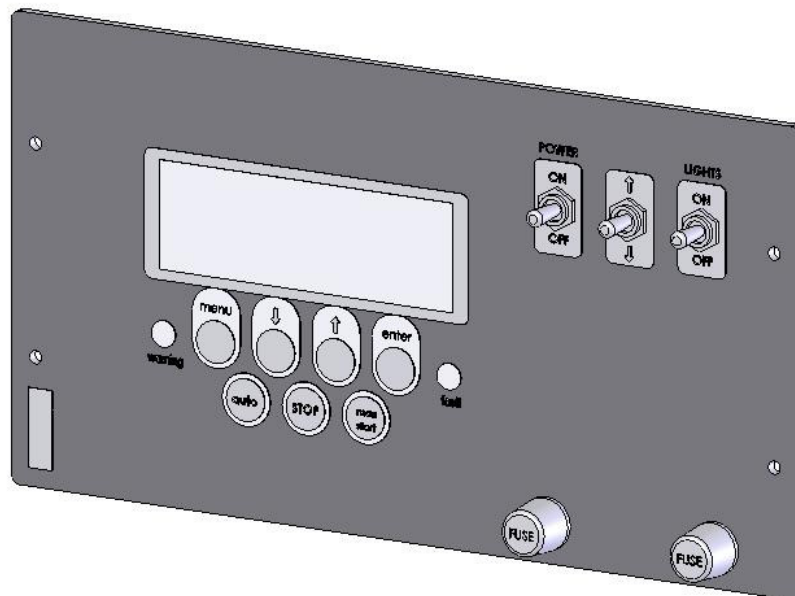


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# DEALER MANUAL

## K45-2 Engine Control Panel

FOR USE ON J1939 OR MECHANICAL  
DIESEL ENGINES



## Table of Contents

Table of Contents .....	2
1 General Warning .....	4
2 Fly-back Diode Installation.....	5
3 Considerations Prior to Operation .....	5
4 Notes about this manual.....	6
5 Notes about the K45-2 .....	6
6 Features of the K45-2 Control Panel .....	6
7 Interface Panel .....	7
7.1 Interface Button Layout .....	7
7.1.1 The K45-2 Interface buttons / switches .....	7
7.2 Interface LEDs and LCD Display .....	8
7.2.1 LCD display with back light .....	8
7.2.2 Warning and Fault LEDs .....	8
7.2.3 Manual mode LED.....	8
8 Basic Operation.....	8
8.1 Starting the engine .....	8
8.1.1 Starting in manual start mode .....	8
8.1.2 <i>Starting in automatic mode</i> .....	9
8.1.3 <i>Stopping the Engine</i> .....	9
9 Menu Items and Setup .....	10
9.1 Main Display (RPM Screen).....	10
9.2 Menu Screens.....	10
9.3 The Run Stop timer.....	11
9.3.1 Setting the Stop timer.....	11
9.3.2 Aborting the Stop timer .....	11
9.4 Settings Menu .....	13
9.4.1 Engine Parameters .....	14
9.4.2 Throttle Parameters (when Enabled) .....	18
9.4.3 4-20mA Sensor Parameters.....	22
9.4.3.1 Flow Parameters.....	23
9.4.3.2 Pump Parameters .....	24
9.4.4 Fuel Level Sender Parameters .....	26
9.4.5 Pump Oil Temperature Parameters .....	27
9.4.6 Pump Pressure #2.....	28
9.4.7 Digital inputs.....	30
9.4.8 Vacuum Priming .....	32
9.4.9 Flow Switch .....	34
9.4.10 Reset Fault History .....	36
9.4.11 Start Types .....	37
9.4.12 MODBUS .....	38
9.4.12.1 MODBUS Communications .....	38
9.5 ECU Warnings and Faults .....	39
9.5.1 View Codes Present (No Fault Present).....	40
9.6 System Information.....	41
9.7 Fault History .....	42
9.8 Engine Configuration.....	42
10 Default Settings and Definitions.....	44
11 Troubleshooting (Fault Finding).....	47
11.1 Serviceable Parts.....	47

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11.2	General .....	48
11.3	LCD Display Faults .....	48
11.4	Power Faults.....	49
11.5	Tachometer Faults.....	50
11.6	Engine Starting Faults.....	50
11.7	Sensor Faults .....	51
11.8	Pump Pressure Faults .....	52
12	Appendix A: Run Process Diagram .....	53
13	Appendix B: K45-2 Menu Map .....	54
14	Appendix C: Float Setup Examples .....	55
	Limited Warranty.....	56

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## 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.

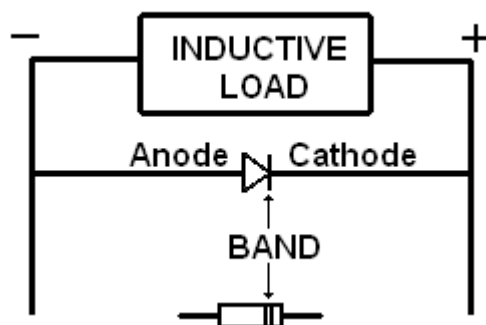
### Prior to Engine Ignition

- 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 persons with expert knowledge. Failure to do so may result in serious damage to equipment, persons and may also void warranty.

## 2 Fly-back Diode Installation

All Inductive Loads (eg. 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.



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

### Note:

If you have purchased this control panel with the engine, it is likely that the fly-back diodes have been fitted to the engine wiring loom by the engine manufacturer or panel installer. Ask your place of purchase to confirm that all necessary diodes have been fitted.

## 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. **It is mandatory that vibration mounts are used when mounting the K45-2 control panel to an engine or engine base.**
- 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 manufacturer's guidelines.
- Sensor wires must not be bundled with other wiring.

## 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**

- Directions to press an interface button are all shown IN CAPITALS.  
Eg: press MENU button
- Labels for Menu Items are shown *in italics*.

## 5 Notes about the K45-2

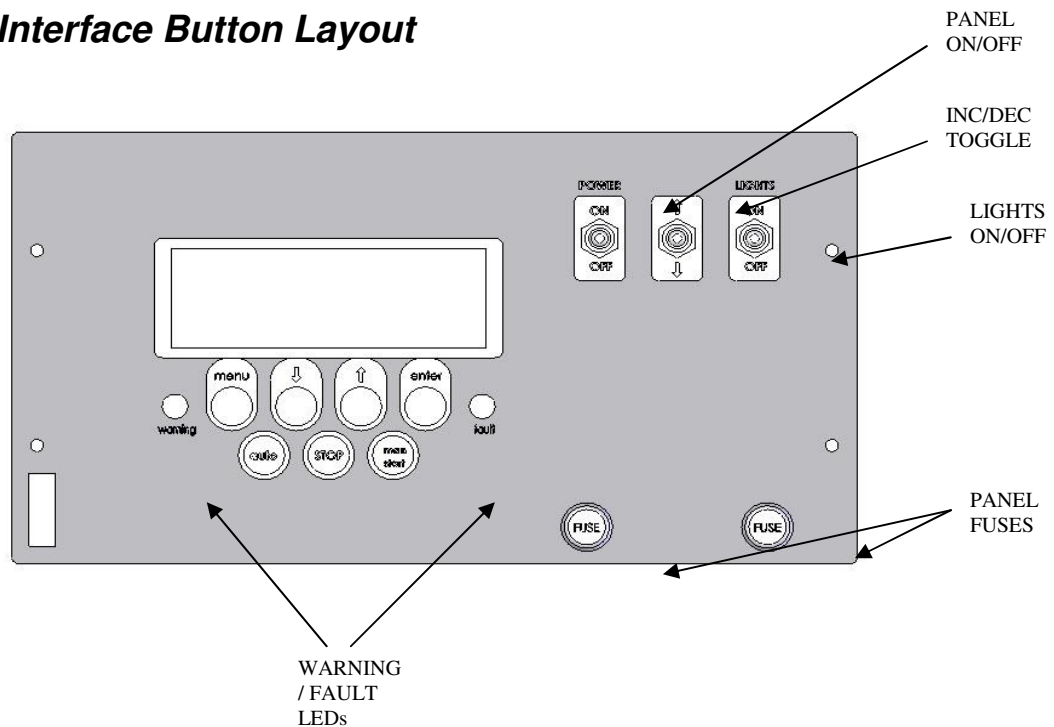
- Due to a service requirement every 100 hours for most applications, the stop timer will not exceed this value.
- Always press the ENTER button to confirm any changes made. Not pressing the ENTER button will not cause changes to take effect.
- It is important to set all changes/settings correctly – these are used to determine the behavior of the K45-2 while the engine is running. **Do not run the engine without checking all values and settings. Factory set values may not be applicable to your engine setup.** Failure to do so may cause damage to engine, controller or personnel.

## 6 Features of the K45-2 Control Panel








- Operates with both J1939 Electronic ECU and Mechanical Engines using applicable wiring harness.
- Throttle Torque/Speed Control (TSC) for J1939 electronic engines or Mechanical engine Speed Control via Linear Actuator with the ability to automatically ramp the engine to a fixed speed.
- Engine Warm-Up and Cooldown timers with variable idle and RPM ramp rate.
- J1939 data providing Active Codes and Engine Configuration.
- Engine Fault History logging and display.
- Clear, large (4x20 Character) and easily visible Liquid Crystal Display shows Battery Voltage, Engine RPM with Over Speed / Under Speed protection and Engine Hour Meter.
- 7 x interface buttons for clear, easy control.
- Adjustable 100 Hour Run Timer.
- 1 x Fuel Level analogue input designed for VDO Fuel Level Senders.
- 4-20mA sensing for Flow or Pump Pressure with adjustable engine shutdowns for Low Flow/Loss of Prime and Maximum Flow/Pump Pressure, with built-in Bypass Timer and Slush Timer.
- 1 x 4-20mA Pump Discharge Pressure with adjustable engine shutdown setpoint, built-in Bypass Timer and Slush Timer.
- Remote Start/Stop ability using external switching device eg. Water Float
- 1 x Relay output used to control ECU power or fuel stop solenoid including Energize to Run or Energize to stop functionality.
- Analogue sensing for Pump Oil Temperature with Adjustable Setpoint.
- 1 x RS232/RS485 port for advanced data and configuration purposes.
- 1 x Speed detection input (Magneto, Magnetic Pickup or Alternator pulse detection) used on mechanical engines.
- 3 x grounded digital inputs with individual re-naming capability.

# 7 Interface Panel

## 7.1 Interface Button Layout



### 7.1.1 The K45-2 Interface buttons / switches

Interface Button	Purpose
<b>MENU</b>  Menu Button	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.
<b>DOWN</b>  Down Button	The DOWN button allows for scrolling through menu items and the decreasing of various values. This is signified on the screen by ↓
<b>UP</b>  Up Button	The UP button allows for scrolling through menu items and the increasing of various values. This is signified on the screen by ↑
<b>ENTER</b>  Enter Button	The ENTER button is used to alter values and confirm changes. Pressing this button in the main menu will enter a sub menu.
<b>AUTO</b>  Auto Button	The AUTO button will place the K45-2 into Automatic mode.
<b>STOP</b>  Stop Button	The STOP button will stop the engine. The Engine Cooldown Timer will commence. Pressing STOP a 2 <sup>nd</sup> time will bypass the cooldown timer.
<b>MANUAL START</b>  Test Button	The MANUAL START button will manually run the engine by starting it immediately.
<b>INC/DEC TOGGLE SWITCH</b>	The INC/DEC toggle switch allows for a RPM trim adjustment between the Speed Select speed points.

## 7.2 Interface LEDs and LCD Display

### 7.2.1 LCD display with back light

The large character LCD unit will display all engine and controller data. The LED backlight provides ease of operation in low light environments.

### 7.2.2 Warning and Fault LEDs

Colour/State	K45-2 Status
Steady Amber	Engine Warning.
Steady Red	Engine Shutdown, Fault.

### 7.2.3 Manual mode LED

Used to indicate when the K45-2 is in manual mode (ie: has been powered on, but not placed in automatic mode). This LED will remain lit until the unit is placed in automatic mode by pressing the AUTO button.

## 8 Basic Operation

### 8.1 Starting the engine

As a general rule, auto-start functions and engine protection features are identical in both manual start and automatic start modes, with the exception of the Stop Timer function which will only operate in manual mode only. All bypass timers begin their count down from engine start/running.

#### 8.1.1 Starting in manual start mode

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

In manual mode the manual mode LED will be on.

Pressing the manual button will trigger the engine starting procedure, providing power to the ECU or fuel solenoid and will show “Status:Starting“, along with a count down timer on the display. This countdown timer is the same length as the *glow period*, if used. On CAN J1939 engines a ‘Wait To Start’ message may appear.

The moment the engine starts an automatic bypass timer on all sensors is active. The duration of this time can vary depending on how the K45-2 or ECU has been set up. A minimum engine sensor lock out time of 20 seconds applies to all sensors except for low oil pressure, this is typically less than 20 seconds.

On a successful start the LCD display will show the engine RPM, Battery Voltage and Engine Hours.

1500RPM	12.5VDC
	125.0HRS
23PSI	40°C
Status: Running@Load	

Main Display



When the engine has started, the engine speed can be quickly adjusted by toggling the increment/decrement switch. The idle and load speeds can be set and adjusted in the controller software which can be accessed by pressing the MENU button, however they may not be accessed whilst the engine is running.

### 8.1.2 Starting in automatic mode

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

To use the unit in Remote Auto-start mode the controller must be set in Auto Mode. This is achieved by pressing the AUTO button. Once in auto mode the *Manual mode LED* will be off and the display will show “Status:Auto:”.

To initiate a start in auto mode the Remote Start Input must be triggered. These are two wires, usually brown and black, provided at the base of the controller.

The start input is either a maintained or momentary input. Please refer to the schematic for your particular setup. The default setup is a maintained input. This is user definable in User Settings Menu under Start Types.

*Maintained* operation is usually a “close to start / open to stop” setup. i.e. while the contacts are closed the engine will be running. When the contacts are open the engine will stop.

*Momentary* operation uses two (active ground) inputs in the controller to start and stop the engine. The same Remote Start Input starts the engine and Remote Stop Input stops the engine.

To avoid false starts the Remote Start Input must be closed for at least 4 seconds before a crank to start will occur. If the Remote Start Input has been triggered the display will show “Status:StartActive” and a countdown timer. If the contactor opens before the elapsed timer the controller will wait for another start signal. The *slush timer* on this input is useful when using single or two floats to start and stop the engine. If the timer reaches 0 the *normal* start procedure will occur as per in manual mode.

### 8.1.3 Stopping the Engine

Pressing the STOP button will stop the engine. To avoid stopping the engine abruptly at high RPM or load, it is recommended the cool down timer is set. When the cool down timer is initiated the engine will return to idle and then shutdown. In this case, the engine RPM can not be manually adjusted.

1500RPM	12.5VDC
	125.0HRS
Pls WAIT or hit STOP	
Status: Cooldown	10

On any stop the shutdown screen above will appear. In the case of a mechanical style engine the screen will appear until the engine RPM drops to zero and/or the stabilization counter has elapsed. In the case of an electronic engine with an onboard ECU, the shutdown period will last for the entire Stabilization timer. No other

operations can be down during this time. The Stabilize period is a safeguard to the ECU ignition input.

### ***Sleep Mode***

When the controller is waiting for a start and no buttons have been pressed for approximately 10mins the K45-2 will go into sleep mode to conserve battery power. The unit is still active but the backlight will be turned off.

## **9 Menu Items and Setup**

### **9.1 Main Display (RPM Screen)**

Engine RPM	1500RPM	12.5VDC	Battery Voltage
Pump Pressure	2500KPA	125.0HRS	Hours Meter
Engine Oil Pressure	23PSI	40°C	Engine Temperature
System Status	Status: OK		

RPM, Battery voltage and engine hours are displayed at all times on the main display. Depending on usage, extra engine data may be displayed on alternative screens that can be displayed by pressing the ↑↓ buttons.

**\*\* Please Note: it is always good practice to return to the main RPM display screen before starting as other information is displayed at various times.**

### **9.2 Menu Screens**

The K45-2 can be configured by accessing the menu items shown on the following LCD screen.

MENU
>1. Set Stop Timer
2. General Settings
3. User Setting

MENU
4. View Active Codes
5. System Info
6. Fault History

MENU
7. Engine Config.

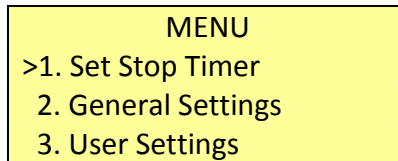
## 9.3 The Run Stop timer

The K45-2 features a 100 Hour Run Timer to limit the runtime of an engine. Once initiated, the timer will count down the remaining time before shutting down the engine.

### 9.3.1 Setting the Stop timer

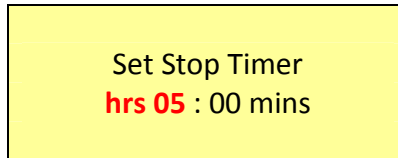
The stop timer can be set either while the engine is running or stopped. This can be accomplished through the following keystrokes:

- Press the MENU button once.
- The Screen will show:



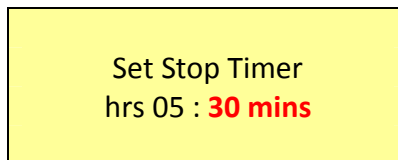
```
MENU
>1. Set Stop Timer
 2. General Settings
 3. User Settings
```

- Press the ↑↓ buttons and select item 1. Set Stop Timer
- Press ENTER and the screen will show:



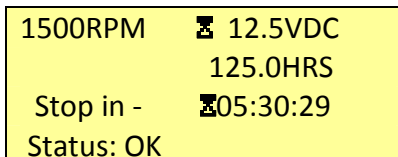
```
Set Stop Timer
hrs 05 : 00 mins
```

- Press the ↑↓ buttons to alter the hours. Press ENTER to save the changes.
- The screen will now show:



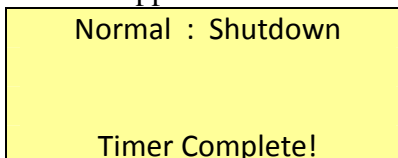
```
Set Stop Timer
hrs 05 : 30 mins
```

- Press ↑↓ buttons to alter the minutes. Press ENTER to save the changes.
- The screen will now return to the main menu.
- Press MENU to return to the RPM screen.
- The screen will now show:



```
1500RPM   ⌚ 12.5VDC
           ⌚ 125.0HRS
Stop in -  ⌚05:30:29
Status: OK
```

The timer will commence when the engine has started and the K45-2 has detected engine RPMs. The hourglass will be animated when the stop timer is active. Upon completion, the engine will be stopped and the screen will show:



```
Normal : Shutdown

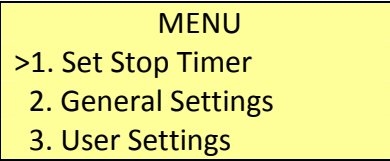
Timer Complete!
```

### 9.3.2 Aborting the Stop timer

The stop timer can be cancelled while the engine is running or stopped. This can be accomplished through the following keystrokes:

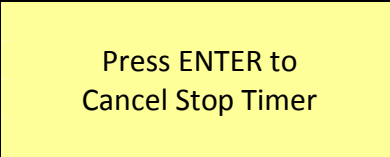
- Press the MENU button once.

- The Screen will show.



MENU  
>1. Set Stop Timer  
2. General Settings  
3. User Settings

- Press the ↑↓ and select item 1.
- Press ENTER and the screen will show.



Press ENTER to  
Cancel Stop Timer

- Press MENU to return to the RPM screen.

## 9.4 Settings Menu

The Settings menu is password protected and should only be accessed by a qualified and authorized user. These settings will define how the system will operate. Care must be taken when changing settings as incorrect values may cause undesirable results. **Exit the settings completely and return to the main display before starting engine.**

- From the Main Display, press the MENU button.
- Press the ↑↓ buttons to select item 3. User Settings.

MENU  
1. Set Stop Timer  
2. General Settings  
>3. User Settings

- Press ENTER. The screen will prompt for a password consisting of 4 values.

Enter Password  
01: 01:01:01

- Use the ↑↓ buttons to enter the required value and press ENTER to proceed to the next. Once all 4 have been set press ENTER

A correct password will allow access to the Setup Menu. For an incorrect password, **“Wrong password Please Re-enter”** will momentarily appear and the screen will return to the Settings Menu.

- Press ↑↓ to cycle through all available menu headings as per below

SETUP  
>1. Engine  
2. Throttle  
3. 4-20mA Sensor

SETUP  
4. Fuel Level  
5. Pump Oil Temp.  
6. Pump Pressure #2

SETUP  
7. Vacuum Priming  
8. Reset History  
9. Start Types

SETUP  
10. MODBUS

Each of these items is associated with different parameters described in detail below. Please note, that at any time the MENU button can be pressed to exit any screen and to return to the RPM screen. Refer to section 7.1.1 for the K45-2 Interface buttons / switches functionality.

## 9.4.1 Engine Parameters

- To access Engine Parameters press the ↑↓ buttons and select item 1.Engine.

SETUP  
>1. Engine  
2. Throttle  
3. 4-20mA Sensor

- Press ENTER, the screen will show:

Engine Parameters  
1. Engine Run Speed  
**1800 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER and then ↑↓ to alter the Engine Run Speed in RPM and ENTER once again to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
2. Speed Source  
**J1939 ECU**  
Enter=Edit ↑↓=Select

- Press ENTER and then ↑↓ to change the Engine Speed Source from J1939 ECU for an electronic engine to Magnetic Pickup or Alternator for a mechanical Engine. Press ENTER once again to save the setting. **Note: It is important to ensure the Engine Speed Source is correctly set. It is vital for the correct operation of the K45-2.**
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
3. Flywheel Teeth  
**120 Teeth**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the number of teeth on the engine flywheel. Press ENTER to save the value. This setting is only applicable when Magnetic Pickup is selected as the Engine Speed source (see above). The K45-2 will not use the Flywheel Teeth when an electronic J1939 ECU is in use.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
4. Pulses per REV  
**10.50 pulses**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the number of pulses from the alternator per engine revolution. This setting is only applicable when Alternator is selected as the Engine Speed source (see above). Press ENTER to save the value. The K45-2 will not use the Pulses per REV when an electronic J1939 ECU is in use.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
5. Underspeed  
**650 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the engine Underspeed set point. Then press ENTER once again to save the value. If the engine speed falls below this value for a minimum of 4 seconds an engine shutdown will occur.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
6. Overspeed  
**1950 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the engine Overspeed set point. Then press ENTER once again to save the value. If the engine speed rises above this value for a minimum of 4 seconds an engine shutdown will occur.

Engine Parameters  
7. Start Speed  
**650 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the engine Start Speed setpoint. Then press ENTER once again to save the value. On a start of the engine when the engine speed rises above this value a crank disconnect will occur.

- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
8. Lockout Delay  
**30 secs**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Engine Sensor Lockout Delay timer then ENTER to save the value. When the engine starts and engine speed is detected, the K45-2 will display sensor readings and will only enable engine shutdowns after the sensor lockout time has expired.

- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
9. Crank Time  
**10 secs**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Engine Crank Time then ENTER to save the value. This value represents the maximum time that the K45-2 will crank the engine on each start attempt. The engine will only crank for the full length of time if it has not successfully started.

- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
10. Crank Rest Time  
**10 secs**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Crank Rest Time then ENTER to save the value. The timer will begin once the K45-2 ceases to crank the engine after an unsuccessful start attempt. After this time has elapsed, the K45-2 may attempt another crank attempt.

- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters

11. Crank Attempts  
**3**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the maximum number of attempts to start the engine, then ENTER to save the value. If this number of unsuccessful crank attempts is reached, the K45-2 will not attempt to start the engine again and the screen will show:

Fault : Shutdown  
Failed 3 Attempts

- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
12. Glow Time  
**3 secs**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the period of time the Glow plugs are energized before engine cranking, then ENTER to save the value. This is used to aid engine starting in colder temperatures.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
13. Warm Up Time  
**0 mins**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Engine Warm Up timer then ENTER to save the value. The timer will begin when the K45-2 detects the engine has started. The engine speed will be set to idle and cannot be adjusted until the Warm Up time has expired.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
14. Cool Down Time  
**0 mins**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Cool Down timer then ENTER to save the value. The timer will begin when the K45-2 detects either an engine fault, a request to switch the engine off, or the ignition switch is turned off. The engine speed will be returned to idle for the Cool Down and a shutdown will occur.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
15. Shutdown Timer  
**1 mins**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Shut Down timer then ENTER to save the value. The shutdown timer is used in applications when it is a requirement to return a pump, compressor or generator to normal operating conditions prior to the engine shutting down. The engine speed will be returned to idle and cannot be adjusted until the timer is complete.



- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
16. Eng. Temp. Alarm  
**105'c**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Engine Temperature Alarm then ENTER to save the value. This is used as a secondary failsafe means for shutting the engine down in the event of high engine temperature.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
17. Read Eng. Temp.  
**Mechanical Sender**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Read Eng. Temp. value then ENTER to save the value. This is used to choose where the engine temperature is read from either a resistive temperature sender or from the J1939 CAN BUS.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
18.Eng OilPrs.Alarm  
**20PSI**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Low Oil Pressure Alarm then ENTER to save the value. This is used as a secondary failsafe means for shutting the engine down in the event of low engine oil pressure.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
19. Read Oil Prs.  
**Mechanical Sender**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Read Oil Prs. value then ENTER to save the value. This is used to choose where the engine oil pressure is read from either a resistive oil pressure sender or from the J1939 CAN BUS.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
20.Coolant Level  
**Disabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Enable/Disable the Water Coolant Level input, then ENTER to save the value. Where fitted, low Coolant Level detection is used to shutdown the engine in the event of an inadequate level of engine coolant.
- Press the ↓ button to move to the next item. The screen will show:

Engine Parameters  
21. Crank Assist

**10 counts**

Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the value of Crank Assistance, then ENTER to save the value. A slight increase of the Crank Assist value may assist with certain engine configurations that exhibit an inability to crank.
- Press the MENU button to move to the SETUP screen.

#### **9.4.2 Throttle Parameters (when Enabled)**

- To access Throttle Parameters Press the ↓ button and select item 2.

SETUP

1. Engine  
>2. Throttle  
3. 4-20mA Sensor

- Press ENTER and the screen will show:

Throttle Parameters  
1. Throttle Type  
**Goto Fixed RPM**  
Enter=Edit ↑↓=Select

- Press ENTER then ↓↑ to Goto Fixed RPM (automatic throttling) then ENTER to save the value. When automatic throttling is enabled, the engine can be started and allowed to automatically reach a set RPM point. Manual RPM adjustment is allowed when the engine has reached this set speed. Alternatively, the Toggle Switch option may be used where automatic throttling is not available.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
2. Engine Idle  
**800 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Engine Idle on engine startup, then ENTER to save the value. An Autodetect option is available for J1939 ECU engines.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
3. Line Fill Speed  
**1200 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Line Fill Speed, then ENTER to save the value. This function becomes active once the engine warm up period has completed. Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
4. Line Fill Time  
**2 mins**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Line Fill Time, then ENTER to save the value. The Line Fill time period will commence once the engine warm up period has completed.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
5. MaxRPM@Variable  
**1800 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the MaxRPM @Variable, then ENTER to save the value. The MaxRPM@ Variable indicates how high the engine will throttle to if Pump Pressure is not being achieved, when throttling with respect to pressure i.e GO Variable.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters

5. MinRPM@Variable  
**1000 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the MinRPM @Variable, then ENTER to save the value. The MinRPM@ Variable indicates how low the engine will throttle to if a Pump Pressure above the target is being achieved, when throttling with respect to pressure i.e GO Variable.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
7.RPM Dead Zone  
**20 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the RPM Dead Zone, then ENTER to save the value. The RPM Dead Zone indicates how close the desired and actual engine rpm must be to be considered satisfactory.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
8.Target Pressure  
**500KPA**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Target Pressure or Flow as selected in 4-20mA Sensors, then ENTER to save the value. The engine RPM will automatically change to try and meet the Target Pressure or Flow.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
9. Prs. Deadband  
**20KPA**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pressure or Flow Deadband as selected in 4-20mA Sensors, then ENTER to save the value. The engine will automatically stop throttling when the Pump Pressure or Flow is within +/- this value of the Target.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
10. J1939 INC Speed  
**20 rpm**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the RPM Increment Speed, then ENTER to save the value. This is the rate at which the engine speed increases with each increment.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
11. J1939 DEC Speed  
**20 rpm**

Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the RPM Decrement Speed, then ENTER to save the value. This is the rate at which the engine speed decreases with each decrement.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
12. Feedback Delay  
**0.5 secs**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the RPM Feedback Delay, then ENTER to save the value. The Feedback Delay is used to adjust the RPM sensitivity when altering engine speed.
- Press the ↓ button to move to the next item. The screen will show:

Throttle Parameters  
13. Ramp Rate RPM/sec  
**100**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the RPM Ramp Rate, then ENTER to save the value. This is the rate at which the engine speed will increase once the engine has started and the warm up timer has expired.
- Press the ↓ button to move to the next item. The screen will show if GO Variable has been selected in Throttle Type :

Throttle Parameters  
14. Stagnant Time  
**1mins**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Stagnant Time, then ENTER to save the value. If Pressure or Flow is not achieved and the RPM is either at the MaxRPM or MinRPM@Variable limit this timer will begin indicating the pressure or flow value is not moving toward the target. This timer indicates how long this state is acceptable. Once this timer has expired the engine will perform a shutdown. This feature can be disabled by setting the time to 0mins.
- Press the ↓ button to move to the next item. The screen will show if GO Variable has been selected in Throttle Type :

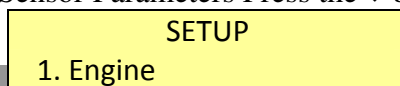
Throttle Parameters  
15. System Retries  
**3**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the System Retries value, then ENTER to save the value. If the Stagnant Time has expired and the engine has shutdown and restarted to achieve water pressure or flow, System Retries defines the amount of times a restart will occur before a fault or latched shutdown is performed.
- Press the MENU button to move to the SETUP screen.

---

### 9.4.3 4-20mA Sensor Parameters

- To access 4-20mA Sensor Parameters Press the ↓ button and select item 3.



2. Throttle  
>3. 4-20mA Sensor

- Press ENTER and the screen will show:

4-20mA Sensor Type  
>Flow Sensor  
Pressure Sensor  
Up/Down to Choose

- Press ↑↓ to alter the usage of the 4-20mA Sensor, and then ENTER to save the setting.

### 9.4.3.1 Flow Parameters

Flow Parameters  
1. Sender Function  
**Enabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to Enable or Disable the Flow sensing function, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Flow Parameters  
2. SenderRange 4-20mA  
**200 L/S**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Range of the 4-20mA Sender in use, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Flow Parameters  
3. Set Min. Flow  
**75 L/S**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Minimum Flow Rate Alarm, then ENTER to save the value. A lower rate of flow than this value will trigger an engine shutdown.
- Press the ↓ button to move to the next item. The screen will show:

Flow Parameters  
4. Set Max. Flow  
**150 L/S**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Maximum Flow Rate Alarm, then ENTER to save the value. A flow rate in excess of this value will trigger an engine shutdown.
- Press the ↓ button to move to the next item. The screen will show:

Flow Parameters  
5. Flow Bypass Time  
**3 mins**

Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Flow Rate Alarm Bypass Timer, then ENTER to save the value. Upon engine startup, the K45-2 will display the flow rate and the Flow Bypass Timer will commence. Engine shutdown due to maximum or minimum flow rates will only be enabled after the bypass time has expired.
- Press the ↓ button to move to the next item. The screen will show:

Flow Parameters  
6. Flow Slush Time  
**10 secs**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Flow Slush Time period, then ENTER to save the value. This value allows for a timer to commence upon detection of a flow rate outside of the minimum or maximum permissible values before the engine will be shutdown.

### 9.4.3.2 Pump Parameters

Pump Parameters  
1. Sender Function  
**Enabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to Disable, Enable or “Enable w. Start\_Stop” the Pump Pressure sensing function, then ENTER to save the value.  
”Enable with Start Stop” when in Auto will enable the engine start and stop to be controlled by Line Pressure start and stop points.
- Press the ↓ button to move to the next item. The screen will show:

Pump Parameters  
2. SenderRange 4-20mA  
**1000 KPA**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Range of the 4-20mA Sender in use, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Pump Parameters  
3. Set Min Press.  
**200 KPA**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Minimum Pump Pressure Alarm, then ENTER to save the value. The low pump pressure or Loss of Prime alarm/engine shutdown is set in this screen.

- Press the ↓ button to move to the next item. The screen will show:

Pump Parameters  
4. Set Max Press.



**600 KPa**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Maximum Pump Pressure Alarm, then ENTER to save the value. A pump pressure in excess of this value will trigger an engine shutdown. Press the ↓ button to move to the next item. The screen will show:

Pump Parameters  
5. Pump Prs. Bypass  
**3min**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Pressure Alarm Bypass Timer, then ENTER to save the value. Upon engine startup, the K45-2 will display the pump pressure and the Pump Pressure Bypass Timer will commence. Engine shutdown due to maximum or minimum pressure pump will only be enabled after the bypass time has expired. Press the ↓ button to move to the next item. The screen will show:

Pump Parameters  
6. Pump Prs. Slush  
**3 secs**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Pressure Slush Timer, then ENTER to save the value. This value allows for a timer to commence upon detection of a pump pressure outside of the minimum or maximum permissible values before the engine will be shutdown. Press the ↓ button to move to the next item. The screen will show:

Pump Parameters  
7. Calibration  
**50counts OKPA**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Calibration Counts then ENTER to save the value. This value allows the operator to Zero the transducer and remove any offset that may occur. Press the ↓ button to move to the next item. The screen will show:

Pump Parameters  
8. Start Option  
**Start Low Stop High**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Start Option then ENTER to save the value. The controller can set set to Start on a Low pressure and Stop on a High Pressure **OR** Start on a High Pressure and Stop on a Low Pressure. Press the ↓ button to move to the next item. The screen will show:

Pump Parameters  
9. Start Pressure  
**300KPA**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Start Pressure then ENTER to save the value. This is the trigger pressure to Start the engine.  
Press the ↓ button to move to the next item. The screen will show:

Pump Parameters  
10. Stop Pressure  
**700KPA**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Stop Pressure then ENTER to save the value. This is the trigger pressure to Stop the engine.

**Please Note:** *The Start and Stop Pressures are usually set between the limits set in SET MIN PRESS. & SET MAX PRESS.*

Press the MENU button to exit the Pump Parameters.

#### 9.4.4 Fuel Level Sender Parameters

**Note:** VDO Fuel Level Sender required. Refer to dealer for part numbers.

- To access Fuel Level Parameters press the ↓ button and select item 4.

SETUP  
>4. Fuel Level  
5. Pump Temperature

## 6. Flow Switch

- Press ENTER and the screen will show:

Fuel Level Setup  
1. Fuel Alarm Point  
**Disabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Low Fuel Level Alarm percentage (%), then ENTER to save the value. This is the percentage of fuel remaining in the fuel tank which will trigger a warning or engine shutdown. Press the ↓ button to move to the next item.

The screen will show:

Fuel Level Setup  
2. Alarm Action  
**Warning**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Low Fuel Level Alarm Action type, then ENTER to save the value. The alarm action can be set to either WARNING or engine SHUTDOWN. Press the ↓ button to move to the next item. The screen will show:

Fuel Level Setup  
3. Fuel Sender Type  
**Float or Arm Type**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Fuel Sender Type, then ENTER to save the value. The options are: Tubular Sender or Float or Arm Type. The Fuel senders used are manufactured by VDO. Press the ↓ button to move to the next item. The screen will show:

Fuel Level Setup  
4. Fuel Calibration  
**82 Counts**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Fuel Calibration Count, then ENTER to save the value. The menu allows for the use of two types of VDO fuel level senders by altering a calibration value. Press the MENU button to move to the SETUP screen.

### 9.4.5 Pump Oil Temperature Parameters

- To access Pump Oil Temp. Parameters press the ↓ button and select item 5.

SETUP  
4. Fuel Level  
>5. Pump Oil Temp.  
6. Pump Pressure # 2

- Press ENTER and the screen will show:

Pump Temp. Param.

1. Pump Temp. Alarm  
**Disabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Temperature Enable/Disable, then ENTER to save. Press ↓ to move to the next item. The screen will show:

Pump Temp. Param.  
2.PumpTemp Setpoint  
**40'c**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Temperature Alarm, then ENTER to save the value. Press the MENU button to move to the SETUP screen.

## 9.4.6 Pump Pressure #2

For Discharge Pressure usage.

- To access Pump Pressure #2 press the ↓ button and select item 6.

SETUP  
4. Fuel Level  
5. Pump Oil. Temp  
>6. Pump Pressure #2

- Press ENTER and the screen will show:

Pump Prs2 Parameters  
1. Sender Function  
**Enable**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Range of the 4-20mA Sender in use, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Pump Prs2 Parameters  
2. SenderRange 4-20mA  
**750 KPA**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to Enable or Disable second Pumping Pressure Sender sensing, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Pump Prs2 Parameters  
3. Set Min Press.  
**200 KPA**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Minimum Pump Pressure Alarm, then ENTER to save the value. The low discharge pressure or Loss of Prime alarm/engine shutdown is set in this screen.
- Press the ↓ button to move to the next item. The screen will show:

Pump Prs2 Parameters  
4. Set Max Press.  
**600 KPa**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Maximum Discharge Pump Pressure Alarm, then ENTER to save the value. A pump discharge pressure in excess of this value will trigger an engine shutdown. Press the ↓ button to move to the next item. The screen will show:

Pump Prs2 Parameters  
5. Pump Prs.2 Bypass  
**3min**  
Enter=Edit ↑↓=Select

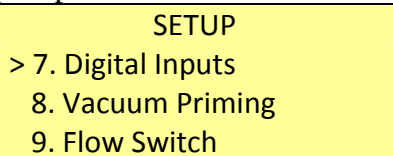
- Press ENTER then ↑↓ to alter the Pump Discharge Pressure Alarm Bypass Timer, then ENTER to save the value. Upon engine startup, the K45-2 will display the pump pressure and the Pump Pressure Bypass Timer will commence. Engine shutdown due to maximum or minimum pressure pump will only be enabled after the bypass time has expired. Press the ↓ button to move to the next item. The screen will show:

Pump Prs2 Parameters  
6. Pump Prs.2 Slush  
**3 secs**  
Enter=Edit ↑↓=Select

Press ENTER then ↑↓ to alter the Pump Discharge Pressure Slush Timer, then ENTER to save the value. This value allows for a timer to commence upon detection of a pump pressure outside of the minimum or maximum permissible values before the engine will be shutdown. Press the MENU button to move to the SETUP screen

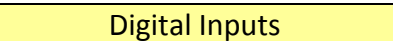
### 9.4.7 Digital inputs

- To access Digital Inputs press the ↓ button and select item 7.



SETUP  
> 7. Digital Inputs  
8. Vacuum Priming  
9. Flow Switch

- Press ENTER and the screen will show:



Digital Inputs

1. Bearing Temp Swt  
**Enabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Bearing Temperature Function to Enable or Disabled, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Digital Inputs  
2. Bearing Temp Swt  
**Normally Closed**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Bearing Temperature Input type to Normally Closed or Normally Open, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Digital Inputs  
3. Pump Oil Lvl Swt  
**Enabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Oil Level Function to Enable or Disabled, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Digital Inputs  
4. Pump Oil Lvl Swt  
**Normally Closed**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Oil Level Input type to Normally Closed or Normally Open, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Digital Inputs  
5. Pump Clutch Input  
**Enabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Clutch Function to Enable or Disabled, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Digital Inputs  
5. Pump Clutch Input  
**Normally Open**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Pump Clutch Input type to Normally Closed or Normally Open, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Digital Inputs  
6. Water Loss Input  
**Enabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Water Loss Function to Enable or Disabled, then ENTER to save the value.

- Press the ↓ button to move to the next item. The screen will show:

Digital Inputs  
6. Water Loss Input  
**Normally Closed**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Water Loss Input type to Normally Closed or Normally Open, then ENTER to save the value.

### 9.4.8 Vacuum Priming

- To access Vacuum Priming press the ↓ button and select item 8.

SETUP  
7. Digital Inputs  
> 8. Vacuum Priming  
9. Flow Switch

- Press ENTER and the screen will show:

Vacuum Priming  
1. Vac. Function



**Disabled**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Vacuum Priming Function to Enable or Disabled, then ENTER to save the value.
- Press the ↓ button to move to the next item. The screen will show:

Vacuum Priming  
2. Slush Time  
**4 secs**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Vacuum Priming Slush Time, then ENTER to save the value. The Slush Time affects the “ Vac. Water Loss” and the ” Accum Pump Clutch” Digital Inputs which in there normal state are Normally Closed. These inputs must see the alternate state (OPEN) for the set slush time before the “Bypass Time” begins to count down and Clutch Relay R9 will be engaged.
- Press the ↓ button to move to the next item. The screen will show:

Vacuum Priming  
3. Bypass Time  
**6 mins**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Vacuum Priming Bypass Time. , then ENTER to save the value. The Bypass Time will begin countdown when the “Vac. Water Loss” input and the “Accum Pump Clutch Inputs” are triggered. If water pressure/flow has not been sensed and the Bypass time has elapsed the engine will commence a controlled shutdown.

### Vacuum Priming Function Screen

From the Main RPM press the ↑button to view the Vacuum Priming status.

Vacuum Priming: OFF  
Water Level : LOW  
Pump : OFF  
Timer: 06:00

If the Function is enabled and the “Vac. Priming” toggle switch on the front of the panel is ON the “Vacuum Priming” status will show “ON”.

If the Vac. Water Loss Input is in its normal state i.e. water present the “Water Level” will show : HIGH else, if the input is triggered (OPEN) it will show “LOW”.

If the “Vac. Water Loss” input is LOW and the Accum. Pump Clutch Inputs is triggered the clutch will be engaged and the status will Show PUMP: ON. Once water has returned the clutch will turn OFF and the Pump status will also show Pump OFF.

The Timer, when counting down, is indicating that the water is low and the pump is on. If the timer reaches 00:00 the engine will shutdown.

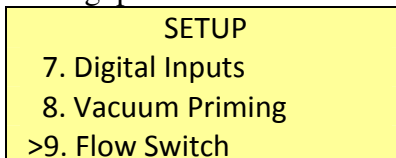
If water returns, the timer will reset to the set time Timer: 06:00

Please note: The displayed timer does not indicate the flow switch timer only the Vacuum Timing Function.

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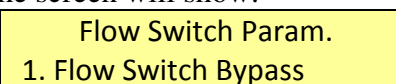
### 9.4.9 Flow Switch

- To access Vacuum Priming press the ↓ button and select item 8.



SETUP  
7. Digital Inputs  
8. Vacuum Priming  
>9. Flow Switch

- Press ENTER and the screen will show:



Flow Switch Param.  
1. Flow Switch Bypass

**Disabled**

Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Flow Switch Bypass Timer, then ENTER to save the value. Upon engine startup, the panel will bypass the Flow Switch until the Bypass Timer has expired. If the Bypass Timer is set, engine shutdown due to a flow switch fault will only be enabled after the bypass time has expired.

- Press the ↓ button to move to the next item. The screen will show:

Flow Switch Param.

2. Flow Slush Timer

**10 secs**

Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Flow Switch Slush Timer, then ENTER to save the value. This value allows for a timer to commence upon detection of a flow switch fault before the engine will be shutdown.
- Press the ↓ button to move to the next item. The screen will show:

Flow Switch Param.

3. Flow Switch Type

**Normally Closed**

Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Flow Switch Type, then ENTER to save the value. A Normally Open or Normally Closed Flow Switch type may be used.
- Press the ↓ button to move to the next item. The screen will show:

Flow Switch Param.

4. Shutdown Type

**Controlled**

Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Flow Switch Shutdown Type, then ENTER to save the value. This value allows for either an Immediate or Controlled engine shutdown to occur upon Flow Switch fault. A Controlled shutdown will allow a cooldown period to expire, an Immediate shutdown type will not.
- Press the ↓ button to move to the next item. The screen will show:

Flow Switch Param.

5. Input Type

**Passive**

Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Flow Switch Input Type, then ENTER to save the value. The settings available are Active, allowing a powered Flow Switch to be used, and Passive, allowing an un-powered switch-type Flow Switch to be used.
- Press the ↓ button to move to the next item. The screen will show:

Flow Switch Param.

6. Latched Shutdown

**Shutdown Latched**

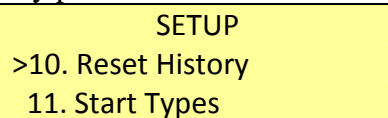
Enter=Edit ↑↓=Select

- 
- Press **ENTER** then **↑↓** to alter the Latched shutdown enable, then **ENTER** to save the value. This value allows for either a latched shutdown or non-latched shutdown to occur upon Flow Switch fault.
  - Press the **MENU** button to move to the **SETUP** screen.

#### **9.4.10 Reset Fault History**

This menu is used to delete fault codes generated prior to an engine or machine repair.

- To access Reset History press the **↓** button and select item 8.



## 12. Modbus

- Press ENTER and the screen will show:

Press Enter to Reset  
the Fault History  
or Menu to Exit

- Press ENTER to reset the fault history or MENU to exit.

### 9.4.11 Start Types

This menu is used to setup the K45-2 Panel's Remote Start and Stop functionality and the Fuel Relay control.

- To access the Start Types menu press the ↓ button and select item 9.

SETUP  
10. Reset History  
>11. Start Types  
12. Modbus

- Press ENTER and the screen will show:

Start Parameters  
1. Set Start Type  
**Maintained**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Type of trigger used for the Remote Start input, then ENTER to save the value. The options are “Maintained”, requiring the trigger to remain active for the duration of the engine runtime, and Momentary, which allows the trigger to deactivate once the engine has started.
- Press the ↓ button to move to the next item. The screen will show:

Start Parameters  
2. Input Type  
**Start NO Stop NO**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Type of trigger used for the Remote Start and Stop inputs, then ENTER to save the value. Four combinations allow for Start and Stop to use Close on Rise (CR) or Close on Fall (CF).  
(See Section 14 Appendix C for Float Setup usage examples.)
- Press ENTER and the screen will show:

Start Parameters  
3. Fuel Relay Ctrl.  
**Energize to Run**  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Fuel Relay type, then ENTER to save the value. In an Energize to Run system the Fuel Relay is energized whilst the engine is in operation and de-energized upon engine shutdown. In an Energize to Stop system, the Fuel Relay is de-energized whilst the engine is in operation and energized upon engine shutdown.
- Press the MENU button to move to the SETUP screen.

---

## 9.4.12 MODBUS

### 9.4.12.1 MODBUS Communications

In “User Settings” the MODBUS Setup Screens can be accessed in

SETUP
10. Reset History

11. Start Types  
>12. Modbus

MODBUS data can be acquired from the controller for SCADA, PLC or any other MODBUS compliant telemetry system. The controller is 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.

Press ENTER and the screen will show:

Modbus  
Active  
RS232  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Communication Protocol. The controller can be configure for RS232 or RS485. Press ENTER to save the value. Press ↓ to move to the next item.

Modbus  
Slave Address  
010  
Enter=Edit ↑↓=Select

- Press ENTER then ↑↓ to alter the Slave Address. The controller has a unique address in the MODBUS chain which can be configured between 0 and 250. Press ENTER to save the value. Press ↓ to move to the next item or MENU to Exit

## 9.5 ECU Warnings and Faults

When used with a J1939 Electronic Engine ECU the K45-2 is able to display Warnings and Faults that are sent over the CAN BUS: For example:

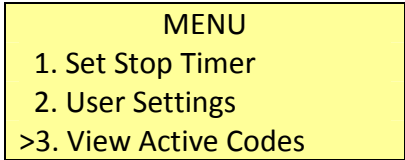
1500RPM      12.5VDC  
                  125.0HRS  
\_23PSI        105'C  
Status: ECU Warning!

The amber LED will illuminate when a warning message is generated. The message will not be cleared until the engine problem is rectified. The K45-2 will not shutdown on an **“ECU Warning!”**, however, the ECU will shut the engine down itself if an **“ECU Stop!”** occurs. The ECU is permitted to self-protect and the **“ECU Stop!”** will be logged in the K45-2. The red LED will illuminate when an engine shutdown message is generated. If a warning or stop is present, the faults can be viewed in the **“View Active Codes”** menu.

If there are more than one code present, pressing the ENTER button will go to the next code available. If there is more than one code present you may have to go out of this screen and return to it to view current information.

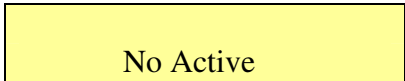
### 9.5.1 View Codes Present (No Fault Present)

- To access View Active Codes press the ↓ button and select item 3.



MENU  
1. Set Stop Timer  
2. User Settings  
>3. View Active Codes

- Press ENTER and the screen will show:



No Active



## Fault Codes

- If there are no active codes broadcasted from the engine's ECU, the screen will show NO ACTIVE FAULT CODES.
- View Active Codes (Fault(s) Present)
- Any fault codes and messages generated by the engine's ECU will be displayed by the K45-2 Control Module.
- Press ENTER and the screen will show: For example:

```
SPN:110      FMI: 3
OC: 1        1/1
Eng Coolant Temp. High
```

- If active codes are present the screen will show the SPN (Suspect Parameter Number), FMI (Failure Mode Identifier), OC (Occurrence Count) and a description of the fault.
- If multiple messages exist then the 1 of 1 (1/1) will be altered to 1 of 2 or 1 of 3 etc. To view multiple messages press ENTER to view each message. Press the MENU button to move to the SETUP screen.

### Note:

An active code can only be cleared by the ECU once the problem has been rectified. The K45-2 Control Module treats ECU warnings for oil pressure and engine temperature as shutdowns. The K45-2 will not permit an engine start if the oil and engine temperature sensors are faulty or disabled.

## 9.6 System Information

This menu provides basic information regarding the controller setup.

- To access the System Information Parameters press the ↓ button and select item 4.

```
MENU
>4. System Info
5. Fault History
6. Engine Config.
```

- Press ENTER and the screen will show:

```
Serial Number
373
```

- Press ENTER and the screen will show:

```
Build Date
20110401
```

- Press ENTER and the screen will show:

Firmware Version  
V1.98VP

- Press ENTER and the screen will return to the MENU screen.

## 9.7 Fault History

- To access the Fault History Information press the ↓ and select item 5.

MENU  
4. System Info  
>5. Fault History  
6. Engine Config.

- Press ENTER and the screen will show all previous faults generated by the pump, generator, or compressor attached to the engine. For example:

Bad or No RPM  
  
Occurrence: 1

- Continue to press ENTER until all faults are shown and the screen returns to the MENU screen.

## 9.8 Engine Configuration

- To access the Engine Configuration Information press the ↓ button and select item 6. The Engine Configuration menu is for use with J1939 Electronic ECU engines. It enables the user to view the various RPM setpoints configured within the ECU.

MENU  
4. System Info  
5. Fault History  
>6. Engine Config.

- Press ENTER and the Screen will now show:

Engine Speed Pt1  
@ Idle 0 rpm

This screen shows the Engine Speed Setpoint 1 value for Idle.

- Press ENTER and the Screen will now show:

Torque @ Idle  
Pt1 131%

This screen shows the Engines Torque output at Engine Speed Setpoint 1 for idle.

- Press ENTER and the Screen will now show:

Engine Speed Pt2  
0 rpm

This screen shows the Engine Speed Setpoint 2 value.

- Press ENTER and the Screen will now show:

Torque Pt2  
131%

This screen shows the Engines Torque output at Engine Speed Setpoint 1 for idle.

- Press ENTER repeatedly to view Setpoint 3, Setpoint 4, and Setpoint 5 values. Following these, the Screen will show:

Engine Speed @High  
Idle Pt6 0 rpm

This screen shows the Engine Speed @ High Idle Setpoint 6.

- Press ENTER and the Screen will now show:

Gain KP Endspeed  
Governor 0%

This screen shows the Gain in KPa. Press ENTER and the Screen will now show:

Reference Engine  
Torque 0 Nm

This screen show the Engine Torque reference value.

- Press ENTER and the Screen will now show:

Max Engine O/Spd  
Pt 7 0 rpm

This screen shows the Maximum Engine Overspeed Setpoint 7 value.

- Press ENTER and the Screen will now show:

Max Mom Engine

Override 0 secs

This screen shows the Maximum Momentary Engine Override value.

- Press ENTER and the Screen will now show:

Req. Spd. Control  
Low Lim. 0 rpm

This screen shows the Requested Speed Control Lower Limit value.

- Press ENTER and the Screen will now show:

Req. Spd. Control  
High Lim. 0 rpm

This screen shows the Requested Speed Control High Limit value.

- Press ENTER and the Screen will now show:

Req. Torque Cntrl  
Low Limit 131%

This screen shows the Requested Torque Control Lower Limit value.

- Press ENTER and the Screen will now show:

Req. Torque Cntrl  
High Limit 131%

This screen shows the Requested Torque Control High Limit value.

## 10 Default Settings and Definitions

Item	Setting Variable	Default Value	Range	Change Amount	Function Description
1	Engine Run Speed	1800RPM	1000 to 4000RPM	25 RPM	Desired speed of engine at load
2	Speed Source	Alternator	J1939/Magnetic Pickup/Alternator	-	Use J1939 for an Electronic ECU Engine, Magnetic Pickup or Alternator for a Mechanical Engine.
3	Flywheel Teeth	120 teeth	60 to 190 teeth	1 tooth	Number of teeth on the engine flywheel when a Magnetic Pickup Speed Source is used for a Mechanical Engine.
4	Pulses Per Revolution	10.50 pulses	2.00 to 25.00 Pulses/Revolution	0.02	Number of Pulses from Alternator for 1 Revolution of the engine. Use when Alternator is selected as Speed Source for Mechanical Engine.

5	Under speed	650RPM	550 to 2000RPM	25 RPM	Engine overload slow speed protection with slush delay of 5secs.
6	Over speed	1950RPM	1000 to 4000RPM	25 RPM	Engine high speed protection with slush delay of 5secs
7	Start Speed	600rpm	400 to 2000RPM	25RPM	Digital and analogue sensor shutdown bypass timer on engine startup.
8	Lockout delay	30secs	20 to 60secs	1 sec	Digital and analogue sensor shutdown bypass timer on engine startup.
9	Crank Timer	10secs	5 to 20secs	1sec	Maximum time engine will crank on a start attempt.
10	Crank Rest Timer	10secs	5 to 60secs	1sec	Allows engine to rest after an unsuccessful start attempt before retry.
11	Crank Attempts	3 attempts	3 to 10 attempts	1	Allows engine to retry after a failed start attempt.
12	Glow Timer	3sec	0 to 20secs	1	Time to energize Glow plug(s) when starting engine as an aid in cold temperatures.
13	Warm Up Timer	0 mins	0 to 20 mins	10 min	Allows engine to warm up at idle prior to throttling at full load.
14	Cool Down Timer	0 mins	0 to 20 mins	1 min	Allows engine to cool down to idle after operating at full load.
15	Shutdown Timer	1mins	0 to 20mins	1 min	Allows engine to cool down to idle after a Pump fault has occurred.
16	Engine Temp Alarm	105°C	0 to 200°C	1 °C	If the Engine Coolant temperature rises above this value the engine will be immediately shutdown.
17	Read Eng. Temp	Mechanical Sender	Mechanical Sender or J1939 ECU	--	Source of Engine Coolant Temperature -- Resistive sender or J1939 CAN BUS value.
18	Engine Oil Pressure Alarm	20PSI	0 to 144PSI	1 PSI	If the Engine Oil Pressure falls below this value the engine will be immediately shutdown.
19	Read Oil. Prs.	Mechanical Sender	Mechanical Sender or J1939 ECU	--	Source of Engine Oil Pressure -- Resistive Sender or J1939 CAN BUS value.
20	Engine Coolant Level	Disabled	Disabled to Enabled	-	Allows Low Engine Water Coolant Level detection with 5sec slush before Engine Shutdown.
21	Crank Assist	10counts	0 to 150counts	1 count	Allows engines that exhibit rpm faults to extend their initial crank time.
<b>Item</b>	<b>Setting Variable</b>	<b>Default Value</b>	<b>Range</b>	<b>Change Amount</b>	<b>Function Description</b>
	<b>Throttle Parameters</b>				
1	Throttle Type	Go to Fixed RPM	Disabled to Go to Fixed RPM	-	Enables automatic engine throttling to fixed speed or Variable RPM
2	Engine Idle	800	Auto detect to 1200RPM	25 RPM	Idle Speed Select for engine startup speed.
3	Line Fill Speed	1200RPM	900 to 2000 RPM	25 RPM	After the warm up timer has elapsed the engine (when in auto) will throttle to this speed for the adjustable time set to fill irrigation lines.
4	Line Fill Time	2min.	0 to 20mins	1 min	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.

5	MaxRPM@ Variable	1800RPM	900 to 4000RPM	25 RPM	When in Variable and pump pressure is not achieved this is the maximum RPM the engine will throttle to.
6	MinRPM@ Variable	1000RPM	900 to 4000RPM	25 RPM	When in Variable and pump pressure is achieved this is the minimum RPM the engine will throttle to.
7	RPM Dead Zone	20RPM	10 to 200RPM	10 RPM	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
8	Target Pressure	500KPA	0 to 3200KPA	10KPA	When in Variable the Target Pressure the system is trying to achieve
9	Pressure Deadband	20KPA	10 to 300KPA	5KPA	When the engine speed is changing the throttle will cease to alter once the real time pressure is within +/- the pressure dead zone of the target Pressure
10a	J1939 INC Speed (ECU electronic engines)	20RPM/SEC	10 to 250RPM/Sec	10 RPM	When throttling to idle, line fill speed, fixed speed or max/min RPM this defines the incremental rate at which the throttle will increase.
11a	J1939 DEC Speed (ECU electronic engines)	20RPM/SEC	10 to 250RPM/Sec	10 RPM	When throttling to idle, line fill speed, fixed speed or max/min RPM this defines the decremented rate at which the throttle will decrease.
10b	Linear INC Speed	20%	10 to 100%	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.
11b	Linear Dec Speed	20%	10 to 100%	1%	When throttling to idle, line fill speed, fixed speed or max/min RPM this defines the decremented rate at which the throttle will decrease.
12	Feedback Delay	0.2sec.	0.5 to 4.0secs	0.1 sec	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 genset system to respond.
13	Throttle Ramp Rate	100RPM/SEC	10 to 600RPM/Sec	10 RPM	Engine speed rate of increase at engine startup, normally after warm up and line fill timer.
14	Stagnant Time	1min	0 to 20mins	1min	When in Variable, if the target is not achieved and the RPM is at MIN or MAXRPM for the stagnant time, the system has become stagnant and the engine will shutdown. Set to 0mins to Disable.
15	System Retries	3	0 to 20	1	The amount of times the engine will restart when the system becomes stagnant before a latched shutdown occurs.
	<b>4-20A Flow Sensor</b>				
1	Sender Function	Disabled	Enable or Disabled	-	Enable/Disable the 4-20mA Sender.
2	4-20mA Flow Sender Max Range	300L/S	0 to 1000Litres/Sec	5 L/S	Maximum reading of 4-20mA Sender.
3	4-20mA Minimum Flow	75 L/S	10 to Maximum	5 L/S	Minimum Flow rate for Shutdown.
4	4-20mA Maximum Flow	245 L/S	Min to Range	5 L/S	Maximum Flow rate for Shutdown.
5	4-20mA Flow Bypass Timer	3 min	1 to 60mins	1 min	Startup bypass time before shutdowns are enabled.
6	4-20mA Flow Slush Timer	10 sec	10 to 60secs	1 sec	Slush time before shutdown occurs.
	<b>4-20mA Pressure Sender</b>				

1	Sender Function	Disabled	Enable or Disabled	-	Enable/Disable the 4-20mA Sender.
2	4-20mA Pump Pressure Sender Max Range	1000KPa	0 to 3200KPa	10 KPa	Maximum reading of 4-20mA Sender.
3	4-20mA Min Pump Pressure	200KPa	Min to Range	10 KPa	Minimum Pump Pressure Shutdown
4	4-20mA Max Pump Pressure	800KPa	Min to Range	10 KPa	Maximum Pump pressure or High Discharge Shutdown
5	4-20mA Pump Pressure Bypass timer	3mins	1 to 60mins	1 min	Startup bypass time before shutdowns are enabled.
6	4-20mA Pump Pressure Slush timer	10secs	10 to 60 seconds	1 sec	Slush time before shutdown occurs.
	<b>Fuel Level</b>				
1	Fuel Level Alarm Point	Disabled	Disabled to 99%	1%	Enabling low fuel level monitoring using VDO sender as a percentage of 100.
2	Fuel Level Alarm Action	Warning	Warning to Shutdown	-	Enabling low fuel level warning or engine shutdown.
3	Fuel Level Sender Type	Tubular Sender	Tubular Sender to Float or Arm Type	-	Select type of fuel level sender to be used from VDO range.
4	Fuel Level Sender Calibration	82 Counts	10 to 254	1 count	Allows K45-2 calibration for fuel level sender from VDO range.
	<b>Pump Oil Temperature</b>				
1	Pump Temperature Alarm	Disabled	Disable to Enable	-	Enabling Pump Temperature shutdown.
2	Pump Temperature Setpoint	40°C	10 to 145°C	1°C	Maximum allowable operating Pump Temperature.
	<b>System Control</b>				
1	Remote Start Type	Maintained	Maintained to Momentary	-	Trigger type for a remote start input. Maintained type will remain activated, Momentary will activate and deactivate.
2	Remote Start Input Type	Start NO Stop NO	Close to Rise/ Close to Fall	-	Start Trigger may be Close to Rise or Close to Fall. Stop Trigger may be Close to Rise or Close to Fall.
3	Fuel Relay Control	Energize to Run	Energize to Run/Energize to Stop	-	Engine Fuel Solenoid may remain energized or de-energized during engine running.

## 11 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.

### 11.1 Serviceable Parts

The serviceable items within the controller are:

- 1 The fuse on the front panel protects the electronics. Consulting your dealer regarding changes to fuse ratings is recommended.
- 2 The Panel Lock located on the front of the door.
- 3 The clear see-through window.

## 11.2 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 fly-back 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.
4. The RPM is used for a variety of purposes by the microprocessor program apart from just displaying the engine speed. If the RPM is measured using a signal from the alternator rather than a magnetic pickup then a faulty alternator may be the likely cause, rather than a flat battery, in the event of RPM read errors.

When an alarm or warning occurs during the operation of the engine, the engine will be shutdown and a fault will be shown on the screen. The faults are shown in English, though the following is a more detailed table of descriptions:

<b>Fault</b>	<b>Possible Cause</b>	<b>Remedy</b>
Oil Press. Low	The oil pressure of the engine is low	Check Oil Level and Oil Pressure Sender
Engine Temp High	Engine temperature has exceeded defined 'safe' limit	Check Water Level, Radiator Hoses & Leaks, Oil Level.
Coolant Low / Water Level Low	Engine coolant run out/low	Check radiator coolant level. Check water level sensor
Alt Failure	The Alternator fail signal has been given to the K45-2	Check alternator. Check belts
Overspeed	The engine has exceeded the safe speed limit.	
Zero/Low RPM	The engine has stopped, or was traveling too slowly	Check Speed Sensing device
Maximum Pressure	The PSI / KPa level was higher than the limit set via Pressure Sender menu	Check Pressure Sender
Minimum Pressure	The PSI / KPa level was lower than the limit set via Pressure Sender menu	Check Pressure Sender. Check for blockages.
Failed Attempts	The engine has failed to start several times, and exceeded the maximum number of starting attempts.	Check Fuel Level. Check Belts

Please note that the above is a guide to possible causes and remedies to faults only. User discretion is advised. Only authorized and trained personnel can diagnose, repair or service engine equipment.

## 11.3 LCD Display Faults

Display not visible	Controller switched off	Turn key to ON position
	Battery voltage low	Charge / Replace battery



	Controller is in sleep mode	Press and hold any button for a few seconds
Display is slow to refresh	Ambient temperature is below range	Relocate controller to warmer area
Display is difficult to see	Ambient temperature is above range	Relocate controller to cooler area
	Controller is mounted in direct sunlight	Mount controller away from direct sunlight
On Power Up, the display backlight is on with black bar across top line	Program not installed correctly	Contact authorized dealer
Clock will not keep time once controller turned off	RTC Battery requires replacement	Contact authorized dealer for replacement battery.
	Startup power glitch	Do a power reset. Remove power for 3 or more seconds then reconnect

### **11.4 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	Fly-back diode incorrectly fitted to fuel solenoid (or missing)	Ensure Fly-back diode requirements are met as per wiring diagram
	Fly-back diode incorrectly fitted to starter motor (or missing)	Ensure Fly-back 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	Fly-back diode incorrectly fitted to fuel solenoid (or missing)	Ensure Fly-back diode requirements are met as per wiring diagram
	Low battery voltage	Check battery condition and condition of battery leads

## 11.5 Tachometer Faults

Engine is running, 0 rpm shown	Alternator wiring incorrect	Ensure wiring adheres to wiring diagram
	Alternator not excited	Ensure wiring adheres to wiring diagram
	Alternator failure	Alternator replacement may be required
	Controller has incorrect tachometer settings	Contact authorized dealer
	No CAN BUS signal	Ensure wiring adheres to wiring diagram
Engine is running, incorrect rpm shown	Controller has incorrect tachometer settings	Contact authorized dealer
Started motor does not disengage	Alternator wiring incorrect	Ensure wiring adheres to wiring diagram
	Alternator not excited	Ensure wiring adheres to wiring diagram
	Alternator failure	Alternator replacement may be required
	Controller has incorrect tachometer settings	Contact authorized dealer
RPM is incorrect only at certain engine speeds	Alternator failure	Alternator replacement may be required
	Alternator incompatibility	Contact authorized dealer
Engine fault indicates over speed	Reduction in engine load	Check conditions of load
		Check throttle settings
	Tachometer incorrectly set	Contact authorized dealer
Engine fault indicates zero rpm	Fuel level low	Ensure adequate fuel level
	Alternator failure	Alternator replacement may be required
	Alternator wiring incorrect	Ensure wiring adheres to wiring diagram

## 11.6 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 / Pressure / RPM fault	See relevant troubleshooting section

### **11.7 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
Pump Temperature	Pump temperature is above user Setpoint (sender type)	Check Sender Check Water in pump
Flow Switch	Low Flow has been detected	Check RPM is not too low. Check for Blockages in lines. Check Sensor.
Alternator fault is indicated	Alternator wiring is incorrect	Ensure wiring adheres to wiring diagram
	Alternator failure	Alternator replacement

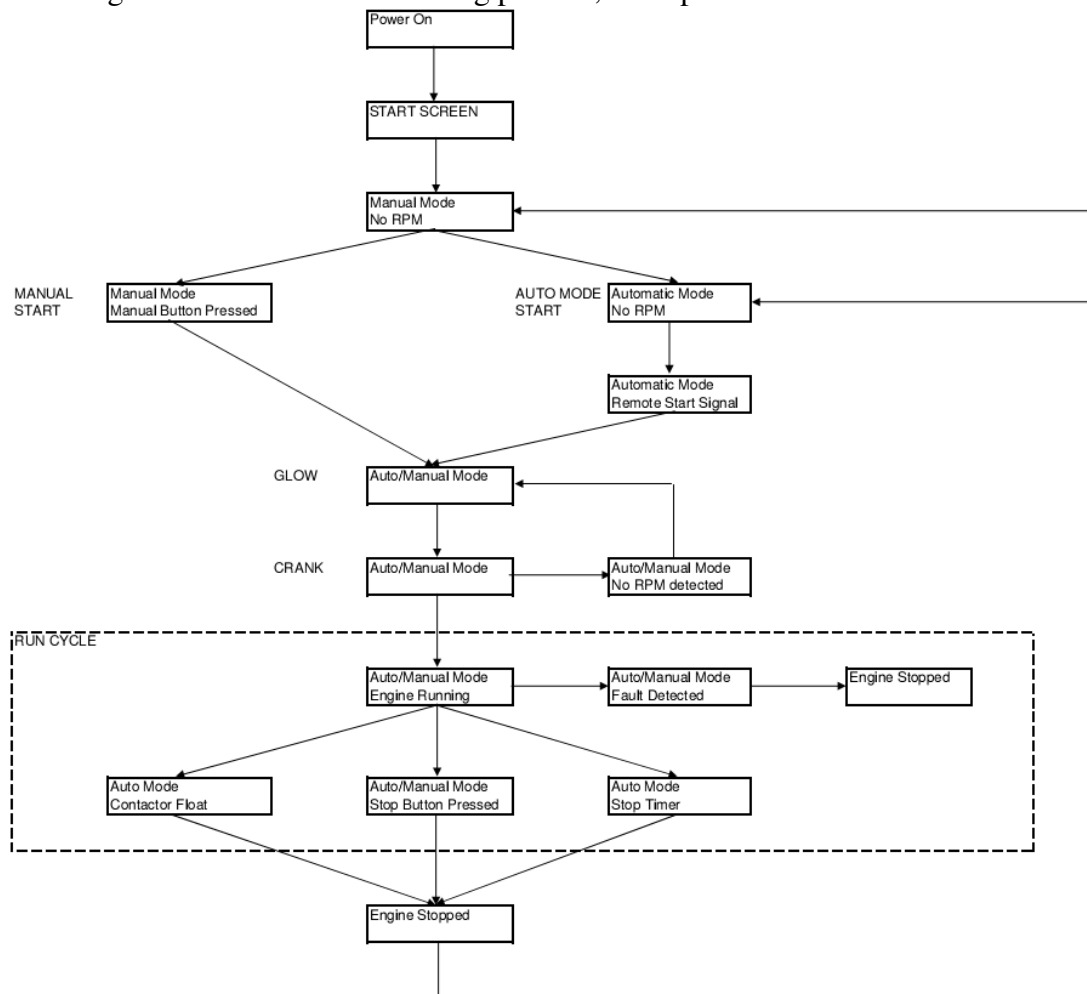
		may be required
Sensor # fault is indicated	The applicable sensor has indicated a fault	Check condition for which sensor provides protection

### **11.8 Pump Pressure Faults**

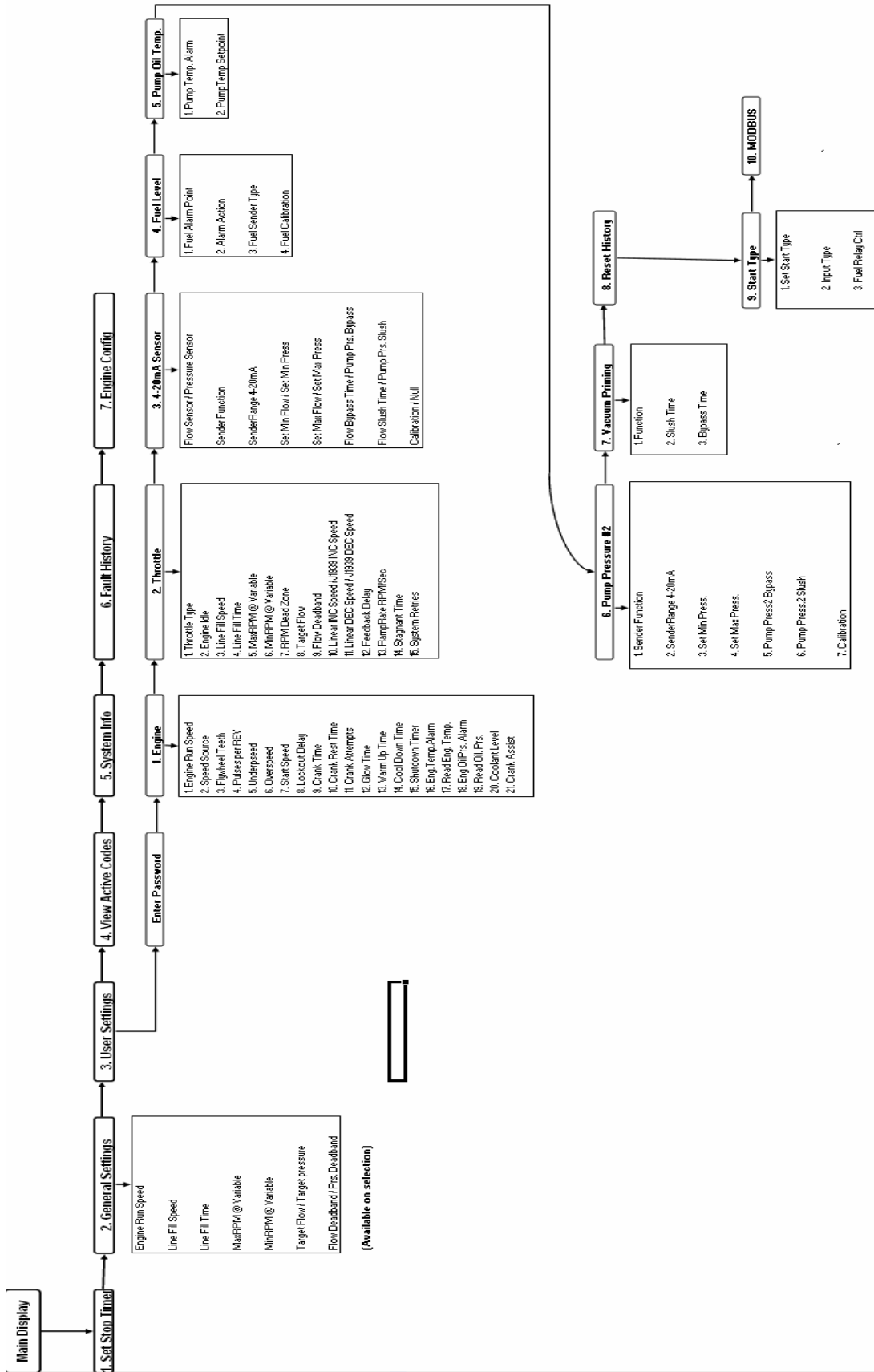
Pressure reading is zero	Sender wiring incorrect	Ensure wiring adheres to wiring diagram
	Sender is incorrect type	Contact authorized dealer
	Sender settings incorrect	Contact authorized dealer
Pressure is not displayed	The controller does not measure pressure	Contact authorized dealer
Pressure is displayed as --	The pressure reading is outside the applicable range	Check pressure sender is appropriate for application
	Sender wiring incorrect	Ensure wiring adheres to wiring diagram
	Sender is incorrect type	Contact authorized dealer
	Sender has incorrect settings	Contact authorized dealer
Engine shutdown due to Max Pressure	Blocked pump and/or pipes	Check pump and pipes for blockage
	Max pressure is incorrectly set	Adjust Max pressure setting in <i>Set Pump Pressure Sender</i> Menu
Engine shutdown due to Min Pressure	Pump head is not sufficiently submerged	Check water level
	Min pressure is incorrectly set	Adjust Min pressure setting in <i>Set Pump Pressure Sender</i> Menu

## 12 Appendix A: Run Process Diagram

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



# 13 Appendix B: K45-2 Menu Map



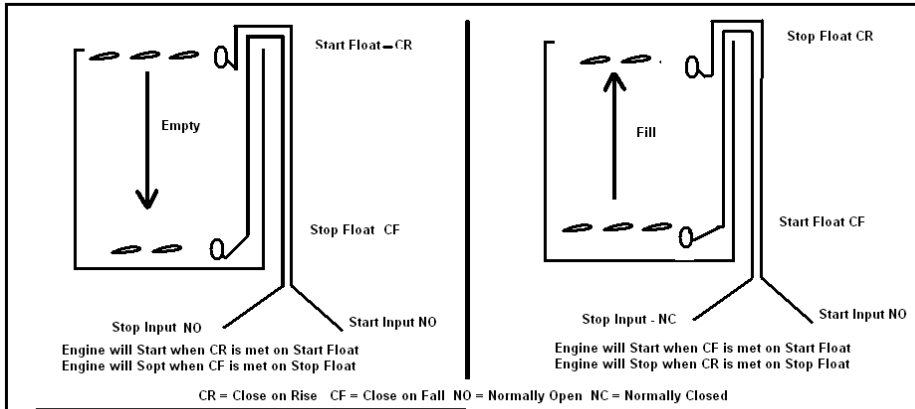
# 14 Appendix C: Float Setup Examples

Set in Start Parameters Input Type.

Input Type – “Start NO Stop NO” using 1 CR Float and 1 CF Float

Example shows both an Empty and Fill Application.

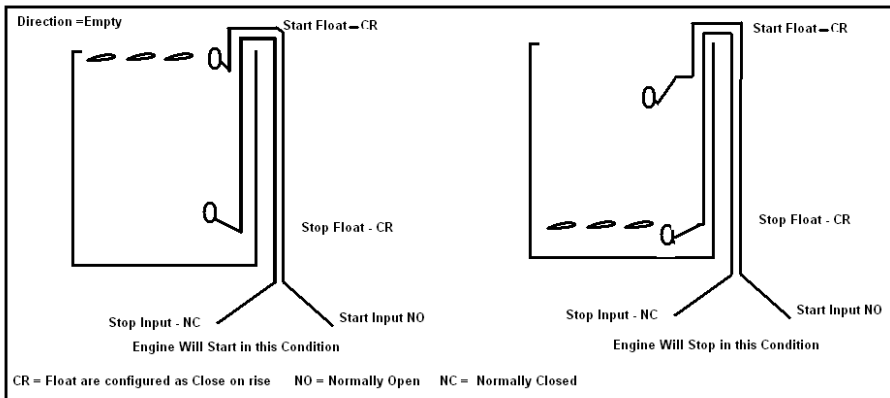
Note the orientation of the Start and Stop Floats in examples.



Input Type – “Start NO Stop NC” using 2 x CR Floats.

Example shows an Empty Application

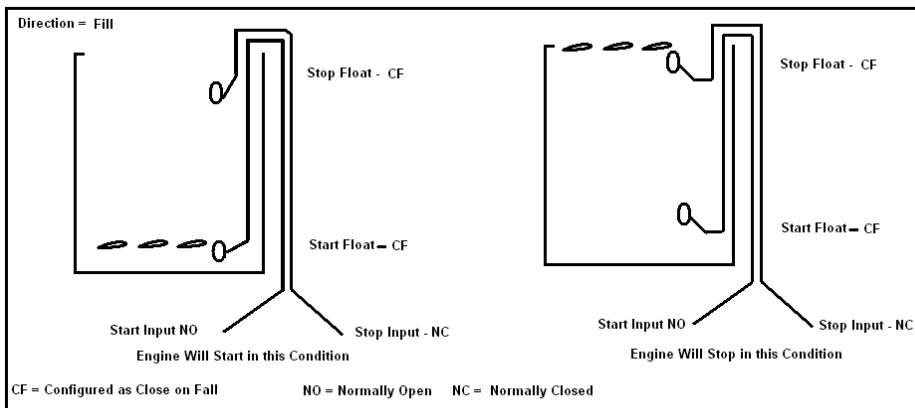
Note the orientation of the Start and Stop Float.



Input Type – “Start NO Stop NC” using 2 x CF Floats.

Example shows a Fill Application

Note the orientation of the Start and Stop Float.



## Limited Warranty

**Intention ...** This policy is written with the consumer in mind, therefore, the language is intended to be simple and hopefully may assist consumers and companies in fully understanding the terms, their obligations and the conditions of contract outlined within this warranty policy.

**Names ...** **Kensho P/L** for the purposes of this warranty is the Original Equipment Manufacturer (OEM) or **‘the manufacturer’**. The **‘consumer’** means the end user, persons, company or group using the Kensho product. The **‘original retail purchaser’** or **ORP** means (but not limited to) the aftermarket re-seller, supplier or dealer of a particular brand of product/s. The ‘ORP’ also includes Original Equipment Manufacturers and assemblers that have purchased any product from Kensho P/L. The term **‘Stand-Alone Product’** means a Kensho product sold separately by the ORP and the ORP has not fitted the Kensho product to their equipment or engines as a complete package.

**What is covered ...** This warranty covers defects in manufacturing workmanship or materials manufactured by Kensho P/L, with the exceptions as stated below.

**Who is covered ...** This warranty and period of warranty strictly applies to the “original retail purchaser”, that means the OEM, re-seller, supplier or dealer that “directly” bought the product from the manufacturer.

**How Long Coverage Lasts ...** This warranty runs for 24 months or 2000 engine operating hours (whichever occurs first) from the day you purchase the product/s. Warranty periods in general may be subject to change in future without notice. Please refer to the Manufacturer or Dealer in which the product/s was purchased for any changes periodically.

**What Kensho Will Do ...** KENSHO P/L at its discretion will repair any product proven to be defective in materials or workmanship. In the event repair is not possible, replacement of the product with a new or similar product/s and price, or refund of the full purchase price of the product, whichever is deemed by the manufacturer appropriate to the original retail purchaser on a case by case basis.

**ORP Obligations ...** Your obligations as the original retail purchaser are simple. The original retail purchaser must consult Kensho from the suitability of the product to the environment and its intended use. Fly-back diodes are a warranty requirement and correct wiring and installation of the product must be followed as per the manufacturer’s requirements. Please also be aware that product was intended to be installed by authorized agents with expert and technical knowledge and not for the average consumer. You must therefore inform Kensho of each product sold as a ‘stand-alone product’ but not fitted by you or your company as this warranty will not cover such claims. Also in the event of complete product failure and on-site repairs are necessary Kensho must have the ‘first-right’ of call, in other words, you must notify us prior to attempting repairs.

**Consumer Obligations ...** The consumer must take care not to abuse, misuse, tamper with or damage the product. Doing so will likely void this warranty but more importantly may cause loss of life or limb. Please follow the instruction manuals on all your equipment and products carefully. Do not modify, alter or repair this product under any circumstances. Please consult your approved and authorized dealer or seller for technical issues. You are also obligated to be diligent during the operation of your machinery.

**What is not covered ...** This warranty does not cover equipment, components or engines supplied by manufacturers’ other than Kensho P/L. Misused, Abused, Neglected, Damaged or Tampered with product/s (whether accidental, intentional or incidental) are not eligible for any kind of warranty claim. The product/s being used for a purpose or application not specifically designed for or intended by the manufacturer. The product/s are not covered if electrically installed or wired incorrectly, contrary to the manufacturer’s schematic and instructions or any unauthorized product/s modifications or alterations not intended by the manufacturer. This warranty does not cover circumstances whereby the manufacturer’s product is used in conjunction with or coupled to another manufacturer’s product (whether electronic or otherwise) thus causing conflicts in operation, electrical interference or damage to person and property. Excessive or incorrect power (voltages & amperages) to the product/s, contrary to the manufacturer’s specifications, will void this warranty. The absence of FLY-BACK diodes in the



controllers' electrical system will void warranty. This warranty will not cover damage to components and circuit boards caused by excessive physical force applied by the user or original retail purchaser when removing 'replaceable relays' or 'pressing buttons'. This warranty does not cover disruption caused by the manufacturer's product/s to other electronic devices normal operation due to unshielded radio/microwave frequencies or EMF interference. This warranty does not cover miscellaneous expenses for removal, installation, service, towing or any down time, nor does it cover material, labor, or additional parts required for replacement or repair of damages caused by abuse (including fire or wreckage), misuse, neglect, if the product is defective by way of manufacturer, failure to follow manufacturer's operating, wiring and /or installation instructions. This warranty does not cover peeling, fading or discoloration of decal/stickers, protective enclosure/s and the product in general caused by extreme climates and temperatures, 'Acts of God', prolonged exposure to direct sunlight or frost, chemicals or abrasives. Please consult your manual to determine the products acceptable operating range, warning and recommendations. **THE MANUFACTURER SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING WITHOUT LIMITATION, INDIRECT AND SPECIAL DAMAGES CAUSED BY AND RESULTING FROM DEFECTS IN THE PRODUCT/S WHETHER CAUSED BY THE MANUFACTURER OR NOT.** The replacement, repair, time taken for repair or any other equitable remedy to the original retail purchaser will be solely at the discretion of KENSHO P/L, including the cost for transit of faulty product/s from the manufacturer to the original retail purchaser if the product is deemed to be a manufacturing fault. The manufacturer will not be liable for loss or damage to product/s in transit between the original retail purchaser and customer. Warranty claims are limited to the retail price paid for the product and may not include the cost of labor or transport. The warranty period does not extend if the defective product/s is repaired or replaced with new or is re-sold as second-hand goods by the consumer. This warranty will not cover controllers sold as stand-alone units (in other words, sold without being fitted to a specific engine) for reason that the product was intended to be installed by authorized agents with expert knowledge. Repairs for product failure undertaken without the knowledge or consent of the manufacturer will void warranty whether the repairs were undertaken by consumer or authorized agent.

**How to get Service ...** The consumer may contact the OEM or dealer in the State or Country in which the product was purchased. The dealer, reseller or OEM may proceed in making claim to the manufacturer of the product. Warranty claims are for defect and manufacturing faults only and any claims are only valid if;

- The warranty claim is made within the warranty period and before the allowable engine operating hours,
- The customer makes a claim within 30 days of discovering the failure or fault,
- The "original retail purchaser" makes the warranty claim,
- Proof of purchase is supplied by way of serial number and company order/record,
- The product is not re-sold as second-hand good,
- The product fault is deemed by the manufacturer to be a manufacturing fault and not caused by the customer.

**How Law applies**

This warranty gives you specific legal rights, and you may also have other rights which may vary from State or Country.

**THIS WARRANTY AND WARRANTY PERIODS ARE SUBJECT TO CHANGE WITHOUT NOTICE. PLEASE CONSULT THE MANUFACTURER'S WEBSITE FOR CHANGES TO WARRANTY TERMS AND CONDITIONS FOR YOUR PARTICULAR PRODUCT**

**THIS IS THE WHOLE AGREEMENT**