

# **Deep Sea Electronics Plc**

**MODEL 509**

**AUTOMATIC MAINS FAILURE SENSING**

**AND**

**ENGINE MANAGEMENT SYSTEM**

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## INTRODUCTION

The Deep Sea Electronics Model **509** in it's basic form, has been designed to be configured to meet most of the industry's complex specifications. Variations of the unit allow many other functions such as the RS232 interface for communicating with building management systems or remote monitoring by a Volt free relay module or Annunciator.

The **DSE 509** Automatic Mains Failure Module has been primarily designed to start a generator on a mains failure, transfer the load when the engine's operating criteria have been met, then shut down the engine on restoration of the mains.





Once activated the **509** module carries out all the start and stop procedures of the engine, indicating the operational status and fault conditions; automatically shutting-down the engine and giving a true first up fault condition of an engine failure. This information is displayed on an illuminated Liquid Crystal Display.

Selective operational sequences and text can be altered by the customer. Alterations to the system are made by the use of the **801** Calibration Unit. The adjustable parameters are displayed on the screen when the **CONFIGURATION** mode is activated.

Access to the critical operational sequences and timers for use by qualified engineers are barred by a security code.

The module is housed in a robust plastic case for front panel mounting. Connection to the module are via locking plug and sockets.

### CLARIFICATION OF NOTATION USED WITHIN THIS PUBLICATION.

 <b>NOTE:</b>	Highlights an essential element of a procedure to ensure correctness.
 <b>CAUTION!:</b>	Indicates a procedure or practice which, if not strictly observed, could result in damage or destruction of equipment.
 <b>WARNING!:</b>	Indicates a procedure or practice which could result in injury to personnel or loss of life if not followed correctly.
	<b>DEEP SEA ELECTRONICS PLC own the copyright to this manual, which cannot be copied, reproduced or disclosed to a third party without prior written permission.</b>

## 1. OPERATION

On connection of the DC power supply to the module, the LCD display will momentarily display:-



SYSTEM ACTIVE

### 1.1 CONTROL

Control of the 509 module is by a four position rotary or key switch (specified on ordering), mounted on the front of the module with **OFF**, **AUTO**, **MANUAL** and **TEST** positions.

**NOTE:-** All sequences of operation, load status and fault conditions are displayed on the LCD. To reset a fault condition, turn the selector switch to OFF.

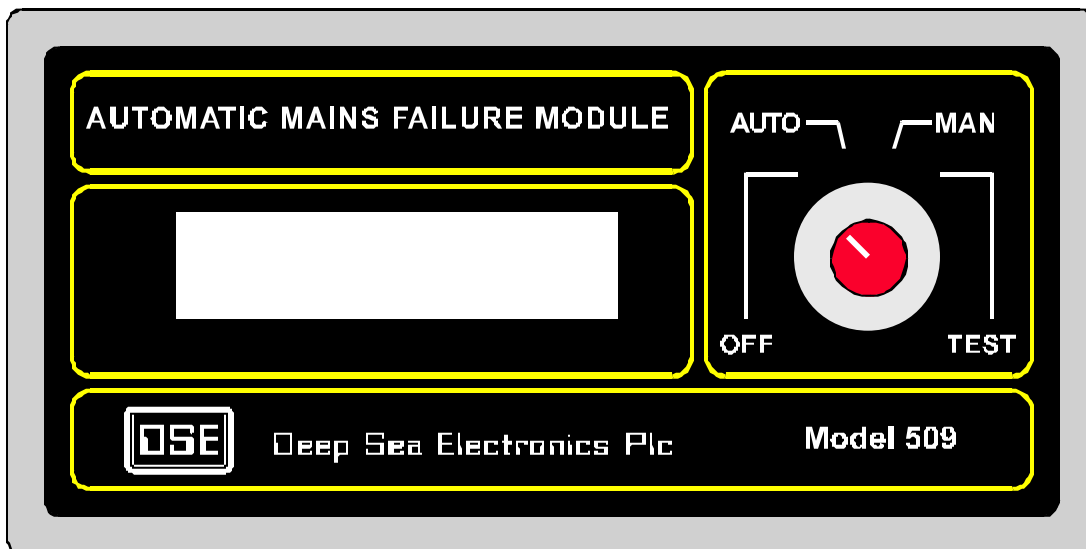


FIG 1

## 1.2 AUTOMATIC MODE OF OPERATION

The module is activated by turning the selector switch to the **AUTO** position, the LCD will momentarily display:-

**509 AMF ENGLISH  
VERSION #.##**

Then will display:-

**WAITING IN AUTO  
MAINS ON LOAD**

When a mains failure or an external default parameter (From Remote Start on Load) is detected, the following sequence is initiated and the LCD displays the following:-

**▲ NOTE:- If the Mains drop out has been selected to be immediate, then the mains contactor is removed immediately, however if delayed has been selected then the mains contactor is held in, assuming the phase powering the contactor is still present, until the generator is running at load transfer speed when contactor changeover from the mains to generator will take place.**

Start Delay. If selected Pre-Heat is active during this period.

**STARTING IN AUTO  
START DELAY 5s**

After this delay the Fuel Solenoid is energised.

**FUEL ON**

The starter motor is engaged.

**FUEL ON  
STARTER ON**

The engine is cranked for a pre-set time period.

**CRANKING 10s  
ATTEMPT No.1**

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Preheat is also active during this period.

**CRANK AT REST  
FOR 1 SECONDS**

Should this sequence continue beyond the set number of attempts, the fault will be displayed on the LCD in a flashing mode.

**FAILED TO START**

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency derived from the Alternator output. Alternatively a magnetic pickup mounted on the flywheel housing can be used for speed detection. (This is selected using the **801** Calibration unit).

After the starter motor has disengaged the internal Protection Hold Off Timer is activated, allowing Oil Pressure, High Engine Temperature, Underspeed, Charge Fail and any delayed Auxiliary fault Inputs to stabilise without triggering the fault.

Once the Oil Pressure has risen and the engine has reached its pre-set Load Transfer speed, the Load will be transferred to the generator. However if the Warm Up timer has been selected this will start to time out. Allowing the Generator to stabilise.

**WARMING 00:05  
GENERATOR 50.0Hz**

Once the Warm Up timer has timed out the Load is Transferred to the Generator.

**TRANSFERRING TO  
GENERATOR**

Whilst the Generator is running the LCD will alternate between the following two displays:-

**GEN ON LOAD  
GENERATOR 50.0Hz**

**RUNNING IN AUTO  
GENERATOR 50.0Hz**

On return of the Mains Supply, the mains return timer will start it's count down.

**GEN ON LOAD  
MAINS AVL 00:30**

After this period, the load will be transferred back to the mains.

**TRANSFERRING TO  
MAINS**

After the load has been transferred, the run on timer starts its countdown allowing the engine a cooling down period off load before shutting down.

**MAINS ON LOAD  
RUN ON 00:30**

Should the mains fail during this period, then transfer of the load back to the Generator will take place.

The module will now return to its Automatic standby mode.

**WAITING IN AUTO  
MAINS ON LOAD**

### 1.3 TEST MODE OF OPERATION

To activate the **TEST** sequence, turn the selector switch to **TEST**.

Start Delay. If selected, Pre-Heat is active during this period.

**STARTING IN TEST  
START DELAY 5s**

After this delay the Fuel Solenoid is energised.

**FUEL ON**

The starter motor is engaged.

**FUEL ON  
STARTER ON**

The engine is cranked for a pre-set time period.

**CRANKING 10s  
ATTEMPT No.1**

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Preheat is also active during this period.

**CRANK AT REST  
FOR 1 SECONDS**



Should this sequence continue beyond the set number of attempts, the fault will be displayed on the LCD in a flashing mode.

**FAILED TO START**

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency derived from the Alternator output. Alternatively a magnetic pickup mounted on the flywheel housing can be used for speed detection. (This is selected using the **801** Calibration unit).

After the starter motor has disengaged the internal Protection Hold Off Timer is activated, allowing Oil Pressure, High Engine Temperature, Underspeed, Charge Fail and any delayed Auxiliary fault Inputs to stabilise without triggering the fault input.

Once the Oil Pressure has risen and the engine has reached its pre-set Load Transfer speed the Load will be transferred to the generator. However if the Warm Up timer has been selected this will start to time out. Allowing the Generator to Stabilise.

**WARMING 00:05  
GENERATOR 50.0Hz**

Once the Warm Up timer has timed out the Load is Transferred to the Generator.

**TRANSFERRING TO  
GENERATOR**

Whilst the Generator is running the LCD alternates between the following displays.

**RUNNING IN TEST  
MAINS AVAILABLE**

**GEN ON LOAD  
GENERATOR 50.0Hz**

To complete the **TEST** sequence, turn the selector switch to **AUTO**. The mains return timer begins to count down.

**GEN ON LOAD  
MAINS AVL 00:30**

After this period, the load will be transferred back to the mains.

**TRANSFERRING TO  
MAINS**

After the load has been transferred, the run on timer starts its countdown allowing the engine a cooling down period off load before shutting down.

**MAINS ON LOAD  
RUN ON 00:30**

Should the mains fail during this period, then transfer of the load back to the Generator will take place. The module will now return to its Automatic standby mode.

**WAITING IN AUTO  
MAINS ON LOAD**

If the mains should be lost whilst running in **TEST** then the LCD alternates between the following displays.

**RUNNING IN TEST  
GENERATOR 50.0Hz**

**GEN ON LOAD  
GENERATOR 50.0Hz**

#### 1.4 MANUAL MODE OF OPERATION

To initiate a start sequence in **MANUAL**, turn the selector switch to **MANUAL**.

 **NOTE:- There is no start delay or pre-heat in this mode of operation.**

The Fuel Solenoid is energised.

**FUEL ON**

The starter motor is engaged.

**FUEL ON  
STARTER ON**

The engine is cranked for a pre-set time period.

**CRANKING 10s  
ATTEMPT No.1**

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period.

**CRANK AT REST  
FOR 1 SECONDS**

Should this sequence continue beyond the set number of cycles, the fault will be displayed on the LCD in a flashing mode.

**FAILED TO START**

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency derived from the Alternator output. Alternatively a magnetic pickup mounted on the flywheel housing can be used for speed detection. (This is selected using the **801** Calibration unit).

After the starter motor has disengaged the internal Protection Hold Off Timer is activated, allowing Oil Pressure, High Engine Temperature, Underspeed, Charge Fail and any delayed Auxiliary fault Inputs to stabilise without triggering the fault input.

Whilst the Generator is running the LCD alternates between the following displays.

**RUNNING IN MANUAL  
MAINS AVAILABLE**

**MAINS ON LOAD  
GENERATOR 50.0Hz**

To stop the Generator turn the selector switch to **AUTO**, the run on timer is initiated, allowing a cooling down period off load before shutting down the Generator.

**MAINS ON LOAD  
RUN ON 00:30**

The module will now return to it's Automatic standby mode.

**WAITING IN AUTO  
MAINS ON LOAD**

Turning the selector switch to **OFF** will stop the Generator immediately without a cooling down period.

If the Mains should fail whilst running in **MANUAL** the Load will transfer to the Generator immediately.

**TRANSFERRING TO  
GENERATOR**

Whilst the Generator is running the LCD alternates between the following displays.

**RUNNING IN MANUAL  
GENERATOR 50.0Hz**

**MAINS ON LOAD  
GENERATOR 50.0Hz**

On Mains return the LCD alternates between the following two displays.

**RUNNING IN MANUAL  
MAINS AVAILABLE**

**GEN ON LOAD  
GENERATOR 50.0Hz**

The Load will not transfer back to the Mains whilst running in **MANUAL**, by turning the selector switch to **AUTO** will initiate the shut down sequence. The mains return timer starts to countdown.

**GEN ON LOAD  
MAINS AVL 00:30**

After this period, the load will be transferred back to the mains.

**TRANSFERRING TO  
MAINS**

After the load has been transferred, the run on timer starts it's countdown allowing the engine a cooling down period off load before shutting down.

**MAINS ON LOAD  
RUN ON 00:30**

Should the mains fail during this period, then transfer of the load back to the Generator will take place.

The module will now return to it's Automatic standby mode.

**WAITING IN AUTO  
MAINS ON LOAD**

## 1.5 REMOTE START OFF LOAD

The Auxiliary inputs can be configured using the **801** calibration unit to give a **REMOTE START “ OFF LOAD”** facility.

With the module selector switch in the **AUTO** position, and a remote start signal on the Auxiliary input, a start sequence will be initiated.

Start Delay. If selected, Pre-Heat is active during this period.

**START BY REMOTE  
START DELAY 5s**

After this delay the Fuel Solenoid is energised.

**FUEL ON**

The starter motor is engaged.

**FUEL ON  
STARTER ON**

The engine is cranked for a pre-set time period.

**CRANKING 10s  
ATTEMPT No.1**

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Preheat is also active during this period.

**CRANK AT REST  
FOR 1 SECONDS**

Should this sequence continue beyond the set number of attempts, the fault will be displayed on the LCD in a flashing mode.

**FAILED TO START**

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency derived from the Alternator output. Alternatively a magnetic pickup mounted on the flywheel housing can be used for speed detection. (This is selected using the **801** Calibration unit).

After the starter motor has disengaged the internal Protection Hold Off Timer is activated, allowing Oil Pressure, High Engine Temperature, Underspeed, Charge Fail and any delayed Auxiliary fault Inputs to stabilise without triggering the fault input.

Whilst the Generator is running the LCD alternates between the following displays.

**RUNNING REMOTE  
MAINS AVAILABLE**

**MAINS ON LOAD  
GENERATOR 50.0Hz**

Removal of the Remote Start signal will initiate a shutdown sequence. the run on timer starts it's countdown allowing the engine a cooling down period off load before shutting down.

**MAINS ON LOAD  
RUN ON 00:30**

The module will now return to it's Automatic standby mode.

**WAITING IN AUTO  
MAINS ON LOAD**

 **NOTE:- If the mains should fail whilst running in REMOTE START OFF LOAD the load will transfer to the generator immediately.**

**TRANSFERRING TO  
GENERATOR**

Whilst the Generator is running the LCD alternates between the following displays.

**RUNNING REMOTE  
GENERATOR 50.0Hz**

**GEN ON LOAD  
GENERATOR 50.0Hz**

On Mains return the mains return timer begins to count down.

**GEN ON LOAD  
MAINS AVL 00:030**

After this time period the load transfers back to the mains.

**TRANSFERRING TO  
MAINS**

## 1.6 REMOTE START ON LOAD

The Auxiliary inputs can be configured using the **801** calibration unit to give a **REMOTE START “ ON LOAD”** facility.

With the module selector switch in the **AUTO** position, and a remote start signal on the Auxiliary input, a start sequence will be initiated.

**NOTE:-** If the Mains drop out has been selected to be immediate, then the mains contactor is removed immediately, however if delayed has been selected then the mains contactor is held in, assuming the phase powering the contactor is still present, until the generator is running at load transfer speed when contactor changeover from the mains to generator will take place.

Start Delay. If selected, the Pre-Heat is active during this period.

**START BY REMOTE  
START DELAY 5s**

After this delay the Fuel Solenoid is energised.

**FUEL ON**

The starter motor is engaged.

**FUEL ON  
STARTER ON**

The engine is cranked for a pre-set time period.

**CRANKING 10s  
ATTEMPT No.1**

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the Rest period of a pre-set time. Preheat is also active during this period.

**CRANK AT REST  
FOR 1 SECONDS**

Should this sequence continue beyond the set number of attempts, the fault will be displayed on the LCD in a flashing mode.

**FAILED TO START**

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency derived from the Alternator output. Alternatively a magnetic pickup mounted on the flywheel housing can be used for speed detection. (This is selected using the **801** Calibration unit).

After the starter motor has disengaged the internal Protection Hold Off Timer is activated, allowing Oil Pressure, High Engine Temperature, Underspeed, Charge Fail and any delayed Auxiliary fault Inputs to stabilise without triggering the fault input.

Once the Oil Pressure has risen and the engine has reached its pre-set Load Transfer speed the Load will be transferred to the generator. However if the Warm Up timer has been selected this will start to time out, allowing the Generator to Stabilise.

**WARMING 00:05  
GENERATOR 50.0Hz**

Once the Warm Up timer has timed out the Load is Transferred to the Generator.

**TRANSFERRING TO  
GENERATOR**

Whilst the Generator is running the LCD alternates between the following displays.

**RUNNING REMOTE  
MAINS AVAILABLE**

**GEN ON LOAD  
GENERATOR 50.0Hz**

On removal of the start signal the return timer begins to count down.

**GEN ON LOAD  
MAINS AVL 00:30**

After this period, the load will be transferred back to the mains.

**TRANSFERRING TO  
MAINS**



After the load has been transferred, the run on timer starts its countdown allowing the engine a cooling down period off load before shutting down.

**MAINS ON LOAD  
RUN ON 00:30**

Should the mains fail during this period, then transfer of the load back to the Generator will take place.

The module will now return to its Automatic standby mode.

**WAITING IN AUTO  
MAINS ON LOAD**

If the mains should be lost whilst running in **REMOTE** then the LCD alternates between the following displays.

**RUNNING REMOTE  
GENERATOR 50.0Hz**

**GEN ON LOAD  
GENERATOR 50.0Hz**

## 1.7 SIMULATED MAINS

The Auxiliary inputs can be configured using the **801** calibration unit to give a **SIMULATED MAINS** facility.

Different applications that this facility can be used for are described later in section 5.2.3.

With the module selector switch in the **AUTO** position, and a remote signal on the Auxiliary input, the **509** module will be prevented from starting even if there is no mains present on the mains sensing input.

Removal of the remote signal with **NO** mains present will initiate a start signal.

Start Delay. If selected, the Pre-Heat is active during this period.

**START IN AUTO  
START DELAY 5s**

After this delay the Fuel Solenoid is energised.

**FUEL ON**

The starter motor is engaged.

**FUEL ON  
STARTER ON**

The engine is cranked for a pre-set time period.

**CRANKING 10s  
ATTEMPT No.1**

If the engine fails to fire during this cranking attempt then the starter motor is disengaged for the pre-set rest period. Preheat is also active during this period.

**CRANK AT REST  
FOR 1 SECONDS**

Should this sequence continue beyond the set number of attempts, the fault will be displayed on the LCD in a flashing mode.

**FAILED TO START**

When the engine fires, the starter motor is disengaged and locked out at a pre-set frequency derived from the Alternator output. Alternatively a magnetic pickup mounted on the flywheel housing can be used for speed detection. (This is selected using the **801** Calibration unit).

After the starter motor has disengaged the internal Protection Hold Off Timer is activated, allowing Oil Pressure, High Engine Temperature, Underspeed, Charge Fail and any delayed Auxiliary fault Inputs to stabilise without triggering the fault input.

Once the Oil Pressure has risen and the engine has reached its pre-set Load Transfer speed the Load will be transferred to the generator. However if the Warm Up timer has been selected this will start to time out. Allowing the Generator to Stabilise.

**WARMING 00:05  
GENERATOR 50.0Hz**

Once the Warm Up timer has timed out the Load is Transferred to the Generator.

**TRANSFERRING TO  
GENERATOR**

Whilst the Generator is running the LCD alternates between the following displays.

**RUNNING IN AUTO  
GENERATOR 50.0Hz**

**GEN ON LOAD  
GENERATOR 50.0Hz**

On return of the remote signal or return of the mains, the mains return timer begins to count down.

**GEN ON LOAD  
MAINS AVL 00:30**

After this period, the load will be transferred back to the mains.

**TRANSFERRING TO  
MAINS**

After the load has been transferred, the run on timer starts its countdown allowing the engine a cooling down period off load before shutting down.

**MAINS ON LOAD  
RUN ON 00:30**

Should the mains fail during this period, then transfer of the load back to the Generator will take place. The module will now return to its Automatic standby mode.

**WAITING IN AUTO  
MAINS ON LOAD**

**NOTE:** - With either the mains or the simulated mains input present, the generator will not attempt to start, and if running the generator will shutdown. Therefore, if the simulated mains input is activated whilst the generator is running on load with no mains present, the 509 module will attempt to transfer the load to the non-existent mains causing a break of supply to the load.

## 1.8 ENERGISE TO STOP

To control the module in the **ENERGISE TO STOP** mode, the module must be configured by using the **801** calibration unit. See section 5.2.3.

The starting sequences for the different modes of operation are exactly the same as described in sections **1.2 to 1.7**, however during the shutdown sequence, the configurable output will operate for 30 seconds to allow the engine to stop, and the LCD will countdown the timer and display the following:-

**WAITING FOR GEN  
TO STOP 12 s**

At the end of this time period the configurable output will de-energise.

**NOTE:** - When turning the module to off from auto, manual & test, this will activate the energise to stop timer. This timer is self resetting and prevents any attempt to restart the generator until it has timed out.

## 2. PROTECTIONS

The LCD will display a flashing message indicating the fault condition and the common alarm output goes active.

### 2.1 WARNINGS

Warnings are non latching and do not stop the Generator.

If the Oil Pressure is high before a crank, the following is displayed The **509** will only attempt to crank the generator if the oil pressure is initially low. Also indication of possible Oil Switch failure.

**CHECK OIL SWITCH  
NORMALLY CLOSED**

If the voltage from the warning lamp terminal of the charge alternator should fall below half plant supply voltage after the end of the protection hold off timer. An indication that the charge alternator has failed.


**CHARGE FAIL**

If the Plant battery goes below the pre-set trip voltage set in the configuration mode. An indication that the batteries are being undercharged.

**BATTERY 11:0**

If the Plant battery rises above the pre-set trip voltage set in the configuration mode. An indication that the batteries are being overcharged.

**BATTERY 31:0**

 **NOTE:- The 509 constantly monitors the Plant Battery voltage when the selector switch is in all positions with the exception of the OFF position. This warning circuit displays the voltage on the LCD immediately but has a 10 second delay before giving an alarm, to allow for voltage dips on starting etc.**

If an Auxiliary input has been selected to be a warning and this input is activated, then the following message will be displayed, unless the text has been changed in the configuration menu to indicate the fault.

**AUXILIARY No.1**

If the generator has been started by a parallel control system, i.e. Keystart, the module will not attempt to crank the engine if the **509** is called to do so and the display will indicate that the generator is running by either of the following two messages depending on type of speed sensing being used.

**ALTERNATOR**

**GENERATOR  
AC PRESENT**

**MAGNETIC PICKUP**

**MAG PICKUP  
PULSES PRESENT**

If a generator is slow to come to a rest and the generator voltage is still present a message will be displayed as follows.

**WAITING FOR GEN  
TO STOP**

Once the generator voltage has been removed from the module, if the Oil Pressure is still high another message is displayed as follows.

**WAITING FOR GEN  
LOW OIL PRESSURE**

If the Oil Pressure fails to rise, the Alternator contactor will be prevented from closing and taking the load, and this message will be displayed and if still present at the end of protection hold off will shut the generator down.

**LOW OIL PRESSURE**

## **2.1 SHUTDOWNS**

Shutdowns are latching and stop the Generator.

Removal of the negative from the Emergency Stop input will shutdown the generator and prevent a restart until the fault has been removed.

**EMERGENCY STOP  
STOP**

If the module detects Low Oil Pressure after the protection hold off timer.

**LOW OIL PRESSURE  
SHUTDOWN**

If the module detects High Engine Temperature after the protection hold off timer.

**HIGH TEMPERATURE  
SHUTDOWN**

If the speed of the engine falls below the pre-set trip set in the configuration mode after the protection hold off timer.

**UNDERSPEED  
Tripped at 30 Hz**

If the speed of the engine rises above the pre-set trip set in the configuration mode. Overspeed is not delayed, it is an immediate shutdown.

**OVERSPEED  
Tripped at 57 Hz**

If the engine fails to fire after the pre-set number of attempts to crank.

**FAILED TO START**

If the speed sensing signal is lost, the Generator is shutdown immediately and a message is displayed, depending on type of speed sensing being used.

**GENERATOR**

**NO SPEED SENSING  
FROM GENERATOR**

**MAGNETIC PICKUP**

**NO SPEED SENSING  
FROM MAG PICKUP**

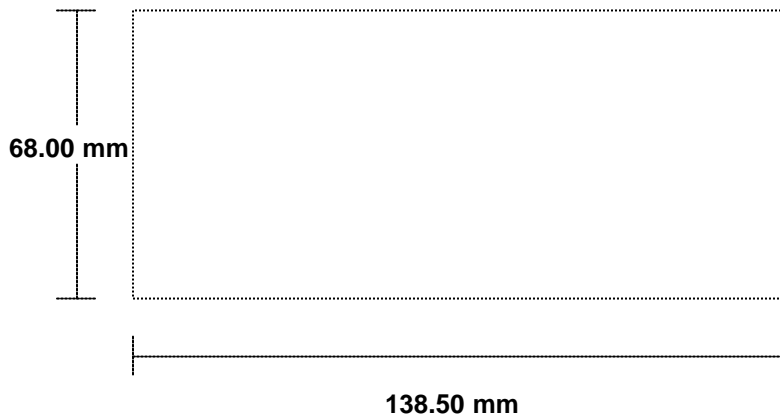
If an Auxiliary input has been selected to be a shutdown and this input is activated, then the following message will be displayed, unless the text has been changed in the configuration menu to indicate the fault.

**AUXILIARY No.1  
SHUTDOWN**

### 3. INSTALLATION INSTRUCTIONS

The model **509** Automatic Mains Failure Module has been designed for front panel mounting. Fixing is by 2 spring loaded clips for easy assembly.

#### 3.1 PANEL CUT-OUT



**FIG 2**

In conditions of excessive vibration the module should be mounted on suitable anti-vibration mountings.

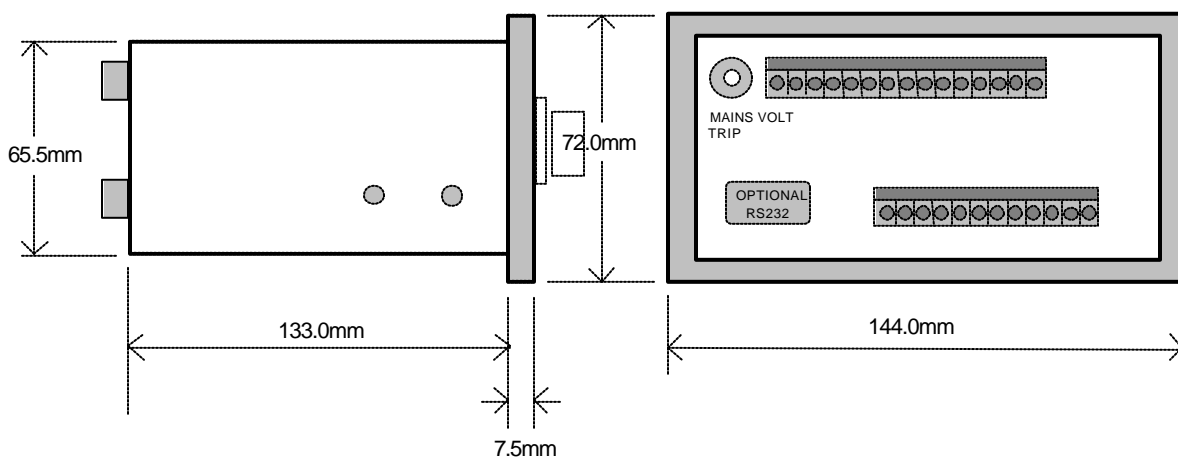
#### 3.2 COOLING

The module has been designed to operate over a wide temperature range of **-10** to **+60C**. However allowances should be made for temperature rise within the cabinet. Care should be taken **NOT** to mount possible heat sources near the module unless adequate ventilation is provided.

The relative humidity inside the enclosure should not exceed **85%**.

#### 3.3 UNIT DIMENSIONS

All dimensions in mm



**FIG 3**

3.4 FRONT PANEL LAYOUT

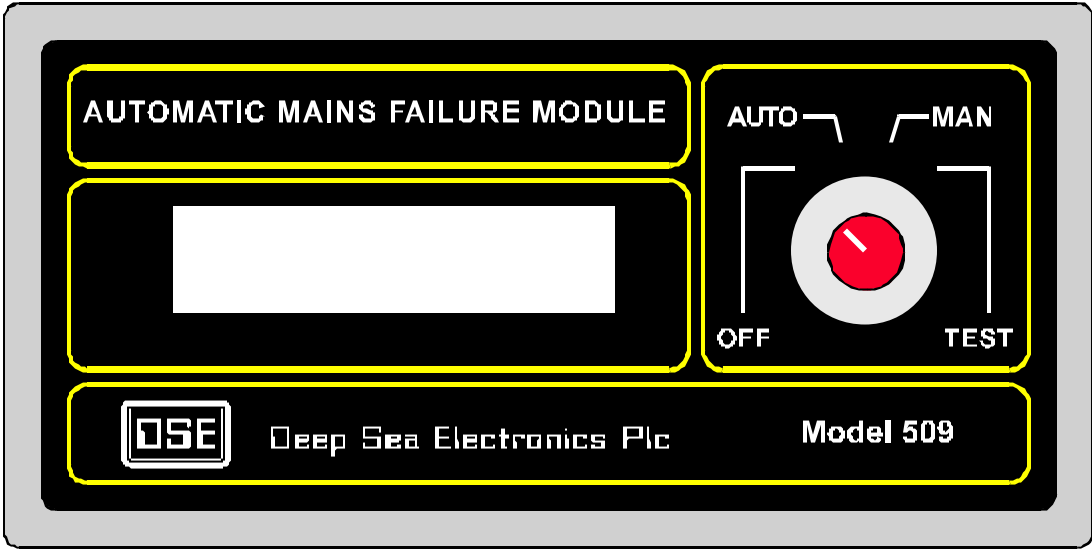


FIG 4

3.5 REAR PANEL LAYOUT

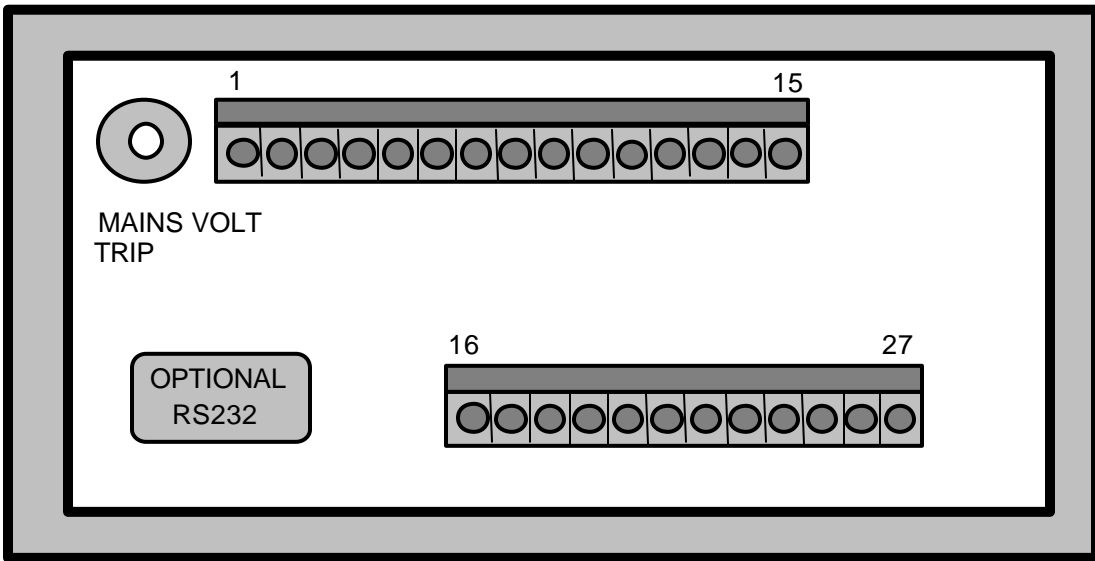


FIG 5



## 4. ELECTRICAL CONNECTIONS

Connections to the **509** Module are via plug and sockets.

### 4.1. CONNECTION DETAILS

The following describes the connections to the 2 plugs and sockets on the rear of the **509** Module. See rear panel layout **FIG 5**.

#### PLUG "A" 15 WAY

##### PIN

1	Mains AC Neutral input	
2	Mains AC Phase L1 input	
3	Mains AC Phase L2 input	
4	Mains AC Phase L3 input	
5	Alternator AC Neutral input	
6	Alternator AC Phase L1 input	
7	Mains contactor control relay	<b>Volt free 8 Amp rated</b>
8	Mains contactor control relay	
9	Alternator contactor control relay	<b>Volt free 8 Amp rated</b>
10	Alternator contactor control relay	
11	Charge Alternator Excitation Output	
12	Starter relay output	<b>16 Amp rated, Plant Supply DC Voltage</b>
13	Fuel relay output	<b>16 Amp rated, Plant Supply DC Voltage</b>
14	Magnetic pickup input (-ve)	
15	Magnetic pickup input (+ve)	

##### NOTE

Screened cable must be used for connecting the Magnetic pickup, ensuring that the screen is earthed at the Magnetic pickup end **ONLY**.

#### PLUG "B" 12 WAY

##### PIN

16	DC Supply input (-ve)	<b>2.5mm Cable is recommended</b>
17	DC Supply input (+ve)	<b>2.5mm Cable is recommended</b>
18	Alarm relay output	<b>6 Amp rated, Plant Supply DC Voltage</b>
19	Configurable relay output	<b>6 Amp rated, Plant Supply DC Voltage</b>
20	<b>DO NOT CONNECT</b>	
21	Low Oil Pressure input	
22	High Temperature input	
23	Emergency Stop input	
24	Auxiliary No.1 input	
25	Auxiliary No.2 input	
26	Auxiliary No.3 input	
27	<b>DO NOT CONNECT</b>	

## 4.2 CONNECTOR FUNCTION DETAILS

The following describes the functions of the 2 connectors on the rear of the module. See rear panel layout FIG 5.

### PLUG "A" 15 WAY

#### PIN

- 1 Mains AC Neutral input. Used as part of the mains sensing circuit
- 2 Mains AC Phase L1 input. Used to detect the voltage level of mains Phase L1
- 3 Mains AC Phase L2 input. Used to detect the voltage level of mains Phase L2
- 4 Mains AC Phase L3 input. Used to detect the voltage level of mains Phase L3
- 5 Alternator AC Neutral input. Used as part of the Alternator speed sensing circuit
- 6 Alternator AC Phase L1 input. Used as part of the Alternator speed sensing circuit.
- 7 Mains Contactor / Circuit Breaker. Normally closed volts free contact. Closes to 8.  
Used to control the mains contactor. **8 Amp rated**
- 8 Mains Contactor / Circuit Breaker. Normally closed volts free contact . Closes to 7.
- 9 Alt Contactor / Circuit Breaker. Normally open volts free contact. Closes to 10.  
Used to control the alternator contactor. **8 Amp rated**
- 10 Alt Contactor / Circuit Breaker. Normally open volts free contact. Closes to 9.
- 11 Supplies excitation to the Plant Battery Charging Alternator, also acts as an input for the Charge Fail detection circuit.
- 12 Starter relay output. Used to control the Starter Motor relay. **16 Amp rated**
- 13 Fuel relay output. Used to control the fuel rack relay. **16 Amp rated**
- 14 Mag Pickup (-ve). An AC signal from the speed sensing magnetic pickup (-ve). The -ve is not grounded in the **509** module
- 15 Mag Pickup (+ve). An AC signal from the speed sensing magnetic pickup (+ve)

### PLUG "B" 12 WAY

#### PIN

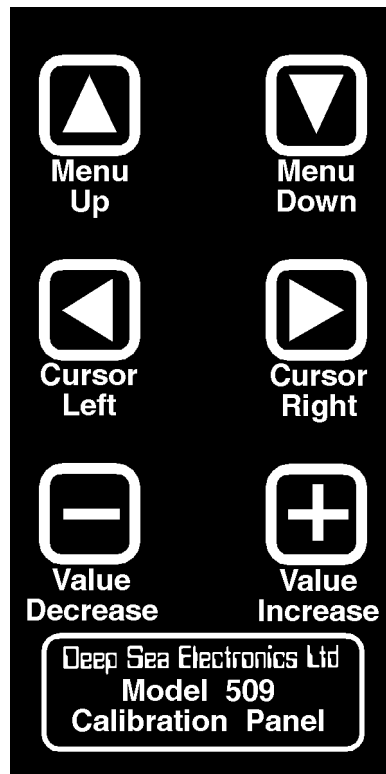
- 16 DC Supply -ve. System DC negative input. (Battery Negative)
- 17 DC Supply +ve. System DC positive input. (Battery Positive)
- 18 Common alarm relay output. Gives Plant Battery positive output on any shutdown or warning condition and will remain so until the warning is reset or on the case of a shutdown, the selector switch is turned to **OFF**. **6 Amp rated**
- 19 Configurable relay output. Gives Plant Battery positive output whenever chosen function is active. See Configuration Mode section 5 for different functions available. **6 Amp rated**
- 20 **DO NOT CONNECT**
- 21 Low Oil Pressure. Depending on type of sensing selected i.e. Normally Closed, Closing contact to negative or Normally open, opening contact to negative signals to the module that the Oil Pressure is low
- 22 High Temperature. Depending on type of sensing selected i.e. Normally Open, Closing contact to negative or Normally Closed, Opening contact to negative signals to the module that the Engine Temperature is too high
- 23 Emergency stop. If this input is **NOT** connected to negative the module will be locked out, and if the engine is running will shutdown immediately
- 24 Auxiliary No.1. Depending on type of sensing selected i.e. Normally Open, Closing contact to negative or Normally Closed, Opening contact to negative signals to the module to activate the chosen function
- 25 Auxiliary No.2. Depending on type of sensing selected i.e. Normally Open, Closing contact to negative or Normally Closed, Opening contact to negative signals to the module to activate the chosen function
- 26 Auxiliary No.3. Depending on type of sensing selected i.e. Normally Open, Closing contact to negative or Normally Closed, Opening contact to negative signals to the module to activate the chosen function
- 27 **DO NOT CONNECT**

## 5. CONFIGURATION MODE

The Configuration Mode allows the User or Engineer to alter the operating parameters to match the system which is to be used to control. Because of the comprehensive adjustment facilities available, it is completely menu driven. Some of the values have restricted access to prevent unauthorised modification to certain set values. Access is gained by entering a password. These can be obtained from Deep Sea Electronics.

### 5.1. 801 CALIBRATION UNIT

To gain access to the Configuration Mode the **801** Calibration Unit (**FIG 6**) is required.



**FIG 6**

The **801** Calibration Unit comes complete with a simple self explanatory key pad.

“**Menu Up and Menu Down**” push buttons scroll you through the menu of parameters which can be adjusted.

“**Cursor Left and Cursor Right**” push buttons position the Cursor over the number or text which is to be changed.

“**Value Increase and Value Decrease**” push buttons change the value of the number or text highlighted by the cursor or toggle through the sub-menu on the Auxiliary inputs etc.

Connection of the **801** Calibration Unit is as follows:-

- 1) Isolate the DC Supply to the **509** Module
- 2) Remove the 12 Way Plug “B” from the rear of the module
- 3) Connect the through connector of the **801** Calibration unit to the 12 way socket of the **509** module
- 4) Re-connect the 12 Way Plug “B” to the **801** Calibration unit
- 5) Re-connect the DC Supply to the **509** module

**NOTE:-** An alternative DC supply can be connected to the through connector if you wish to configure the 509 on the bench rather than the generator.

To activate the configuration menu, connect the key pad as explained on the previous page, ensure the **509** module is in the **OFF** position. The **509** LCD will display.

**Model 509 AMF  
Config Menu**

The **509** Module is now ready to be adjusted.

### For Example

To change the **Start Delay** Timer, scroll the Menu by using “**Menu Up and Down**” push buttons until you reach **Start Delay**.

**Start Delay  
00:30 min:sec**

By using the “**Cursor Left and Right**” push buttons, position the cursor over the number to be altered. Then by using the “**Value Increase and Decrease**” push buttons alter the value Up or down as required.

Alternatively, to select a mode of operation such as one of the Auxiliary inputs. Locate **Auxiliary No.1** by using the “**Menu Up and Down**” push buttons. The toggle through the Sub-menu using the “**Value Increase and Decrease**” to select the mode of operation required i.e. **Remote Start**.

**Auxiliary No.1  
Remote Start**

Once all the parameters are correctly selected / adjusted.

- 1) Isolate the DC Supply from the **509**.
- 2) Remove the 12 Way Plug “B” from the **801** calibration unit through connector.
- 3) Remove the **801** calibration unit through connector from the 12 way socket of the **509** module.
- 4) Re-connect the 12 way Plug “B” to the 12 way socket on the **509** module.
- 5) Re-connect the DC supply to the **509** module.

The **509** is now ready for operation.

 **NOTE:- On older versions of the 509, the selector switch had to be switched to the AUTO position to access the configuration menu. On the new version the selector switch has to be in the OFF position. If AUTO, MANUAL or TEST is selected then a message to switch to OFF is displayed.**

## 5.2 CONFIGURATION MENUS

There are three Configuration Menus allowing different levels of access. **Passwords available from Deep Sea Electronics Plc.**

### 5.2.1. LEVEL 1

The level first which does not require a password allows access to the following by pressing the “**Menu Down**” push button.

<b>Start Delay</b> 00:05 min:sec
-------------------------------------

**Start Delay.** Inhibits starting on mains failure. Allows for false signals and voltage dips. Also during this period the Preheat is active.

<b>number attempts</b> 03
------------------------------

**Multi attempts to start.** The number of times the module attempts to crank the engine.

<b>Crank time</b> 00:10 min:sec
------------------------------------

**Crank time.** The maximum time that the start solenoid is held in for cranking.

<b>rest time</b> 00:10 min:sec
-----------------------------------

**Rest time.** The time period between crank attempts. Preheat is also active.

<b>return time</b> 00:30 min:sec
-------------------------------------

**Return Timer.** Operates when the mains returns within pre-set levels. Allows for the mains supply to stabilise before reconnecting the load to the mains.

<b>run on</b> 01:00 min:sec
--------------------------------

**Run On.** Operates when the load is transferred back to the mains , allowing the engine to run for a set time **OFF** load to cool down. Increasing the operational life of engine and turbo charger.

### 5.2.2. LEVEL 2

To gain access to level 2 a Password must be entered. (This can be obtained from Deep Sea Electronics Plc). This level includes those in level 1 and others. Use the “Cursor Left and Right” and “Value Increase and Decrease” push buttons to alter the Password.

PASSWORD  
####

Press “Menu Down” Push button.

Model 509 AMF  
Config Menu

Start Delay  
00:05 min:sec

**Start Delay.** Inhibits starting on mains failure. Allows for false signals and voltage dips. Also during this period the Preheat is active.

number attempts  
03

**Multi attempts to start.** The number of times the module attempts to crank the engine.

Crank time  
00:10 min:sec

**Crank time.** The maximum time that the start solenoid is held in for cranking.

rest time  
00:10 min:sec

**Rest time.** The time period between crank attempts. Preheat is also active.

crank disconnect  
20 Hz

**Crank Disconnect.** Speed of engine necessary to disengage the starter motor.

**warm-up time**  
**00:00 min:sec**

**Warm Up.** Operates when the generator reaches load transfer speed. Time delay used to allow the generator to stabilise before accepting the load.

**load transfer**  
**45 Hz**

**Load transfer.** Speed of engine necessary to allow the contactors to transfer the load to the generator.

**pro holdoff**  
**00:10 min:sec**

**Protection holdoff.** During engine cranking and for the hold off period activated after crank disconnect, the alarm inputs, Low Oil Pressure, High Engine Temperature, Underspeed and any Auxiliary inputs which are designated as delayed are inhibited, to enable the engine to start and establish normal running conditions. At the end of this period the alarm inputs are enabled, providing normal protection to the installation.

**return time**  
**00:30 min:sec**

**Return Timer.** Operates when the mains returns to within the pre-set levels. Allows for the mains supply to stabilise before reconnecting the load to the mains.

**run on**  
**01:00 min:sec**

**Run On.** Operates when the load is transferred back to the mains , allowing the engine to run for a set time **OFF** load to cool down. Increasing the operational life of engine and turbo charger.

**Battery Lo volts**  
**11.0**

**Battery Lo volts.** Plant Battery Low Voltage warning trip level.

**Battery Hi volts**  
**33.0**

**Battery Hi volts.** Plant Battery High Voltage warning trip level.

### 5.2.3. LEVEL 3

To gain access to level 3 a Password must be entered. (This can be obtained from Deep Sea Electronics Plc). This level includes those in level 2 and others. Use the “Cursor Left and Right” and “Value Increase and Decrease” push buttons to alter the Password.

PASSWORD  
####

Press “Menu Down” Push button.

Model 509 AMF  
Config Menu

Start Delay  
00:05 min:sec

**Start Delay.** Inhibits starting on mains failure. Allows for false signals and voltage dips. Also during this period the Preheat is active.

number attempts  
03

**Multi attempts to start.** The number of times the module attempts to crank the engine.

Crank time  
00:10 min:sec

**Crank time.** The maximum time that the start solenoid is held in for cranking.

rest time  
00:10 min:sec

**Rest time.** The time period between crank attempts. Preheat is also active.

crank disconnect  
20 Hz

**Crank Disconnect.** Speed of engine necessary to disengage the starter motor.



**warm-up time**  
**00:00 min:sec**

**Warm up.** Operates when the generator reaches load transfer speed. Time delay used to allow the generator to stabilise before accepting the load.

**load transfer**  
**45 Hz**

**Load transfer.** Speed of engine necessary to allow the contactors to transfer the load to the generator.

**pro holdoff**  
**00:10 min:sec**

**Protection holdoff.** During engine cranking and for the hold off period activated after crank disconnect, the alarm inputs, Low Oil Pressure, High Engine Temperature and any Auxiliary inputs which are designated as delayed are inhibited, to enable the engine to start and establish normal running conditions. At the end of this period the alarm inputs are enabled, providing normal protection to the installation.

**under speed**  
**30 Hz**

**Underspeed.** Minimum allowable engine speed. Shutdown operational after Protection holdoff.

**over speed**  
**57 Hz**

**Overspeed.** Maximum allowable engine speed. This is an immediate Shutdown fault.

**return time**  
**00:30 min:sec**

**Return Timer.** Operates when the mains returns within pre-set levels. Allows for the mains supply to stabilise before reconnecting the load to the mains.

**run on**  
**01:00 min:sec**

**Run On.** Operates when the load is transferred back to the mains , allowing the engine to run for a set time **OFF** load to cool down. Increasing the operational life of engine and turbo charger.

 **NOTE:-** The Auxiliary inputs can be configured for a variety of different functions. To scroll through the Sub-menu, use the “Value Increase and Decrease” (+ &-) Push buttons.

aux 1 function  
Shutdown

**Auxiliary No.1. Shutdown**, first up indication, indicated by a message on the LCD and a shutdown sequence of the generator is initiated. The generator can only be restarted once the **509** has been switched to the **OFF** position and the fault cleared.

aux 1 function  
Warning

**Auxiliary No.1. Warning**, a non shutdown fault condition, indicated by a message on the LCD giving an alarm only. Self resetting input once the fault has been cleared.

aux 1 function  
Remote on load

**Auxiliary No.1. Remote on Load**. An input used to start the generator and transfer the load from the Mains to the Generator regardless of the status of the Mains. Refer to section 1.6 for operational sequence. Can be used for adding extra mains monitoring equipment such as Frequency modules to give other mains out of limits conditions.

aux 1 function  
Simulated Mains

**Auxiliary No.1. Simulated Mains**. If the Mains or the Simulated input are present the generator will not attempt to start. Used to remotely control the starting of the generator. Uses for this input are where inhibiting of the generator from starting is required such as **Mutual Standby** (Duty Cycle), Pump stations where pumps are not required if water levels etc are low, input can be controlled with a float switch, therefore generator would only start if water level was high and the mains had failed. Can also be used when Mains are not available to be monitored but contactor control is required or as an Auto Start module. Refer to section 1.7 for operational sequence.

aux 1 function  
Remote start

**Auxiliary No.1. Remote Start**. An input used to start the generator and run it **OFF** load, however should the Mains fail whilst running in this mode load will be automatically transferred to the generator. Refer to section 1.5 for operational sequence.

Press “ **MENU DOWN**” push button for next parameter.

aux 1 text  
AUXILIARY No.1

**Auxiliary No.1. Text.** The text of the Auxiliary input can be edited to any message up to 16 characters or spaces in length to display the fault condition. This message is displayed on the LCD if the input is activated. Use the “**Cursor Left and Right**” push buttons to position the cursor over the letter which is to be altered and use the “**Value Increase and Decrease**” (+ & -) push buttons to scroll through the alphabet / numbers etc. When message is completed press Menu Down push button to reach next parameter.

aux 1 delay  
Immediate

aux 1 delay  
Delayed

**Auxiliary No.1. Delay.** When the Auxiliary input is designated as either Shutdown or Warning the input can be designated as either Immediate which is active when the Selector switch is in any position except the **OFF** position, or Delayed until after the Protection holdoff timer. To toggle between Immediate and Delayed use the “**Value Increase and Decrease**” (+ & -) push buttons.

aux 1 sense  
normally Open

aux 1 sense  
normally Closed

**Auxiliary No.1. Sense.** The Auxiliary input can be designated as either Normally Closed, activated by a Opening contact from negative or Normally Open, activated by a Closing contact to negative. To toggle between Normally Open and Normally Closed use the “**Value Increase and Decrease**” (+ & -) push buttons.

 **NOTE:-** Auxiliary inputs 2 and 3 are the same as the above for auxiliary 1. This enabling you any combination of inputs i.e. 3 shutdown or 3 warnings or 1 shutdown, 1 warning & 1 remote start etc.

 **NOTE:-** The configurable output can be used for a variety of different functions. When active gives plant battery positive output. To scroll through the sub-menu , use the “**Value Increase and Decrease**” (+ & -) push buttons.

configured op  
Pre Heat

**Configurable Output. Preheat.** Active during start delay and crank rest periods of the start cycle to initiate the operation of the engine glow plugs.

configured op  
Air Flap

**Configurable Output. Airflap.** Is used to drive the air shut off valve on the engine. Operates on Overspeed and Emergency Stop conditions for an adjustable time, then resets. (See Configuration Output Timer).

configured op  
Energise to Stop

**Configurable Output. Energise to Stop.** On a shutdown sequence drives the fuel rack of an **Energise To Stop (ETS)** type engine for an adjustable time, Then resets. (See Configuration Output Timer).

 **NOTE:- WHEN USING THIS OPTION, DO NOT CONNECT THE FUEL OUTPUT (TERMINAL 13) TO THE FUEL SOLENOID.**

configured op  
System in AUTO

**Configurable Output. System in Auto.** Only present when the selector switch is in the **AUTO** position without a fault condition present.

configured op  
Louvre control

**Configurable Output. Louvre Control.** Active from the initiation of a start sequence until the generator has stopped. Used to control the opening and closing of louvres.

configured op  
Engine running

**Configurable Output. Engine Running.** Active once the generator is up to Load Transfer speed and until the generator has stopped.

timer for op 1  
00:10 min:sec

**Configuration Output Timer.** This timer is only used to adjust the operational time of either “**Energise to Stop**” or “**Airflap**” functions, if selected. It does not affect operation of the other functions.

**Battery Lo volts**  
**11.0**


**Battery Lo volts.** Plant Battery Low Voltage warning trip level.

**Battery Hi volts**  
**33.0**

**Battery Hi volts.** Plant Battery High Voltage warning trip level.

**text emergency stop**  
**EMERGENCY STOP**

**Text Emergency Stop.** If the Emergency Stop input is used for another function such as “System in Bypass”, then the text can be altered to read the new message. Use the “**Cursor Left and Right**” and “**Value Increase and Decrease**” push buttons to alter the message.

 **NOTE:- The emergency stop facility cannot be changed, when activated it ensures a complete lockout of the module until the input is reset.**

**sense temp**  
**normally Open**

**sense temp**  
**normally Closed**

**Sense Temperature.** The input can be designated as either Normally Closed, activated by a Opening contact from negative or Normally Open, activated by a Closing contact to negative. To toggle between Normally Open and Normally Closed use the “**Value Increase and Decrease**” push buttons.

**text temp**  
**HIGH TEMPERATURE**

**Text temp.** If the high engine temperature input is used for another function, then the text can be altered to read the new message. Use the “**Cursor Left and Right**” and “**Value Increase and Decrease**” push buttons to alter the message.

**sense oil**  
**normally Open**

**sense oil**  
**normally Closed**

**Sense Oil.** The input can be designated as either Normally Closed, activated by a Closing contact from negative or Normally Open, activated by a Opening contact to negative. To toggle between Normally Open and Normally Closed use the “**Value Increase and Decrease**” push buttons.

text oil  
OIL TEMPERATURE

**Text oil.** If the low oil pressure input is used for another function, then the text can be altered to read the new message. Use the “**Cursor Left and Right**” and “**Value Increase and Decrease**” push buttons to alter the message.

no. teeth  
0118

**No. Teeth.** If a Magnetic Pickup is being used for Speed sensing then the number of teeth on the Flywheel have to be entered so that the internal speed sensing circuit can calculate the speed of the engine.

Engine sensing  
Alternator

Engine sensing  
Magnetic Pickup

**Engine Sensing.** The module can sense the speed from either a Magnetic Pickup mounted on the Flywheel housing **or** from the Alternator. To toggle between Magnetic Pickup and Alternator use the “**Value Increase and Decrease**” (+ & -) push buttons.

display Hz / RPM  
Hertz

display Hz / RPM  
RPM

**Display Hz / RPM.** Whilst the generator is running the speed of the engine (**RPM**) or the Frequency of the Alternator (**Hz**) can be displayed on the LCD. To toggle between **RPM** and **Hz** use the “**Value Increase and Decrease**” (+ & -) push buttons.

Text mns  
MAINS

**Text mns.** This allows the word ‘MAINS’ to be replaced if required on the LCD message screen. Use the “**Cursor Left and Right**” and “**Value Increase and Decrease**” push buttons to alter the message.

text mns avail  
MAINS AVAILABLE

**Text mns avail.** This allows the words ‘MAINS AVAILABLE’ to be replaced if required on the LCD message screen. Use the “**Cursor Left and Right**” and “**Value Increase and Decrease**” push buttons to alter the message.

**text mns avail s**  
**MAINS AVL**

**Text mns avail s.** This allows the words 'MAINS AVL' to be replaced if required on the LCD message screen, these words are displayed during the return sequence. Use the “**Cursor Left and Right**” and “**Value Increase and Decrease**” push buttons to alter the message.

**text mns onload**  
**MAINS ON LOAD**

**Text mns onload.** This allows the words 'MAINS ONLOAD' to be replaced if required on the LCD message screen. Use the “**Cursor Left and Right**” and “**Value Increase and Decrease**” push buttons to alter the message.

**mains dropout**  
**Immediate**

**mains dropout**  
**Delayed**

**Mains Dropout.** This function controls the Mains Contactor .

If Immediate is selected, then on a Mains Failure or Remote Start On Load is initiated, the Mains Contactor will be de-energised immediately removing the load from the Mains whilst running in any mode of operation . This will occur even with the selector switch in the **OFF** position.

If Delayed is selected then the Mains Contactor is held energised (assuming the phase powering the Contactor is present) until the Generator is up to Load Transfer speed at which point the Load will be transferred from the Mains to the Generator.

To toggle between Immediate and Delayed, use the “**Value Increase and Decrease**” (+ &-) push buttons.

**Preheat option.** This function allows you to select the length of time the preheat is required to be active when selected as the function for the configurable output. To scroll through the sub-menu, use the “**Value Increase and Decrease**” (+ & -) push buttons.

**preheat option**  
**end of start delay**

**End of start delay.** This activates the preheat output for the duration of the start delay timer, and if the generator fails to start, will preheat during crank rest.

**preheat option**  
**end crank disc**

**End of crank disconnect.** This activates the preheat output for the duration of the start delay timer, crank and rest timers and up until the crank disconnect signal is received.

**preheat option**  
**end holdoff time**

**End of protection holdoff timer.** This activates the preheat output for the duration of the start delay time, crank and rest timers and up until the termination of protection hold off timer.

The module has a maximum of 21 installed languages, English and up to twenty additional languages. The module does not contain a translator so the Auxiliary Text's and Emergency Stop Text must be altered Manually into the Language required. All the other operational Text strings are automatically changed on selection of the Language. An up to date list of current languages available is available from DSE.

<b>Default language</b> <b>England</b>
---

**Default Language.** To toggle between the available languages use the “**Value Increase and Decrease**” (+ & -) push buttons.

<b>Password</b> <b>####</b>
--------------------------------

 <b>NOTE:- THERE IS NO NEED TO ALTER THE PASSWORD, WHEN THE 509 IS SWITCHED TO OFF THE PASSWORD IS AUTOMATICALLY RESET TO NONE.</b>
--



### 5.3. FACTORY SET DEFAULTS

 **NOTE:-** To avoid confusion when adjusting the parameters, it is recommended that you first fill in the user settings in the table below. This table will also act as a record for future reference.

**SERIAL No:**

PARAMETER	FACTORY SET DEFAULT	USER SETTING
Password	NONE	NONE
Mains Trip Voltage	180 Vac	
Start Delay	5 secs	
Number Attempts	3	
Crank Time	10 secs	
Rest Time	10 secs	
Crank Disconnect	20 Hz	
Warm Up	0 secs	
Load transfer	45 Hz	
Protection Holdoff	10 secs	
Underspeed	30 Hz	
Overspeed	57 Hz	
Return time	30 secs	
Run On	60 secs	
Auxiliary No.1 Function	Shutdown	
Auxiliary No.1 Text	Auxiliary No.1	
Auxiliary No.1 Delay	Delayed	
Auxiliary No.1 Sense	Normally Open	
Auxiliary No.2 Function	Warning	
Auxiliary No.2 Text	Auxiliary No.2	
Auxiliary No.2 Delay	Delayed	
Auxiliary No.2 Sense	Normally Open	
Auxiliary No.3 Function	Remote Start	
Auxiliary No.3 Text	Auxiliary No.3	
Auxiliary No.3 Delay	Delayed	
Auxiliary No.3 Sense	Normally Open	
Configurable Output	Preheat	
Configurable Output Timer	10 secs	
Battery Low Volts	11 Volts DC	
Battery high Volts	33 Volts DC	
Text Emergency Stop	Emergency Stop	
Sense Temperature	Normally Open	
Text Temp	High Temperature	
Sense Oil	Normally Closed	
Text Oil	Low Oil Pressure	
No Teeth	118	
Engine Sensing	Alternator	
Display	Hz	
Text Mns	Mains	
Text Mns Avail	Mains Available	
Text Mns Avail s	Mains Avl	
Text Mns onload	Mains On Load	
Mains Dropout	Delayed	
Preheat Option	End of start delay	
Default Language	England	

## 6. MAINS FAILURE TRIP CALIBRATION

The 509 module has been pre-calibrated in the factory to give a mains failure trip at 180 Vac and mains return of 200 Vac Phase to Neutral. If a different setting is required, follow the following procedures. (Refer to fig 7).

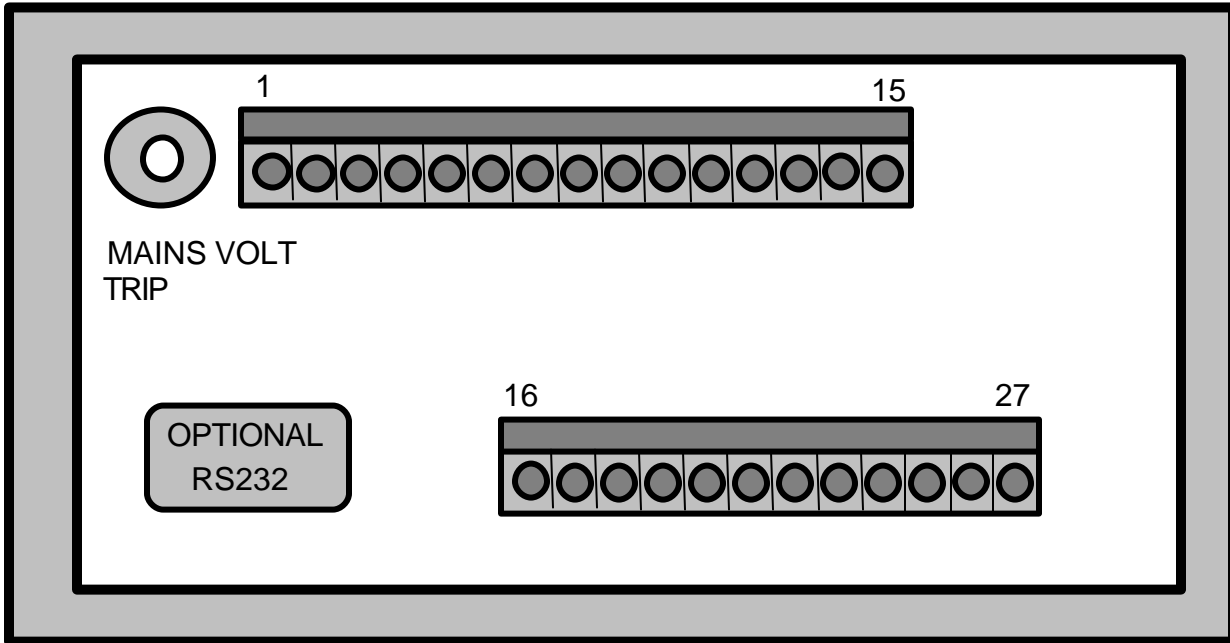


FIG 7

- Turn the Mains Volts Trip potentiometer fully anti-clockwise.
- Connect the DC supply.
- Connect a variable AC voltage to the mains sensing inputs and set the trip voltage required.
- Turn the module to the **AUTO** position.
- Very slowly** turn the potentiometer clockwise until the LCD displays **START DELAY** this is an indication that the module has sensed the mains failure at the required level.

The **MAINS RETURN** will be approximately 20 Vac above the trip level

## 7. SPECIFICATION

<b>DC Supply</b>	8.0 to 35 volts
Cranking Dropouts	Able to survive 0V for 50 mS, providing supply was at least 10V before dropout and supply recovers to 5V.
<b>3 Phase Mains Sensing</b>	
<b>Mains Trip Range</b>	Voltage detection range 75 - 275V ac rms
Mains Input Range	100 - 300V ac rms
<b>Alternator Input Range</b>	15 - 300V ac rms
<b>Alternator Input Frequency</b>	50 - 60 Hz at rated engine speed
<b>Magnetic Pickup Input Range</b>	0.5 to +/- 70V (Clamped by transient suppressers)
<b>Magnetic Pickup Frequency</b>	2300 - 6000 Hz at rated engine speed
<b>Start Relay Output</b>	16 Amp DC at supply voltage
<b>Fuel Relay Output</b>	16 Amp DC at supply voltage
<b>Configurable Relay Output</b>	6 Amp DC at supply voltage
<b>Alarm Relay Output</b>	6 Amp DC at supply voltage
<b>Mains Contactor Relay</b>	8 Amp volt free normally closed contact
<b>Generator Contactor Relay</b>	8 Amp volt free normally open contact
<b>Dimensions</b>	72 X 144 X 140 (Excluding Keyswitch)
<b>Excitation Output</b>	13V DC - 150 mA max 26V DC - 300 mA max
<b>Charge Fail Input Trip</b>	1/2 Plant supply
<b>Battery Low Trip</b>	Adjustable between 0 - 40V DC
<b>Battery High Trip</b>	Adjustable between 0 - 40V DC
<b>Operating Temp Range</b>	-10 to +60 °C

## 8. COMMISSIONING

### PRE-COMMISSIONING CHECK

Before the system is started, it is recommended that the following checks are made:-

#### 8.1

The unit is adequately cooled and all wiring to the module is of a standard and rating compatible with the system.

#### 8.2

The unit **DC** supply is fused and connected direct to the battery and of correct polarity.

#### 8.3

The Emergency stop input is wired to an external normally closed stop switch. **IF NOT**, link this input to the negative rail.

#### 8.4

To check the start cycle take appropriate measures to stop the engine from starting (disable the operation of the fuel solenoid). After a visual inspection to ensure it is safe to proceed, connect the battery supply. Turn the selector switch to "**MANUAL**". The unit start sequence will commence.

#### 8.5

The starter will engage and operate for the pre-set crank period. After the starter motor has attempted to start the engine for the pre-set number of attempts "**FAILED TO START**" will be displayed on the LCD and the alarm output goes active. Turn to **OFF** to reset the unit.

#### 8.6

Restore the engine to operational status (reconnect the fuel solenoid), again select "**MANUAL**" and this time the engine should fire and the starter motor should disengage automatically. If not then check that the engine is fully operational (fuel available etc) and that the fuel solenoid is operating. The engine should now run up to operating speed. If not, and alarm is present, check the alarm condition for validity, then check input wiring. The engine should run for an indefinite period and the LCD will display "**Generator 50(60) Hz**" to indicate that the generator is running.

#### 8.7

Select **AUTO** on the front panel, the engine will run for the pre-set cooling down period, then shutdown. The generator should stay in the standby mode. If not, check the mains are present on all 3 phases. (For single phase operation link all 3 phases together). Or a remote start input is active.

#### 8.8

Remove 1 of the phases. The start sequence will commence (refer to section 1.2) and the engine will run up to operational speed. The Generator contactor will accept the load. If not, check the wiring to the Generator contactor coil. Check the engine has reached the Load Transfer speed.

#### 8.9

Return the mains, the mains return timer will be displayed on the LCD and the mains return sequence will start. After the pre-set time period the load will be transferred back to the mains supply. The engine will run for the pre-set cooling down period then shutdown. If not, then check that all 3 phases are present. Check the wiring to the mains contactor coil.

 **CAUTION!:-**  
**SELECTING TEST WILL CAUSE A BREAK IN THE SUPPLY TO THE LOAD AS THE LOAD IS TRANSFERRED FROM THE MAINS TO THE GENERATOR, AND ON COMPLETION OF THE TEST BACK TO THE MAINS.**

### **8.10**

All internal timers and selections should now be adjusted to the customers specifications or to the engine manufacturers recommendations.

### **8.11**

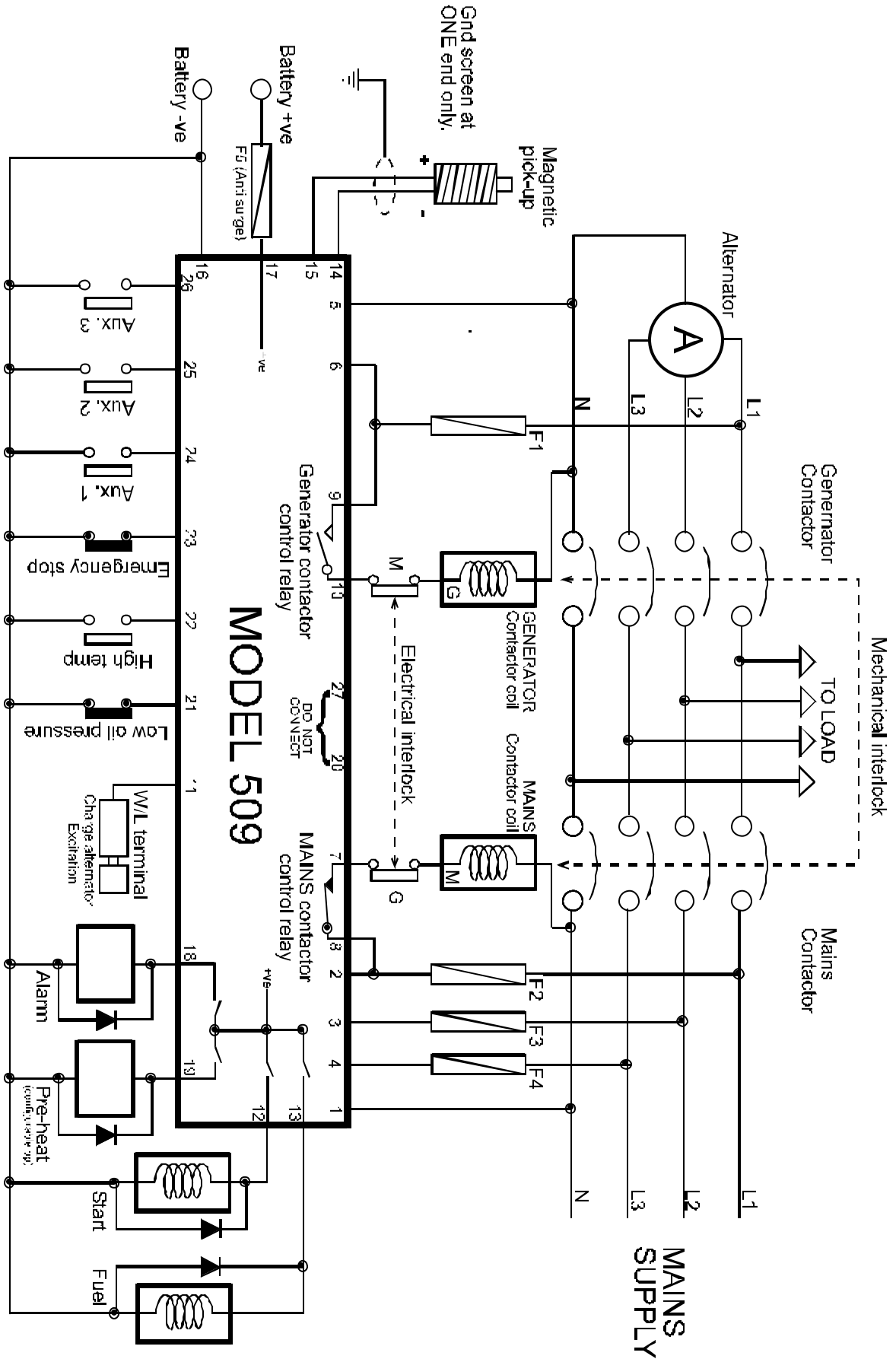
If despite repeated checking of the connections between the **509** and the customers system, satisfactory operation cannot be achieved, then the customer is requested to contact the factory for further advise on:-

**INTERNATIONAL TEL: 44 (0) 1723 377566**  
**INTERNATIONAL FAX: 44 (0) 1723 354453**  
**EMAIL: Support@deepseapl.com**

## 9. FAULT FINDING

SYMPTOM	POSSIBLE REMEDY
Unit is inoperative	Select <b>AUTO</b> on the front panel. Check the battery and wiring to the unit. Check the DC supply. Check the DC fuse
Unit shuts down	Check DC supply voltage is not above 35 Volts. Check the operating temperature is not above 60 °C. Check the DC fuse
Unit trips on Emergency Stop	If an Emergency Stop switch is not fitted, ensure that a negative is connected to the input. Check Emergency stop switch is functioning correctly. Check wiring
Intermittent sensor fault	Magnetic pick-up screen connected at both ends enables the screen to act as an aerial and will pick up random voltages
Low Oil pressure fault operates after engine has fired	Check engine oil pressure. Check Oil pressure switch and wiring
High engine temperature fault operates after engine has fired	Check engine temperature. Check switch and wiring. Check configuration of input i.e. Normally Open and Normally Closed.
Shutdown fault operates	Check relevant switch and wiring. Check configuration of input
Warning fault operates	Check relevant switch and wiring. Check configuration of input
Fail to Start is activated after multi attempts	Check wiring and operation of fuel solenoid. Check battery. Check the speed sensing signal is present on the <b>509</b> input. Refer to the engine manual.
Continuous starting of Generator when in <b>AUTO</b>	Check that mains voltage is correct and present on all phase inputs. Check for incorrect setting of the mains undervoltage trip. If an Auxiliary input is configured for a remote start, check negative is not present on this input
Generator fails to start on mains failure	If an Auxiliary input is configured to be Simulated mains ensure that a negative is not present on this input
Pre-heat inoperative	Check wiring to engine heater plugs. Check battery supply is present on output of module. Check Pre-heat has been selected on the configurable output
Starter motor inoperative	Check wiring to starter solenoid. Check battery supply. Check battery supply is present on output of module
Engine runs but Generator will not take load	Check engine is attaining Load transfer speed. Check the configuration menu for percentage of load transfer speed.

# 10. TYPICAL 509 WIRING DIAGRAM



## 11. OPTIONAL EXTRAS

### 11.1 RS 232 REMOTE RELAY MODULE, MODEL 154

#### INTRODUCTION

The **509** can be ordered with an RS 232 serial port so that the Remote Relay Module, Model 154 can be connected for Remote Annunciation of the internal states of the **509**, such as Low Oil Pressure, Mains On Load and many more described later in this section.

The relay board is powered from a DC supply of between 6 and 40 volts and has 8 relays with volt free change over contacts, brought out to terminals for easy connection to remote monitoring equipment. There is also provision for connection of an “**Alarm Mute**” push button to be connected to the relay board. The “**Alarm Mute**” will mute the alarm of the **509** if activated.

The Relay board is designed for control panel mounting on a standard DIN rail.

Communication with the **509** is by an RS 232 data cable and the signal can be amplified through equipment such as a suitable Modem or Radio equipment for remote usage of the relay board. To indicate that this serial link is made the LED on the centre of the relay board will be in a flashing mode.

Selection of the states to be remotely monitored is achieved by using the **801** calibration unit.

#### 11.1.1. RS 232 RELAY MODULE LAYOUT

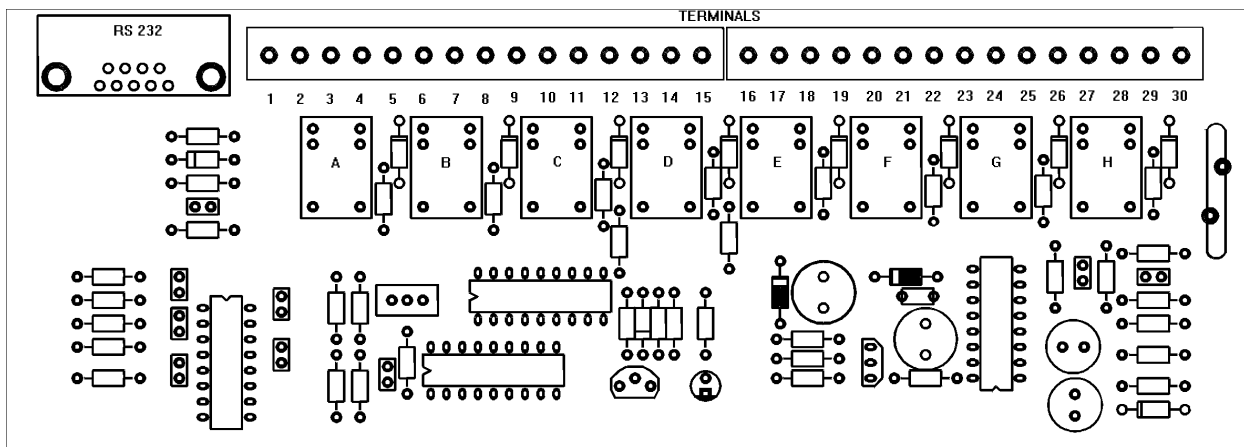


FIG 8



## 11.1.2. ELECTRICAL CONNECTIONS

### RELAY BOARD CONNECTOR

1	Alarm Mute Positive Input
2	Alarm Mute Switch Input
3	Alarm Mute Negative Input
4	Relay A N/C Contact
5	Relay A Common
6	Relay A N/O Contact
7	Relay B N/C Contact
8	Relay B Common
9	Relay B N/O Contact
10	Relay CN/C Contact
11	Relay C Common
12	Relay CN/O Contact
13	Relay DN/C Contact
14	Relay D Common
15	Relay DN/O Contact
16	Relay E N/C Contact
17	Relay E Common
18	Relay E N/O Contact
19	Relay F N/C Contact
20	Relay F Common
21	Relay F N/O Contact
22	Relay G N/C Contact
23	Relay G Common
24	Relay G N/O Contact
25	Relay HN/C Contact
26	Relay H Common
27	Relay HN/O Contact
28	DC SUPPLY NEGATIVE
29	DC SUPPLY POSITIVE
30	DC SUPPLY POSITIVE

Refer to Section 11.1.4 for connection details of Normally Closed and Normally Open switches.

### RS 232 DATA CABLE

509 PIN		RELAY BOARD PIN
2	to	3
3	to	2
5	to	5

 **NOTE:-** The cable used for the data cable must be screened cable and the screen connected to terminal pin 5 at one end only.

### 11.1.3. CONFIGURATION PROCEDURE

To select the states of the **509**, access the Calibration Mode with the **801** Calibration Unit.


“**Menu Up and Menu Down**” push buttons scroll you through the menu of states which can be selected shown on the top line of the LCD.

“**Cursor Left and Cursor Right**” push buttons position the Cursor over the relay options shown on the bottom line of the LCD.

“**Value Increase and Value Decrease**” push buttons change the state of the relay output **ON** or **OFF**.

Connection of the **801** Calibration Unit is as follows:-

- 1) Isolate the DC Supply to the **509** Module
- 2) Remove the 12 Way Plug “B” from the rear of the module
- 3) Connect the through connector of the **801** Calibration unit to the 12 way socket of the **509** module
- 4) Re-connect the 12 Way Plug “B” to the **801** Calibration unit
- 5) Re-connect the DC Supply to the **509** module

 **NOTE:- An alternative DC supply can be connected to the through connector if you wish to configure the 509 on the bench instead of on the generator.**

Once all the parameters are correctly selected / adjusted.

- 1) Turn the **509** to the **OFF** position.
- 2) Isolate the DC Supply from the **509**.
- 3) Remove the 12 Way Plug “B” from the **801** calibration unit through connector.
- 4) Remove the **801** calibration unit through connector from the 12 way socket of the **509** module.
- 5) Re-connect the 12 way Plug “B” to the 12 way socket on the **509** module.
- 6) Re-connect the DC supply to the **509** module.

The **509** is now ready for operation.

To activate the configuration menu, connect the key pad as above then turn the **509** module to the **OFF** position. The **509** LCD will display.


**Model 509 AMF  
Config Menu**

The **509** Module is now ready to be adjusted.

Using the “**Menu Up & Down**” push buttons locate the **PASSWORD** screen and enter the password. (**This can be obtained from Deep Sea Electronics**).

**PASSWORD  
####**

Then using the “**Menu Up & Down**” push buttons, scroll through the list of **509** states that are available.

 **NOTE:-** The top line displays the 509 state and the first 8 character spaces from the left on the bottom line represent one of the relays "A to H". The following list shows the 509 states available and their default relay selection.

**FAILED TO START**  
A

**LOW OIL PRESSURE**  
A

**HIGH ENGINE TEMP**  
A

**EMERGENCY STOP**  
A

**NO SPEED SENSING**  
A

**OVER SPEED FAIL**  
A

**UNDER SPEED FAIL**  
A

**AUXILIARY No.1**  
B

**AUXILIARY No.2**  
B

**AUXILIARY No.3**  
B

**BATTERY VOLT LOW**  
B

**BATTERY VOLT HI**  
B

**CHARGE FAIL**  
B

<p><b>MAINS AVAILABLE</b> C</p>
<p><b>MAINS ON LOAD</b> D</p>
<p><b>ENGINE RUNNING</b> E</p>
<p><b>GEN ON LOAD</b> F</p>
<p><b>SYSTEM IN AUTO</b> G</p>
<p><b>SHUTDOWN</b> H</p>
<p><b>WARNING</b> H</p>

By using the “**Cursor Left & Right**” push buttons you can position the cursor over the relay you wish to select to be associated with the 509 state, and by using the “**Value Increase & Decrease**” ( + & - ) push buttons selects the relay to be either **On (+)** or **Off (-)**. When the letter is showing then that state will activate the relay of that letter.

More than one state can share a relay output as shown in the list above, so if either of the states is activated then the relay is energised. Also one **509** state can drive more than one relay if required or a combination of both as shown below.

<p><b>SHUTDOWN</b> E H</p>
<p><b>WARNING</b> E G</p>

The above selection means that if **WARNING** was activated then both Relays **E & G** would be energised and if **SHUTDOWN** was activated then Relays **E & H** would be energised.

To assist identification of which relay is energised an LED will illuminate.

 **NOTE:- A warning is self resetting, however to reset the system after a shutdown, the front panel switch on the 509 has to be turned to the OFF position. This will reset the remote relay board outputs.**

#### **11.1.4 ALARM MUTE**

The alarm mute feature of the relay board when activated will cause the following sequence:-

If a fault has occurred then it would de-activate the alarm output of the **509**, however the LCD of the **509** will still indicate the fault message and the relay output of the Relay Board will still be active.

#### **CONNECTION OF SWITCHES**

##### **NORMALLY CLOSED**

DC Supply Positive to Terminal 1

DC Supply Negative to Terminal 3

Normally Closed Switch between Terminals 2 & 3

##### **NORMALLY OPEN**

DC Supply Positive via Normally Open Switch to Terminal 1

DC Supply Negative to Terminal 3

## **12. APPENDIX**

### **540 (5 way) & 541 (10 way) FAULT EXPANSION / ANNUNCIATOR**

The **540 or 541** Fault Expansion /Annunciator can be used to increase the number of fault inputs to the **509**.

For further information on this module contact the Deep Sea Electronics sales office.