec	Maximum crank attempts allowed before a failed to start is registered.
12	Glow Time	3secs	0 to 20secs	1sec	Time to energise the glow plug(s) before cranking the engine as an aid in cold temperatures.
13	Warm Up Time	mins00:00secs	00:00 to 20:00	10secs	Allows the engine to warm up at idle prior to throttling to the specified RUN Speed.
14	Cooldown Time	mins00:00secs	00:00 to 20:00	10secs	Allows the Engine to return to idle for a set period before shutting down. The cool down timer may not begin until the RPM is within 50rpm of the set IDLE.
15	Engine Temp. Alarm	105°C	0 to 215°C, Disabled	1°C	If the coolant temperature rises above this value the panel will shutdown the engine. This can be Disabled and set to READ only. (Does not affect ECU protections.)
16	Read Engine Temp.	Mechanical Sender	Mech or J1939 or Dig	-	The source can be Mechanical Sender or J1939 even if the Speed Source is J1939.
17	Eng OilPrs. Alarm	20PSI	0 to 144PSI, Disabled	1PSI	If the engine pressure drops below this value the panel will shutdown the engine. This can be Disabled and set to READ only. (Does not affect ECU protections.)
18	Read Oil Prs.	Mechanical Sender	Mech or J1939 or Dig	-	The source can be Mechanical Sender or J1939 even if the Speed Source is J1939.
19	Coolant Level	Disabled	Enabled/Disabled	-	This is the panel Coolant Level probe input usually used for Mechanical engines or Electronic ECU engines with an additional probe connected to the panel. (This does not effect a J1939 ECU Coolant level probe.)
20	Crank Assist.	0counts	0 to 150Counts	1count	Ignores erroneous values from the ECU, ALT or MPU for a set period.
21	Read Engine Hours From	J1939 ECU	J1939 ECU, Read From Panel	-	Display the Engine Hours read from ECU or display the controller recorded Engine Hours.

3.3 Throttle Parameters



Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Throttle Type	Disabled	GOTO Fixed RPM, Go Variable 1, Toggle Switch Multi-Dam Level, MODBUS Control, Go Variable 2, Remote 4-20mA	-	Enabled Throttle Control for J1939 Engines or Mechanical Engines with a Throttle Actuator. There are a number of different throttle modes the engine can be set and will be described in detail in the following section. Note: Remote 4-20mA Input uses the Dam Level Input on Hardware Versions 1.41 and below. Hardware V1.50+ has a unique input, see schematic, Range is idle(4mA) to Overspeed (20mA)
2	Actuator Type	Linear	Linear, Proportional, Digital Output and J1939ECU	-	Linear Actuator moves with respect to a PWM Signal (frequency and Direction). Proportional Actuator moves with respect to an electrical input signal. (Requires a GAC Module fitted to the Controller). Digital output will trigger FET outputs. J1939 ECU is to use TSC
3	Engine Idle	800RPM	Auto detect,600 to 1200RPM	5RPM	Throttle Controlled Engine can have a panel set IDLE point. Please note: the IDLE point set in the panel cannot be lower than the IDLE set in the ECU or mechanical governor.
4	Line Fill Speed	1200RPM	800 to 2000RPM	25RPM	After the warm up timer has elapsed, the engine (when in auto) will throttle to this speed for the adjustable Line Fill Time set to fill irrigation lines.
5	Line Fill Time	mins2:00secs	0 to mins20:00secs	10sec	After the warm up timer has elapsed the engine (when in auto) will throttle to Line Fill Speed for the adjustable time set to fill irrigation lines.
6	Max RPM @ Variable	1800RPM	900 to 4000RPM	25RPM	Indicates how high the engine RPM will throttle to if target value is not being achieved, when throttling with respect to pressure or flow.
7	Min RPM @ Variable	1000RPM	900 to 4000RPM	25RPM	Indicates how low the engine RPM will throttle to if Pump Pressure/flow is over target value, when throttling with respect to pressure or flow.
8	RPM Dead Zone	20RPM	10 to 200RPM	5RPM	When the engine speed is changing the throttle will cease to alter once the real time speed is within +/- the RPM dead zone of the target RPM
9	Target Pressure/Flow	500KPA 10L/S	0 to Sensor Range	10KPA 5L/S	The target Pressure or flow rate to be achieved, when GO Variable is selected as the Throttle Type.
10	Pressure/Flow Dead band	20KPA 20L/S	10 to 200KPA 10 to 100L/S	10KPA 5L/S	When the engine speed is changing the throttle will cease to alter once the real pressure or flow is within +/- the dead zone value of the target Pressure or Flow.
11	J1939 INC SPEED LINEAR INC SPEED	40RPM 40%	10 to 250RPM 10 to 100%	10RPM 1%	When throttling to idle, line fill speed, fixed speed or max/min RPM this defines the incremental rate at which the throttle will increase.
12	J1939 DEC SPEED LINEAR DEC SPEED	40RPM 40%	10 to 250RPM 10 to 100%	10RPM 1%	When throttling to idle, line fill speed, fixed speed or max/min RPM this defines the incremental rate at which the throttle will decrease.
13	FEEDBACK DELAY	0.2sec	0.2 to 4Sec	0.1sec	When throttling to idle, line fill speed, fixed speed or max/min RPM this defines the delay between throttling steps to allow the pump or generator system to respond. It is recommended that the feedback delay for mechanical engines is greater than 1sec.
14	Ramp Rate RPM/SEC	100RPM/SEC	10 to 600RPM/SEC	10RPM	Electronic engine - The J1939 TSC will respond to the ramp/rate specified. Mechanical engine - This value entered is an estimation of how quickly we believe the Throttle is running. Increasing this number will dynamically calculate and increase the RPM dead Zone (item 7) when in Auto. We do this to stop hunting. If the arm on the pivot of the throttle body is long we can decrease this number but if it is short then increasing this number better reflects the ramp/rate.
15	Stagnant Time (LOW)	0mins	0 to 20mins	1min	GO Variable only - Begins timing when Pressure or Flow is at Min RPM @ VARIABLE and will shut the engine down, restart the engine to try and meet the pressure or flow.
16	Stagnant Time (HIGH)	0mins	0 to 20mins	1min	GO Variable only - Begins timing when Pressure or Flow is at MAX RPM @ VARIABLE and will shut the engine down, restart the engine to try and meet the pressure or flow.
17	System Retries	3	0 to 20 retries	1	Go Variable only - If the system has shutdown on the stagnant time it will attempt restarts for the Retries set before a latched shutdown

3.3.1 Throttle Type - Method of Operation

Throttle Type	Description of Operation
<p>Go to FIXED RPM</p> 	<p>Manual Mode: The RPM will not throttle unless the UP or DOWN keypad buttons used. The maximum RPM allowed is governed by the over speed set point in Engine Parameters.</p> <p>Auto Mode: On an engine start in Auto mode the throttle is governed by the Ramp/Rate set in throttle parameters. It will remain at IDLE for the Warm UP period, throttle to the Line Fill RPM if a time is set then proceed to run to the Engine RUN Speed set in Engine Parameters. On an engine stop signal the RPM will return to idle for the cool down period then shutdown.</p>
<p>Go Variable</p> 	<p>Manual Mode: The RPM will not throttle unless the UP or DOWN keypad buttons used. The maximum RPM allowed is governed by the over speed set point in Engine Parameters.</p> <p>Auto Mode: On an engine start in Auto mode the throttle is governed by the Ramp/Rate set in throttle parameters. It will remain at IDLE for the Warm UP period, throttle to the Line Fill RPM if a time is set then proceed to throttle with respect to Pressure or Flow to meet the target as set in Throttle parameters. 4-20mA Sensor will need to be enabled otherwise Set 4-20mA will appear on the Main RPM Screen below the tachometer.</p> <p>When the actual value is below the target then the engine will increase to the Max RPM @ Variable limit.</p> <p>If the Stagnant High Timer is enabled and the RPM remains at Max RPM @Variable limit, the timer will count down. Once elapsed it will cause a shutdown.</p> <p>When the actual value is above the target then the engine will decrease to the Min RPM @ Variable limit.</p> <p>If the Stagnant LOW Timer is enabled and the RPM remains at Min RPM @Variable limit, the timer will count down. Once elapsed it will cause a shutdown.</p> <p>On a stagnant timer shutdown event, if the system retries count has not been exceeded the engine will automatically restart and attempt to achieve its target, otherwise it will remain as a Stagnant Timer shutdown.</p> <p>On an engine stop signal the RPM will return to idle for the cool down period then shutdown.</p>
<p>Toggle Switch (Keypad)</p>	<p>Auto or Manual Mode: The RPM will not throttle unless the UP or DOWN keypad buttons used. The maximum RPM allowed is governed by the over speed set point in Engine Parameters.</p>
<p>Multi Dam Level</p> 	<p>Manual Mode: The RPM will not throttle unless the UP or DOWN keypad buttons used. The maximum RPM allowed is governed by the over speed set point in Engine Parameters.</p> <p>Auto Mode: On an engine start in Auto mode the throttle is governed by the Ramp/Rate set in throttle parameters. It will remain at IDLE for the Warm UP period, throttle to the Line Fill RPM if a time is set then proceed to run to the Speed as set in the DAM LEVEL parameter Level Points 1 to 5. Each Level (in mm) point has an associated speed to which the engine will be asked to run to. As each level point is crossed the target run speed is changed to the associated speed set. This is done with respect to the DIRECTION i.e. EMPTY or FILL application.</p> <p>On an engine stop signal the RPM will return to idle for the cool down period then shutdown.</p>
<p>MODBUS Control</p>	<p>Manual Mode: The RPM will not throttle unless the UP or DOWN keypad buttons used. The maximum RPM allowed is governed by the over speed set point in Engine Parameters.</p> <p>Auto Mode: : On an engine start in Auto mode the throttle is governed by the Ramp/Rate set in throttle parameters. It will remain at IDLE for the Warm UP period, throttle to the Line Fill RPM if a time is set then proceed to run to the Engine RUN Speed. If a remote command is received via MODBUS register 40048 and is within the IDLE to OVERSPEED range the, engine will throttle to the speed indicated by this register. On an engine stop signal the RPM will return to idle for the cool down period then shutdown.</p>

3.4 4-20mA Sensors

- 4-20mA Sensor Setting
>> 1. Flow Sensor
2. Pressure Sensor
3. Sensor Type

The 4-20mA Sensor is the primary pressure or flow sensor input and will be displayed on the main RPM Screen. The GO Variable option in Throttle Parameters uses this input when the engine RPM varies with respect to pressure or flow. If the throttle type is set to GO Variable and no primary pressure or flow sensor has been enabled—SET 4-20mA will appear just below the tachometer, indicating that the sensor needs to be activated for pressure or flow control. **The K37 supports a 2 wire (loop powered device) or 3 wire 4-20mA Sensor. This is selectable in the Sensor Type menu option. Refer to the user manual of your device before setting the Sensor Type option.**

3.4.1 Flow Sensor (4-20mA)

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Sender Function	Disabled	Enabled/Disabled	-	Enables or disables the 4-20mA Flow as the primary sensor.
2	Sender Range 4-20mA	300L/S	0 to 1000L/S	5L/S	The range or scale of the Flow sensor i.e. 4mA = 0 L/S , 20mA = 300 L/S
3	Set Min. Flow	75L/S	0 to Sensor Range	5L/S	Low flow value alarm point to which the controller will then shutdown the engine when monitoring and the slush period has elapsed.
4	Set Max. Flow	245L/S	0 to Sensor Range	5L/S	High flow value alarm point to which the controller will then shutdown the engine.
5	Flow Bypass Time	3mins	0 to 60mins	1min	Duration of time, only at engine start up to which the low alarm point is not monitored. (High Flow is not bound by this timer and is monitored immediately at start up.)
6	Flow Slush Time	10secs	10 to 60secs	1secs	When the live value falls below or rises above the nominated alarm points, a timer activates and the condition must remain for the full slush time set before a shutdown is triggered.
7	Calibration	50 Counts	0 to 100Counts	1count	A calibration option to zero the value read by the controller when at 4mA
8	Latched Shutdown	Disabled	Enabled/Disabled	-	The controller can be set to a Normal or Fault shutdown. A normal shutdown will allow another start when in Auto. A fault or Latched shutdown requires the controller to be reset before it can be used again.

3.4.2 Pressure Sensor (4-20mA)

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Sender Function	Disabled	Disabled, Enabled Enabled With Start_Stop	-	Disable or Enabled pressure sensor input as Primary Sensor. Enabled with Start_Stop allows the controller to start and stop the engine based in a static line pressure input when in Auto.
2	Sender Range 4-20mA	1000KPA	0 to 3200KPA	10KPA	The range or scale of the Flow sensor i.e. 4mA = 0KPA , 20mA = 1000KPA
3	Set Min. Pressure	200KPA	0 to Max Pressure	10KPA	Low pressure or loss of prime value alarm point to which the controller will then shutdown the engine when monitoring and the slush time has elapsed.
4	Set Max Pressure	800KPA	Min Pressure to Sender Range	10KPA	High or Over pressure value alarm point to which the controller will then shutdown the engine.
5	Pump Prs. Bypass	3mins	0 to 60mins	1min	Duration of time, only at engine start up to which the low alarm point is not monitored. (High pressure is not bound by this timer and is monitored immediately at start up.)
6	Pump Prs. Slush	10secs	10 to 60secs	1secs	When the live value falls below or rises above the nominated alarm points, a timer activates and the condition must remain for the full slush time set before a shutdown is triggered.
7	Calibration	50Counts	0 to 100counts	1count	A calibration option to zero the value read by the controller when at 4mA. Modifying this value will increase or decrease the live value to zero the sensor at 4mA.
8	Start Option	Start Low Stop High	Start Low Stop High Start High Stop Low	-	When the sender function is "Enabled with Start_Stop" when in Auto the engine can be made to start on a low or drop in pressure and stop on a rise or high pressure and vice versa. Usually the start and stop parameters is set within the Min and Max Pressure alarm points.
9	Start Pressure	300KPA	Min pressure to Max Pressure	10KPA	4-20mA Pressure value to which the engine will start.
10	Stop Pressure	700KPA	Min Pressure to Max Pressure	10KPA	4-20mA Pressure value to which the engine will stop.

Sender Function :Enabled with Start_Stop.

When starting and stopping the engine based on line pressure a clear understanding of the application is required and some simple questions need to be answered before you begin.

1. What is my line pressure when the engine is not running ? i.e. is the line statically charged or at atmosphere?
2. What is my nominal line pressure when the engine is running?
3. What pressure is required to start the engine?
4. What pressure is required to stop the engine?

The following is an example of how this function can be used.

Example: Starting on a drop of pressure and stopping on over pressure.

The following example is only representative of an actual system, please refer to the specifications of your engine, pump and lines for your specific requirements.

A statically charged line with the engine not running has a constant charged pressure of approx. 350KPA. A valve or outlet is opened 1km away from the pump and the pressure in the line pressure begins to fall as the water flows. Once the pressure drops below 200KPA the engine /pump is expected start and run at a fixed speed of 1500RPM to which the line pressure is nominally about 500KPA. After running for a period of time the outlet valve is closed. The line pressure while running rises above 600KPA to which the user wants the engine to stop. The pipe work is rated to 800KPA of max pressure. A loss of prime condition is when the engine is running and the pressure is below 100KPA. The sensor used is a 4-20mA 10bar (1000KPA) device.

Below is an example settings list for the 4-20mA Pump Pressure sensor.

Item	Parameter	Set Value	Functional Outcome
1	Sender Function	Enabled with Start_Stop	The Engine will start on low and stop based on pressure. Please note: Set Start Type must be set to MOMENTARY in Start Types.
2	Sender Range 4-20mA	1000KPA	The Sender used is 10bar (1000KPA)
3	Set Min. Pressure	100KPA	Low pressure or loss of prime value alarm point to which the controller will then shutdown the engine as a fault.
4	Set Max Pressure	750KPA	High or Over pressure value alarm point to which the controller will then shutdown the engine as a fault.
5	Pump Prs. Bypass	3mins	The loss of prime or low pressure will be ignored for the first 3mins of operation.
6	Pump Prs. Slush	10secs	Low / High/ start and stop pressure slush times
7	Calibration	50Counts	No calibration required for this example.
8	Start Option	Start Low Stop High	When the live pressure drops below the start pressure and the slush has elapsed the engine will start, when live pressure rises above the stop pressure the engine will stop.
9	Start Pressure	200KPA	4-20mA Pressure value to which the engine will start.
10	Stop Pressure	600KPA	4-20mA Pressure value to which the engine will stop.

Please consider the values when choosing your start and stop and low and high pressure alarm points.

It is preferred that the start and low pressure , stop and high pressure values are not too close as surges or pulses may trigger an undesired shutdown.

The type of engine and pump also plays a part in the way the system operates i.e. Engine Throttle control, pump type if clutches are used etc.

3.5 Fuel Level

- Fuel Level Setup
 >> 1. Fuel Alarm Point
 2. Alarm Action
 3. Fuel Sender Type

The K37 supports a number of different fuel senders that are resistive in nature in tubular or “float or arm type” formats. Generally senders from VDO or WEMA are supported but sender with same resistance ranges can be used. Please note that when choosing a fuel level sensor depends of the DEPTH of the tank and the type of mounting system.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Fuel Alarm Point	Disabled	Disabled to 100%	1%	Setting a value here will enable the sensor. Pressing enter at the main screen will reveal a small bar graph with a percentage or a full gauge in the gauge screens
2	Alarm Action	Warning	Warning, Shutdown	-	The alarm action can be set to warning, to which a screen prompt only indicating a low fuel level which be shown, Setting this shutdown which will cause the controller to shutdown the engine with a fault condition.
3	Fuel sender Type	Tubular	Tubular, Float-I, Generic 240-30ohm, Float-II	-	Tubular sensors: Resistance 82-78ohm to 2-3ohm (EMPTY to FULL) Float-I Type Resistance 10 to 180ohm or 0 to 190ohm (EMPTY to FULL) Generic 240-20ohm Resistance 240 to 30ohm (EMPTY to FULL) Float-II Type Resistance 315 to 7ohm (EMPTY to FULL)
4	Output Control	Start 15% Stop 70%	OFF, 1 to 99%	1%	Fuel Level value to which the Fuel Output Control will start or stop respectively. When set to OFF the Output will only be based on the Fuel Alarm Point. When set to a value the controlled output will be based on the start and stop percentage. Please note: On a Fuel Level Sensor error the controlled output will be switched OFF such that the fuel pump connected will not run. The Alarm point error will only be shown on the LCD screen based on a Warning or Shutdown.
5	Fuel Calibration	82Count	10 to 254Counts	1count	Only appears when the sender type is Tubular. The tank can be empty and the calibration can zero the reading on the screen.

3.6 Gear Box Temp

Gear Box Temp
>> 1. Gear Box Temp Alarm
2. Gear Box Temp Point

A temperature sensor can be added to a gearbox or transmission that may be installed between the engine and driven equipment to monitor oil temperature. If the gear box temperature rises above nominated temperature, the controller will shut the engine down.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Gear Box Temp Alarm	Disabled	Enabled, Disabled	-	Enables and Disable the sensor input. Bypass Timer is governed by the Lockout Delay in Engine Parameter.
2	Gear Box Temp point	40°C	0 to 145°C	1°C	The temperature point that the engine will be shutdown.

3.7 Pump Temperature

Pump Temp. Param.
>> 1. Pump Temp. Alarm
2. Pump Temp. Point

A temperature sensor can be added to a pump volute or bearings to monitor temperature. If the pump temperature rises above nominated , the controller will shut the engine down. Pump Temperature will not be available if the "Read Oil Pressure." in Engine Parameter is set to mechanical sender Murphy Resistive or Deutz Resistive.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Pump Temp. Alarm	Disabled	Enabled, Disabled, HYD OIL	-	Enables and Disable the sensor input. Bypass Timer is governed by the Lockout Delay in Engine Parameter. HYD OIL allows the user to use the alternate oil temp calibration sensor.
2	Pump Temp Set point	40°C	0 to 145°C	1°C	The temperature point that the engine will be shutdown.

3.8 Flow Switch

Flow Switch Param.
>> 1. Flow Switch Bypass
2. Flow Slush Time
3. Flow Switch Type

Flow Switch Param.
4. Shutdown Type
5. Input Type
6. Latched Shutdown

The flow switch input is a simple digital input where the bypass timers, slush timer are user adjustable from the panel. A basic paddle or trailing wire flow switch can be used and **does not** need to be a powered device which requires any external timers. When allocating a bypass time in the settings, take in account, warm up at idle, line fill time etc such that you give enough time to achieve flow. The input can support normally open or normally closed wired inputs from the flow switch. Some ultrasonic devices used as flow/no flow may have a switched positive (Active) or switch negative (Passive) output. The K37 can accept either input and is selectable in the Input Type menu option. Please note that these are physically different inputs and a wiring modification may be required.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Flow Switch Bypass	Disabled	Disabled, 1 to 20mins	1min	Entering a Bypass time upon start up will enable the function.
2	Flow Slush Time	10secs	10 to 300secs	1sec	When the switch is in the no flow position, a timer activates and the condition must remain for the full slush time set before a shutdown is triggered.
3	Flow Switch Type	Normally Open	Normally Open Normally Closed	-	Normally Open : The flow switch closes when NO FLOW Normally Closed : The flow switch opens when NO FLOW (usually wired and set in this mode for failsafe operation)
4	Shutdown Type	Immediate	Immediate, Controlled	-	Immediate i.e. no cool down on engines with no throttle control. Controlled i.e. return to idle for the cool down period before shutdown.
5	Input Type	Active	Active, Passive	-	Active : The common/output of the flow switch is Batt+ and should be wired to Terminal 29 of the K37. Passive : The common/output of the flow switch is Batt- and should be wired to Terminal 26 of the K37
6	Latched Shutdown	Shutdown Latched	Shutdown Latched Shutdown NON Latched	-	Shutdown Latched is recorded as a fault and the controller requires a RESET. Shutdown NON Latched is a normal shutdown and will allow a restart when in Auto mode.

3.9 Suction Parameters

- User Settings

 - 7. Pump Temperature
 - 8. Flow Switch
 - >> 9. Suction 4-20mA

A 4-20mA sensor can be added, before the inlet of a pump to monitor a suction (or vacuum) condition and shut the engine down. The same sensor can be used to Start and Stop the engine when in Auto mode when the suction sensor see a rise in pressure in the line. This condition can occur if there are **2 or more pumps in series**, this may also be called **staged** pumping. i.e. the outlet of pump 1 feeds the inlet of pump 2 which may be 500m away. Pump 1 is running and feeding water in to the lines and at pump 2 the inlet pressure rises above the nominated start pressure. Pump 2 starts and runs its automatic procedure to transfer the water. If pump 1 stops, the pressure in the inlet side of pump 2 drops and a suction condition eventuates causing a value greater than the suction stop to shut down the engine. Please note: The respective elevation of the two pumps and any non-returned valves that may be in the lines between the pumps must be taken into consideration when using this feature. It is suggested that pumps running in this mode are set to GO TO FIXED RPM in Throttle Parameters.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Sender Function	Disabled	Disabled, Enabled Enabled with Start_Stop	-	Disables or Enables the 4-20mA Suction Sensor function. Enabled with Start_Stop allows the sensor, when in Auto, to start and stop the engine based on a rise of pressure to start and a suction condition to stop. Please note: Set Start Type must be set to MOMENTARY in Start Types.
2	Sender Range 4-20mA	-100 to 600KPA	-500 to 3200KPA	10KPA	The range or scale of the suction sensor i.e. 4mA = -100KPA , 20mA = 600KPA
3	Suction Alarm (High) Suction Alarm (Low)	5KPA Disabled	-500 to -5 KPA -50 to -1 KPA	5KPA 1KPA	High and Low Suction alarm points to which the controller will then shutdown the engine when monitoring and the slush period has elapsed.
4	Suction Bypass	3mins	0 to 60mins	1min	Duration of time, only at engine start up to which the suction alarm point is not monitored.
5	Suction Slush	30secs	0 to 60secs	1sec	When the live value falls below the nominated alarm point, a timer activates and the condition must remain for the full slush time set before a shutdown is triggered.
6	Invert Output	Disabled	Disabled, Enabled	-	This function is enabled if the scale of the sensor is in reserve. E.g. Normal Scaling 4mA = -100 KPA, 20mA = 0 KPA Inverted Scaling 4mA = 0 KPA, 20mA = -100 KPA
7	Calibration	0 offset	-120 to 120 counts	1count	Allows the sensor to be digitally set to Zero when the sensor is at 0 pressure or atmosphere.
8	Suction Start	100KPA	0 to 3200KPA	10KPA	4-20mA Pressure positive pressure value to which the engine will start.
9	Suction Stop	-50 KPA	-500 to 0KPA	10KPA	4-20mA Pressure suction value to which the engine will stop.

Please Note: Suction Alarm Low can not be used with **Sender Function** as 'Enabled with Start Stop'.

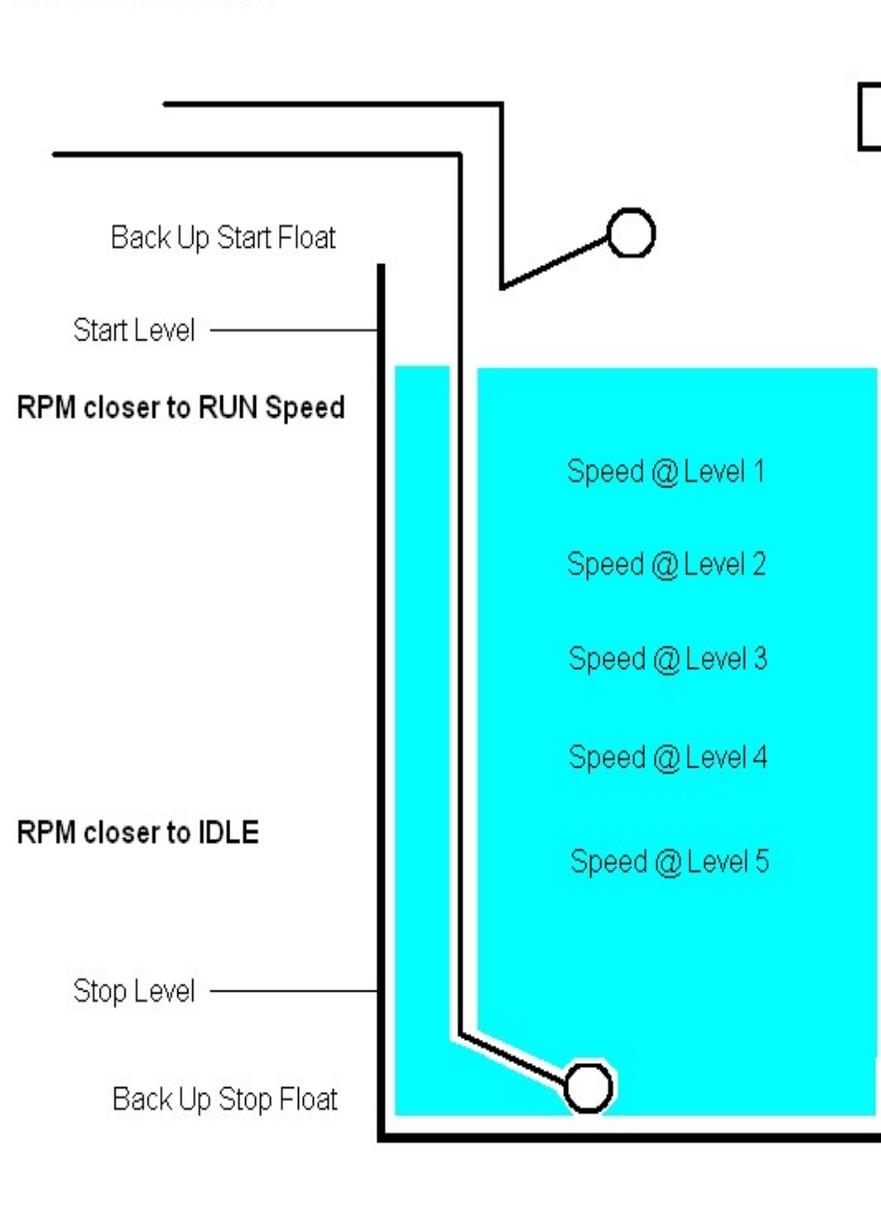
3.10 Dam Level

User Settings
 >> 10. Dam Level
 11. Discharge Pressure
 12. Digital Inputs

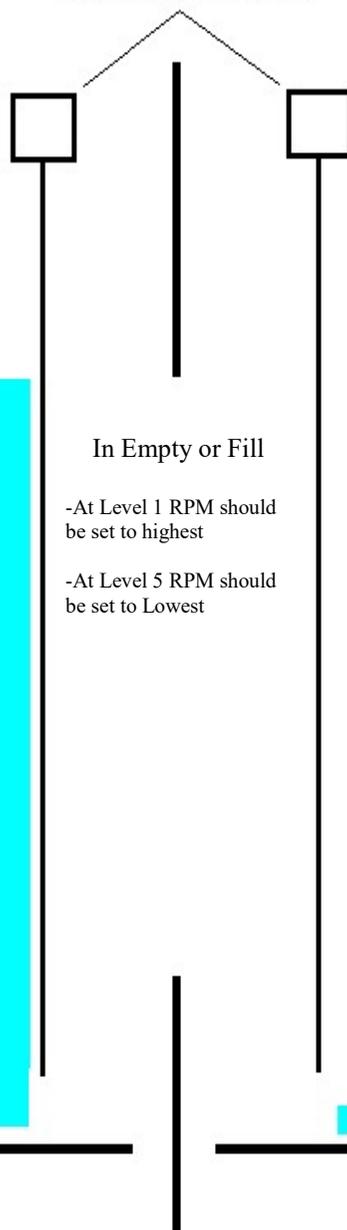
4-20mA Dam Level, also known as Sump Level, has two functions. It can be used to start and stop the engine when in Auto and it can be used to change the speed of the engine at various different level points when the Throttle Type is set to :Multi Dam Level". Irrespective of direction i.e. fill or empty application the closer you are to your stop point the slower the engine will need to be running, the further away you are from your stop point the faster the engine will be running. At each level point an engine run speed can be defined. Speed changes are

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Sender Function	Disabled	Disabled, Enabled	-	Disables or Enables the 4-20mA Dam Level function.
2	Sender Range 4-20mA	8000mm	0 to 10000mm	50mm	The range or scale of the level sensor i.e. 4mA = 0mm, 20mA = 8000mm
3	Direction	Empty	Empty, Fill	-	Defines if you are running to Empty or Fill the Dam or Sump.
4	Start Level	6000mm	0 to 10000mm	50mm	The Level at which the engine will start. On a Fill application when the level drops below this value the engine will start. On an Empty application when the level rises above this value the engine will start.
5	Stop Level	2000mm	0 to 10000mm	50mm	The Level at which the engine will stop. On a Fill application when the level rises above this value the engine will stop. On an Empty application when the level drops below this value the engine will stop.
6	Dead Band	50mm	0 to 200mm	25mm	At + or (-) Xmm of the target level—throttling will be paused to over come hunting due to turbulence.
7	Target Level	4000mm	0 to 10000mm	50mm	A reference only for the User for the optimal DAM Level value.
8	Level Point Num	0	0 to 5	1 point	The number of Levels at which speeds changes can occur.
9	Level Point 1	2050mm, 1800RPM	0-10000mm, Idle to Run Speed	50mm,25RPM	Defines the RUN Speed at Level Point 1
10	Level Point 2	2050mm, 1800RPM	0-10000mm, Idle to Run Speed	50mm,25RPM	Defines the RUN Speed at Level Point 2
11	Level Point 3	2050mm, 1800RPM	0-10000mm, Idle to Run Speed	50mm,25RPM	Defines the RUN Speed at Level Point 3
12	Level Point 4	2050mm, 1800RPM	0-10000mm, Idle to Run Speed	50mm,25RPM	Defines the RUN Speed at Level Point 4
13	Level Point 5	2050mm, 1800RPM	0-10000mm, Idle to Run Speed	50mm,25RPM	Defines the RUN Speed at Level Point 5
14	Dam Level Slush	10secs	3 to 25secs	1 sec	When the level point has been reached and the slush time has elapsed the engine speed will change to nominated RPM.
15	Calibration	50Counts	0 to 100counts	1 count	The real time level can be digitally put to 0mm offset at 4mA.

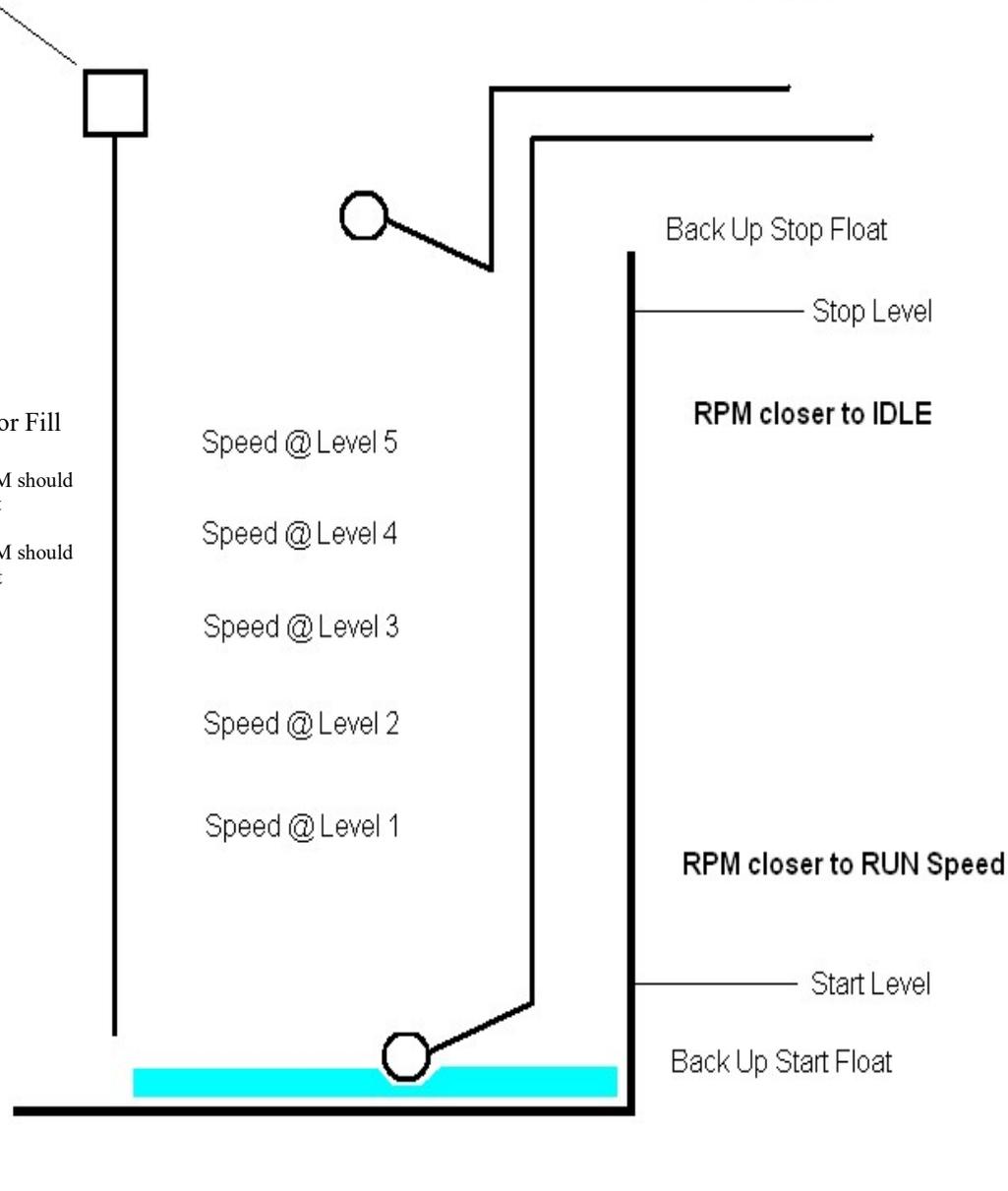
EMPTY OPERATION



4-20mA Level Sensor



FILL OPERATION



TANK or DAM

3.11 Discharge Pressure

User Settings
 10. Dam Level
 >> 11. Discharge Pressure
 12. Digital Inputs

The 4-20mA Sensor is the secondary primary pressure input and will be displayed on the third line of main RPM Screen when you press ENTER. **It appears as PUMP Press.2: - xxxx KPA.** This secondary sensor can be used in conjunction with the primary 4-20mA sensor which is usually Flow but can be Pressure in the event that two pressure sensors are required.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Sender Function	Disabled	Disabled, Enabled	-	Disable or Enabled pressure sensor input .
2	Sender Range 4-20mA	1000KPA	0 to 3200KPA	10KPA	The range or scale of the Flow sensor i.e. 4mA = 0KPA , 20mA = 1000KPA
3	Sensor Type	2 Wire 4-20mA	2 Wire 4-20mA 3 Wire 4-20mA	-	The K37 supports a 2 wire (loop powered device) or 3 wire 4-20mA Sensor. This is selectable in the Sensor Type menu option.
4	Set Min. Pressure	200KPA	0 to Max Pressure	10KPA	Low pressure or loss of prime value alarm point to which the controller will then shutdown the engine when monitoring and the slush time has elapsed.
5	Set Max Pressure	800KPA	Min Pressure to Sender Range	10KPA	High or Over pressure value alarm point to which the controller will then shutdown the engine.
6	Pump Prs. Bypass	3mins	0 to 60mins	1min	Duration of time, only at engine start up to which the low alarm point is not monitored. (High pressure is not bound by this timer and is monitored immediately at start up.)
7	Pump Prs. Slush	10secs	10 to 60secs	1secs	When the live value falls below or rises above the nominated alarm points, a timer activates and the condition must remain for the full slush time set before a shutdown is triggered.
8	Calibration	50Counts	0 to 100counts	1count	A calibration option to zero the value read by the controller when at 4mA. Modifying this value will increase or decrease the live value to zero the sensor at 4mA.
9	Screen Label	Discharge Pressure, Hydraulics Pressure, Air Pressure, Gearbox Pressure	Discharge Pressure	-	The Screen will display the selected label in menu and all the faults will also represent the selected label.

3.12 Digital Inputs

- User Settings
 10. Dam Level
 11. Discharge Pressure
 >> 12. Digital Inputs

There are up to 5 digital inputs that can be utilised by the user. Each digital input is triggered by a connection to Battery negative or GND. All are configurable inputs for Normally Open or Normally Closed conditions, individual bypass upon start up and slush timers. User definable names or labels can be given to the input such that the eventual shutdown is as described by the user. E.g. Aux Digital 1 can be changed to "PIVOT STOP" The description is up to 12 characters and/or numbers. Digital Input 1,2 &3 can also be used for send a GSM Warning Only or Alternate Speed Input. See Section 3.16 Digital Input 4 can be used for Auxiliary Hour Digital Input 4 and 5 can be used to with a momentary toggle Switch for RPM Increment and Decrement if required.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Input Enable	Disabled	Enabled, Disabled, Immediate, Start Inhibit [Dig 4&5 only]	-	Enables or Disables the digital input, Immediate i.e. no cool down on engines with no throttle control. Start Inhibit will Inhibit the engine to start.
2	Input type	Normally Closed	Normally Open Normally Closed Auxiliary Hour [Dig 4 only] Flow Totalizer [Dig 4 only] Toggle Sw (DOWN) [Dig 4 only] Toggle Sw (UP) [Dig 5 only]	-	Normally Open : The switch closes to GND on the fault condition Normally Closed : The switch is disconnected from GND on the fault condition. (usually wired and set in this mode for failsafe operation) Auxiliary Hour: When Aux Hours is set to PUMP and Dig 4 set to Auxiliary Hour engine does not shutdown only increment the hour counter. Toggle SW option on Digital 4 and 5 for throttling with a momentary toggle switch. Bypass and slush timers to not apply when set to Toggle SW.
3	Bypass Time	3min:00sec	00:00 to 20:00 Minutes	10secs	Digital input is ignored on engine start up for the nominated period.
4	Slush Time	5secs	0 to 60secs	1secs	When the input is in the fault condition, a timer activates and the condition must remain for the full slush time set before a shutdown is triggered.
5	Shutdown Type	Shutdown Latched	Shutdown Latched Shutdown NON Latched GSM Warning Only Alternate Speed Alternate Pressure Warning Only Clutch Input [Dig 5 only] Timed Alternate Spd [Dig 3 only]	-	Shutdown Latched is recorded as a fault and the controller requires a RESET. Shutdown NON Latched is a normal shutdown and will allow a restart when in Auto mode. GSM Warning: Will send a GSM TXT message if the 3G Modem is active, at any time the condition is met. Alternate Speed: When the Throttle type is set to GOTO FIXED RPM, on activation of this input the engine will throttle to the Speed defined in item 7. When the input returns to its normal state the engine will return to the defined "Engine RUN Speed". Warning Only: Will only display warning Icon with input label on Status line. Clutch Input will engages or disengages clutch output on low RPM.
6	Input Label	AUX. INPUT X	12 Character and/or Number Combination	-	The message that appears for the defined input can be changed to suit the application to better describe the fault or shutdown condition. The text can be up to 12 characters made up of letters, numbers, spaces and some symbols.
7	Alternate Speed	1200RPM	800 to 4000RPM	25RPM	When Digital Input 1,2 or 3 has been defined as Alternate Speed and the throttle type is set to GOTO FIXED RPM. On activation of this input after the bypass period the engine will throttle to the defined speed. When the input returns to its normal state the engine will return to the defined "Engine RUN Speed".
8	Alternate Pressure	500KPA	0 to Sensor Range	1KPA	When Digital Input 1,2 or 3 has been defined as Alternate Pressure and the throttle type is set to GO VARIABLE, on activation of the input after the bypass period the engine will try to achieve the target pressure entered. When the input returns to its normal state the Target pressure will be the default value set in Throttle parameter.

3.12.1 Digital Input 4 - Flow Totalizer Option

When digital input 4 is enabled and the Input Type is set to Flow Totalizer this input becomes a pulse counter for Flow meters with pulse outputs. On a transition to GND a pulse is counted and added to a running total beginning at m³ then transitioning to ML. It may be necessary to reset this value on first activation.. Once activated at the main RPM screen , pressing ENTER will reveal to Total Flow on the third line. At System Info in the main Menu pressing down in this menu will reveal the Last Run Flow . On first activation it may be 65535m³ but you do not need to reset this as this will automatically clear itself on the next engine run when the pulses are counted for that run.

This Totaliser can be used to keep track of how many ML (Mega-litres) of water has been pump or used in the irrigation or dewatering process. The Max Flow Function can be used to allocated a measured water allotment for that run up to 10000m³.

Please refer to your Flow meter manual for the type of output as external components maybe required e.g. 10Kohm resistor for pull up or pull down.

Item	Parameter	Default Value	Range	Change Amount	Functional Description
7	Litre Per Pulse	1 Litre/Pulse	1 to 1000 Litres / pulse	1	How many litres are added to the current total per pulse received.
8	Max Flow	Disabled	Disabled to 9950m ³	50m ³	When a value is set here the engine and pump can be run to a desired ML per day up to 9.95ML (9950m ³) before shutting down.
9	Flow Reset/Save	Save	Save or Reset	-	Save—will allow the Totaliser to run a continuous count. Reset—will reset to 0 the current Totaliser.

3.13 Reset History

```
User Settings
>> 13. Reset History
    14. Start Type
    15. Modbus
```

The Reset History function deletes the recorded faults engine or others sensors the “panel” has detected. This has no bearing on codes or faults that are recorded in an electronic engine (ECU).

At 13. Reset History press ENTER. The Are you Sure? Prompt will appear. Use the UP button to say YES and press ENTER.

```
User Settings
13. Reset History
Are you sure?      No
Enter=Save Up/Dn=Change
```

When the panel shuts down the engine on a “fault” condition it is recorded in non volatile memory on the controller. The fault description, engine hours and occurrence count of type of fault is saved. These faults can be viewed on screen or send via RS232 to a PC with the program GUI interface.

At the main RPM screen press MENU then use the down arrow to option 6. Fault History and uses the UP and DOWN button to scroll through the faults until the End of History prompt appears.

3.14 Start Type

```
User Settings
13. Reset History
>> 14. Start Type
    15. Modbus
```

The Start Type parameters defines the mode of operation for the remote start and stop inputs which are both voltage free contacts. It also defines if the engine fuel stop solenoid, on a mechanical engine is an “energize to run” or “energize to stop” system.

The Force Auto option on a hardwired input , either on panel powered up or at any time can automatically place the panel into Auto Mode.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Set Start Type	Maintained	Maintained or Momentary	-	Maintained: Simple two wire operation. Momentary: 2 Switch or 2 float operation, and must be used when GSM, MODBUS, Pressure, Suction and DAM Level start/stops are used.
2	Input Type	Start NO Stop NO	Start NO Stop NO Start NO Stop NC Start NC Stop NO Start NC Stop NC	-	NO = Normally Open, NC = Normally Closed. The both the remote start and remote stop inputs can be set for NO or NC combinations depending of the wiring configuration of floats used or failsafe requirements. i.e. on a broken wire a the engine can stop safely.
3	Fuel Relay Control	Energize to Run	Energize to Run Energize to Stop	-	Energize to Run: The fuel stop solenoid has a constant power signal while the engine is running. Energize to Stop: The fuel stop solenoid is activated for 10seconds to stop the engine and then released.
4	Force Auto	Disabled	Disabled, Enabled	-	The Force Auto option on a hardwired input , either on panel powered up or at any time can automatically place the panel into Auto Mode.
5	Slush Time	Start: 4 Secs Stop: 4 Secs	0 to 10 Secs	1	Start input full slush time must pass before start is registered. Stop input full slush time must pass before stop is registered.

3.15 MODBUS Communication

User Settings
 13. Reset History
 14. Start Type
 >> 15. Modbus

This menu is used to setup the K37 Panel's MODBUS communication functionality. MODBUS data can be acquired from the controller for SCADA, PLC or any other MODBUS compliant telemetry system. The controller is always the SLAVE in the MODBUS relationship. A register list of all controller data is available on request. It is recommended that all registers are polled at once with at a baud rate 19200 or 9600, 8 data bits, 1 stop bit, No Parity. The Master can poll the K37 as fast as every 2 seconds with a response timeout generally set to 1000ms. In multi drop systems, it is best to have polling at 3 to 5 seconds.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	MODBUS Channel	RS485	RS485 RS232 (GSM Disable)	-	The K37 has two configurable communication ports. By default MODBUS is on the RS485 port allowing the RS232 be free for 3G TEXT MODEM, the combination WEB MODEM or connection to the PC for the GUI interface. If for some reason the SCADA or PLC device requires RS232 the MODBUS can be placed on this port and the GSM Txt Modem will automatically be disabled.
2	Slave Address	10	0 to 250	1	By default the slave address is 10, but in RS485 systems with more than one slave device is present this value can be changed
3	Baudrate	9600bps	2400, 4800,9600, 19200 and 38400bs	-	A number of different baud rates are support which may depend on the requirements of the master device, distance between Master and Slave or whether a wireless link is used. E.g. Packet Radio.
4	Diagnostics	-	-	-	This is a simple tool to indicate if the panel is receiving, decoding and sending data. The counters for the Receive, Sent and Valid data will increase on a successful poll from the Master. Please note: If you are in a multi-drop system and the message received is intended for a different slave address, the receive counter will increase but a sent response will not be given.

3.16 GSM Parameters

User Settings
>> 16. GSM
17. Aux Hour
18. Maintenance



The K37 GSM Modem facility allows registered users to start, stop and receive engine status information via GSM text messaging. Up to 5 users can receive messaging when the engine starts, stops, or shuts down on a fault. As status request message Up to 5 registered users can be entered always starting from User 1 and entered sequentially in the following positions. Network Connectivity and Signal Strength of modem is represented in the ICON Zone as shown in the Graphical LCD ICON Zone on Page 7. It is recommend that a sim card suitable for the region on a low cost plan is used instead of a pre-paid and this is usually setup and managed by the end user. Messages to the unit from Unregistered Users are ignored and delete.

Please Note: Messaging is carrier or network dependant. In low coverage areas or peak times it may take up to several minutes for a message to be sent or responded too. The controller will make 3 attempts to send a message for each user.

PLEASE NOTE: A STANDARD VOICE SIM IS REQUIRED. DATA SIM CARDS WILL NOT WORK.

Item	Parameter	Default Value	Range	Function Description
1	Active	Disabled	Enabled, Disabled	Disables or Enables the GSM Modem Function.
2	Message Enable	Enabled	Enabled, Disabled	If the panel is set to run on floats it may not be necessary to receive messages every time it starts and stop Disabling Messages will only text on faults or INFO requests.
3	Site Name	Blank	Up to 8 Characters and Numbers	Can be set up to 8 character e.g. Engine 1, Station 3, DAM PUMP
4	Baudrate	38400bps	2400,4800,9600,19200 and 38400bps	Default is 38400bps—if there is a reason to slow down communications it must be done within the modem and saved before changing the panel to suit.
5	Bootup delay	15secs	0 to 20secs	Some modems take longer to boot than others and allow a boot time before we begin communicating. If the modem does not connect try extending this time to the maximum.
6	Security Lock	Disabled	Enabled, Disabled	Can be locally or remotely locked such that no-one can operate the engine. The password may be changed until unlocked.
7	User Phone No. 1	+61#####	Mobile number in international notation.	Enter in a mobile for the registered users e.g. +61457123123 for each user. Leaving a user +61##### disables the user but there should be no gaps in user positions i.e. if there are 3 users they must be in positions 1,2 and 3.
8	User Phone No. 2			
9	User Phone No. 3			
10	User Phone No. 4			
11	User Phone No. 5			
12	Ini GSM Modem	-	Yes, No	Forces an initialization on the modem. It may take up to 2 minutes to run this procedure.

Instructions for GSM Modem

Authorized Users can use the following commands to control the engine. The Text messages must appear as below with no spaces and it is case sensitive.

Commands

Item	Command	Command Description
1	START	Text command to Start the engine.
2	STOP	Text command to Stop the engine.
3	AUTO	Text Command to force the controller into Auto Mode. If you try and start the engine when in Manual Remotely you will receive a message "TEST ENGINE CANNOT START:- MANUAL MODE"
4	INFO	Real time status giving engine and pump information including RPM, Volts, Load, Fuel Rate, Oil Prs, Eng.Temp, Hours, Pump pressure etc.
6	LOCK	Text command to remotely enable the Security Lock.
7	UNLOCK	Text command to remotely disable the Security Lock

Basic Operation

To START the Engine/Pump via a text Message.

1. Ensure the control panel is on and in AUTO,
2. If your phone number is entered in the panel send "START" via text message to the controller
3. If a message is sent and received successfully by the controller the engine will start as per normal operation. Once the Engine is running, the programmed users will be each sent a message in the order they are entered.

e.g. PUMP 1 ENGINE RUNNING AUTO MODE

To STOP the Engine/Pump via a text Message.

1. While the engine is running in AUTO,
2. If your phone number is entered in the panel send "STOP" via text message to the controller.
3. If a message is sent and received successfully by the controller the engine will stop as per normal operation. Once the Engine has stopped the message Sending SMS ICON will appear will the programmed users will be each sent a message in the

order they are entered.

e.g. PUMP 1 ENGINE STOPPED – STOP via SMS

FAULT Text Messages

- If the Engine Stops on a fault, example, Low Oil Pressure a message will be sent
e.g. PUMP 1 ENGINE STOPPED – Low Oil Pressure
e.g. PUMP 1 ENGINE STOPPED – High Temp
e.g. PUMP 1 ENGINE STOPPED – Low Pump Pressure.
- If there is an active ECU Fault SPN and FMI message will be sent to user.
- If the battery voltage drops a message will be sent to user indicating a low battery status.

Note: The modem operation is subject to the network provider and signal strength in the area. Please ensure that you have a SIM Card that best works in the area and that The Modem Antenna is mounted in the best position to receive network coverage. On power up of the controller – please wait until the Signal strength is not "X" as commands from the controller will timeout and may not be sent if there is no coverage. The controller will attempt to send a message 3 times in 20second intervals if a message sent response is not received by the network. This may occur in times of high network traffic or poor coverage.

3.17 Aux Hours

User Settings
 16. GSM
 >> 17. Aux Hour
 18. Maintenance

The Auxiliary Hours function is gives the ability to add an hour counter for any driven equipment. A separate hour meter can be used for the new pump or generator connected to an existing engine or vice versa. The new hour meter appears on the main RPM screen by pressing ENTER and viewing the third line.
 E.g. Pump Hr: 1234.0 HRS or Genset Hr: 100.0 HRS
 The Auxiliary Hours can be preset in the Early Setup Parameters if an existing pump or generator is being up fit to a new engine.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Aux. Hour Function	Disabled	Disabled, Enabled	-	Enables or Disables the Function
2	Label	Pump	Pump, Genset	-	Label for the main RPM screen.

3.18 Maintenance (Timers)

User Settings
 16. GSM
 17. Aux Hour
 >> 18. Maintenance

The Maintenance Timer function is gives the ability to add an service hour counter for engine and driven equipment. The maintenance or service timers will bring an Service ICON in the ICON Zone indicating when the nominated hours have been reached for the engine or driven equipment or both.
 The maintenance timer can be set in 50hour blocks up to 1000 hours.
 The timers can be reset in the menu when the service is completed.



Refer the engine and pump manufacturers specifications for the recommended service interval.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Engine	Disabled	Disabled (0) to 1000hours	50Hours	A time here enables the timer and an ICON will be shown when the hours have elapsed.
2	Pump	Disabled	Disabled (0) to 2000hours	50hours	A time here enables the timer and an ICON will be shown when the hours have elapsed.
3	Reset Timers	No	No, Yes	-	Resets the timers and begins the count again.

3.19 Language Setting

```

User Settings
>> 19. Language Setting
    20. Change Password
    21. Change Unit
  
```

The system language of the K37 (by default) is English. We can however, set the Language to Chinese if the user requires it.

Pressing ENTER here will reveal two options when using the UP and Down arrows to change the option.

```

Language Setting
English
Are you Sure? No
Enter = Save Up/Dn = Change
  
```

```

Language Setting
  中 文
Are you Sure? No
Enter = Save Up/Dn = Change
  
```

Changing the **Are you sure?** to **YES** and pressing ENTER will commit the change.

All menus and the main RPM screen will be in the chosen language.

3.20 Change Password

```

User Settings
19. Language Setting
>> 20. Change Password
    21. Change Unit
  
```

The user has the ability to change the password from the default and provide added security such that only authorised users can change settings in the panel.

Please note: that once the password has been changed, the user is responsible for remembering the new password and limiting its distribution to authorised users only.

Pressing ENTER here will reveal the first of 4 numbers that will need to be changed.

```

Enter New Password
00 00 00 00
Are you Sure? No
Enter=Save Up/Dn=Change
  
```

Using the UP and DOWN arrow change the number and the press ENTER to reveal the next number.

On the entry of the last number : **Are you sure? NO** will appear.

Change this to **YES** and press ENTER is you which to proceed, otherwise leave it as **NO** and press ENTER to exit.

3.21 Change Unit

User Settings
 19. Language Setting
 20. Change Password
 >> 21. Change Unit

This item allows the user to change the Temperature units for Celsius to Fahrenheit or vice Versa. Press UP and Down to change the unit and press ENTER to commit to the changes.

Change Reading Unit
 >> 1. Temperature Unit

Change Reading Unit
 1. Temperature Unit
 Celsius
 Enter=Save Up/Dn=Change

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Temperature Unit	Celsius	Celsius, Fahrenheit	-	Changes the reading to the desired unit.
2	Pressure (Pump) Unit	KPA	KPA, BAR	-	Changes the reading to the desired unit.

3.22 Pump Lube/Clutch

User Settings
 >> 22. Pump Lube/Clutch
 23. I/O Test

Pre and Post start lubrication allows the pre-lube solenoid output to be energised for the nominated amount of time pre or post starting of the engine, The clutch output enables or disables a clutch solenoid to engage above or disengage below the drive shaft at the nominated RPM.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	Pre-start Lubrication	0:00	0:00 to 20:00 m:ss	10secs	On an engine signal to start a pre-lube timer will energise an output (FETH) for the nominated time, before the crank cycle begins
2	Post-start Lubrication	0:00	0:00 to 20:00 m:ss	10secs	On an engine start the post-lube timer will energise and output (FETH) after engine start for the nominated time.
3	Clutch Output	Disabled	Enabled, Disabled	-	Enables and Disables (FETG) an output when clutch Setpoint RPM has been reached.
4	Clutch Setpoint	0800 RPM	0700 to 1000	25 RPM	When the actual RPM rises above the nominated RPM the output will energise, when the actual RPM goes below the nominated RPM the output will de-energize.
5	Clutch Slush	0:00	5 to 30secs	5secs	The actual RPM will need to be above or below the Clutch Setpoint for the nominated time set to avoid false engagements and disengagements of the clutch output

3.23 I/O Test

User Settings 22. Pump Lube/Clutch >> 23. I/O Test	I/O TEST >> 1. Digital Inputs 2. Resistive Inputs 3. 4-20mA Inputs	<p>Please note that user must disconnect all connections between control panel and engine especially outputs before entering into the unit test screen.</p> <p>Select "I/O Test" menu option and press ↑↓ then ENTER at the item you wish to test.</p> <p>Please refer to your specific panel schematic for circuit name e.g. Schematic circuit and settings configuration as to what Inputs, Outputs, Communications and CAN functions are available and in use.</p>
--	---	--

Select 1. "Digital Inputs" and press "Enter" button, the screen will display the state the digital input is currently in.

OFF = Open Circuit, ON = Closed Circuit.

e.g. FSW-AL(26) (Defined as Flow switch) Connect this input to GND and see the change of State from OFF to ON. Only Coolant Level is ON open circuit as the normal condition is Closed.

1. Digital Inputs RSTART(32): OFF RSTOP(24): OFF DIG_1(33): OFF DIG_2(25): OFF DIG_3(34): OFF FSW-AL(26): OFF	1. Digital Inputs DIG_4(35): OFF DIG_5(27): OFF F_AUTO(28): OFF FSW-AH(25): OFF Coolant Level Input(31): ON
--	---

Select 2. "Resistive Inputs" and press "Enter" button, the screen will display the raw 12bit analogue value.

With the exception of OIL(56) the open circuit condition is value = 4095, the closed or shorted to ground is approximately 290 when diagnosing faults.

Only OIL(56) (Oil Pressure) is 0 when open circuit or shorted to ground as this is an active 0 to 5VDC sensor. Its range is 0.5 to 4.5V

If a value is shown other than open or closed e.g. 2831 then the sensor is connected and resistance of the sensor is being correctly calculated. At this stage you can go to the relevant sensor screen and see temperature, fuel or pressure values.

The range of the analogue value is 0 to 4095 (12bit) For Resistive sensors - coolant temperature, fuel level, pump temperature and oil pressure.

2. Resistive Inputs	
PUMP_T: 4095	TEMP(54): 4095
GBT(55): 4095	OIL(56): 0
FUEL(57): 4095	BAT_IN: 1375

3.23 I/O Test

User Settings 22. Pump Lube/Clutch >> 23. I/O Test	I/O TEST >> 1. Digital Inputs 2. Resistive Inputs 3. 4-20mA Inputs	I/O TEST >> 4. Relay & Aux Outputs	
--	---	---------------------------------------	--

Select 3. "4-20mA Inputs" and press "Enter" button, the screen will display the raw 12bit analogue value.
 The range of the analogue value is 0 to 4095 (12bit).
 The 4-20mA Sensor input already has the load resistor and when not connected will be pulled down to 0V and will show 0 counts. At 4mA the sensor will show approximately 820 in this test screen. shorted to high source will show close to 4095

3. 4-20mA Inputs	
LEVEL(41): 0	4-20mA(43): 0
SUCT(44): 0	DISCH(46): 0
REMSPD(42): 0	VIBSEN(45): 0

Select 4. "Relay & Aux Outputs" and press "Enter" button, the screen will display the output state of the Relay or Aux Output. The Relay Output will be Battery Positive when ON and the Aux output is closed or sink to ground (Battery negative). Please check your specific circuit as the Auxiliary outputs may be connected to relays or other internal devices. When Entering this screen all outputs are switched OFF. By Pressing the ENTER button in this screen you will sequentially turn on each output one by one.

RELAY1: OFF	RELAY2: OFF
RELAY3: OFF	RELAY4: OFF
RELAY5: OFF	AUX.1(10): OFF

AUX.2(11): OFF	AUX.3(12): OFF
----------------	----------------

Please note: RELAY1, RELAY2 and RELAY3 are Fuel/IGN, Crank and Glow respectively and will cause the fuel solenoid/ECU ignition, crank and glow to become active.(Please check your setting as Relay3 can be engine running or glow)

RELAY4 and RELAY5 are connected to engine running output and Alarm respectively.
 AUX.1, AUX.2 and AUX3 are connected to FET F, FET G, FET H respectively.

Select 5. "Throttle Actuator" and press "Enter" button, the screen will display **"Throttle Command: —"**. If the Actuator Type in Throttle Parameter is set to mechanical or Digital Output then the actuator will move throttle up or down depending on which button is pressed

Warning: Please disconnect the output harness when doing Relay and Aux Outputs Test to avoid unexpected operation on engine!

Please note that when the I/O Test screen displayed, engine cannot start by any start triggers even the condition meets.

3.24 Vibration 4-20mA

User Settings
 22. Pump Lube/Clutch
 23. I/O Test
 24. Vibration 4-20mA

Vibration Parameters
 >> 1. Sender Function
 2. Sender Range 4-20mA
 3. Vibration Slush

Vibration Parameters
 4. Vibration Warning
 5. Vibration Shutdown

The 4-20mA Vibration Transmitter has the following function.

It can be used to Shutdown the Pump Unit if the Vibration reading is above the User defined Shutdown setting after a Slush time has elapsed. Based on user discretion, if the user alarm point is met the speed can be changed either at the controller by the UP (Rabbit) and DOWN (Tortoise) or remotely changed over MODBUS if the Throttle Type is set to MODBUS Control. Throttle capability must be capable on the engine.

Below are the User Settings available in K37Controller.

Item	Parameter	Default Value	Range	Function Description
1	Sender Function	Disabled	Disabled, Enabled	Disabled or Enabled Vibration Sensor Input.
2	Sensor Range 4-20mA	50 mm/sec	0 to 200mm/sec	The Range or Scale of the Vibration Sensor. 4mA = 0 mm/sec 20mA = 50mm/sec
3	Vibration Slush	5 mins	1 min to 60 mins	Slush Timer will be enabled upon Warning (OR) Shutdown value is reached.
4	Vibration Warning	20 mm/sec	0 to Shutdown Value	On reaching this value a message on LCD only will appear to warn the Operator if high vibration is detected.
5	Vibration Shutdown	30 mm/sec	Warning Value to Sensor Range	After Slush Time has elapsed, this will Shut down the engine on "High Vibration".

Please note:

The 4-20mA Vibration sensor uses the same input as the Dam Level Sensor on Hardware Versions 1.41 and below. Hardware Versions 1.50 and above have a dedicated input.

Hardware Version 1.41 and below : Vibration Sensor is only available if Dam Level Sensor Option is not Selected 'OR' Disabled. That is User can able to only select either 'DAM LEVEL SENSOR' (OR) 'VIBRATION SENSOR'.

4. View Diag Codes (CAN J1939 ECU Diagnostic Codes)

The K37 talks directly to the ECU of an electronic engine over a CAN network using the J1939 protocol. The controller derives all of its engine information from the ECU and also requests some vital information when required. The ECU also has a method of reporting faults under this protocol when there is a problem with the engine. When the ECU is currently sending a live message to the controller this is referred to as an Active Diagnostic Trouble Code which we have the ability to view in [1. View Active code](#) or by pressing the Warning Button.

Any codes that were once active and now rectified are committed to the memory in the ECU and are called "previously active" or "stored" code. The K37 can request this information from the ECU and display the information on the LCD screen. Go to [2. View Stored](#) and press ENTER where the message "Requesting Stored Code" will appear and the ECU will respond with the required data. If the request does not get serviced a "Request Timeout" message will appear.

The Active or Stored codes are made up of an

SPN: Suspect Parameter Number. Defines the area of the problem e.g. Oil Pressure
FMI: Failure Mode Identifier Describes the type of problem e.g. Data Valid but below normal operating range
O/C: Occurrence Count How many times this fault has occurred.

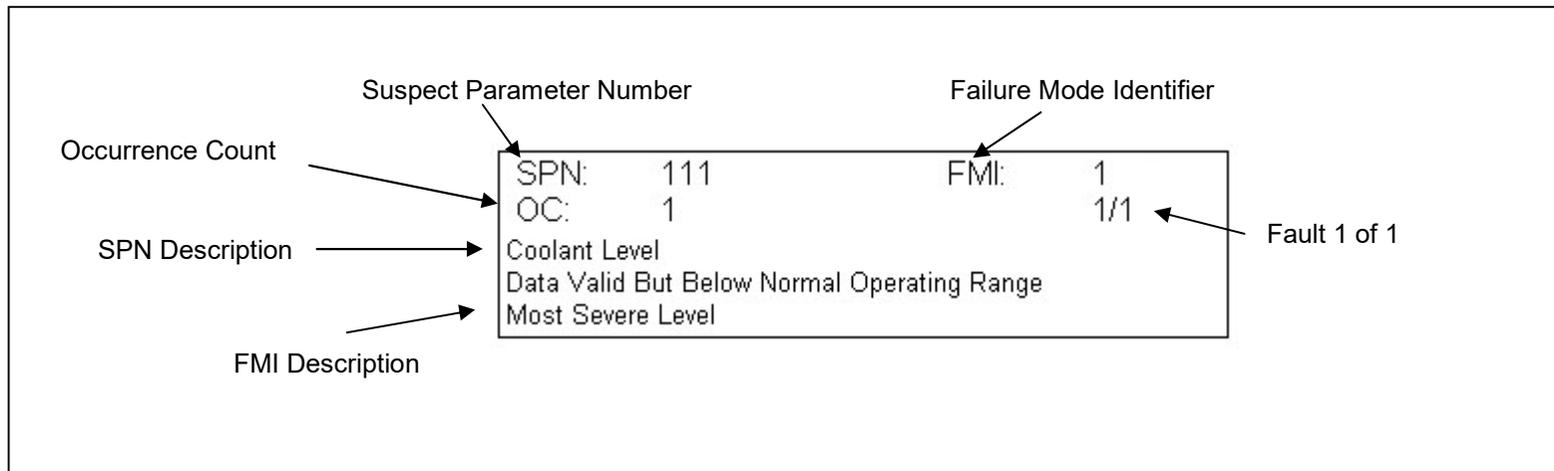
Most all engine manufacturers comply to the J1939 standard and use the same SPN and FMI numbers to identify the type of fault on the engine.

E.g. SPN 100 Engine Oil Pressure, SPN 110 Engine Coolant Temperature

Menu
 >> 4. View Diag Codes
 5. System Info
 6. Fault History

View Diag Code
 1. View Active Code
 >> 2. View Stored Code
 3. Ignore SPN Code

Example



Ignore SPN Code:

For non-critical warnings users can enter the SPN in the ignore list, this will inhibit the warning to be shown on the LCD screen. There are four single codes the user can enter, the fifth one is the range of SPN greater than the number entered in the controller.

Please note critical warning including SPN:100(Low Oil Pressure), SPN:110(High Engine Temp), SPN:111(Low Coolant Level) and SPN:175(Oil Temperature) will not be ignored.

It is recommended to not ignore critical warnings and resolve the issues related to warnings, as it can damage the engine.

```

Ignore SPN Code
Ignore SPN
0 0 0 6 3 9
    
```

To add an SPN number use the Up and Down arrows to change the current digit then press Enter to set each digit. To set for example SPN 639, please set the first three digits as 0's .

Please Note: Ignoring SPN Code is done at your own risk and may cause damage to the Engine.

Ignoring SPN codes does not stop the Engine ECU from logging them into its database.

TSC1 Checksum:

Torque speed control (TSC) checksum can be enabled or disabled depending on the ECU being used. By default this checksum is enabled, for some ECUs we might need to disable the checksum as it will not throttle if enabled. Please check with the engine manufacturer manual.

Source Address 00:

'Source Address 00' can be enabled or disabled depending on the engine being used, for a Dual ECUs-based engine Source Address 00 option can be enabled to read values only from the ECU with the source address as '00'.By default, it is disabled so values from ECU with any source address can be read.

```

View Diag Code
1. View Active Code
2. View Stored Code
>> 3. Ignore SPN Code
    
```

```

Ignore SPN Code
4. Ignore SPN 4
>> 5. Ignore SPN Range
    
```

```

View Diag Code
4. TSC1 Checksum
>> 5. Source Address 00
    
```

5. System Info (System Information)

System Info provides the controller details, status information and ECU J1939 information. To Navigate through System Info use the UP and Down arrow.

Serial # The electronics or module serial number
 Build Date: The manufacturing date of the module.
 PCB Version: The hardware version of the controller
 Firmware: The current software level of the controller. (PC GUI Updatable)

Serial # :	12369
Build Date:	2015 11 12
PCB Version:	2.0
Firmware:	2.0

The E2 File version The Graphical, LCD ICON version. (PC GUI Updatable)
 PCB Temp The internal temperature of the module.
 (It may be a few degrees higher than the outside temperature).

E2 File Version:	2.0
PCB Temp:	29'C
Last Shutdown:	
Stop Button Pressed	

Last Shutdown describes the reason for the last engine stop which could be a normal shutdown (buttons or remote input) or fault shutdown(engine or added sensors). Refer to Section 11 for full descriptions.

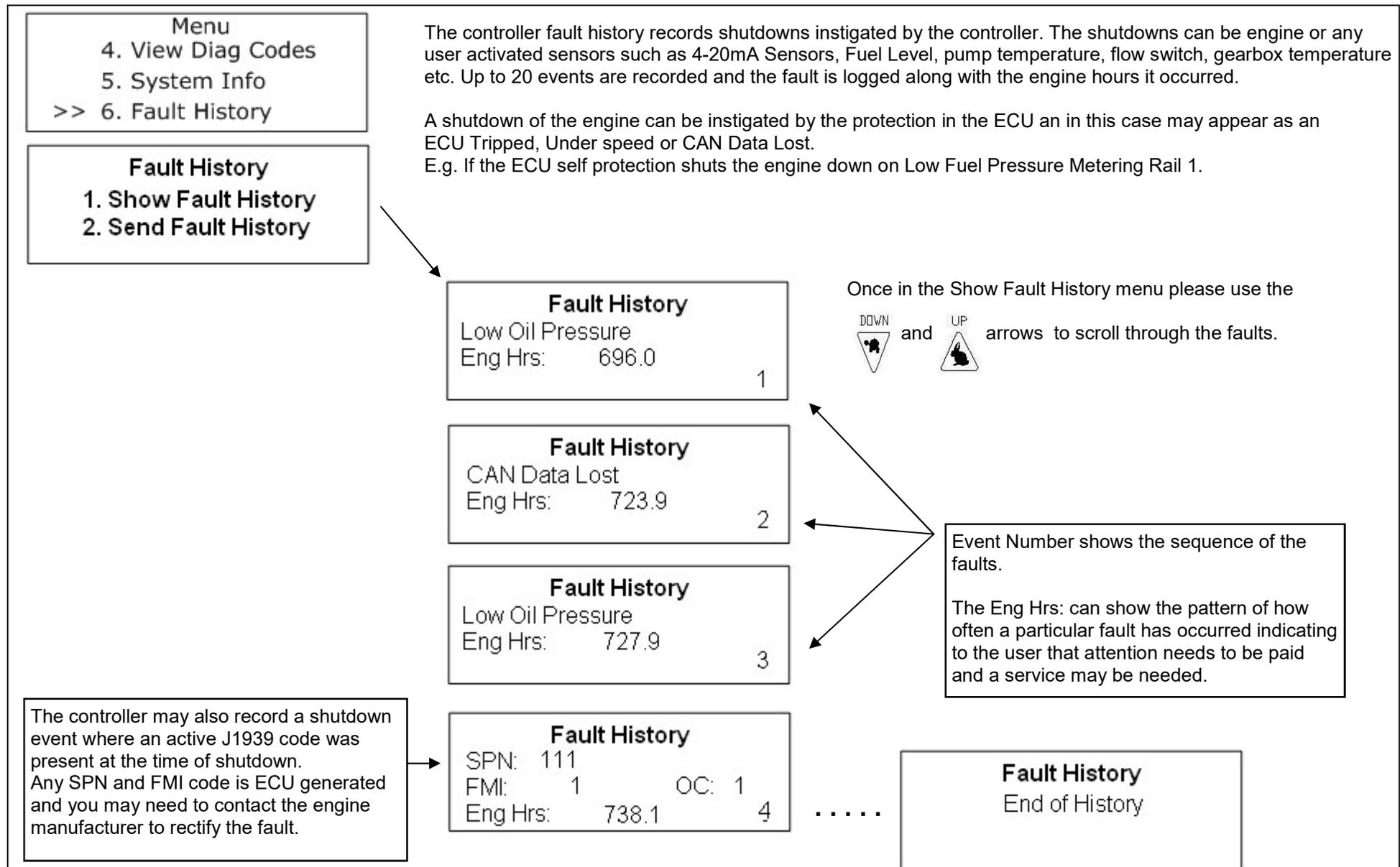
When connected to an Electronic CAN J1939 engine some data can be obtained from the ECU about the engine details including ECU part number, Firmware or Software date, composition ID and engine vehicle identification number.

ECU SW PN:	3136867-00
ECU SW DATE:	
COMP ID:	CTRPL*C6.6L866610279
VIN:	Kensho Test

This window can used as a diagnostic tool to show what the desired or requested speed from the panel as compared to the actual speed. Please note: The Desired speed is a calculated variable from the ECU. Most ECU's will calculate this value, however, some may just give a fixed value e.g. 1500RPM. The TSC ID and TSC Mode should always remain constant. Some of these values are set in the Early Setup and need to be set correctly otherwise you may not have throttle control of the engine.

Desired Speed:	1000
Actual Speed	0
TSC ID:	C0000EA
TSC Mode:	205

6. Fault History



7. Engine Config. (Engine Configuration)

The Engine Configuration is read only data stream from an ECU that describes the stationary behaviour of the engine and the torque indicated as a given speed. The map reflects the effect of changes due to barometric pressure, engine temperature, and any other stationary changes (sensor failures, etc.) which influence the engine torque curve more than 10%. This map is only valid for maximum boost pressure. At low boost pressures the torque limit may be much lower. The engine configuration message is sent at any time that the engine configuration map has changed by more than 10% of speed or torque (due to events other than boost pressure) since that last time the message was transmitted. As an alternative, it may be sent periodically, once every 5s. For more information refer to the engine manufacturer. This information may be useful to follow the performance of speed and torque with respect to any driven equipment such as pumps or generators. Pressing ENTER here will show any data captured. If no data is currently present it will momentarily show NO CAN DATA Press UP and DOWN to scroll through all the parameters given.

Menu
>> 7. Engine Config

Engine Configuration Parameter	Scale / Unit	Example Value
Engine speed at idle, point 1	Range 0 to 8031RPM	1000RPM
Percent torque at idle, point 1	-125 to 125%	76%
Engine speed at point 2	Range 0 to 8031RPM	2200RPM
Percent torque at point 2	-125 to 125%	81%
Engine speed at point 3	Range 0 to 8031RPM	1700RPM
Percent torque at point 3	-125 to 125%	97%
Engine speed at point 4	Range 0 to 8031RPM	2000RPM
Percent torque at point 4	-125 to 125%	89%
Engine speed at point 5	Range 0 to 8031RPM	1400RPM
Percent torque at point 5	-125 to 125%	100%
Engine speed at high idle, point 6	Range 0 to 8031RPM	2740RPM
Gain (KP) of end speed governor	Calculated Value	-1%
Reference engine torque	0 to 64255NM	695NM
Maximum momentary engine override speed, point 7	Range 0 to 8191RPM	8191RPM
Maximum momentary engine override time limit	0 to 25secs	25sec
Requested speed control range lower limit	0-2500RPM	255RPM
Requested torque control range lower limit	0-2500RPM	255RPM
Requested torque control range upper limit	-125 to 125%	125%

Example

```
Engine Configuration
Engine Speed @Idle
Pt 1 1000 RPM
```

```
Engine Configuration
Torque @Idle
Pt 1 111%
```

Please Note:
Data may take up to 30secs to populate all parameters after ignition power on.

8. Early Setup Parameters

The Early Setup parameters can be access by turning of the controller , as you turn the controller on press MENU and ENTER just as the Controller , date and time appear on the screen. As per the User Settings, these parameters are to be changed by qualified and authorised users only. Please refer to your deal and /or Engine manufacturer before making changes to any of these settings. Incorrect settings may produce undesirable results.

Item	Parameter	Default Value	Range	Change Amount	Function Description
1	TSC1 Address	234	0 to 254	1	Torque/Speed Control address in the ECU to which throttle messages are directed. Refer to the engine manufacturer for the address information. If the address does not match the ECU then no speed control will occur.
2	TSC Control Mode	205	0 to 254	1	The governing method with respect to speed or torque. Refer to the engine manufacturer for the address information. If the governed type is not set correctly the engine may not run to the speed defined.
3	TSC1 Trans, Rate	12ms	10 to 50ms	1ms	The TSC1 Message rate must be sent at a particular speed, if the message speed is too slow the ECU will revert to its alternate throttling method. An ECU Warning may be presented in this case e.g. SPN 639 FMI 9
4	SPN Conversion	4	1 to 4	1	Under the J1939 protocol there are 4 methods of conversion. Most engine manufacturers are at method 4. Some Mercedes for e.g. engines may use 2.
5	ECU Warnings	Treat as Shutdowns	Treat as Shutdowns Treat as Warnings	-	The panel has the ability to treat ECU Earnings as a fault condition and shutdown the engine. If the ECU presents an SPN for Oil Pressure, Coolant Temp, Oil Temp or Coolant Level these will be treated as a shutdown. This is an added level of protection for the engine is desired.
6	ECU Shutdown Time	10secs	10 to 60secs	1sec	If the ECU Warning is treated as a shutdown the panel will wait the set period before shutting down to allow the ECU to process the fault.
7	Read Volts From	Read ECU Voltage	Read ECU Voltage Read from Panel	-	Some J1939 ECU do not transmit a battery voltage. In this case, the panel monitors and display this Battery voltage of the system.
8	R3 Function	Engine Running	Engine Running Glow	-	Relay 3 on the K37 can be configured as an Engine Running or Glow output. What ever R3 is set to R4 will take on the alternate function
9	Set Engine Hours	NO	No, to Hours Set	5hours	For a mechanical engine, the engine hours run can be set or reset on the controller.
10	Set Aux Hours	NO	No, to Hours Set	5hours	For any driven equipment, the hour runs can set or reset on the controller.
11	Asset Tag Num	0	0 to 10000	1	Used in MODBUS this register can be used to give a unique number for the asset being monitored via MODEM or SCADA system.
12	Toggle SW Max Point	Disabled RPM	0 to Overspeed	25 RPM	When an RPM value has been set the user will be unable manually ramp past this point. This may be used to stop users from running over the pump curve RPM.
13	Engine Type	Generic	Generic, Scania, Volvo, Cummins	-	Allow to select which engine type to be used. E.g. Cummins, Caterpillar, Mercedes, Perkins, Yamaha, Deutz etc

9. MODBUS Registers

MODBUS Setup	Default Settings
K37 standard MODBUS RTU format.	
Baud 2400, 4800, 9600, 19200, 38400	9600bps
Data Bits 8	8
Stop Bits 1	1
Parity None	None
Slave MODBUS Address Engine 1 (Adjustable)	10
RS485 is default. RS232 is selectable see Section 3.15	

Data accessible via MODBUS

MODBUS	K37 Terminal	Description	Range	Resolution
40001	J1939	Percent Load	0-125%	1%/bit
40002	J1939	Engine RPM	0-8131.875RPM	0.125/bit
40003	J1939	Total Engine Hours LSB	0-210554060.75Hrs	0.05Hrs/bit
40004	J1939	Total Engine Hours MSB		
40005	J1939	Engine Coolant Temp	-40c -210c (410F)	1°c/bit (-40c offset)
40006	J1939	Engine Oil Temp	-273c-1735c	0.03125c/bit (-273c Offset)
40007	J1939	Engine Oil Pressure	0-145PSI	4kPa/bit 0.58015psi/bit
40008	J1939	Coolant Level	0-100%	0.4%/bit
40009	J1939	Fuel Rate	0 - 3212.75L/H	0.05L/H /bit
40010	J1939	Boost Pressure	0 - 72.5PSI	2kPa/bit 0.29007psi/bit
40011	J1939	Intake Manifold Temp	-40c – 210c	1°c/bit (-40c offset)
40012	J1939	Electrical Potential	0.00 – 3212.75VDC	0.05V/bit
40013	J1939	Battery Potential	0.00 – 3212.75VDC	0.05V/bit
40014	43	Pressure or Flow	0 to 3200 KPA 0 to 1000 L/S	1KPA/bit (-256offset) 1L/S /bit (-256offset)
40015	44	Suction Pressure	-100 to 3200 KPA	1KPA/bit (-256offset)
40016				
40017	53	Pump Temp	0 -150°C	1°c/bit (-40°c offset)
40018	J1939	Machine Hours LSB	0-210554060.75Hrs	0.05H/bit
40019	J1939	Machine Hours MSB		

MODBUS	K37 Terminal	Description	Range	Resolution
40020	-----	Remote Start/Stop	0xAA = Start 0x55 = Stop	** Write to Controller
40021	-----	Force Reset/Auto mode	0x66 = Reset 0xBB = Auto mode	** Write to Controller
40022	-----	Auto/Manual mode	Bit 1 1 = Auto 0 = Manual Bit 2 1 = Engine Running Bit 3 1 = Warm Up Bit 4 1 = Line Fill Bit 5 1 = Cool Down Bit 6 1 = Common Alarm	
40023	-----	Configuration #	0-65535	** Write to Controller
40024	-----	Asset Tag)	0-65535	Asset/Pump Number
		Mechanical Engine Data		
40025	56	Engine Pressure (MECH)	0 – 145 psi	2.91psi/bit
40026	54	Engine Temp (MECH)	-40c -210c (410F)	1’c/bit (-40c offset)
40027	-----	Battery Volts (MECH)	0.00 – 3212.75VDC	0.05V/bit
40028	30	Engine Speed (MECH)	0-4000RPM	0.125/bit
40029	-----	Eng Hrs LSB (MECH)	0-210554060.75Hrs	0.05H/bit
40030	-----	Eng Hrs MSB (MECH)		
40031	27	Flow_Totaliser_LSB	See 40034	
40032	-----	Aux. Hours LSB	0-210554060.75Hrs	
40033	-----	Aux. Hours MSB		
40034	27	Flow_Totaliser_MSB		
40035	46	Pump Pres. #2 4-20mA	0 to 3200 KPA	1KPA/bit (-256offset)
40036	41	Dam Level 4-20mA	0 to 10000mm	1mm/bit
40037	42	Remote Speed	Range Idle (40mA) to Overspeed (20m	
40038	J1939	CAN SPN		
40039	J1939	CAN FMI		
40040	RESERVED			
40041	RESERVED			

MODBUS	K37 Terminal	Description	Range	Resolution
40042		RESERVED		
40043		RESERVED		
40044		RESERVED		
40045	57	Fuel level	0 -100%	1%/bit
40046		Gearbox Temp	0 -150°C	1°c/bit (-40°c offset)
40047		Heart_Beat	Continuously changing counter	
40048	-----	Remote RPM/Target Pressure	0-4000RPM/0-3200KPA ⁽¹⁾	1RPM/Bit or 1KPA/Bit ** Write
40049	45	Vibration Sensor	0-100mm/s	1mm/s per bit (-256mm/s offset)
		Digital Inputs		
40050	32	Remote Start Input Active Low	Bit 1 1 = Active 0 = Not Active Bit 2 1 = NO* 0 = NC*	
40051	24	Remote Stop Input Active Low	Bit 1 1= Active 0 = Not Active Bit 2 1 = NO* 0 = NC*	
40052	25	Auxiliary Digital Input 2 Active Lo	Bit 1 1= Active 0 = Not Active	
40053	34	Auxiliary Digital Input 3 Active Low	Bit 1 1= Active 0 = Not Active	
40054	35	Toggle INC, Aux Input 5 Active Low	Bit 1 1= Active 0 = Not Active	
40055	27	Toggle DEC, Aux Input 4 Active Low	Bit 1 1 = Active 0 = Not Active	
40056	33	Auxiliary Digital Input 1 Active Low	Bit 1 1 = Active 0 = Not Active Bit 2 1 = NO 0 = NC	
40057	28	Flow Switch Active Low – (Passive)	Bit 1 1 = Active 0 = Not Active	
40058	29	Flow Switch Active Hi (B+) (Active)	Bit 1 1 = Active 0 = Not Active	
40059		Firmware Version		
40060	31	Coolant Level Probe	Bit 1 1 = Active 0 = Not Active	

MODBUS	K37 Terminal	Description	Range	Resolution
40061	-----	Status/Fault Code Output	0 – 250 Codes Code: 0 = Normal Operation 1 = Low Oil Pressure 2 = High Engine Temp. 3 = Auxiliary 3 4 = Loss of Flow Sw. 5 = Alt Failure 6 = Coolant Level Low 7 = Overspeed 8 = Underspeed 9 = Bad or NO RPM 10 = Failed Crank Attempts 11 = Aux. Input 1 12 = Aux. Input 2 13 = Aux. Input 3 14 = Low Fuel Level 15 = Low Pump Press #2 16 = Max Pump Press #2 17 = Low Pump Pressure 18 = Max Pump Pressure 19 = CAN BUS Failure 20 = Pump Temperature 21 = Internal Protection 22 = Suction Pressure 23 = Check ECU Codes 24 = Timer Complete 25 = Normal Shutdown 25 26 = Dam Level Sensor Error 29 = Low Flow 30 = High Flow 31 = Stagnant Timer 32 = Normal Shutdown 32 33 = Pressure Stagnant 34 = Gear box Temp	8bit code number

*(NC = Normally Closed, NO = Normally Open)

Register 61 is status and fault code register. When the register has the value:

0 The panel is in a normal operating mode with no faults.

24 The panel has shutdown due to a Set Stop Timer completion. In Auto, the Register will show 24 for the stabilize period and return to 0, In manual it will remain until reset.

- 25 The panel has shutdown due to the stop button being pressed. It will return to 0 after the stabilize time has elapsed.
- 32 The panel has shutdown due to the remote or normal stop when in Auto Mode. It will return to 0 after the stabilize time has elapsed.

All the remaining in Register 61 table, shown above, are fault related shutdowns. The fault value will remain in this register until the panel has been reset.

Standard polling:

It is recommend as a default - 9800bps, 8 data bit, 1 Stop bits, No parity.
Where possible, poll all 61 registers starting from 0 at the Address set in the controller.

The fastest polling peer to peer, can be every 2 seconds with a minimum response timeout of 1000ms. Longer polling periods are recommended for Multi-drop systems. i.e. multiple slaves when using RS485. (Communication ports for RS232 or RS485 can be selected in the panel.)

When using the MODBUS start or a stop in the controller the Start Type must be set to Momentary in the menu:
3.User Settings –14. Start Types > 1 Set Start Types.

Writing to the Command Registers:

To perform a write to the controller that will be recognized you must change or increment the value in the configuration register. Register 40023. This configuration number change stops multiple or accidental writes and actions to the controller.

E.g. When using the MODBUS start or a stop in the controller the Start Type must be set to Momentary in the menu:
3.User Settings –14. Start Types > 1 Set Start Types.

The number in the configuration **Register 40023** must be changed or incremented.
Then a write to the Start Register can be initiated. i.e. **Register 40020** 0xAA (Start)

The number in the configuration **Register 40023** must be changed or incremented.
Then a write to the stop Register can be initiated i.e. **Register 40020** 0x55 (Stop)

The number in the configuration **Register 40023** must be changed or incremented.
Then a write to the Force Reset Register can be initiated. i.e. **Register 40021** 0x66 (Force Reset)

The number in the configuration **Register 40023** must be changed or incremented.
Then a write to the Auto Register can be initiated. i.e. **Register 40021** 0xBB (Auto Mode)

Depending on your SCADA/PLC or MODEM system you may need at least 500ms between sequential writes to the K37 taking into account the time it takes for the K37 to respond.

Remote RPM Register 40048

When running to MODBUS Control a write to this register will change the nominated run speed that the engine will run to in auto mode. This does not require a write to the configuration register BUT there are safeguards in place to ignore erroneous writes. The write will only be recognized or acted on when the engine is running and validated by the controller. If for example, a message is read that is outside the engine Idle or engine Overspeed panel set points then the message is ignored and not saved. The engine will either retain the current run speed or move to back to in the internal Engine Run Speed set in Engine Parameters.

Target Pressure Register 40048

When Throttle Type is selected as Go Variable 1 or Go Variable 2 this register will change the Target Pressure set point. This does not require a write to the configuration register BUT there are safeguards in place to ignore erroneous writes. The write will only be recognized and saved when the value is within the range.

Note: 1. Target Pressure can only be with the limit of Maximum an Minimum Pump Pressure or Discharge Pressure set point.

EXAMPLE: STARTING in AUTO via MODBUS.

You must perform the following sequence.

If the Panel is already in Auto you can Write a Start.

1. The number in the configuration register 40023 must be changed or incremented.
Write a number to 40023. Allow the allocated response time.
2. Write to the start Register i.e. 40020 command 0xAA (Start)

Check Register 40022 if you have the engine running bit or the RPM register.

Setting the panel to Auto Mode

If the panel is not in Auto - you must write a FORCED RESET command first and once MODBUS communications has returned then write an AUTO command. This sequence has been implemented as safety precaution for any local users who is working at the engine. During the forced reset the panel beeper will also be active, alerting the local user that the panel condition has been changed.

When a remote reset has occurred, MODBUS responses are paused until the boot up cycle completes. This may take up to 25 to 30secs to complete as there is a 10secs warning and buzzer before reset, the boot cycles takes up to 15 to 20secs to reboot, which includes a reported forced reset message (including the beeper) and also show the Last Fault message (if reset after a fault). MODBUS communications will return to normal at this point.

10. Fault and Last Shutdown Messages

Last Shutdown Message	Description	Reference
Stop Timer	Normal Stop – Shutdown on Set Stop Timer	Section 1.1
7 Day or Everyday Scheduler	Normal Stop – Shutdown on Scheduled Event	Section 1.3
Remote Start Removed	Maintained Operation – Start Signal Removed	Section 3.14
Remote Stop	Momentary Operation – Stop Input triggered	Section 3.14
Stop Button Pressed	User Stopped by Keypad button	Keypad Description
Dam Level (Normal)	Normal Shutdown on stop level set point	Section 3.10
Pump Pressure (Normal)	Normal Shutdown on pressure set point	Section 3.42
Suction Pressure Shutdown	Normal shutdown on suction set point	Section 3.9
Suction Pressure Alarm	Alarmed Shutdown on Suction Pressure set point	Section 3.9
SMS Command	Normal stop via SMS Text Message	Section 3.16
SMS Emergency Command	Alarmed Shutdown via SMS Text Message	Section 3.16
MODBUS Command	Shutdown via MODBUS (PLC, SCADA or Website)	Section 3.15 & Section 9
AUX. INPUT 1 (user configurable)	Normal or Fault shutdown on Digital Input 1	Section 3.12
AUX. INPUT 2 (user configurable)	Normal or Fault shutdown on Digital Input 2	Section 3.12
AUX. INPUT 3 (user configurable)	Normal or Fault shutdown on Digital Input 3	Section 3.12
AUX. INPUT 4 (user configurable)	Normal or Fault shutdown on Digital Input 4	Section 3.12
AUX. INPUT 5 (user configurable)	Normal or Fault shutdown on Digital Input 5	Section 3.12
Pump Temperature	Fault Shutdown on High Pump Temperature	Section 3.7
Gear Box Temperature	Fault Shutdown on High Gearbox Temperature	Section 3.6
Over Speed	Fault Shutdown on Engine RPM Overspeed	Section 3.2
Under Speed	Fault Shutdown on Engine RPM Underspeed	Section 3.2
Coolant Temp Abnormal	Fault Shutdown on High Engine Coolant Temperature	Section 3.2
Low Oil Pressure	Fault Shutdown on Low Engine Oil Pressure	Section 3.2
Coolant Level Low	Fault Shutdown on Low Coolant Radiator Level	Section 3.2
Pump pres max alarm point	Fault Shutdown on High Discharge 4-20mA Pump Pressure	Section 3.4.2
Pump pres min alarm point	Fault Shutdown on Low or Loss of 4-20mA Pump Pressure	Section 3.4.2
Pump pres#2 max alarm point	Fault Shutdown on High Discharge Pump Pressure	Section 3.11
Pump pres#2 min alarm point	Fault Shutdown on Low or Loss of Pump Pressure	Section 3.11

Last Shutdown Message	Description	Reference
Flow max alarm point	Fault Shutdown on High Flow L/S (4-20mA Sensor)	Section 3.4.1
Flow min alarm point	Fault Shutdown on Low Flow L/S (4-20mA Sensor)	Section 3.4.1
Dam Level Sender Error	Fault Shutdown on Dam Level 4-20mA Sensor Fault.	Section 3.10
Flow Switch Shutdown	Fault Shutdown on Low Flow Switch	Section 3.8
Stagnant Timer Timeout	Shutdown on Stagnant Timer	Section 3.3
Stagnant Timer-Max Attempts	Cannot achieve target pressure.	Section 3.3
Low Fuel Level	Fault Shutdown on Low Fuel Level Set point	Section 3.5
Max Crank Attempts	Engine start Attempts exceed	Section 3.2
Switch Power In Turn Off	Stopped by Power ON/OFF Toggle Switch	Control Panel Layout
E-Stop Button Pressed	Stopped by Emergency Stop or Isolated power.	Emergency Stop /Battery Isolation
HALT Button Pressed	Stopped by Halt Button during a 7 Day or Set Timer cycle.	Section 1
ECU TRIPPED	Shutdown by J1939 CAN SPN, FMI Active Fault	Section 4
CAN Data Lost	Fault Shutdown because J1939 CAN is lost	Check ECU and/or Wiring

Fault and Last Shutdown messages shown in the System Information can be either on a “Normal Shutdown” operation or a protected Latched Fault Shutdown. Fault Shutdowns and the toggle “Switch Power In Turn OFF” are shown in the Last Shutdown in System Info screen and also recorded in the Fault History against engine hours.

11. Outputs

The K37 has 3 Outputs (FET F, FET G, and FET H) which are currently fixed function. In future, these may be user configurable.

Please note: These are low current (up to 1A) outputs that should be used as volt free contact with respect to an earth source or drive diode protected external relay. Please refer to the K37 Example Wiring Diagrams for further information.

Output	Function (Firmware version dependant)	Reference
Output 1 FET F	IN AUTO—Grounded Output when the Panel is in AUTO MODE	Keypad Description
Output 2 FET G	<ul style="list-style-type: none"> LOW FUEL—Grounded Output when Fuel Level value is below the fuel control start value. If Clutch in enabled—Grounded Output when engine RMP is above or Below the nominated RPM or if Digital Input 5 is selected as Clutch Input then Grounded Output when engine RPM is below nominated RPM and Digital Input 5 is active 	Section 3.5, Section 3.22
Output 3 FET H	Pump Lube—Grounded Output when Pre or Post Start Lubrication timer is active	Section 3.22

12. Glossary of Terms

Auto Mode	The mode in which the control panel will start and stop from a remote source. E.g. Floats, Pressure Start/Stop, GSM Modem. If enabled, the Automatic Throttle feature is active. All engine and pump protection is active.
Manual Mode	The mode in which the panel will only start and stop from Manual Start button and Stop button on the keypad. If enabled, throttling is done manually by the user with the toggle switch. All engine and pump protection is active.
Engine Run Speed	The Engine speed or RPM the controller will automatically throttle to in Auto Mode only.
Speed Source	Defines the Engine Type and where the tachometer (Engine RPM) receives its data. E.g. J1939 CAN BUS, Alternator W+ or Magnetic Pickup.
J1939 CAN BUS	Electronic Engine communication protocol. Engines fitted with an ECU (Electronic Control Unit) that supports J1939 Engine protocol.
ECU Warning	A warning message generated by an Engine ECU over J1939 CAN BUS to the control panel.
ECU Stop	A critical error message generated by an Engine ECU over J1939 CAN BUS to the control panel.
SPN	Suspect Parameter Number : Describes the specific area of the source of a fault.
FMI	Failure Mode Identifier : Defines the type of fault for the SPN generated.
O/C	Occurrence Count : How many times the SPN and FMI combination has occurred on the engine.
Magnetic Pickup	Inductive sensor placed over the teeth of a flywheel generating a tachometer output.
Pulses per REV. (Pulses/Revolution)	Calibration unit for an Alternator or Dynamo/Regulator for the Tachometer output.
Underspeed	Low tachometer (RPM) alarm point to which the controller will shutdown the engine.
Overspeed	High tachometer (RPM) alarm point to which the controller will shutdown the engine.
Start Speed	The nominated Engine RPM at which the controller will disconnect the crank signal to the starter motor upon engine startup.
Lockout Delay	On engine start up engine and some pump sensors are NOT monitored or "locked out" for the set period. Once the delay has elapsed engine and pump protection monitoring is active.
Warm Up Time	The time the engine will remain at IDLE, when in Auto Mode, before running to a higher engine RPM. This allows the engine to get to operating temperature before running at a higher RPM with load.

Cooldown Time	The time the engine will run at IDLE before shutting down. Also known as a turbo timer.
Bypass Time	The initial time that a given sensor will NOT be monitored after a engine start. Once the bypass time has elapsed the given sensor protection will become active.
Slush Time	The continuous time at which a given sensor is beyond the alarm point to trigger an action or engine shutdown.
4-20mA Sensor	A universal standard for a device which has a variable current output between 4mA and 20mA. E.g. Pump Pressure Sensor 0 to 2500KPA , 4mA = 0KPA, 20mA = 2500KPA
Controlled Shutdown	When throttle control is enabled, when called to stop the engine will return to engine idle for a cool down before shutting down.
Immediate Shutdown	The controller when called to stop the engine will shut down immediately with no cool down.
Digital Input	A “switch” type input to the controller which is either on or off.
Analogue Input	A variable signal input to the controller from a Resistive or 4-20mA Sensor allowing a readable value on the LCD screen.
Passive (Input Type)	A digital input which responds to a Battery Negative (B-) signal.
Active (Input Type)	A digital input which responds to a Battery Positive (B+) signal.
MODBUS	(Modicon Communication BUS) A standard communication protocol, which is now a commonly available means of connecting industrial electronic devices.
IMT	Intake Manifold Temperature: Temperature of pre-combustion air found in intake manifold of engine air supply system
CL	Coolant Level: Ratio of volume of liquid found in engine cooling system to total cooling system volume.

13. Limited Warranty.

Contact your dealer with any warranty queries or claims.

- This warranty runs for 12months or 1000 engine operating hours (whichever occurs first) from the date of purchase.
- Warranty or repair is specifically “Return to Base”.
- Any on site work must be authorized before work commences.

For a full description of the Warranty Please contact your local dealer.

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