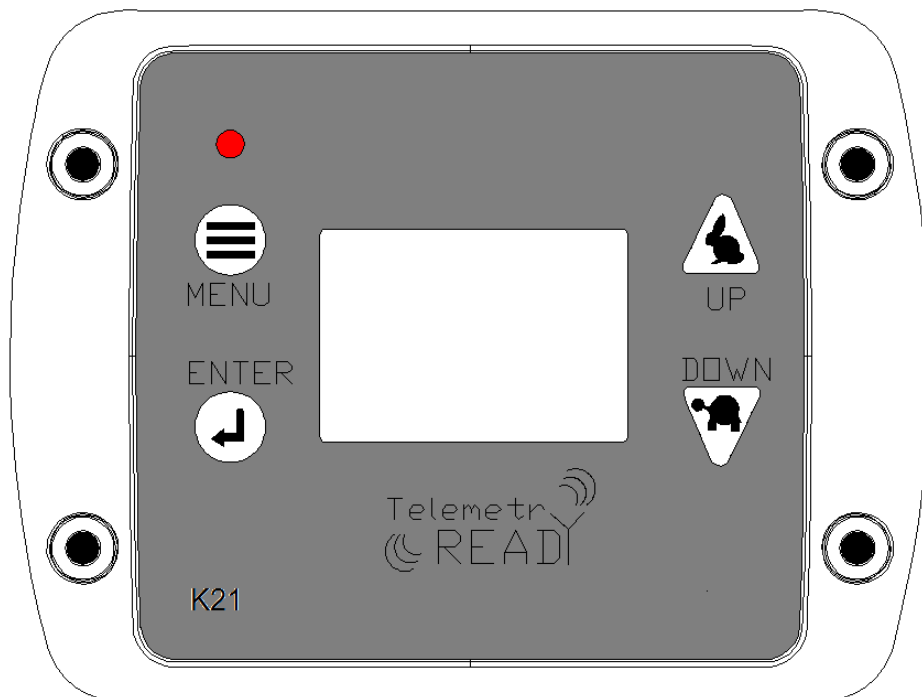


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# K21

## USER MANUAL

FOR USE ON MEHCANICAL AND ELECTRONIC  
DIESEL ENGINES



# K21 User Manual

K21 User Manual .....	2
1 General Warning .....	3
2 Flyback Diode Installation .....	3
3 Considerations Prior to Operation .....	4
4 Notes about this manual .....	4
Notes about the K21 .....	4
5 Features of the K21 .....	5
6 Interface .....	6
6.1 Front Face .....	6
6.1.1 LED Indication .....	6
6.1.2 Icon Indication .....	6
7 Basic Operation .....	7
7.1 Starting the engine .....	7
7.2 Sensor Delays .....	7
7.3 Engine Running .....	7
8 Menu Items and Setup .....	8
8.1 Set Stop Timer .....	8
8.2 4-20mA Sensor .....	8
8.2.1 Pump Pressure .....	8
8.2.2 Pump Flow .....	9
8.3 Settings - Protected by Password .....	9
8.3.1 Engine Parameters .....	10
8.3.2 Communication .....	11
8.3.3 GSM Text Message Commands .....	11
8.3.4 System .....	11
8.3.5 Unit Test .....	12
8.4 Fault History .....	14
8.5 System Information .....	14
8.6 View DTC (Diagnostic Trouble Codes) .....	15
8.7 LCD Contrast .....	16
8.8 Early Setup .....	16
9 MODBUS Register List .....	17
10 Troubleshooting (Fault Finding) .....	18
10.1 Serviceable Parts .....	18
10.2 General .....	19
10.3 Power Faults .....	19
10.4 Engine Starting Faults .....	20
10.5 Sensor Faults .....	20
Appendix A: Run Process Diagram .....	21
11 Limited Warranty .....	22

## 1 General Warning

# WARNING

### Prior to Installation

- 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.

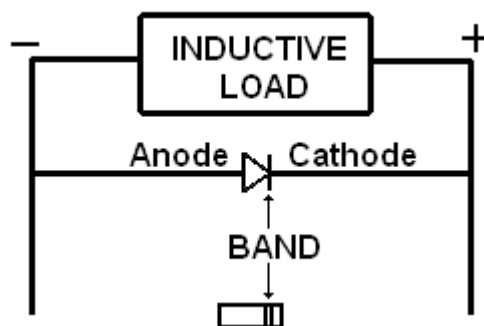
### Prior to Engine Ignition

- 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 those with expert knowledge. Failure to do so may result in serious damage to equipment and persons as well as void warranty claims.

Always follow installation instructions. Failure to do so could result in harm or accident.

## 2 Flyback Diode Installation

All Inductive Loads ( eg. Solenoids, Relays ) must be fitted with a flyback 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 flyback diode is sometimes also referred to as a snubber diode, free-wheeling diode, suppressor diode, catch diode, or clamping diode.



**FAILURE TO USE A FLYBACK DIODE MAY CAUSE DAMAGE TO THE CONTROLLER AND WILL VOID WARRANTY.**

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### 3 Considerations Prior to Operation

- When mounting and during the life of the controller, please avoid subjecting the controller to external elements including excessive heat, oil, dust, vibration, and rain.
- High pressure cleaning devices must not be used and will likely cause damage to the controller. Use a damp soft cloth to clean the face of the decal and controller.
- Grounding of the controller must be carried out to prevent damage from lightning strike
- Persons under the influence of drugs and/or alcohol must not use controller or operate any machinery.
- Maintenance of the engine must be carried out within the manufacturers guidelines
- Sensor wires must not be bundled with other wires.

### 4 Notes about this manual

- Wherever the following symbol is shown, please check engine for obstruction, debris, etc before proceeding. Ensure that it is safe to start engine

**Caution: Check safety of engine before proceeding**

### Notes about the K21

- It is important to verify that the preset values are correct – these are used to determine the behavior of the K21 while the engine is running.

**DO NOT RUN ENGINE WITHOUT CHECKING ALL SETTINGS. The Factory set values may not be applicable to your engine set up, therefore, it is the responsibility of the user to consult an authorized dealer for correct settings. Failure to do so may cause damage to engine, controller or personnel.**

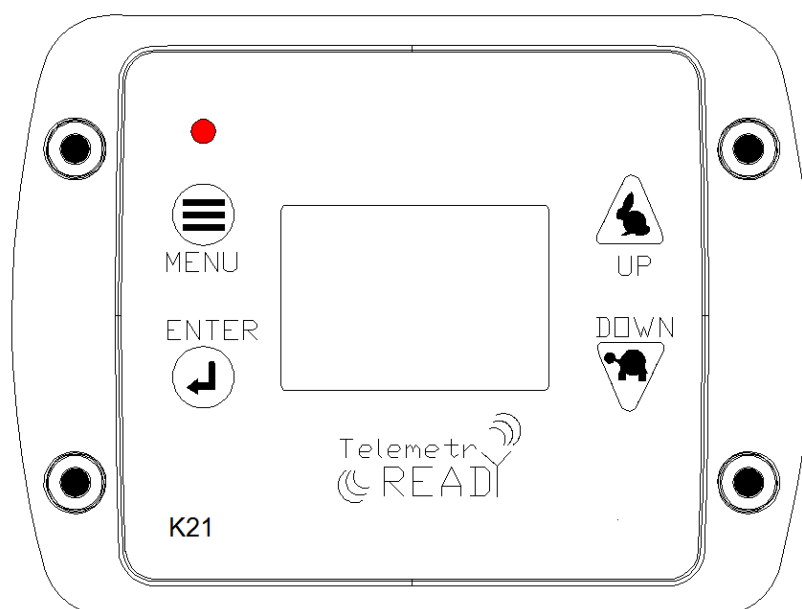
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## 5 Features of the K21

- Graphical 2.6”LCD Display.
- K21 Module 12VDC / 24VDC input power.  
(Please refer to the panel schematic for any other voltage specific devices.)
- Engine Hours display (Hour Meter).
- Engine RPM Display and Overspeed Protection.
- Battery voltage display and low battery warning.
- Speed detection from Alternator, Magnetic Pickup or J1939 data.
- Electronic J1939 Messaging support and basic Throttle Control
- Easy Push button Start/Stop.
- Fuel, Crank and Glow Outputs.
- Energize to Run/ Energize to Stop Function.
- 2 Grounded input engine sensors (includes coolant level sensor) to protect engine.
- 1 Active High engine sensor to protect engine.
- 2 Analogue /Digital Input Configurable
- 1 4-20mA Loop Powered Sensor input (Pressure or Flow)
- 1 x LEDs for ECU Warning /ECU Stop /Fault indication.
- 100 Hour Stop Timer
- Basic Fault History recording.
- Telemetry Ready Connector for remote monitoring via RS232/485 (MODBUS)

## 6 Interface

### 6.1 Front Face



#### 6.1.1 LED Indication.

Color	Battery Status
Amber	N/A
Red	ECU Stop/Warning , Blink on Fault Shutdown

#### 6.1.2 Icon Indication

	System OK and Waiting to start
	Animated Cranking Symbol while attempting to start.
	Blinking, after start up, during the lockout period only.
	Low Battery Symbol.
	Animated Hour glass Symbol when 100 Hours Stop Timer is active and engine is running.
	Active J1939 Engine ECU Warning or Stop Symbol
	Appears when CAN J1939 communication is lost.

## 7 Basic Operation

### 7.1 Starting the engine

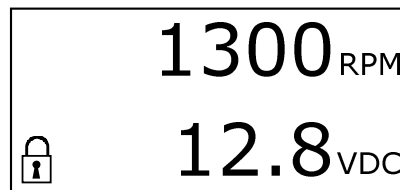
**Caution: Check safety of engine before proceeding**

1. Ensure that persons, the engine and all moving parts are clear and free from debris/obstruction
2. Turn the toggle switch on to apply power to the K21 unit.
3. Press the button switch to start engine and stop the engine.
4. When GSM or Web Modem Connected starting and stopping can be achieved by phone or website. On a mechanical engine the engine will start and stop at the set speed. With a J1939 Electronic engine with TSC1 enabled the engine will start and go to the Engine Run Speed set in Engine Parameters.

### 7.2 Sensor Delays

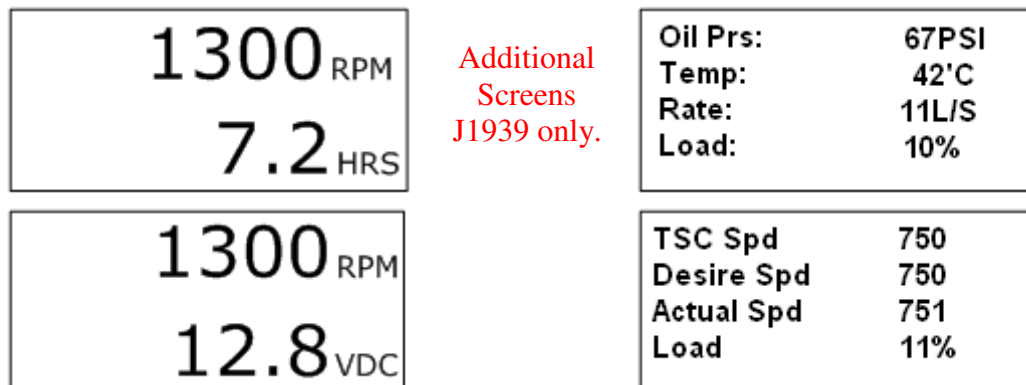
The sensor delay is the timeout period also known as lockout delay or bypass delay. This takes place only at engine start, prior to the sensor protection comes online. During this period a “padlock” icon will be blinking, at the end of the delay period it will disappear indicating protection has commenced.

The screen will show like below:



### 7.3 Engine Running

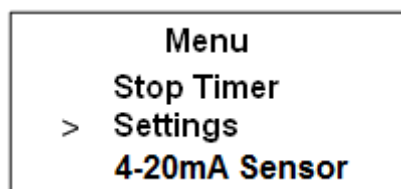
While the engine is running, the user can Press “Menu” button to enter in menu screen, and set the stop timer or view the system information. In addition, the user can press the ENTER button to swap the main screen to get more engine information such as Battery voltage and running hours and on J1939 engines Engine Temp, Engine Oil Pressure, Flow or Pump Pressure, Fuel Rate and Load. The screens will show like below:



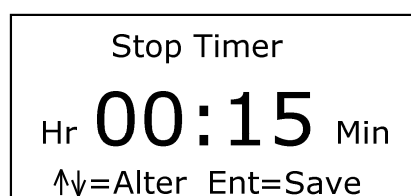
## 8 Menu Items and Setup

### 8.1 Set Stop Timer

Press “Menu” button at main RPM display as showed in last section, then the screen will display



Select “Stop Timer” menu option and press “Enter” button to set stop timer, the screen will display



Press up and down buttons to change the hours of timer, then press “Enter” button to confirm it and move to minutes setting. After changing the minutes of timer by using up and down arrows, press “Enter” button again to save this setting. If the timer is a non-zero number, then it will start count down right after user finishes setting this value.

### 8.2 4-20mA Sensor

The 4-20mA Sensor can be enabled and setup without having to go into the Settings protected area. This sensor can be either a Pressure (KPA) or Flow (L/S) as selected in the sub menu.

#### 8.2.1 Pump Pressure

Item	Default value	Range	Change Amount	Functional Description
Function	OFF	OFF, ON		Disable or Enabled pressure sensor input as Primary Sensor.
Sender Range	2500KPA	0 to 3200KPA	10KPA	The range or scale of the Flow sensor i.e. 4mA = 0KPA , 20mA = 1000KPA
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.
Max Pressure	800KPA	Min Pressure to Range		High or Over pressure value alarm point to which the controller will then shutdown the engine.
Bypass Time	1min	1 to 20mins	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.)
Slush Time	10secs	10 to 60sec	1sec	When the live value falls below or rises above the nominated alarm points, a timer activates and the condition must remain for



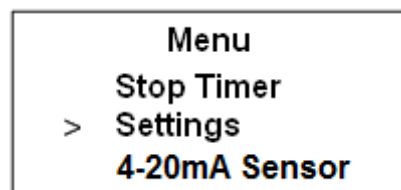
				the full slush time set before a shutdown is triggered.
Calibration	50counts	0 to 100counts	1count	A calibration option to zero the value read by the controller when at 4mA. Modifying this value will increase or decrease the live value to zero the sensor at 4mA.

### 8.2.2 Pump Flow

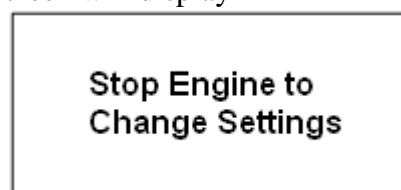
Item	Default value	Range	Change Amount	Functional Description
Function	OFF	OFF, ON		Disable or Enabled flow sensor input as Primary Sensor.
Sender Range	300L/S	0 to 1000L/S	5L/S	The range or scale of the Flow sensor i.e. 4mA = 0L/S , 20mA = 300L/S
Min Pressure	75L/S	10 to Max Flow	5L/S	Low flow value alarm point to which the controller will then shutdown the engine when monitoring and the slush period has elapsed.
Max Pressure	245L/S	Min Flow to Range	5L/S	High flow value alarm point to which the controller will then shutdown the engine.
Bypass Time	1min	1 to 20mins	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.)
Slush Time	10secs	10 to 60sec	1sec	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.
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.

### 8.3 Settings - Protected by Password

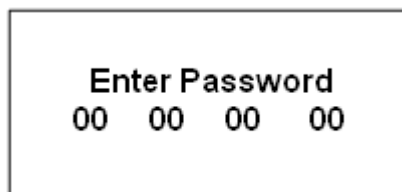
Press “Menu” button at main RPM display as showed in last section, then the screen will display



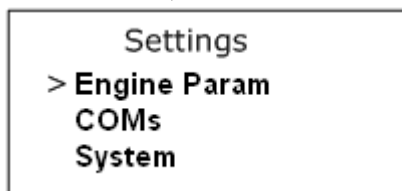
Select “Settings” menu option and press “Enter” button to enter the settings menu. If the engine is running, the screen will display



If the engine is not in running, the screen will display



Using up and down buttons to input the password and then press “Enter” button. If the password is wrong, the screen will show “Wrong Password” and back to menu screen automatically. If the password is correct, the screen will display



Use UP and Down buttons then press the ENTER for the option you require.

### 8.3.1 Engine Parameters

Item	Default Value	Range	Change Amount	Functional Description
Speed Source	Alternator	Alt, MPU1,MPU2, J1939	-	Tachometer Source from Alternator, J1939 or Magnetic Pickup (MPU2 is a no Filter Option used for engines with high flywheel teeth count.)
Pulse/Rev	10.50	6.00 to 25.00 pulses/rev	0.02	Number of Pulses from an Alternator for 1 revolution when Alternator as the speed source on a Mechanical Engine.
Flywheel	120	80 to 190 Teeth	1	Number of Teeth on the Flywheel when MPU is selected as the speed source for a Mechanical Engine.
Bypass Delay	30secs	20 to 120secs	1	Digital and Analogue sensor shutdown bypass timer upon engine start up.
Overspeed	2300RPM	1000 to 4000RPM	25RPM	Engine/Pump high speed protection with a slush delay of 5 seconds.
Oil Pres. Type	10bar	OFF, Digital, 7bar,10bar	-	Enables or Disables Oil Pressure Switch Detection
Oil Pres. Alarm	20PSI	OFF to 145PSI	1	When Set to 7 or 10bar only the shutdown point can be set by the user. OFF disables the sensor.
Eng Tmp.Type	ON	OFF , Digital, JD Res, Resistive	-	Enables or Disables Engine Temp. Switch Detection
Eng Tmp Alarm	105'c	OFF to 215'c	1	When Set to JD Res, Resistive or J1939 Speed Source only the shutdown point can be set by the user. OFF disables the sensor.
Auxiliary 4	ON	ON/OFF	-	Enables or Disables Aux Switch Detection
Aux4 Bypass	60secs	0 to 20:00secs	5secs	Bypass upon startup timer for Aux 4 input usually for loss of prime pressure or flow switch.
Fuel RL Control	Energize to Run	ETR= Energize to Start ETS = Energize to Stop	-	Energize the fuel stop solenoid to either run the engine or stop the engine.
Crank Time	10secs	5 to 20secs	1	Maximum Crank time allowed
Coolant Level	ON	ON /OFF	-	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 affect a J1939 ECU Coolant level probe.)
Start Speed	600RPM	200 to 2000RPM	25	Speed at which the start motor will crank disconnect.
Crank Assist	0	0 to 10	1	Ignores erroneous values generate by an ECU, Alternator or MPU for a set period.
Eng Run Speed	1800RPM	1000 to 4000RPM	25	Running speed achieved only for Electronic Engines when started by MODEM or SCADA interface.

### 8.3.2 Communication

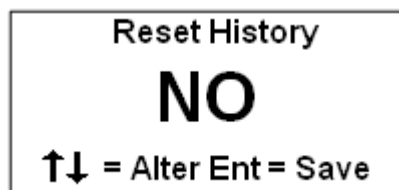
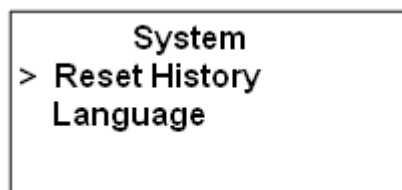
Item	Default Value	Range	Change Amount	Functional Description
Function	MODBUS	MODBUS, NONE, GSM	-	MODBUS: SCADA/PLC integration. GSM: Basic Text messaging 3G Modem NONE – Disable communications. Please cycle power here when making this change.
Baud rate	9600bps	2400,4800,9600, 19200,38400	-	User can choose baud rate when implementing SCADA/PLC MODBUS. For GSM – it is automatically set to 38400bps.
Port Type	RS232	RS232/RS485	-	Supports RS232 or RS485 hardware protocol. May require the addition of an external termination resistor when using RS485 as per standard bus requirements
Slave Address	10	0 to 250	1	User definable slave address. In multi-drop RS485 networks the slave address can be altered to accommodate more than 1 device.
Site Name	Blank	8 Characters		User can define a Site Name. e.g. Pump 1
Phone 1	+61000000000	Standard mobile phone number international format without the preceding 0		Phone number for Registered User 1
Phone 2	+61000000000		Phone number for Registered User 2	
Phone 3	+61000000000		Phone Number for Registered User 3	
Modem Delay	0 to 60secs	30secs	1	Allows time for modem registration on the Mobile Network before messaging is allowed.

### 8.3.3 GSM Text Message Commands

Command	Action (By Registered Users only)
START	Text message command from a mobile phone to start the engine.
STOP	Text message command from a mobile phone to stop the engine.
INFO	Text message command from a mobile phone to receive status. RPM, Volts, Engine Hours

### 8.3.4 System

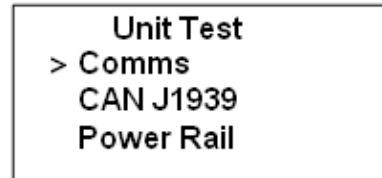
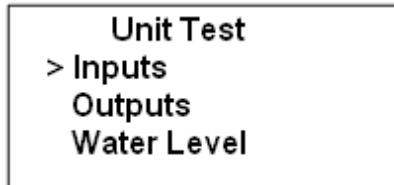
The System Menu allows the use to reset the on board shutdown fault history and change the Language. The current languages supported are English and Chinese.



### 8.3.5 Unit Test

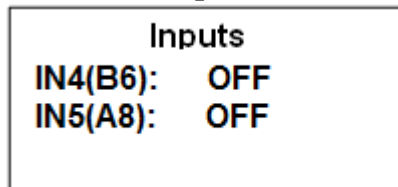
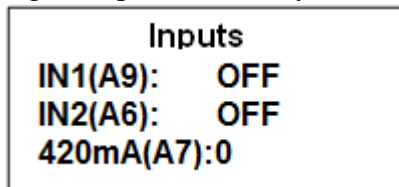
Please note that user must disconnect all connections between control panel and engine especially outputs before entering into the unit test screen.

Select "Unit Test" menu option and press UP, DOWN then ENTER at the item you wish to test.



Please refer to your specific panel schematic for circuit name e.g. A6 and settings configuration as to what Inputs, Outputs, Communications and CAN functions are available.

Select "Inputs" and press "Enter" button, the screen will display and the state the digital input is currently in. **OFF = Open Circuit, ON = Closed Circuit.**



IN1 (A9) = Oil Pres. Switch.

IN4 = Aux 4 Input.

IN2 (A6) = Engine Temp. Switch

IN5 = Start /Stop Button

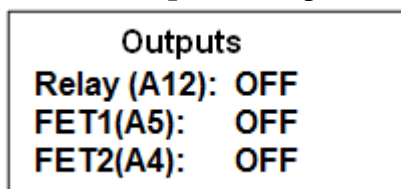
420mA (A7) = Pump Pressure 4-20mA 2 Wire Sensor

Note: IN1 to IN5 are switches to Batt - ,IN5 is to Batt + via Start/Stop Switch

E.g. To test the Temperature switch circuit A6 on the schematic for IN2 Input. Connect the temp switch wire to Battery Neg. The state will change from **OFF** to **ON**. Remove the connection and it should return to **OFF**.

The 4-20mA Input when unconnected is 0 due to the load resistor. When connected at 4mA it should show approximately 820 and is normal. If it is close to 4095 it means the input is shorted to high source and is in error.

Select "Outputs" and press "Enter" button, the screen will display



Press "Enter" button to turn on those outputs one by one. The current output being tested will change from OFF to ON.

Relay = FUEL, FET1 = CRANK, FET2 = GLOW

E.g. Relay set to ON should apply power to the Fuel Stop / ECU Ignition circuit.

Select “Water Level” and press “Enter” button, the screen will display

<p><b>Water Level</b> <b>Water</b></p>
--

Wait for 10 seconds, if the screen show “Water”, the circuit has continuity to Earth.  
If “No Water” appears the radiator Coolant may be low or there is an open circuit on the coolant level wiring.

Select **COMMs** to test the MODBUS/GSM input.

This is a self test of the communications hardware. Please disconnect and device that may be connected to the MODBUS/GSM Port while testing.

<p><b>Comms</b> <b>Send: Test OK</b> <b>Recv: Test OK</b></p>
---

Passed: Testing appears on both lines.  
If the Receive test failed you may see Recv: Failed indicating a hardware issue.

Select CAN J1939 to test the CAN BUS Link.

CAN J1939	
CAN ID	LEN
18FEF600	8
18FEE500	8
0CF00300	8
0CF00400	8

CAN J1939	
CAN ID	LEN
0	0
0	0
0	0
0	0

Passed : Data Present

Failed : No or Corrupted Data

Select **Power Rail** to see the main microcontroller operating power and the Excitation current.

<p><b>Power Rail</b> <b>5V Rail: 5.0V</b> <b>Alt-Excite: 0.0A</b></p>
---

The 5V Rail should always be 4.8Vmin to 5.2Vmax. If outside this range then the main power supply may be damaged.

Alt Excite in this screen should always be 0.0A. If there is a problem with the excitation circuit i.e. fused full or partially ON a current reading may appear. In this situation the battery may be going flat far quicker than expected.

Press “Menu” button to exit the Unit Test and password protected area.

#### Please Note

While in Settings screens if no buttons are pressed for more than one minute it will automatically exit. It will however remain in the Unit Test screen.

## 8.4 Fault History

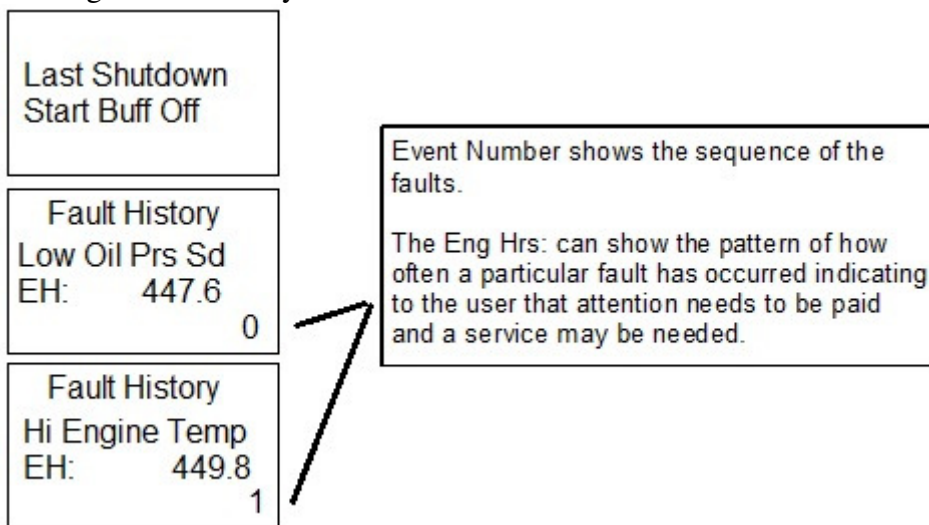
The controller fault history records shutdowns instigated by the controller. The shutdowns can be engine or any user activated sensors such as the 4-20mA Sensor, Aux 4 Input, Oil Pressure Switch or Sensor etc. Up to 20 events are recorded and the fault is logged along with the engine hours it occurred. For ECU history see Section 8.6 View DTC (Diagnostic Trouble Codes).

A shutdown of the engine can be instigated by the protection in the ECU and in this case may appear as an ECU Tripped, Under speed or CAN Data Lost.

E.g. If the ECU self protection shuts the engine down on

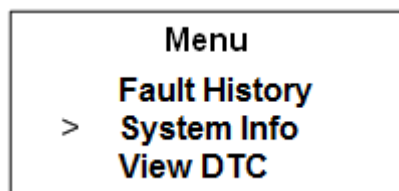
Low Fuel Pressure Metering Rail 1.

When entering the Faulty History menu, the first screen shows the Last Shutdown by the controller whether it is a normal shutdown or a fault. Pressing the Down Arrow scrolls through the fault only shutdown events and the hours it occurred.

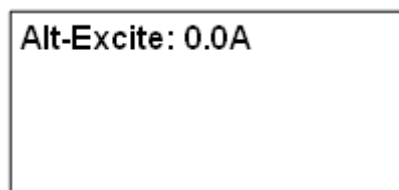
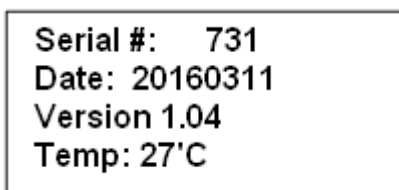


## 8.5 System Information

Press “Menu” button at main RPM display as showed before, then the screen will display



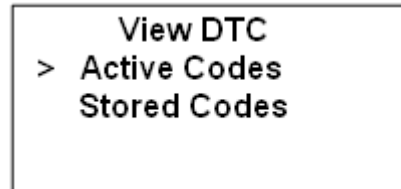
Select “System Info” menu option and press “Enter” button and UP and Down to view system information screens.



The Temp value shows the ambient temperature within the module and panel as a reference only.

The Alt-Excite value should will display if the Excite output is Active.

## 8.6 View DTC (Diagnostic Trouble Codes)



Example:

<b>SPN:</b>	<b>111</b>
<b>FMI:</b>	<b>1</b>
<b>OC:</b>	<b>1</b>
	<b>1/2</b>

SPN 111 = Coolant Level

FMI = 1 Data below normal operating level

Most sever level

OC: Occurrence = 1

If more than one code is present i.e. 1 / 2 use the UP and DOWN arrow to scroll through the active codes.

An ECU Warning or Stop is broadcast to the panel along with an SPN (Suspect Parameter Number), FMI (Failure Mode Identifier) and O/C Occurrence Count.

Any previously active codes are stored on the ECU and can be retrieved from the ECU by entering "Stored Codes". These stored codes cannot be deleted by the panel.

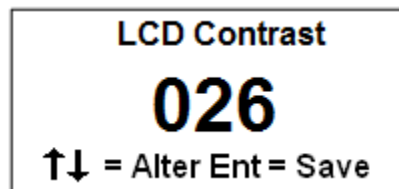
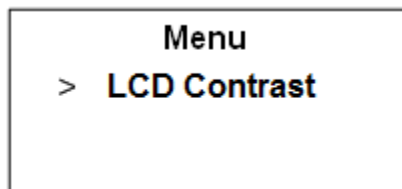
Please refer to the specific engine manufacturer for the code and rectification.

A short list of the most common ECU codes are listed below as a reference only.

SPN	Description
51	Throttle Position
52	Engine intercooler temperature
91	Throttle / Accelerator pedal position 1
95	Fuel filter differential pressure
96	Fuel level
97	Water in fuel indicator
98	Engine oil level
99	Engine oil filter differential pressure
100	Engine oil pressure
101	Crankcase pressure
102	Boost pressure
105	Intake manifold 1 temperature
106	Air inlet pressure
107	Air filter 1 differential pressure
108	Barometric pressure
109	Coolant pressure
110	Engine coolant temperature
111	Coolant level
129	Injector metering rail 2 pressure
132	Inlet air mass flow rate
157	Injector metering rail 1 pressure
168	Electrical potential (voltage)
173	Engine Exhaust Gas Temperature
175	Engine oil temperature 1
176	Turbo oil temperature
627	Power Supply

639	Network Error- Abnormal Update Rate
723	Secondary engine speed
1127	Turbocharger 1 boost pressure
1134	Eng intercooler thermostat opening

## 8.7 LCD Contrast



The contrast of the text can be lightened or darkened by entering this menu and adjusting the number between 0 and 255 by using the up and down arrows.

Please note, the lightest setting or darkest settings may be unreadable depending on temperature.

## 8.8 Early Setup

The Early Setup parameters can be accessed by turning on the controller, as you turn the controller on press MENU and ENTER just after the Controller shows the splash screen. As per the User Settings, these parameters are to be changed by qualified and authorized 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	Default Value	Range	Change Amount	Functional Description
TSC Address	0xEA (234)	0x00 to 0xFE (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.
TSC Mode	0xCD (205)	0x00 to 0xFF (0 to 255)	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.
TSC Rate	20	10 to 55ms	-	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
SPN Version	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.
ECU Warning	Warning	Warning, Shutdown	-	The panel has the ability to treat ECU Warnings 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 if desired.
Engine Hour	NO	NO, YES	-	For a mechanical engine, the engine hours run can be set or reset on the controller.



## 9 MODBUS Register List

MODBUS	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	Pump Pressure Pump Flow	0 – 3200KPA 0 – 1000L/S	1KPA/bit (-256bit offset) 1L/S/bit (-256bit offset)
40020	Remote Start/Stop	0xAA = Start 0x55 = Stop	** Write to Controller
40023	Configuration #	0-65535	** Write to Controller
40024			
40025	Engine Oil Pressure (MECH)	0-145psi	2.91psi/bit
40026	Engine Temperature (MECH)	-40 – 210° C	1°c/bit (-40°c offset)
40027	Battery Volts (MECH)	0.00 – 3212.75VDC	0.05V/bit
40028	Engine Speed (MECH)	0-4000RPM	0.125/bit
40029	Eng Hrs LSB (MECH)	0-210554060.75Hrs	0.05H/bit
40030	Eng Hrs MSB (MECH)		
40038	J1939 SPN		
40039	J1939 FMI		
40047	Hear Beat	0 to65535	
40052	Digital Input 2 Engine Temperature Switch	Bit 1 1 = Active 0 = Not Active	
40053	Digital Input 3 Belt Break	Bit 1 1= Active 0 = Not Active	
40054	Button Increment	Bit 1 1= Active 0 = Not Active	
40055	Button Decrement	Bit 1 1 = Active 0 = Not Active	
40056	Digital Input 1 Oil Pressure Switch	Bit 1 1 = Active 0 = Not Active	
40057	Input 4 Auxiliary 4	Bit 1 1 = Active 0 = Not Active	
40059	Input 5 Start/Stop button	Bit 1 1 = Active 0 = Not Active	
40060	Coolant Level Module	Bit 1 1 = Active 0 = Not Active	
40061	Status/Fault Code Output	0 – 250 Codes 0 = Normal Operation 1 = Low Oil Pressure 2 = High Engine Temp. 3 = Belt Break 4 = Loss of Flow Sw. 5 = Alt Failure 6 = Coolant Level Low 7 = Overspeed 8 = Underspeed	8bit code number

		9 = Bad or NO RPM 10 = Failed Crank Attempts 11 = Aux. Input 1 12 = Aux. Input 2 13 = Aux. Input 3 19 = CAN BUS Failure 23 = Check ECU Codes 24 = Timer Complete 25 = Normal Shutdown 25 32 = Normal Shutdown 32	
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\*(NC = Normally Closed NO = Normally Open)

### Baud Rate and Polling

RS232 or RS485 can be selected in the COMMS menu.

It is recommend that baud rate of 9800bps, 8 data bit, 1 Stop bits, No parity.

Poll all 61 MODBUS registers at once starting from 0.

The fastest polling 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.

### Writing to the Command Registers:

To perform a Start or Stop to the controller you must write a different number to the configuration register then the start or stop command value. This configuration number change stops multiple or accidental writes and actions to the controller.

E.g. Start

The number in the configuration register 40023 must be changed or incremented.

Then a write to the Start Register can be initiated i.e. 40020 0xAA (Start)

E.g. Stop

The number in the configuration register 40023 must be changed or incremented.

Then a write to the stop Register can be initiated i.e. 40020 0x55 (Stop)

## 10 Troubleshooting (Fault Finding)

It is important to comply with the engine manufacturers safety recommendations when troubleshooting the controller. The troubleshooting information provided is for reference only. Only authorized and trained personnel should diagnose, repair or service engine equipment.

### 10.1 Serviceable Parts

There are two serviceable items within the controller.

- 1 The circuit breaker on the front panel protects the electronics, relays and associated wiring. The controller is shipped with a 10 amp circuit breaker pre-installed due to the 3mm wiring loom 10 amp rating. Any changes to wiring looms must take the current rating into account. Further consideration must also be given to the current needs of the installed device, as they are controlled by on-board relays. For example, a fuel

solenoid, which has a hold current of approx. 0.5 amps and a start current of approx. 3 Amps is better suited to a 5 Amp fuse. Consulting your dealer regarding changes to fuse ratings is recommended.

- 2 The automotive type on-board relay(s) are also serviceable items. The relays are mounted in the rear of the controller. Removal of the face panel will expose the module and wiring. Please ensure that all power to the controller is disconnected prior to replacing relays. Due to vibration caused by engine operation, the relay must be fastened to the rear of the controller. It is recommended that relays are only serviced by experienced technicians or authorized dealers.

## 10.2 General

When troubleshooting problems, these general causes should be kept in mind:

1. Incorrect wiring of the unit.
2. Poor battery condition, battery not charged or poor battery connections.
3. Incorrectly connected or missing flyback diodes on the engine electrics which have inductive loads (starter motor, solenoids etc), which can cause problems when they are switched off. These can cause resetting problems for electronic components.

## 10.3 Power Faults

Does not power on	Battery leads not attached correctly	Ensure connections are secure and free of corrosion
	Fuse blown	Check fuse condition
	Low battery voltage	Check battery condition
	Battery leads incorrect polarity	Ensure terminal polarity adheres to wiring diagram
Controller loses power while starting engine	Flyback diode incorrectly fitted to fuel solenoid (or missing)	Ensure flyback diode requirements are met as per wiring diagram
	Flyback diode incorrectly fitted to starter motor (or missing)	Ensure flyback diode requirements are met as per wiring diagram
	Low battery voltage	Check battery condition
	Power short due to incorrect wiring	Ensure all wiring adheres to wiring diagram
	Alternator failure	Alternator replacement may be required
Fuel solenoid chatters	Flyback diode incorrectly fitted to fuel solenoid (or missing)	Ensure flyback diode requirements are met as per wiring diagram
	Low battery voltage	Check battery condition and condition of battery leads

## 10.4 Engine Starting Faults

Starter motor does not crank	Battery voltage low	Check battery condition
	Starter motor wiring is incorrect	Ensure wiring adheres to wiring diagram
Engine cranks but does not start	Fuel solenoid not operating correctly	Ensure "Energize to Stop" / "Energize to Run" operation is set correctly
		Ensure wiring adheres to wiring diagram
		Ensure adequate fuel level in tank
Fuel solenoid does not operate	Fuel solenoid wiring incorrect	Ensure wiring adheres to wiring diagram
	Fuel solenoid is incorrect type – 'Energize to Stop' / 'Energize to Run'	Contact authorized dealer
Engine runs briefly and is then automatically shutdown	Sensor fault	See relevant troubleshooting section

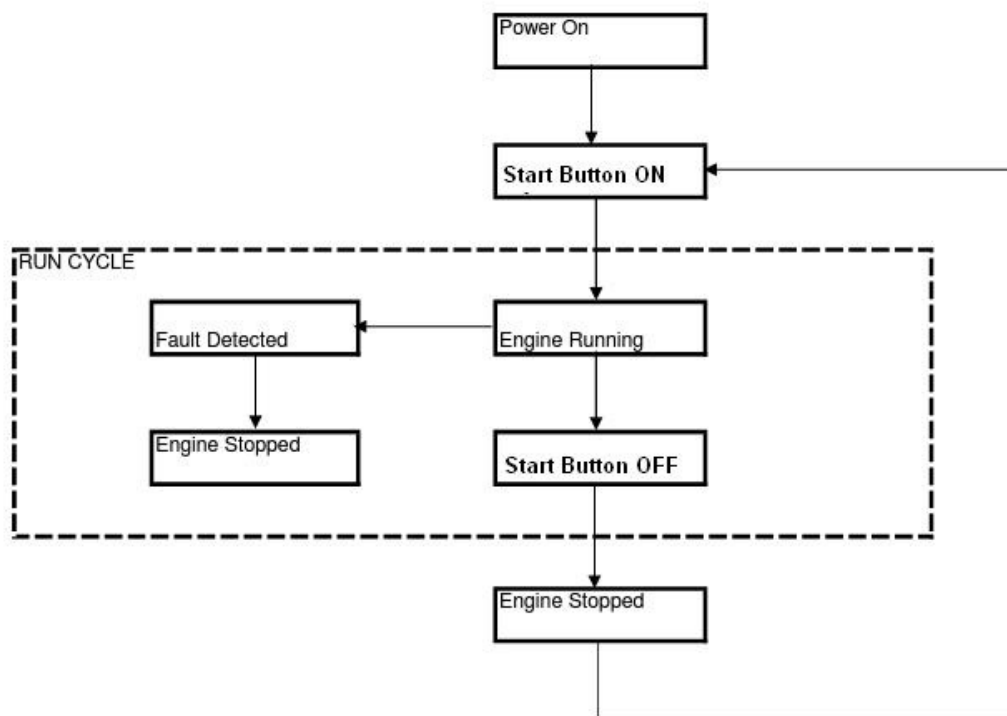
## 10.5 Sensor Faults

Oil pressure fault is indicated	Oil level low	Ensure oil level is adequate
	Oil requires changing	Check condition and age of oil
	Oil lines/sender has become blocked	Verify oil flow is adequate
	Sender wiring is incorrect	Ensure wiring adheres to wiring diagram
	Oil pressure sender is incorrect type	Contact authorized dealer
Coolant level fault is indicated	Coolant level low	Ensure radiator coolant level is adequate
	Coolant requires changing	Check condition and age of coolant
	Sender wiring is incorrect	Ensure wiring adheres to wiring diagram
	Sender is incorrectly mounted	Ensure sender is submerged at maximum water level
	Radiator is not grounding correctly	Check condition of radiator ground wire and terminal
	Sender is incorrect type	Contact authorized dealer

Alternator fault is indicated	Alternator wiring is incorrect	Ensure wiring adheres to wiring diagram
	Alternator failure	Alternator replacement may be required
Sensor # fault is indicated	The applicable sensor has indicated a fault	Check condition for which sensor provides protection

## Appendix A: Run Process Diagram

This diagram shows the basic running process, from power on.



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## 11 Limited Warranty

Contact your dealer with any warranty queries or claims.

- This warranty runs for 12 months 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.